ADVANCING AND RESOLVING THE GREAT SUSTAINABILITY DEBATES AND DISCOURSES.

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Abstract

This thesis demonstrates, in Chapter 1, that there is significant scientific evidence that the current form of global economic development is unsustainable. Whilst much of the general public assume that concerns and debates about the sustainability of development are relatively new, Chapter 2 shows that concerns debates about the sustainability of development have a long history. This thesis shows in Chapter 2 and 3 that debates about the sustainability of development have significantly mattered to the course of modern human history and quality of life for over a hundred years. This thesis, in Chapter 2, shows that, by 1909, that enough of the key understandings and ideas and enough new emerging technologies needed to define and pursue purposefully sustainable development were known. Chapter 3 considers what have been some of the major barriers to sustainable development. An historical perspective is used to help explain why so little progress has been made on many of the sustainability debates over the last hundred years. Chapter 3 shows that one of the main barriers to the implementation of sustainability has been vested interests and their sustainability blocking coalitions which have been very effective in preventing governments from progressing sustainability policy. The thesis shows that it is rare for purposeful sustainability policy and institutional reform ever to occur without a fight from those vested interests, who either will be, or perceive that they will be, negatively effected. This thesis seeks to offer a resource with information and strategies to help address and overcome such vested interests and their blocking coalitions.

Chapter 3 shows how there are patterns to how these sustainability blocking coalitions seek to undermine and prevent progress on sustainable development. Chapter 3 provides an historical perspective which shows that these blocking coalitions have sought to stall progress on sustainable development by arguing that sustainable development will harm business competitiveness, economic growth and lead to job losses. Thus this thesis focuses on these centrally important sustainability debates about whether achieving the goal of sustainable development will help or harm business competitiveness/profitability and economic growth and led to job losses.

The thesis also focuses on these centrally important sustainability debates because the issue of whether or not economic growth and sustainable development can be compatible goes to the heart of the sustainability debates initiated by Limits to Growth in 1972 and further developed by the Brundtland Report, *Our Common Future*. This thesis also focuses on these debates because they are at the heart of differences between the key environmental discourses as shown by Dryzek in his 1997 publication *The Politics of the Earth: Environmental Discourses*. These “growth debates” are also important because they address the key claim of ecological modernisation. As Dryzek stated “Much of its (ecological modernisation’s) appeal lies in its promise that “we can have it all: economic growth, environmental
conservation, social justice”. This thesis examines in Chapters 5-8 whether we can indeed have it all as described by Dryzek.

The key hypothesis of this thesis is whether or not environmental protection, economic growth and social justice can be compatible and under what conditions is the achievement of this compatibility most likely? The intent of this thesis is to make a substantial advance on this question. In so doing the thesis seeks to make a significant contribution to discussions on whether or not it is possible to achieve “Green Growth”?

This thesis defines the range of goals for environmental and social sustainability to create a sustainable society based on the Earth Charter. The Earth Charter is chosen as a comprehensive list of sustainability goals because of the extensive global process under which it was created and reviewed. The thesis investigates to what extent pursuing the environmental and social sustainability goals of the Earth Charter correlate with economic growth? This thesis acknowledges that the implementation of some aspects of the Earth Charter will involve significant investment costs and harm economy growth but the thesis shows that the implementation of many of the other goals of the Earth Charter positively correlate with economic growth better than “business as usual.” A key finding of the thesis is that, whilst a transition to sustainable development will involve upfront investment, social and political costs, numerous studies now show that these costs of early action will be far less than the costs of inaction. Such studies show now that, lack of action on major sustainability issues like climate change and peak oil significantly threaten long term global economic growth.

Thus the thesis demonstrates that there is potential for the implementation of sustainable development, wisely applied, to result in better social and environmental outcomes in every respect whilst still ensuring strong economic growth this century and beyond. Hence the conclusion of this thesis is that social justice, environmental protection and economic growth can be compatible through the necessary political will, with active and meaningful business and community engagement, underpinned by purposeful sustainability policy and educational reform. This conclusion is contested by a number of academics who blame economic growth for the current environmental crisis and social ills. This thesis responds to these academics by arguing that the current unsustainable nature of economic growth is a symptom of more fundamental causes and drivers of un-sustainability. This thesis argues that the current form of economic growth is unsustainable due to market, informational and institutional failures, rebound effects, a failure to mainstream sustainable design, rising global population plus a rapid expansion of unsustainable western consumption patterns globally. This thesis argues that, only by recognising this and focusing on the necessary changes needed to mainstream sustainability design, education, policy and institutional changes can the current unsustainable forms of development be...

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turned around to become sustainable. Once it is understand that economic growth per se is not the problem then this helps to clarify what society needs to focus on to achieve the goal of sustainable development. This thesis argues that if we make the mistake of simplistically blaming economic growth for the current unsustainable form of economic growth then this plays into the hands of anti-sustainability blocking coalitions main argument, namely that social and environmental sustainability initiative will harm the economy too much and are therefore too costly to undertake. This thesis, by clearly differentiating between economic and physical growth, focuses on how best to decouple economic growth from negative social and environmental pressures. This thesis demonstrates that it is possible to cost effectively achieve significant decoupling of economic growth from environmental pressures including greenhouse gas emissions, biodiversity loss, freshwater withdrawal, air pollution, waste and hazardous waste production.

This thesis thus seeks, by providing significant evidence for decoupling, to help move the “growth” debates forward and encourage a focus on what changes to technology and design, what changes to policy and institutions will lead to a significant and cost effective decoupling. This thesis brings together literature in Chapters 4-8 which demonstrates that there exists still, twenty years on from the publication of *Our Common Future*, significant potential to decouple economic growth from physical throughput and environmental pressures through eco-efficiencies, eco-innovation, whole system design, sustainable consumption and policy and institutional change. The thesis seeks to show that such decoupling can be a useful part of broader strategy to achieve sustainable development as long as rebound effects are minimised through effective policy. This thesis brings together much new evidence to support this hypothesis that a “green” form of economic growth can be achieved.\(^3\) Having said that it is beyond the scope of one thesis to provide a complete overview of all the technological, sustainable consumption and policy advances which will assist nations achieve decoupling. Hence this thesis provides a sample of technical, sustainable consumption and policy advances whilst referencing much more comprehensive sustainable technology and policy publications. This thesis presents a broad, integrated approach, bringing the three pillars of sustainability - environment, society and economy - more closely together than in much other work, and supports this with a new synthesis of empirical evidence. The thesis also presents an overview of the case that to date there has been significant underinvestment in key social sustainability goals such as poverty reduction and mounts the case or greater levels of such investment by demonstrating their positive effects from a humanitarian and economic point of view.

This thesis is grounded theoretically in the tradition of “strong” ecological modernisation. This thesis shows how a stronger form of ecological modernisation can assist to advance and resolve long standing sustainability debates. Finally, this thesis is not simply theoretical. As part of the practice of

the thesis, the author has co-founded in 2002 a sustainability think tank, The Natural Edge Project (TNEP) (www.naturaledgeproject.net). This think tank has put into practice many of the operational actions, such as improving education for sustainable development, recommended by this thesis to help create conditions within which ecological modernization is more likely to progress in Australia.
Preface

This kernel of this thesis arose after the process of co-editing and co-authoring The Natural Edge Project publication *The Natural Advantage of Nations* with Karlson ‘Charlie’ Hargroves. Having sent the manuscript off to the publishers, I realised that there was an important emerging theme in the book that had been completely missed. A number of empirical studies in the book showed that seeking to achieve certain aspects of environmental sustainability would not harm the macro-economy significantly at all. Rather, there was encouraging evidence that decoupling economic growth from environmental pressure could be achieved with a focus on eco-efficiency to help increase productivity and thus positively correlate with economic growth. In addition, studies by Robert Putnam suggested that increasing social capital could help economic growth. Some studies were showing that a transition to environmental and social sustainability could even help create higher economic growth than business as usual. At the last minute, at my insistence, our publishers Earthscan, allowed these interesting results, which I had researched and integrated, to be added to the final draft of *The Natural Advantage of Nations* (see pages 26-33). Clearly these results deserved further investigation. For instance, Robert Putnam’s work on social capital showed that improving social capital can help economic growth, but what about other social sustainability goals? How would seeking to achieve them affect economic growth? Also, whilst in Chapter 17 of *The Natural Advantage of Nations*, Alan Pears and I had shown that economic growth could be decoupled from greenhouse gas emissions without harming economic growth significantly, the book did not address the question of whether this decoupling could be universally achieved cost effectively more broadly for other environmental pressures? Chapters 5, 6, 7 and 8 of this thesis do this and thus bring together new evidence to allow this thesis to revisit and shed new light the “growth” debates. Chapters 5-8 of this thesis address numerous new questions not covered in *The Natural Advantage of Nations*.

Discussions about whether ecological and social sustainability goals can be achieved without trade-offs with economic growth have a long history. For instance, ever since the publication of *Limits to Growth* in 1972 there have been ongoing “growth” debates and discourses. This thesis is original and new, because it not only brings together a current overview of the literature and history of the “growth” debates, but it also provides a comprehensive discussion of the arguments and resolves them once and for all. In particular, this thesis attends in novel ways to the long standing and unproductive confusion between economic growth (monetary growth) and physical throughput (physical growth of energy and resources) in modern economies, and the implications of such a clarification for achieving consensus and progress on sustainability. This thesis investigates, also for the first time, whether it is possible to cost effectively decouple economic growth significantly from a wide range of environmental pressures and thus provides a new way to reconcile the need for economic growth and environmental sustainability. This thesis, also for the first time, examines how seeking to achieve a comprehensive array of social and environmental sustainability goals will affect economic growth in
chapters 6, 7 and 8. The resolution of the growth debates has significant implications for many other sustainability debates such as the climate change debates. This is shown in new ways in Chapter 7 of this thesis which focuses on the climate change debates.

Many studies now show that there are several key assumptions that determine whether economic modeling predicts that achieving ecological sustainability helps or harms economic growth. One of the key assumptions relates to micro-economics and businesses. Simply put, if you assume that there are significant eco-efficiency and resource productivity opportunities still available for many industries then this makes it possible to reduce environmental pressures while making a profit. But what if business has already found all the cost effective eco-efficient savings, then any eco-tax or further requirement on business to achieve eco-efficiency gains will inevitably lead to higher costs to business and the economy. Debates about these issues at the microeconomic business level therefore have important macroeconomic implications for the “growth” debates. Therefore these questions are addressed in detail in Chapter 4 of this thesis. The results from Chapter 4 are important therefore for the “growth” debate discussions in Chapters 5-8.

There is a long and established history of environmental and social sustainability debates and discourses. Chapter 2 for the first time brings together an overview of when many of the great sustainability debates started. Whilst most people see the environmental movement and concerns about social capital as a recent phenomenon, Chapter 2 shows that many of the key ideas, insights and enabling solutions needed to begin to define and pursue sustainable development were known by 1909. This new perspective allows this thesis to then ask in Chapter 3 why did the world not pursue sustainable development from 1909 onwards? A goal of this thesis is, through asking such questions to ensure that in the 21st century we learn from and avoid the mistakes of the 20th century and do not repeat them.

An historical perspective shows that there are many common patterns to the sustainability debates. This thesis, through investigating the common patterns of these debates, in Chapters 2, 3 and 9, distills the lessons of history and offers suggestions and ways forward of relevance to all those currently engaged in aspects of sustainability debates. This thesis seeks to provide a timeless resource to assist not just all sustainability think tanks and researchers engaged in research and such debates on sustainability and climate change issues but anyone interested in building a better future and positive legacy for their children and their children’s children.

Statement of Use of Previously Published Materials

Before proceeding with the thesis, it is important to clarify that around 5% of this thesis is derived from, or updated from, previously published work, all of which I am lead author. Specifically some text in this thesis draws upon or significantly updates small excerpts from The Natural Advantage of Nations’s chapters 1, 2, 3, 5, 6 and 8, all of which I am lead author;


The co-author of these chapters, Mr Hargroves, was sent the drafts of all the chapters of this thesis both when the thesis was originally submitted in 2006 and again after I had addressed examiner’s queries in 2008. He agreed that, since I was responsible for the research and drafting of the following excerpts from these chapters of *The Natural Advantage of Nations*, it was fair to include and update these excerpts in my thesis. Specifically this applies to the following sub-parts of the thesis:

- **1.2.1 Definitions of Sustainable Development**, page 32-33, parts of this are derived from page 51-52 in *The Natural Advantage of Nations*, Chapter 3, “How do Nations Measure Progress?”

- **1.2.2 Clarifying Sustainable Development and the Role of Ethics and Values**, and **1.2.3 Sustainable Development Requires No Major Trade Offs** is based on the line of argument on pages 45-50 of *The Natural Advantage of Nations*. These pages from *The Natural Advantage of Nations* were written based on conversations with Melbourne sustainability expert Philip Sutton and his work over many years to define sustainable development ([http://www.green-innovations.asn.au/sustainability-getting-orientated.htm](http://www.green-innovations.asn.au/sustainability-getting-orientated.htm)).

- **3.9 The Business Competitiveness versus Sustainable Development Debate**, the last page of this sub-section of Chapter 3 is based on my research and adapted text based on text that I researched and drafted in Chapter 1 and 5 of *The Natural Advantage of Nations*. 
4.2 What determines business competitiveness? This expands on Table 1.2 in Chapter 1 of The Natural Advantage of Nations. Table 1.2 is from Professor Michael Porter’s publication The Competitive Advantage of Nations as acknowledged in the text.

4.5 Additional benefits of decoupling profits from environmental pressures and negative social outcomes. The opening two pages here are based on page 94-95 of Chapter 6 of The Natural Advantage of Nations, which I researched and wrote. These pages were edited by Karlson Hargroves in The Natural Advantage of Nations.

4.7 The Porter Hypothesis, builds upon, significantly updates and expands upon the second half of the journal paper by Professor Bruce Paton, entitled ‘Efficiency Gains Within Firms Under Voluntary Environmental Initiatives.’ Journal of Cleaner Production, vol 9, pp167-178

Statement of Use of PhD Material in Forthcoming Co-Authored Publications

At this time of submission, one other co-authored book manuscript had been completed and is with the publisher, Earthscan Publishing. That book is Whole System Design: An Integrated Approach to Sustainable Engineering of which I am second author. Research and ideas from Chapter 5 under the subheading “5.3.6 Advanced Strategies for Decoupling – Whole System Approaches to Sustainable Design” on pages 243-251 are used in Chapters 1 and 2 of the Whole System Design publication. I am the lead researcher and lead author of these two chapters for the Whole System Design publication. The integration of the 10 elements of whole system design as proposed by Appendix 5.1 of this thesis has also been used prominently in this forthcoming publication. This book is also significantly based on my TNEP colleague Peter Stasinopoulos’s University of South Australian Master’s thesis entitled Elaborated Whole System Approach to Achieve More Environmentally Sustainable Engineered Systems. He is lead author of this new publication Whole System Design. Peter’s thesis provides further evidence that the discussion of whole system design in this thesis is my own work. As Peter Stasinopoulos’s thesis states, my PhD thesis here is the source of the idea and rationale for integrating the 10 elements of whole system design (See Appendix 5.1 of this thesis) which are used, with acknowledgement, in Peter’s Masters thesis. In addition, chapter 7 of this thesis, entitled “Decoupling Economic Growth from Greenhouse Gas Emissions to Achieve Environmental Sustainability”, provided a significant percentage of the research, references, and argument for The Natural Edge Project’s 2008 submission to the Garnaut Review, of which I am lead author. Finally, this thesis, its research and core arguments will be used to significantly inform and assist the development of a new co-authored publication, of which I will be lead author, Cents and Sustainability, which will focus on the topic of decoupling of economic growth from environmental pressures. As such this book’s arguments and evidence will be significantly informed by the research, source documents, arguments and evidence presented in this thesis.

Unless otherwise attributed or referenced, I hereby declare that all the work contained in this dissertation is substantively my own.
Thesis Topic: Advancing and Resolving the Great Sustainability Debates and Discourses

Introduction: Succinct Outline of Thesis

It is still contested whether or not current forms of development are sustainable or not, so Chapter 1 first addresses this key question by reviewing recent empirical scientific results and evidence. Hence, Chapter 1 discusses the results of major scientific studies such as the UN Millennium Ecosystem Assessment and the IPCC assessments to understand whether or not current development pathways are environmentally sustainable. Through a discussion of the latest science, Chapter 1 will show that there is mounting scientific evidence that the current paths of development are environmentally unsustainable and that this threatens social sustainability and the prospects for long term global economic prosperity. Chapter 1 also demonstrates that, according to the latest science, humanity has a small window of a few decades within which to reduce environmental pressures adequately to avoid dangerous climate change and other ecosystem tipping points. Chapter 1 shows that over the next 30 years experts warn that development and policy choices will largely determine whether humanity sees

a) the sixth mass extinction of species⁴

b) the positive climate change feedback loops unleashed, leading to runaway dangerous climate change which will hurt the most vulnerable on the planet⁵

c) the significant spreading of diseases such as AIDS and vector borne diseases from global warming⁶

d) increased intensity and vulnerability to natural disasters⁷

e) loss of soil fertility globally⁸

f) ecosystems pushed past the threshold point of irreversible decline⁹

g) the peaking of world oil production leading to high oil, food and chemical prices¹⁰

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⁷ UN Millennium Ecosystem Assessment, (2005) Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC

⁸ Ibid.

Thus, this thesis argues, it behoves us to learn from the past, to understand what has historically prevented progress on a transition to sustainable development especially now that, according to the latest science, such a transition is urgently needed. Global recognition of these concerns and debates about whether development is environmentally and socially sustainable are not new. Likewise for some time now respected institutions have supported the call for a transition to sustainable development especially since the publication of The Brundtland Commission’s *Our Common Future*\(^\text{11}\) in 1987. This thesis is a response to The Brundtland Commission’s *Our Common Future*,\(^\text{12}\) which was the first publication to significantly mainstream and move forward sustainability debates and generate a remarkable level of consensus and support for the pursuit of sustainable development. Following the 20th anniversary of *Our Common Future* in 2007, it is timely to review what have been the lessons from the last twenty years of efforts to move forward the sustainability debates about whether or not development is sustainable and debates about how best to achieve sustainable development. An historical perspective is useful, this thesis argues, to help identify patterns to the sustainability debates and to identify what “elements” or “key factors” enabled the sustainability debates to progress, stall or even go backwards.

This thesis, in Chapter 2, first briefly covers the key conclusions from Tainter’s and Jared Diamond’s\(^\text{13}\) histories of past civilisations which highlight both the old nature of these issues and debates but also point to long term historical patterns and “elements” or “factors” which determine whether or not sustainability debates progress or not. Chapters 2 and 3 then highlight that many aspects of these patterns have repeated themselves within the sustainability debates over the last 100 years. Chapter 2 brings together and integrates for the first time a wide range of evidence to show that by 1908 humanity possessed a far greater knowledge of the major threats to the sustainability of development than has been previously understood. Chapter 2 is a novel contribution to the history of sustainability debates in that it highlights that by 1908 many of these debates about the sustainability of development had begun. As shown in Table 2.1 in Chapter 2 already by 1908 the risks of over fishing (1865), pushing beyond ecological thresholds (1864), dry land salinity (1864), soil degradation (B.C), deforestation (~300 B.C), materials like asbestos (1898), chemicals such as PCB’s (1899), benzene (1897), and radiation (1896) were known and whether action should be taken was being debated. With this one hundred year historical perspective, Chapter 3 then looks at some of the patterns of the last one hundred years of how these debates have evolved. Chapter 3 asks what patterns have emerged in the sustainability debates? Chapter 3 finds that often over the last one hundred years, when new


\(^{12}\) Ibid.

social or environmental programs or higher standards were proposed to address such issues, vested interests and often economists/experts (often hired by these vested interests) have opposed such change. This aligns well with Jared Diamond’s\(^\text{14}\) conclusions looking at more ancient civilizations. Jared Diamond found that whether or not the vested interests – the elite wealthy ruling class – of a particular civilization was directly effected by environmental threats was critical as to whether or not that civilization was able to adapt and respond early enough to avert ecological disaster and the collapse of the civilization.

Chapter 3 shows that, whilst the nature of vested interests has changed, since ancient times, with the rise of market capitalism and the corporation, many of the overall patterns, identified by Jared Diamond, have continued in the sustainability debates of the last 100 years. Chapter 3 shows that, just as with ancient civilizations, vested interests have been a major barrier to progress being made to achieve sustainable development in modern times as well. Chapter 3 shows that, in modern times, vested interests have used sophisticated justifications and played on ordinary people’s fears to fight proposed changes to achieve a transition to sustainable development. Often vested interests have argued that specific efforts to enable development to be more sustainable would lead to at least one or more of the following:

a) add significantly to costs and thereby harm business competitiveness
b) lead to loss of jobs
c) force their business/corporation to relocate the respective business to developing countries where regulatory costs are less\(^\text{15}\).
d) lead to loss of economic growth and even an economic recession.

This thesis addresses whether or not such claims are true. This thesis addresses issues around whether there is an inevitable trade off between sustainable development and jobs, business competitiveness and economic growth in Chapters 3-8. This thesis can also be seen as a response to Gro Brundtland’s call in the Forward to *Our Common Future*\(^\text{16}\) when she stated that ‘What is needed now is a new era of economic growth-growth that is forceful and at the same time socially and environmentally sustainable’. Following the 20th anniversary of *Our Common Future* in 2007 it seems timely to re-examine this question. This thesis aims to present a comprehensive synthesis to address this question. Whilst some scholars have addressed aspects of this question we lack an integrated view of how both a socially and environmentally sustainable form of economic growth could be achieved. To date no study exists like this which is investigating potential correlations between both social and environmental sustainability goals and economic growth.

\(^{14}\) Ibid.


The thesis also focuses on the “growth” debates and discourses because the issue of whether or not economic growth and sustainable development can be compatible goes to the heart of the differences between the key environmental discourses as shown by Dryzek in his 1997 publication *The Politics of the Earth: Environmental Discourses*. This question also goes to the heart of ecological modernisation. As Dryzek stated “Much of its (ecological modernisation’s) appeal lies in its promise that “we can have it all: economic growth, environmental conservation, social justice”\(^\text{17}\). This thesis examines in Chapters 5-8 whether we can indeed “have it all” as described by Dryzek. The “growth” debates also go to the heart over discussions over whether or not it is possible to achieve “green growth”? This thesis seeks to make a significant contribution to that discussion.\(^\text{18}\)

No one thesis can cover in detail all the nuances of the history of all of the specific great social, economic and environmental debates. But there are common themes across many of these debates. Thus, it is possible to derive patterns and lessons that are relevant to almost all of these specific debates. One of the underlying issues that is reflected in so many sustainability debates is the question of whether it is possible to achieve better social, economic and environmental outcomes, the triple bottom line, with no major trade-offs? Those that believe it is possible to achieve better triple bottom line outcomes with no major trade-offs tend to argue for sustainable development in these debates, whilst those who believe that major trade-offs are inevitable tend to argue against sustainable development. By addressing the underlying assumptions behind specific debates such as whether or not trade-offs are inevitable, this thesis seeks to create a general resource that can assist anyone concerned with these issues.

This thesis also recognizes that rational discussion about the economic and business competitiveness impacts of a transition to sustainable development is not going to be sufficient to address the barriers to progress because of vested interests and blocking coalitions. This thesis makes clear that a rationale discussion and resolution of these sustainability debates on its own will not be sufficient to result in a rapid transition to sustainable development. Whilst achieving sustainable development is in the common interest of the vast majority of citizens, it runs against the vested interests of powerful organizations, corporations and political parties. Such changes cannot be achieved simply by convincing government decision makers or the vested interests themselves alone by rational argument. Change to achieve sustainable development is helped by either

- a) the creation of a new vested interest that is as powerful in terms of political donations, influence in the media and contributions to the economy as the old vested interests or

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b) through the more diffuse kind of power exercised by a mass movement of progressive organisations and citizens.\(^\text{19}\)

Such a mass movement would include sympathetic pro environment businesses, professional organisations, trade unions, churches and environmental and social justice non-government organisations (NGOs). If the vast array of groups and individuals, making up such a movement can agree on common principles, goals and strategies, the movement can be almost irresistible to any government that wishes to stay in office and to any opposition party wishing to achieve office. This thesis argues that there is a need for new institutions, new campaign strategies and new anti-blocking coalition style “think tanks” that are networked with progressive industry groups, innovation/R&D and educational institutions. Such new strong anti-blocking coalitions are needed to provide confidence to other progressive business, government and civil society organizations to publicly commit and implement sustainability actions and measures.

To set the scene, these thesis chapters seek to address the following specific issues and questions:

- Chapter 1 sets up the thesis by examining the question of whether or not current forms of development are environmentally and socially sustainable? Chapter one also seeks to outline and clarify the scope of the thesis and define what is sustainable development. Defining sustainable development is not a major focus of this thesis. Hence this thesis defines the range of goals for a sustainable development based on established sets of sustainability principles such as the Earth Charter. The Earth Charter is chosen as a comprehensive list of sustainability goals because of the extensive global process under which it was created and reviewed. Chapter 1, and the accompanying Appendix 1.3, also begin to position the thesis theoretically in the ecological modernisation tradition and begin to address criticisms of ecological modernisation. Subsequent chapters will build on from this.

- Chapter 2 discusses when these sustainability debates began in a novel way by addressing the question: when did humanity have the first chance to define and pursue sustainable development globally? Through asking this question the chapter seeks to show that not only did these debates begin well before Rachel Carson’s *Silent Spring*\(^\text{20}\) but also that these debates have mattered to the course of human history globally for at least one hundred years. Chapter 2 shows through this historical approach that the sustainability debates are not new. This historical perspective enables the thesis to look at why many sustainability debates have failed to progress significantly leading to overall insufficient business, government and societal action for change over the last 100 years. The historical perspective enables this thesis to


investigate what factors have held back progress on sustainable development for a considerable time in the following chapter, Chapter 3.

- Chapter 3 addresses the question: why has there been so little progress on the sustainability debates and what have been the major barriers to sustainable development over the last 100 years? Chapter 3 asks what lessons can we learn to help progress the sustainability debates today.

- Chapter 4 addresses the question: are significant trade-offs between business competitiveness and corporate social and environmental responsibility inevitable or not? Chapter 4 addresses the question: are significant trade-offs inevitable or not at the micro-economic level? Many studies now show that there are several key microeconomic assumptions that determine whether macroeconomic modelling predicts that achieving ecological and social sustainability helps or harms economic growth. One of the key assumptions relates to micro-economics and businesses. Simply put, if you assume that there are significant eco-efficiency and resource productivity opportunities still available for many industries then this makes it possible to reduce environmental pressures while making a profit. But what if business has already found all the cost effective eco-efficient savings, then any eco-tax or further requirement on business to achieve eco-efficiency gains will inevitably lead to higher costs to business and the economy. Debates about these issues at the microeconomic business level therefore have important macroeconomic implications for the “growth” debates. Therefore these questions are addressed in detail in Chapter 4 of this thesis. The results from Chapter 4 are important therefore for the “growth” debate discussions in Chapters 5-8.

- Chapter 5 addresses the question: is it possible for there to be a form of economic growth that is socially and environmentally sustainable, and if so, under what conditions? Chapter 5 starts the main focus of this thesis namely whether or not it is possible to achieve better economic, social and environmental outcomes at a national, macro-economic level. This builds on from the results from the microeconomic level of Chapter 4. This thesis argues that the current unsustainable nature of economic growth is a symptom of more fundamental causes of unsustainability. This thesis argues that current economic growth is unsustainable due to market, informational and institutional failures, rebound effects, a failure of sustainable design to be adopted by the majority of mainstream designers (engineers, architects, industrial designers), rising global population, a rapid expansion of unsustainable western consumption patterns globally plus lack of global co-operation. This thesis argues that, only by recognising this and focusing on the necessary sustainability design, policy and institutional changes to address these barriers to sustainability can the current unsustainable forms of development be turned around to become sustainable. Once it is understood that economic growth per se is not the problem then this helps to clarify what society needs to focus on to achieve the goal of
sustainable development. Chapter 5 starts to bring together literature which demonstrates that there is significant potential to decouple economic growth from physical throughput and environmental pressures through eco-efficiencies, eco-innovation, sustainable consumption and policy and institutional change. Chapter 5 shows that decoupling can be a useful part of broader strategy to achieve sustainable development as long as rebound effects are minimised through effective policy.

- Chapter 6 investigates the relationship and correlations between the social justice goals of the Earth Charter and economic growth. Chapter 6 shows that whilst some social sustainability goals, like sustainable consumption, will negatively affect economic growth, many of the other Earth Charter goals – such as stabilising population growth, reducing corruption, building social capital, reducing inequality, enhancing gender equality, investing in education and health - show a positive correlation with economic growth. However, in achieving the social justice goals of the Earth Charter and eliminating poverty this will create an additional 2-3 billion people aspiring to consume just as much as is currently consumed unsustainably in OECD countries. As Chapter 1 will show, it is physically impossible for all developing nations to achieve Western material living standards with previous modes of development, as the global ‘ecological footprint’ (the equivalent land and water area required to produce a given population’s material standard, including resources appropriated from other places) is already greater than the carrying capacity of our planet.\(^\text{21}\)

- So Chapter 7 investigates environmental pressures from rising greenhouse gas emissions and discusses potential costs of inaction versus action of making the necessary investments to decouple economic growth from greenhouse gas emissions on a global scale. Chapter 7 also investigates strategies to reduce the costs of action and in Appendix 7.3 policies to underpin a decoupling of economic growth from greenhouse gas emissions are outlined. Chapter 7 concludes by overviewing recent positive developments to build a global movement amongst business, governments, churches, the union movement and civil society campaigning for action on climate change.

- Chapter 8 looks at the other main sources of environmental pressure and investigates the costs of inaction versus action of decoupling economic growth from these additional environmental pressures. The environmental pressures investigated in this chapter have not been chosen randomly. Rather they reflect the main areas chosen by the OECD for their frameworks on decoupling economic growth from environmental pressures.

In Chapter 9 the results of Chapters 5-8 are combined to address the main hypothesis of the thesis is it possible to “have it all” – environmental sustainability, social justice and economic growth and prosperity? The results of Chapters 5-8 seek to answer the question therefore of whether it is possible to achieve sustainable development at the macroeconomic level. This thesis does this deliberately to compliment books such as *Natural Capitalism*\(^\text{22}\) and *Factor Four*\(^\text{23}\) which have already shown that it is possible to achieve sustainable development at the micro-economic level of business. Chapter 9 also concludes the thesis by synthesising ten key steps that would, if applied, help to move the great sustainability debates forward and create conditions under which strong ecological modernisation would be more likely to occur. Chapter 9 also calls for the prioritisation of education for sustainable development to help create the conditions for ecological modernisation globally.

Whilst Chapter 9 discusses this in more detail there is an important understanding that comes from this discussion that relates to the discussion of debates in this thesis. Hence it is important to note it now so that the discussion of the debates which follows can be seen with this additional context and understanding. The key insight is that many of these debates around whether it is possible to achieve sustainability and greater business competitiveness or higher economic growth are subject to a key condition. That condition is that those people in decision making positions in business and government are good at finding triple bottom solutions that improve social, economic and environmental outcomes simultaneously without any major trade offs. This thesis’s research in Chapters 4-9 shows that there is an overwhelming case that triple bottom line solutions are possible at the microeconomic and macroeconomic levels. But whether business and government and society fulfil this potential and realise these triple bottom line possibilities is another matter. This is because whether a company or a government achieves sustainable development depends on how well a company or a government implements these sustainable development principles and ideas in practice. How well a company or a government implements a sustainability strategy depends on the decisions, technical choices or detailed policy decisions made by many people in that company or government over many years. If a company or government does not identify carefully win-win-win opportunities and instead implements sustainable development poorly they can incur significant economic costs. Clearly that is not sustainable. How well people make decisions in this area depends on many factors including their knowledge and experience on developing strategies, processes and solutions for sustainable development. When it comes to implementing sustainable development for companies or government the devil is in the detail. Detailed insights are needed by decision makers in companies or government to achieve real eco-


innovation or effective policy choices respectively. Whether decision makers in business and government make wise choices depends critically on whether they have had a good education in sustainable development. Education and professional development for sustainable development to help business and government decision makers make wise choices regarding the implementation of their sustainability strategies is critical to whether sustainable development is implemented well or not. This was acknowledged recently by a CSIRO report on the issue of climate change. A CSIRO report predicts a carbon emissions trading scheme will require three million workers to be trained or re-skilled by 2015.24 The report says without retraining the workforce with the necessary skills they need to help achieve a low carbon economy there is little chance the Government will meet its target of reducing greenhouse gas emissions by 60 per cent by 2050.25 Society currently require years of training for all specialists before they are expected to be world class at their profession. Yet currently there are few courses training the next generation in how to be world class at sustainable development at the tertiary level. Addressing this gap is a central focus of my research and publications to date (see Appendix 1.1) For eight years I have researched and co-authored a range of publications and educational programs freely available online designed to assist both formal professional development and adult self-directed learning in education and training for sustainable development. These will be discussed further in the concluding chapter, chapter 9.

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25 Ibid.
Chapter 1: Setting the Context

Even a cursory overview of human history will conclude that the last few centuries have witnessed remarkable change. The first industrial revolution has enabled significant change to occur. During the industrial revolution, much of the world, in large measure, shifted from local agrarian economies to an increasingly urbanised, globalised, industrial and service economy with international financial capital flows worth trillions of dollars daily. During the first industrial revolution, innovations in new technologies spurred and made possible still greater economic growth. Throughout the first industrial revolution, the economy faced factors limiting development and economic growth. In the past, economic development has periodically faced one or more limiting factors, such as skilled people, energy resources and financial capital. At such times, industrial nations sought to optimise the productivity and increase the supply of the limiting factor. Technological innovation enabled labour productivity to increase over one hundred fold in just three hundred years. A lack of financial capital was addressed by the formation of central banks, credit, stock exchanges and currency exchange mechanisms. A lack of cheap energy was overcome with the discovery of oil and coal. Governments and business working together have created remarkable material prosperity and economic growth for many living today. (See Figure 1.1)

Figure 1.1 Economic Growth in Western Economies (Source, Cosier, P26, 2006)

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Considering the last 30 years, according to the OECD,

“Life expectancy has risen by more than 20 years, infant mortality rates have been halved and primary school enrolment rates have doubled. Food production and consumption have increased around 20 per cent faster than population growth. Improvements in income levels, health and educational attainment have sometimes closed the gap with industrialised countries. Advances have been made in the spread of democratic, participatory governance, and there have been forward leaps in technology and communication. New means of communication support opportunities for mutual learning about sustainable development processes and for joint action over global challenges.”

1.1 What are the Current and Future Limiting Factors on Economic Prosperity?

Whilst these successes are significant, today many experts argue that there are new limiting factors on economic growth and prosperity.\(^27\) As the World Bank outlined in 2003,

“The next 50 years could see a fourfold increase in the size of the global economy and significant reductions in poverty but only if governments act now to avert a growing risk of severe damage to the environment and profound social unrest. Without better policies and institutions, social and environmental strains may derail development progress, leading to higher poverty levels and a decline in the quality of life for everybody. Some problems of sustainability are already urgent and require immediate action; another category of issues unfolds over a longer time horizon. These problems may not be urgent, but the direction of change is unmistakable. For these it is essential to get ahead of the curve and prevent a worsening crisis before it becomes too costly. Biodiversity loss and climate change are in this category. What is clear is that almost all of the challenges of sustainable development require that action be initiated in the near term.”\(^28\)

This thesis will show that the majority of the world’s scientists, The World Bank\(^29\), the OECD\(^30\), the UK Stern Review\(^31\)’s, and many Nobel Prize winning economists argue that these negative trends present new and significant pressing constraints on future economic prosperity and pose a risk to the well being of future generations. This thesis will investigate whether there are material grounds for their concerns\(^32\)

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\(^{29}\) Ibid.


\(^{31}\) Stern, N et al. (2006) *The Stern Review: The Economics of Climate Change*, Cambridge University Press, Cambridge. Available at [www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview.index.cfm](http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview.index.cfm) Accessed 14 April 2007

Whether or not development is environmentally sustainable is contested by some economists who claim that, just as earlier generations invested in capital goods, research and education to bequeath to current generations the ability to achieve high levels of consumption, current generations are making the investments that are necessary to assure higher real living standards in the future, despite stresses on the natural resource base. Indeed, historical trends in the prices of marketed natural resources and the recorded growth in conventional indices of economic progress in currently rich countries suggest resource scarcities have not bitten as yet. Since whether or not current development paths are ecologically and socially sustainable indefinitely is still a contested and debated proposition, firstly, we need to investigate the empirical data to address this debate in detail.

The OECD in 2002 suggested that the following negative trends represented unsustainable aspects of current economic development:

“Economic disparity and poverty, population growth, the impact of diseases such as HIV-AIDS and malaria, over-consumption of resources in the industrialised countries, contributing to climate change, and environmental deterioration and pollution of many kinds, including the impacts of intensive farming, depletion of natural resources and loss of forests, other habitats and biodiversity.”

Hence we next consider each of these in detail plus a number of other issues to consider whether or not current development pathways are indefinitely sustainable or if they do indeed risk compromising the quality of life and economic possibilities of future generations? It is important to clarify a key point before considering the evidence of whether or not current development pathways are sustainable. Much of the following evidence outlined in this chapter references studies which investigate scenarios and trends in resource and energy use. These trends are often assumed to be linear. Such assumptions tend to be made to enable modeling to be done. Ideally, it would be better to be able to describe future trends with dynamical models to both show the potential for non-linear effects and how variables in the model interact in a dynamical fashion. However, such a dynamical study is beyond the scope of this present inquiry.

In the following we consider whether or not key resources such as oil and water are being used sustainability and whether or not ecosystem sources and sinks can cope with rising levels of different types of pollution such as greenhouse gases and nitrogen from fertilisers.

1.1.1 The Threat of Peak Oil to Economic Growth and Global Security

There is concern from many experts (See Table 1.1) that the 2006-2008 high oil price is a sign of the possibility of world oil production peaking soon or at least in the coming decades. An increasing number of industry and academic experts are concerned that the age of cheap oil may be over. Why is this the case? Peaking of oil refers to the point when production in any oil well, field or region begins to decline. Typically, this point is reached when between one-third and one-half of the oil in a reserve has been extracted. The decline is the inevitable result of the loss of pressure in the oil reserve and despite the advanced drilling and extraction techniques now in use, it is irreversible once passed. Once world oil production hits the peak then prices of oil are likely to remain high and increase.

The price of oil has and will have a significant effect on short and long term prosperity. Alan Greenspan has pointed out that “All economic downturns in the US since 1973 have been preceded by sharp increases in the price of oil.”37 There is concern that a peaking of world oil production has already arrived and that, unless significant changes are made, will have negative economic effects. Oil production has already peaked in over 60 countries around the world. A number of CEO’s of major oil companies and a number of experts argue that world oil production is peaking now. (See Table 1.1)

<table>
<thead>
<tr>
<th>Prediction of World Oil Production Peak</th>
<th>Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006-2007</td>
<td>Bakhtari, A.M.S. Oil Executive38 (Iran)</td>
</tr>
<tr>
<td>2006-2007</td>
<td>Simmons, M.R. Investment banker39 (US)</td>
</tr>
<tr>
<td>2006-2008</td>
<td>Newman, P. Professor, Murdoch University.</td>
</tr>
<tr>
<td>2007-2008</td>
<td>ConocoPhillips (COP) Chief Executive James Mulva</td>
</tr>
<tr>
<td>2007-2008</td>
<td>CEO of Total, the French oil company, Mr de Margerie</td>
</tr>
<tr>
<td>2008-2015</td>
<td>CEO of General Motors, Rick Wagoner.40</td>
</tr>
<tr>
<td>2008-2015</td>
<td>CEO of Shell Major oil company (UK), Jeroen van der Veer41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008-2015</td>
<td>International Energy Agency (IEA) (^{42})</td>
</tr>
<tr>
<td>After 2007</td>
<td>Skrebowski, C. Petroleum journal editor (^{44}) (UK)</td>
</tr>
<tr>
<td>Before 2009</td>
<td>Deffeyes, K.S. Oil company geologist (^{44}) (retired., US)</td>
</tr>
<tr>
<td>Before 2010</td>
<td>Goodstein, D. Vice Provost, Cal Tech (^{45}) (US)</td>
</tr>
<tr>
<td>Around 2010</td>
<td>Campbell, C.J. Oil geologist (^{46}) (retired., Ireland)</td>
</tr>
<tr>
<td>After 2010</td>
<td>World Energy Council(^{47}) World Non-Government Org</td>
</tr>
<tr>
<td>2012</td>
<td>Pang Xiongqi(^{48}) Petroleum Executive (China)</td>
</tr>
<tr>
<td>2012</td>
<td>Laherrere, J(^{49}) Oil geologist (retired., France)</td>
</tr>
<tr>
<td>2013</td>
<td>Queensland Government Oil Vulnerability Taskforce</td>
</tr>
<tr>
<td>2020</td>
<td>Thierry Desmarest, former CEO Total (France’s main oil company)</td>
</tr>
<tr>
<td>After 2020</td>
<td>CERA Energy consultants(^{50}) (US)</td>
</tr>
<tr>
<td>Between 2020</td>
<td>US Energy Information Administration</td>
</tr>
<tr>
<td>2025 or later</td>
<td>Shell Major oil company (UK)</td>
</tr>
</tbody>
</table>

Adapted and Updated from Source: Hirsch, R.L. (2005)\(^{51}\)


“I can tell you that we, in the next seven to eight years, need to bring about 37.5 million barrels per day of oil into the markets, for two reasons. One, the increase in the demand, about one third of it, and two thirds, there is a decline in the existing fields [and there is a need] to compensate for the decline. What

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we expect [to be put in production] is 25 million barrels per day, and this is in the case of no slippages, no delays in the projects, and everything goes on time, which is very rare. So, there is a gap of 13.5 [sic] million barrels per day”.

The main reasons an increasing number of experts now argue that world oil production will peak sooner than later are:

- Demand for oil is forecast to keep growing rapidly as China and Indian economies grow rapidly. As the Australian Senate Inquiry into Australia’s reported

“The US Energy Information Administration in 2000 estimated a peak between 2020 and 2050 depending on assumptions about demand growth and the size of the ultimately recoverable resource. The US Energy Information Administration study found that widely differing estimates of the ultimately recoverable resource (URR) make surprisingly little difference to the timing of the peak. The exponential growth of demand is the dominating factor.”

- There are few, if any, large oil fields left to find. The last year that more oil was discovered than was consumed was 25 years ago. The last time a big oil field was discovered was in the 1970s. The peak of oil discovery was in 1965. The Australian Senate commented that

“New field oil discoveries have declined greatly since the 1960s. US Geological Survey estimates of future discoveries (which forecast increases), to be realised, would require a drastic turnaround of this declining trend. Peak oil commentators argue that the declining trend of oil discovery reflects geological fundamentals and should be expected to continue.”

- There is not a lot of oil in storage relative to oil demand. Modern economies work on just-in-time delivery. After the world’s first OPEC oil crisis in 1972, the International Energy Agency was set up. Member nations of the IEA agreed to all ensure that they maintain 90 day stockpiles of oil supplies. Australia is the only member of the IEA who does not do this. Peak oil commentators argue that estimates of remaining reserves are unreliable and most probably overstated, especially in the Middle East. In some OPEC countries, it is believed that reserve estimates were artificially inflated in the 1980s to maximise production under the OPEC quota arrangements in place at that time – the so-called “paper barrels”. National oil reserves estimates in the Middle East are not subject to the audit and disclosure requirements of publicly-listed international oil companies. Thus there may be considerably less conventional oil than previously anticipated.

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53 Ibid.

54 Ibid.
- Forty nine of the sixty five oil producing nations have already passed their peak oil production
topping point and are in decline. Sixty out of sixty five have passed their discovery topping
point. The world biggest oil fields were discovered more than fifty years ago.

- Oil reserves are finite.

Higher oil prices are also negatively affecting the poor and poorer nations who also depend on oil and
petroleum by-products like kerosene for lighting. Currently the global market for kerosene for
lighting is worth ~$(US)$40 Billion. This is a significant percentage of the weekly expenditure of the
world’s poor. Higher oil prices usually correlate with higher kerosene prices for the poor.

1.1.2 Risks of Dangerous Climate Change

The remarkable economic growth of the last few hundred years has been assisted by cheap and
plentiful energy supplies significantly based on the burning of fossil fuels. The International Panel on
Climate Change (IPCC), building on from the work of many scientists like Hansen et al, declared in
2007 that the debate over whether or not climate change is human induced (from the burning of fossil
fuels) is over. Thanks to the IPCC process, to avoid dangerous climate change, there is now broad
international consensus that global warming needs to be kept to no more than 2 degrees Celsius above
pre-industrial levels. A 2 degree rise will not be easy to avoid. So far global temperatures have gone
up 0.8 degrees Celsius. There is another 0.6 degree Celsius of global warming already in the pipeline.
The IPCC argues that to avoid dangerous climate change global emissions need to start to decline no
later than 2012-13 and that by 2020 global cuts of 25-40 per cent are needed. By 2050, at least 80 per
cent cuts are needed.

The Stern Review, published in 2007, demonstrates that rising greenhouse gas emissions and the
climate change, which is caused by the burning of such fuels, now threaten the very economic growth
which they have helped to foster. The Stern Review states that

“We estimate the total cost of business as usual climate change to equate to an average reduction in global
per capita consumption of 5 per cent at a minimum now and for ever.”

The Stern Review describes how the cost would increase were the model to take into account direct
impacts on the environmental and human health, the effects of positive feedbacks and the
disproportionate burden of climate change on the poor and vulnerable globally. Taking these three

http://www.sciencemag.org/cgi/content/summary/308/5726/1263 Accessed 8.01.08

doi:10.1126/science.1110252

http://ipccwgl.ucar.edu/wgl/wgl1-report.html Accessed 8.01.08

Available at www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm
Accessed 14 April 2007

59 Ibid.
factors into account takes the cost of climate change up to as much as 20 per cent of global GDP. The Stern Review predicts that, if fast and dramatic action is not taken on climate change, then climate change could cause an economic recession to rival the great economic recession of the 1930s.

As the Stern Review argues, if humanity fails to rapidly mitigate climate change, climate change will increase more rapidly due to positive feedback effects. Respected scientists like NASA’s James Hansen argue that if rapid mitigation does not occur these “tipping points”, once unleashed, will cause global catastrophe. Such tipping points occur when positive feedbacks from existing global warming lead to a jump in global average temperatures without any additional anthropogenic greenhouse gas emissions. A number of these positive feedbacks are now already occurring at a faster rate than scientists had previously predicted increasing the risks of dangerous climate change. These include:

- **The weakening of the natural ocean carbon sinks.** From the mid-1990s to 2005, measurements taken of the North Atlantic found that the amount of CO₂ in the water had reduced by half. It has been suggested that the quantity of CO₂ being carried down into the deep ocean was being reduced by the warmer surface water. Further, as reported in a recent study of the Southern Ocean, there are signs that there has been an additional relative weakening of oceanic sinks as result of changes in other atmospheric factors (wind, surface air temperatures and water fluxes).

- **The weakening of the natural land carbon sinks.** As a result of human activity and higher temperatures, it is expected that there will be a decrease in the capacity of the earth's carbon sinks. The slow increase over time of the fraction of total anthropogenic CO₂ emissions remaining in the atmosphere implies a slight weakening of carbon sinks relative to emissions. New research released in October 2007 confirmed that significant contributions to the growth of atmospheric CO₂ arise from the slow-down of natural sinks, “a decrease in the planet’s ability to absorb carbon emissions due to human activity.” According to lead author and Executive Director of the Global Carbon Project, CSIRO’s Dr Pep Canadell. “Fifty years ago, for every tonne of CO₂ emitted, 600kg

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61. Ibid.


68. Raupach, M., et al. (2007) "Global and regional drivers of accelerating CO₂ emissions", PNAS, Available at [http://www.pnas.org/cgi/content/abstract/0700609104v1](http://www.pnas.org/cgi/content/abstract/0700609104v1) Accessed 8.01.08
were removed by land and ocean sinks. However, in 2006, only 550kg were removed per tonne and that amount is falling\textsuperscript{69}

- The release of methane\textsuperscript{70} from peat deposits, wetlands and thawing permafrost\textsuperscript{71}. Siberia’s thawing wetlands have been identified in a recent study as a significant, so far underestimated, source of atmospheric methane. The lakes in the region have been growing in number and size. Emission rates appear to be higher than previous estimates. The melting of permafrost is now another "slow" positive, feedback in climate warming.\textsuperscript{72}

- The melting of reflective sea ice which is replaced by dark heat absorbing water. The Arctic Sea Ice melt of 2007 lead to a 20 per cent reduction in the volume of sea ice. Previous years artic ice melts had only involved a loss of sea ice of 2-3 per cent. Some scientists now warn that the Arctic’s floating sea ice is headed towards a complete summer disintegration by as early as 2013, a century ahead of what the IPCC was recently predicting. The rapid loss of Artic sea ice will speed up the disintegration of the Greenland Ice Sheet\textsuperscript{73}, meaning that a rise in sea levels by even as much as 1.4 metres is now possible by the end of this century.\textsuperscript{74}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure12.png}
\caption{Actual Arctic Summer Sea Ice Loss Compared to IPCC Predictions.}
\end{figure}


\textsuperscript{72} Ibid.


The prognosis is serious indeed. As the Stern Review states, “it is the countries with the fewest resources which are most likely to bear the greatest burden of climate change in terms of loss of life, adverse effect on income and growth and damage to living standards generally. Developing countries – and especially the low-income countries in tropical and sub-tropical regions – are expected to suffer most, and soonest, from climate change. Their poverty reduces their capacity to adapt. Millions potentially will be pushed deeper into poverty.”

1.1.3 Climate Change and Reductions in Water Availability

Climate change threatens to significantly reduce water availability and lead to greater frequency of droughts in many countries. This will threaten agricultural production and subsistence farming upon which a significant percentage of the world’s population still depends. Already one third of the world’s population lives in countries that are experiencing moderate to high levels of water shortage. According to the OECD that number could rise to two thirds within 30 years unless serious efforts are made to conserve and use water more efficiently.

Figure 1.3 shows that climate change is leading to a significant loss of glaciers and snow in the Asian High Mountains, North West USA and South West California. Figure 1.3 shows to what extent the glaciers of the Himalayas are already melting. And at the same time global demand for water continues to rise in most regions of the world.

Changes in precipitation and, subsequently water availability and run off into rivers, are particularly critical factors affecting the future farming productivity of the landscape. Already significant change in the climate and water availability is occurring around the world and in Australia. For instance, the Australian Bureau of Meteorology’s September 2007 Drought Statement stated that, ‘This is the first

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time in the record dating from 1900 that an El Niño-drought in the MDB has not been followed by at least one three-month period with above normal rainfall (basin average) by the end of the following winter." Former Prime Minister John Howard\textsuperscript{81} announced on 19 April 2007 that unless there was substantial rain soon no water will be allocated to irrigators in the Murray-Darling basin for the coming year.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{glaciers_loss.png}
\caption{Loss of glaciers and snow in the Asian High Mountains, NW USA and South West California. (Source: Pachauri, R.K, 2007\textsuperscript{82})}
\end{figure}

Currently most farmers in the Murray Darling Basin of Australia are on less than 20 percent of their normal water allocations. The result is directly affecting the 50,000 farmers of the Murray Darling Basin and the economy with the price of food in Australia rising. Already farmers in the Murray Darling Basin are pruning and cutting down significant parts of their orchards to try to survive the drought. Food production is down dramatically in water affected sectors such as cotton, wine and dairy. The Australian government estimates the current drought in Australia shaved 0.75 points from Australia's economic growth in 2006. This drought, the worst ever in Australia’s history, is being made worse by the higher average temperatures due to climate change that further dry out the land.\textsuperscript{83}


\textsuperscript{82} Ibid.

Lack of water availability also has implications for the sustainability of cities and towns. According to the OECD

“Some 30-60 per cent of the urban population in low-income countries still lack adequate housing with sanitary facilities, drainage systems and piping for clean water. Continuing urbanisation and industrialisation, combine with a lack of resources and expertise, and weak governance, is increasing the severity of environmental and social problems, which reinforce one another in densely populated areas. Air-pollution, poor solid-waste management, hazardous and toxic wastes, noise pollution and water contamination combine to turn these urban areas into environmental crises zones.”

1.1.4 Loss of Diversity

An estimated 40 per cent of the global economy comprises biological processes and biologically derived products. Much of this production is based on the cultivation of an increasingly narrow range of species and genes, with many of these large scale processes in agriculture and forestry dependant on eliminating biodiversity. At the same time there is a growing awareness of the value of biodiversity, both in providing intellectual property to help develop new uses (foods, pharmaceuticals, water and air purification) and in the ecosystem services nature provides to the global economy free of charge. Ecological economists are increasingly identifying the costs to the mainstream economy if ecological thresholds are not avoided as this will lead to a loss of ecosystem services. When one group calculated the value of nature's ecosystem services they found it was worth a combined value of at least US$36 trillion annually. That figure is close to the annual gross world product of approximately US$39 trillion—a striking measure of the value of natural capital to the economy. Ecosystem Services in Australia have been valued by CSIRO at AUD$1327 million per annum.

Whilst there is considerable debate over the rate of extinction, most biologists do not hesitate to say that the earth’s sixth mass extinction is underway. Most species’ extinction occurs in those regions richest in biodiversity such as coral reefs, wetlands and rainforests. Most coral and climate scientists predict that, unless there is dramatic and fast climate change mitigation, most of the world’s coral reefs will be bleached by the end of this century having significant impacts on the biodiversity of oceans. Also the damage to coral reefs would devastate many nations fishing and tourism industries which depend on coral reefs. Wetlands are even more endangered. Only 6 per cent of the world’s surface

86 See CSIRO Ecosystems Project at [www.ecosystemservicesproject.org](http://www.ecosystemservicesproject.org)
88 DOI: 10.1126/science.253.5021.736
is wetlands. About half the wetlands have been lost to dredging, draining and ditching.\textsuperscript{90} Similarly many of the world’s rainforests have already been cleared and new pressures from the demand for land for biofuels and soybeans is driving still more rainforest clearing. The estimated rates of extinction are now 1000 times what they would be without human impact.\textsuperscript{91} Unfortunately human activities tend to try to simplify nature’s ecosystems such as monoculture modern farming methods. Also the intensive nature of farming which utilises significant levels of nitrogen fertilisers puts further environmental pressure on the ecosystems downstream from the farm. According to the OECD current intensive farming methods are not sustainable. The OECD states that

“Intensive agriculture, dependant on high levels of fossil fuel combustion and the widespread cultivation of leguminous crops, is releasing huge quantities of nitrogen to the environment, exacerbating acidification, causing changes in the species composition of ecosystems, raising nitrate levels in freshwater supplies above acceptable limits for human consumption, and causing eutrophication in freshwater and marine habitats.”\textsuperscript{92}

The evidence suggests that ecosystem services are currently being used at unsustainable rates. This point was made strongly by 1700 of the world’s leading scientists in a statement in 1992 entitled “World Scientists Warning to Humanity”, which included the majority of Nobel laureates in the sciences.

“Our massive tampering with the world’s interdependent web of life – coupled with the environmental damage inflicted by deforestation, species loss, and climate change – could trigger effects, including unpredictable collapses of critical biological systems whose interactions and dynamics we only imperfectly understand. Uncertainty over the extent of these effects cannot excuse complacency or delay in facing the threats.”\textsuperscript{93}

At the same time that there is significant loss of biodiversity occurring, cultural diversity is also decreasing. Globalisation is leading to a loss of local indigenous knowledge and culture that could be crucial for helping local communities be resilient to economic, social and environmental changes.

1.1.5 Economic Disparity and Political Instability

Many of these environmental trends discussed so far further increase the vulnerability of the world’s poor. Over the last 30 years globally there has been significant progress on reducing poverty. Economic development in Asia has seen the largest ever number of people move out of poverty over such a short period. At the same time, progress has not been sufficient. According to the respected economic advisory organisation, the OECD in 2002

\begin{flushright}
\textsuperscript{90} Meadows, D. et al (2002) \textit{Limits to Growth: The Thirty Year Update}. Earthscan Publishing
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\begin{flushright}
\textsuperscript{91} Ibid.
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\begin{flushright}
\textsuperscript{92} Ibid.
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“Even in prosperous times, extreme poverty still ravages the lives of one out of every five persons in the developing world... The social ills associated with poverty are on the rise in many countries with high rates of poverty. These include, disease, family breakdown, endemic crime and the use of narcotic drugs.”

Insufficient progress has also been made on reducing global economic inequality. One of the most respected annual reports on economic disparity is the UNDP Human Development Report. Each year it investigates the issue of global development. According to the 1997 UNDP Human Development report, in 1960 the share of global income enjoyed by the wealthiest 20% of the world’s people was thirty times larger than the amount shared by the lowest 20%. It reached sixty one to one by 1991 and seventy-eight to one in 1994. This trend is seen by many experts as unsustainable.

By 2005, the UNDP Human Development Report (HDR) showed that only 9 countries (4% of the world’s population) had reduced the wealth gap between rich and poor, whilst 80% of the world’s population have recorded an increase in wealth inequality. The report stated that ‘the richest 50 individuals in the world have a combined income greater than that of the poorest 416 million. The 2.5 billion people living on less than US$2 a day – 40% of the world’s population – receive only 5% of global income, while 54% of global income goes to the richest 10% of the world’s population.’

Many developing countries are struggling currently under the combined pressures of a heavy external debt burden, violent conflict, AIDS-HIV and malaria epidemics, and a lack of investment. Some experts also argue that these problems are exacerbated by trade protectionism from the North. Many of the citizens of these countries suffer from a lack of access to social services, education, energy and basic water sanitation. At best, some become refugees or economic migrants. As a result of these processes, poor countries and poor people are marginalised from the opportunities presented by global economic growth and development.

The UN’s Report on the World’s Social Situation 2005 ‘The Inequality Predicament’, identifies non-economic aspects of global inequality (such as inequalities in health, education, employment, gender and opportunities for social and political participation), as causing and exacerbating poverty. These institutionalised inequalities result in greater marginalisation within society. The report emphasises the inevitable social disintegration, violence and national and international terrorism that this inequality fosters. There is significant literature showing correlations between inequality, poverty and

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conflict. In particular, the results in Alesina et al\textsuperscript{99} suggest that poor economic conditions increase the probability of political coups. Collier and Hoeffler\textsuperscript{100} show that economic variables are powerful predictors of civil war, while political variables have low explanatory power. Miguel, Satyanath, and Sergenti\textsuperscript{101} show that, for a sample of African countries, negative exogenous shocks in economic growth increase the likelihood of civil conflict. The likelihood of armed conflict correlates strongly with a decline in the UNDP’s human development ranking (See Figure 1.4) As Figure 1.4 illustrates, 5.5 per cent of the countries ranked as High Human Development states by the UN Human Development Index (HDI) 2004 experienced one or more armed conflicts during the ten-year period 1995-2004. This figure rises to 29.1 per cent of those ranked as Medium Human Development states. For Low Human Development states, there was almost as much likelihood (47.2 per cent) that they were at war during the decade as not.


1.1.6 The Impact of Diseases such as HIV-AIDS and Malaria

HIV-AIDS and Malaria are crippling diseases that devastate both the productive capacity and the social fabric of the world’s poorest nations. Approximately 500 million people suffer from acute malaria every year, of whom, one million die.\(^\text{103}\) HIV has had a profound effect on communities around the world often killing those adults upon which the elderly and children depend. Numerous publications\(^\text{104}\) have outlined how

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\(^{102}\) See Ploughshares at [www.ploughshares.ca/imagesarticles/ACR05/3%20Hum.Dev.graph.page.pdf](http://www.ploughshares.ca/imagesarticles/ACR05/3%20Hum.Dev.graph.page.pdf) Accessed 8.01.07


“The AIDS epidemic sweeping Africa is not only killing millions of people and tearing apart families -- it is also crippling economic growth in a continent that is already the world's poorest...cost of treating AIDS patients, the loss of experienced workers to the disease and subsequent restrictions on investment will all hamper economic growth in the decades ahead. That will undercut Africa's efforts to prevent the gap between itself and the rest of the world from getting even wider. Governments will have to spend more of their limited resources on health spending, and ordinary families will have to move money away from food and education to caring for the sick.”

As UNAIDS stated in 2004

“Although prevention is the mainstay of the response to AIDS, fewer than one in five people worldwide have access to HIV prevention services. Comprehensive prevention could avert 29 million of the 45 million new infections projected to occur this decade. Although antiretroviral treatment is bringing hope to millions, without sharply reducing the number of new HIV infections, expanded access to treatment becomes unsustainable.”

1.1.7 Over-Consumption of Resources in the industrialised countries.

The demands of people in high-consumption OECD economies have significantly more environmental impact than poorer countries with low levels of per capita resource consumption. This is significant, from a sustainability point of view, because, if global inequality and poverty is to be addressed, then business as usual economic development is no longer an option because it will be physically impossible for all developing nations to achieve Western material living standards. The global ‘ecological footprint’ (the equivalent land and water area required to produce a given population’s material standard, including resources appropriated from other places) is already greater than the carrying capacity of our planet. Since 1963, for instance, there has been a 2.4-fold increase in the material throughput of the global economy and in 2001, humanity’s ecological footprint exceeded the global bio-capacity by 21%. (Figure 1.5)


Research has shown that the scale of the human economy now overwhelms many of the Earth’s natural material cycles, such as nitrogen\textsuperscript{110}, sulphur\textsuperscript{111}, carbon\textsuperscript{112}, water\textsuperscript{113} and trace metals\textsuperscript{114}. It must follow that it would put extreme pressure on the world’s resources, ecosystems and the environment if the developing countries also based their economies on a similar intensive use of resources using “first industrial revolution” technologies and fossil fuels. Consequently, if the emerging economies of developing countries were also to be based on such intensive use of resources and fossil fuel energy sources, this would put extreme environmental pressure on the world’s resource base and the world’s ecosystems sources and sinks. As the UNEP 2002 Sustainable Consumption Status report stated

“If China were to consume seafood at the per capita rate of Japan, it would need 100 million tonnes, more than today’s total catch. If China’s beef consumption was to match the USA’s per capita consumption and if that beef was produced mainly in feedlot, this would take grain equivalent to the entire US harvest.”

1.1.8 Population Growth

All of these problems are exacerbated by population growth, although it is their resource consumption patterns or people’s localised concentrations that effect ecological and social sustainability more than

\textsuperscript{109} Ibid.


\textsuperscript{111} MacKenzie, J.J. (1997). *Oil as a Finite Resource: When is Global Production Likely to Peak?* World Resources Institute, Washington, D.C.


their mere numbers. World population stands at 6.7 billion and is forecast to rise to 8.9 billion before levelling off. UN Environment Program, in its fourth Global Environmental Outlook, stated that Over the past two decades the world population has increased by almost 34 percent to 6.7 billion from 5 billion; similarly, the financial wealth of the planet has soared by about a third. But the land available to each person on earth had shrunk by 2005 to 2.02 hectares, or 5 acres, from 7.91 hectares in 1900 and was projected to drop to 1.63 hectares for each person by 2050. The result of that population growth combined with unsustainable consumption has resulted in an increasingly stressed planet where natural disasters and environmental degradation endanger millions of humans, as well as plant and animal species. Current demand for resources was close to 22 hectares per person, a figure that would have to be cut to between 15 and 16 hectares per person to stay within existing, sustainable limits.115

1.1.9 Natural Resource Depletion and Loss of Ecosystem Services

When different environmental pressures on the world’s ecosystems from different sources – unsustainable consumption, population growth, climate change, water shortages, pollution, eutrophication, loss of biodiversity - combine they have a compound effect on each other.116 The impacts of the greenhouse effect alone may be significantly mitigated, but when these are combined with deforestation and biodiversity loss, the conversion of vast land mass to freshwater intensive modern agriculture, increasing urban waste streams, then the stress on our remaining natural ecosystems can no longer be ignored. In many cases, the cost of destroying ecosystem services becomes apparent only when the services start to break down.117 In late March 2005, the United Nation’s (UN) Millennium Ecosystem Assessment118, conducted by 1360 experts in 95 nations, reported that approximately 60 percent of the ecosystem services that support life on Earth are being seriously degraded or used unsustainably. The UN Millenium Ecosystem Assessment documents several “accelerating, abrupt, and potentially irreversible changes.” These include:

118 Millennium Ecosystem Assessment (2005): Ecosystems and Human Well-being: Opportunities and Challenges for Business and Industry, World Resources Institute, Washington, DC.
- Fishery collapses, illustrated by the collapse of the Newfoundland cod fishery off the coast of Canada.

- Algal blooms, caused by the increased use of nitrogen based fertilisers globally, which have led to massive fish loss and the creation of dead zones such as in the Gulf of Mexico.

- The replacement of corals by algae in many locations caused by eutrophication and the decline in population of fish that feed on algae and with a consequent long term decline in the reefs fish population and overall productivity.

- Desertification, as land degradation worsens due to climate change and loss of biomass leading to the collapse of grasslands, moisture retention and soil structure.

- Increased vulnerability due to climate change and destruction of natural habitat which provides resilience and protection from extreme weather events leading to increased flooding, landslides and coastal storm surges.

- Crop failures, caused by pests, pathogens, lack of diversity, destruction of biodiversity (such as the loss of pollinators), soil erosion, water pollution and increased low level (tropospheric) ozone.

The serious risks posed by such tipping points mean that humanity has just decades to rapidly reduce these environmental pressures to ensure irreversible decline of ecosystem resilience is avoided. Such an assessment of the world’s ecosystems is in accord with previous assessments. For instance, according to an analysis of the world's ecosystems prepared by the United Nations, the World Bank and the World Resources Institute in 2000, ‘There are considerable signs that the capacity of ecosystems, the biological engines of the planet, to produce many of the goods and services we depend on is rapidly declining’119. In 2007, the fourth Global Environment Outlook120 (GEO-4), published by the United Nations Environment Program (UNEP), came to similar conclusions. It stated that “Humanity is changing the Earth's climate so fast and devouring resources so voraciously that it is poised to bequeath a ravaged planet to future generations.” The fourth Global Environment Outlook (GEO-4), was compiled by 390 experts from observations, studies and data garnered over two decades. The 570-page report says world leaders must propel the environment "to the core of decision-making" to tackle a daily worsening crisis.

"The need couldn't be more urgent and the time couldn't be more opportune, with our enhanced understanding of the challenges we face, to act now to safeguard our own survival and that of future generations."\textsuperscript{121}

Further empirical evidence that humankind has already overshot the ecological thresholds in many areas of the world’s ecosystems is covered in detail in numerous publications such as the \textit{UNEP Global Environmental Outlooks}\textsuperscript{122}, \textit{IPCC Assessments}\textsuperscript{123}, \textit{World Resources Reports}\textsuperscript{124}, \textit{DAC Development Reports}\textsuperscript{125}, \textit{Human Development Report}\textsuperscript{126}, \textit{The State of the World reports}\textsuperscript{127}, \textit{Limits to Growth-The Thirty Year Update}\textsuperscript{128}, \textit{Economic Growth and Environmental Sustainability}\textsuperscript{129}.

\section*{1.2 The Emergence of Sustainable Development as a Common Vision}

The negative trends and issues listed in 1.1.1-1.1.9 of this chapter are important to this thesis because recognition of these trends, and the fact that these trends are interlinked, is what led to the call in the 1980s for sustainable development. Starting with the 1972 UN Conference on the Human Environment in Stockholm and the publication of Barbara Ward’s \textit{Only One Earth}, environmental and development issues were given a new level of importance by governments and the United Nations. The 1972 UN conference was historically very significant because, when the United Nations was established in 1945, a shared concern in the environment was not mentioned in its agenda for world security. It focussed on emphasized peace, human rights, peace, and fairequitable socioeconomic development. No mention was made of the environment as a common concern. This lack of attention persisted over the first twenty-five years. Little attention was given to ecological well-being by the United Nations during its first twenty-five years. That changed as a result of The Stockholm Conference on the Human Environment in 1972. Since the early seventies, ecological security has been emerged as the fourth major stated concern of the United Nations.

The 1972 UN Conference on the Human Environment also led to the creation of the UNEP and IIED in 1972. IIED staff would later on, in the 1980s, play a key role in helping to draft chapters of \textit{Our Common Future}\textsuperscript{130}. This 1972 UN conference also led to numerous changes in government and other

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{121} Ibid.
\item \textsuperscript{122} See UNEP Global Environmental Outlook Reports at \url{http://www.unep.org/geo/} Accessed 8.01.08
\item \textsuperscript{123} See IPCC Assessments at \url{http://www.ipcc.ch/} Accessed 8.01.08
\item \textsuperscript{124} See World Resources Reports at \url{http://www.wri.org/project/world-resources} Accessed 8.01.08
\item \textsuperscript{125} See DAC Development Reports at \url{http://www.oecd.org/department/0,2688,en_2649_33721_1_1_1_1_1,00.html} Accessed 8.01.08
\item \textsuperscript{126} See Human Development Reports at \url{http://hdr.undp.org/en/} Accessed 8.01.08
\item \textsuperscript{127} Worldwatch Institute State of the World reports \url{http://www.worldwatch.org/pubs/sow/} Accessed 8.01.08
\item \textsuperscript{128} Meadows, D. \textit{et al} (2005) \textit{Limits to Growth:The Thirty Year Update}. Earthscan Publishing
\item \textsuperscript{130} World Commission on Environment and Development (WCED). (1987) \textit{Our Common Future}. Oxford University Press, p. 43.
\end{itemize}
\end{footnotesize}
institutions to address environmental and development issues. For instance the OECD formed the Environment Directorate in the 1970s which undertook much research which helped inform the landmark 1980s publication on sustainable development *Our Common Future*.

In the early 1980s the World Conservation Strategy and subsequently from 1984-1987 the World Commission on Environment and Development – the Brundtland Commission’s – *Our Common Future (OCF)* were developed in response to increasingly informed analyses of the links between environment, social issues and economic development. The publication of the Brundtland Commission *Our Common Future* is one of the most influential publications ever on these issues, addressing in detail the challenges of poverty, global inequality and threats to environmental sustainability. Since the publication of *OCF*, worldwide acceptance of the importance of and the interlinked nature of environmental, social and economic issues has grown significantly. The World Bank, the OECD, even the IMF all endorsed *Our Common Future*, helping to build significant momentum and political will for the 1992 Earth Summit attended by 189 countries.

1.2.1 Definitions of Sustainable Development

The Brundtland Commission’s publication Our Common Future is famous for its definition of sustainable development - “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” But there were other definitions of sustainable development also outlined in Our Common Future that have since had relatively less attention such as

- ‘consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire.’

- Or development that, ‘at a minimum ... must not endanger the natural systems that support life on Earth: the atmosphere, the waters, the soils and the living beings.’

In addition to defining sustainable development, the Brundtland Commission recommended a series of policy changes and strategies needed to achieve sustainable development such as ensuring a sustainable level of population, to increasing equity within and between nations, to reducing poverty, reducing the energy and resource content of growth, re-orienting technology, and merging environment and economics in decision-making.

In taking the idea and desirability of intergenerational equity seriously, the Brundtland Commission provided some very profound challenges to some little discussed assumptions about our society and ourselves. It was also significant because it challenged our beliefs about what makes us better off and it challenged our perceptions of responsibility for others and future generations. We should at the outset define what we mean by intergenerational equity. One broadly acceptable definition\(^\text{131}\) is this:

\(^{131}\) Harding, Ronnie, Young, Michael and Fisher, Elizabeth (1994) *Sustainability: Principles to practice*, Background paper for the Fenner Conference on the Environment (ANZECC, Canberra)
“The principle of intergenerational equity means that decisions taken today should ensure that at least an equivalent set of opportunities for human welfare is available to succeeding generations.”

Since *Our Common Future* was published many have worked together to help better define in detail what sustainable development and intergenerational equity means. For instance, a number of economists and ecologists published a significant paper *Are We Consuming Too Much?* in 2004 which they argued that sustainable development is development where the inclusive wealth – natural resources, ecosystems, and economic, financial, and manufactured capital, human welfare and human knowledge - of a society does not decline over time.

Their methodology is an attempt to measure the change in value over time of all the critical capital stocks in an economic system, at constant prices. Inclusive Wealth is "inclusive" for two reasons: one, because it tries to include everything that actually matters to human welfare and quality of life and two, because it includes the interests of future generations.

The important distinguishing feature of this method is the use of accounting prices, or what is the "shadow price". Such shadow prices reflect the actual cost of replacing the asset, and do not vary with changes in valuation by the market. They are looking for the value of changes in assets and not for the changes in the value of assets. The authors note that

"Current estimates of genuine wealth depend crucially on the values assigned to shadow prices, yet the empirical basis for these prices is very weak. Numerical growth models can be used to project growth paths of economies and the sensitivity of these paths to changes in capital stocks. In this way, they can generate much better assessments of the critical shadow prices."

The inclusive wealth framework also seeks to measure to what extent different forms are actually substitutable. There are two main lines of thought on the ability to both aggregate different forms of capital and in turn substitute them. One is the ‘Weak’ or ‘Narrow’ definition, which assumes that all forms of capital are substitutable. The other is the ‘Strong’ or ‘Broad’ definition, where the ability to transform one form of capital into another is not assumed; rather great efforts are made to determine whether substitutability is in fact possible. The limitation of the Weak definition is that both human and manufactured capital are complemented by nature and will struggle to find cost effective substitutes for many of its services. Also nature has an intrinsic right to exist. As we described

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133 Loosely, the shadow price is the change in the objective value of the optimal solution of an optimization problem obtained by relaxing the constraint by one unit. In a business application, a shadow price is the maximum price that management is willing to pay for an extra unit of a given limited resource.[1] For example, what is the price of keeping a production line operational for an additional hour if the production line is already operated at its maximum 40 hour limit? That price is the shadow price.

earlier, there is mounting evidence that our ecosystems are more fragile than first thought, suggesting that nature (natural capital) is to be cherished and restored and not converted into other forms of capital. Hence, the inclusive wealth framework brings in the best of the Strong or Broad definition by placing more restrictive conditions on the ability to substitute particular forms of capital. Pearson, Harris and Walker\textsuperscript{135} have been working on incorporating the most useful aspects of both the Weak and Strong definitions into the Inclusive Wealth framework to ensure that Inclusive Wealth has something like the following properties:

- The measure would allow for the quantification of the total capital stock, thus allowing analysis of the overall trend.
- The measure would allow the substitutability of each form of capital within the measure to be governed by an assigned relative weighting.
- The limitations effecting substitutability of each form of capital would be clearly understood and accounted for. In particular, any critical thresholds such as ecological limits or the inability to be further substituted would be taken into account, together with the level of difficulty in reversing the substitution of different types of capital (irreversibility). This last point is very important. As Ehrlich \textit{et al}\textsuperscript{136} have explained

> “It is important to realize that even if an economy satisfies the sustainability criterion (i.e., relative to population, inclusive investment is not negative) today, or has satisfied the criterion in the recent past, it might not continue to do so in the future. Whether it is able to do so depends on the scale of the economy (measured by, say, gross domestic product [GDP]), among other things. If the scale becomes too large relative to the natural capital base of the economy, the economy will be unable to maintain its inclusive wealth. Specifically, as an economy’s scale increases, natural capital (e.g., ecosystems) becomes more scarce relative to the size of the economy. Consequently, the amount of other types of capital needed to substitute for natural capital—that is, the shadow price of natural capital—may rise. The extent to which the shadow price rises depends on a number of factors, including the rate of technological progress. There can even come a point where no amount of feasible investment in manufactured capital or human capital can offset further declines in natural capital.”\textsuperscript{137}

The ecosystem services listed below provided by natural capital, for free currently, are not cost effectively replaceable or substitutable by technological innovation. These ecosystem services complement and are depended on by life on our planet:

- production of atmospheric gases.


\textsuperscript{137}Ibid
• supporting evolutionary processes, and biodiversity;
• purification of soil, water and air.
• storage and cycling of fresh water and nutrients.
• regulation of the chemistry of the atmosphere and oceans.
• maintenance of habitats for wildlife.
• disposing of organic wastes.
• sequestration and treatment of waste.
• pest and disease control by insects, birds and other organisms.
• production of the variety of species for food, fibres, pharmaceuticals and materials.
• conversion of solar energy into natural materials.
• prevention of soil erosion and sediment loss.
• alleviating floods and managing runoff.
• protection against UV radiation.
• regulation of the local and global climate.
• development of topsoil and maintenance of soil fertility.
• production of grasslands, fertilizers and food.

Arrow et al.\textsuperscript{138} have applied the inclusive wealth approach to a number of countries to assess whether or not we are consuming too much or whether in fact "current generations are making the investments that are necessary to assure higher real living standards in the future, despite stresses on the natural resource base."\textsuperscript{139} They stated that

"Although the evidence is far from conclusive... We...find evidence that several nations of the globe are failing to meet a sustainability criterion: their investments in human and manufactured capital are not sufficient to offset the depletion of natural capital...".

1.2.2 Clarifying Sustainable Development and the Role of Ethics and Values

It is also important to clarify that the call for sustainable development is both scientifically and ethically based. In addition to understanding scientifically the state of the planet and the extent of extreme poverty and global inequality there are also ethical decisions to be made by society on what it is they wish to sustain and maintain indefinitely and what they wish to change. Sustainable development involves these two components

• sustaining (maintaining) the things that we value and


\textsuperscript{139} Ibid.
• improving the condition of people, society and the environment to ensure that what we value is sustained for us and for future generations. This is the ethical principle of intergenerational equity.

So we can gain great clarity in our actions if we begin any discussion of sustainable development with the question: ‘What do we value and wish to sustain?’ Having worked this out, it is valuable to then ask ‘What needs to be done to ensure that those things, which we value, are indeed sustained?’ If we value the ecosystems, upon which life and our lives depend, then sustainable development needs to ensure the survival or maintenance of ecosystems services and biodiversity. The greenhouse gas reduction targets that nation’s choose is partly an ethical decision. For every degree that global temperatures may increase due to human induced global warming scientists warn us that more species will become extinct and more vulnerable people are highly likely to die. Table 1.2 illustrates this.

How much do we value the right for all species to survive? How much do we value a human life? CSIRO’s research shows that with a small temperature rise 81 per cent of the Great Barrier Reef will be bleached. How much do we value the sustaining of the Great Barrier Reef and all the jobs and businesses that depend on it? Rising temperatures from global warming is also predicted to lead to more days per annum over 35 degrees in Australia. The elderly, in particular, are vulnerable to such hot days. In Europe, in 2003, extreme heat was a factor in 35,000 deaths. How much do we value our fellow human beings lives? If, through such debates and discussions of ethics and values, we realise that sustaining the things that we value is really important to us then, logically, it is vital that we achieve such greenhouse gas reduction targets and achieve sustainability, otherwise the things that we have said we want to sustain will not be sustained. They will be degraded or made extinct. But in addressing an issue like greenhouse gas emission reduction targets we also need to be sensitive to other social and economic aspects that we wish to sustain. In seeking to achieve ecologically sustainable cuts to greenhouse gas emissions, it is important to do this in a way that ensures that people do not lose their jobs permanently. We do not want towns and communities that, for instance, were dependant on coal mining to collapse and fragment. Thus to ensure that people are treated with respect we also will need to invest in structural readjustment packages and retraining and job creation schemes to ensure people are valued and treated with the dignity that they deserve during a transition to a sustainable society.
Table 1.2: Summary of climate change impacts on Australia across selected areas.  
(Source: CSIRO Marine & Atmospheric Research (2006))

<table>
<thead>
<tr>
<th>Temp rise</th>
<th>Tourism</th>
<th>Water and Primary Industries</th>
<th>Infrastructure and Insurance</th>
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</thead>
<tbody>
<tr>
<td>&gt;4°C</td>
<td>- Most Australian vertebrates lose 90 to 100% of their core habitat</td>
<td>- Extreme rainfall in Victoria increases by 23%</td>
<td>- Peak electricity demand in Adelaide, Brisbane and Melbourne increases by 9 to 23%</td>
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<td>- Distribution of Great Barrier Reef species shrinks by 95%</td>
<td>- 55% loss of Eucalyptus core habitat</td>
<td>- 180 days a year above 35°C in SA and NT</td>
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<td>- 65% of Reef species lost in Cairns region</td>
<td>- Timber yields in southern Australia rise by 25 to 50%, but fall by same margin in North Qld and the Top End</td>
<td>- ’100-year’ storm bides along Victoria’s east coast 30% more frequent</td>
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<td>- Snow-covered alpine area shrinks by 20 to 85%</td>
<td>- Australian net primary production falls by 6%</td>
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<td>- ’60-day’ snow cover declines by 40 to 95%</td>
<td>- Flow in the Murray-Darling falls by 16 to 40%</td>
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<tr>
<td>&gt;3°C</td>
<td>- 97% of the Great Barrier Reef bleached</td>
<td>- Pasture growth slows by 31%</td>
<td>- Dengue fever transmission zone reaches Brisbane and possibly Sydney</td>
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<td>- 80% of Kakadu freshwater wetlands lost</td>
<td>- Macquarie River Basin (NSW) flows fall by 5 to 35%</td>
<td>- Temperature-related deaths of people over 65 rise by 144 to 200%</td>
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<td></td>
<td>- Livestock carrying capacity in native pasture systems falls by 40%</td>
<td>- Oceania experiences a net loss of GDP</td>
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<tr>
<td>&gt;2°C</td>
<td>- 81% of the Great Barrier Reef bleached</td>
<td>- Melbourne’s water supply falls 7 to 35%</td>
<td>- Temperature-related deaths of people over 65 rises by 99 to 123%</td>
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<td>- Vertebrates in the World Heritage Wet Tropics lose 90% of their core habitat</td>
<td>- Murray-Darling flows fall 12 to 25%</td>
<td>- Road maintenance costs in Australia rise by 17%, despite a decline in South Australia</td>
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<td>- Queensland fruit fly spreads south</td>
<td>- ’100-year’ storm bides along Victoria’s east coast 15% more frequent</td>
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<td>- 40% loss of Eucalyptus core habitat</td>
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<tr>
<td>&gt;1°C</td>
<td></td>
<td>- Temperature-related deaths of people over 65 rises by 99 to 123%</td>
<td>- Tropical cyclone rainfall increases 20 to 30%, as wind speed increases 5 to 10%</td>
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<td></td>
<td></td>
<td>- Storm surge rises 25% along Victoria’s east coast</td>
<td>- Forest fire danger rises 10% across Australia</td>
</tr>
<tr>
<td>&lt;1°C</td>
<td>- Snow-covered alpine areas shrink by 10 to 40%</td>
<td>- Melbourne’s water supply falls 3 to 11%</td>
<td>- Height of ’100-year’ storm surge at Cairns rises 22%, doubling the flooded area</td>
</tr>
<tr>
<td></td>
<td>- Vertebrates in the World Heritage Wet Tropics lose half their habitat</td>
<td></td>
<td>- Storm surge rises 25% along Victoria’s east coast</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>- Double the people exposed to flooding in Australia and New Zealand</td>
</tr>
</tbody>
</table>

1.2.3 Sustainable Development Requires No Major Trade Offs

If we value environmental, social and economic conditions and goals, we need to approach sustainability (ecological, social and economic) goals as goals to be achieved, with no major trade-offs. One of the critically important implications to the sustainability decision-making process, where society wants to pursue a range of goals simultaneously, is that it must be based on the principle of ‘no-major-trade-offs’. Logically, if society is committed to sustaining something, it cannot trade-off
the continued existence of that thing or attribute in order to meet other goals. Similarly, in a sustainable development approach, it is desirable for actions taken in the pursuit of one goal to also contribute to the achievement of other goals: ‘win–win–win’ outcomes. As former Australian Liberal Leader of the Senate Robert Hill states

‘We need to develop decision-making processes which take into account, not only the financial costs and benefits of our actions, but also the social and environmental consequences. Those processes will need to shift the focus away from short-term economic gain towards long-term economic, social and environmental impacts – the triple bottom line.’\(^{140}\) Striking the right balance between the economic, social and environmental values of our actions is the essence of sustainable development.\(^{141}\)

In the past, following a rather simplistic application of optimization theory, it has been assumed that the pursuit of multiple goals means that no one goal can be maximized; there must be major trade-offs. But, in complex systems such as economies, societies and ecosystems, we are still so far from a theoretical perfect optimum that there may be significant potential to find solutions that can deliver multiple goals through ‘no major trade-offs’ and ‘win–win outcomes’. To deliver such outcomes does require a major commitment to foster innovation and to increase greatly the capability of long term thinking and the handling of complex issues. Take for instance the award-winning, AUS$3 billion project to tackle salinity in south-western Western Australia. The company, Woodside Petroleum, is the partner for this biomass/activated charcoal/eucalyptus oil project, which will involve the planting of millions of Mallee eucalyptus trees to lower the water table and thus mitigate the effects of salinity in Western Australia.\(^{142}\) The activated charcoal from plantations will take the pressure off native forests that are presently being used for activated charcoal all over the world, as it is in high demand as a reductant in mineral refining. Finally, it will also act as a carbon sink whilst creating new jobs. This thesis will show, through such case studies, that genuine win–win–win opportunities exist.

To capture both the sustaining and changing aspects of Sustainable Development it can be defined as follows: progress that genuinely sustains and improves economic, social and environmental well-being with no major trade offs, locally and globally, now and in the future. This definition captures the ideas in the well being and sustainability literature, the local and global dimensions of the sustainable development challenge and the need to achieve no major trade offs between economic, social and environmental goals and outcomes. But still such a definition is quite abstract for many

\(^{140}\) An address to The International Society of Ecological Economists by the former Federal Minister for the Environment and Heritage Senator the Hon Robert Hill Australian National University Canberra July 6, 2000


people. What does it mean in practice for a society to seek to achieve sustainable development? What does it mean for a society to aspire to becoming a sustainable society?

1.2.4 A Charter for Sustainable Development: The Earth Charter

One of the most significant attempts to work out both what people value and what principles need to underpin the creation of a sustainable society has been the process to develop the Earth Charter which is printed in full in Appendix 1.2. The Earth Charter is a significant document in that it synthesizes both what we value as humanity and also outlines a list of things to do to ensure that what we value is sustained. It was the World Commission on Environment and Development (WCED) chaired by Gro Harlem Brundtland that issued the proposal leading to the early efforts to create an Earth Charter. In *Our Common Future*, the WCED called for creation of "a universal declaration" in the form of "a new charter" that would "consolidate and extend relevant legal principles" creating "new norms . . . needed to maintain livelihoods and life on our shared planet" and "to guide state behaviour in the transition to sustainable development."¹⁴³

The United Nations Conference on Environment and Development (UNCED), the Earth Summit, held in Rio de Janeiro in 1992, took up the challenge of drafting the Earth Charter. A number of governments submitted recommendations and non-governmental organizations got involved. An NGO Earth Charter was drafted at Rio, but efforts to create a UN Earth Charter were abandoned. So, a new Earth Charter Initiative was launched in 1994. A final draft was agreed to and published in 2000.¹⁴⁴ Since 1994, the Earth Charter development and consultation process has been undertaken involving as many stakeholders, people, organizations and nations as was humanely possible. This process promoted a global discussion on ethics. The Earth Charter outlines clearly, what social and environmental principles need to underpin the achievement of sustainable development.

1.2.6 Reaction to the Earth Charter

The Earth Charter has been publicly formally supported by a significant number of people and organizations from all religious, political backgrounds and most types of organisations and professions. Overall, reaction to the document can be characterized as overwhelmingly positive. However, the Charter has also raised some concerns from specific groups and stakeholders. For instance, in a few countries, stakeholders referred to as the religious right have objected to the fact that the document is secular, and contains no reference to the doctrines of their particular faith.¹⁴⁵ Some

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¹⁴⁴ See Earth Charter A Brief History at [http://www.earthcharterusa.org/ec_history.htm](http://www.earthcharterusa.org/ec_history.htm) Accessed 8.01.08

argue that the Earth Charter is part of efforts to supplant national sovereignty with new global governance and institutions which reduces the authority of the nation-state. The Charter document has no statements to support the creation of a “global government” and the document is respectful and inclusive of different religious faiths and traditions. This has not stopped right wing think tanks trying to stir the more orthodox and traditional churches into action against the Earth Charter. For instance, some think tanks, such as the Centre for Independent Studies produced a critique of the idea of there being an intrinsic right of all living things to exist in the early ‘90s. The Centre for Independent Studies in the 1990s was trying to put a case to orthodox churches of why they should not support the Earth Charter.

Since the Earth Charter is an expression of common values and aspirations based on universal ethical principles, not surprisingly it has received widespread support. Few disagree with the goals and principles of the Earth Charter but the Earth Charter does not address the scale and speed issues of how fast these goals and principles need to be achieved. Businesses and governments recognise the need to developing targets to achieve certain sustainability goals by certain dates to achieve sustainable development.

1.2.7 Defining Social, Economic and Environmental Sustainability

In this sub section, what follows is a list of, to date, the toughest targets recommended thus far by scientists of what is required to achieve ecological and social sustainability. These targets are often hotly debated. But in listing the toughest targets and discussing efforts in the world to achieve these tough targets the thesis cannot be accused of underestimating the scale and speed of the task. I have attempted to do this below with the following lists that I have developed of social, environmental and economic goals befitting a society aspiring to become simultaneously socially, environmentally and economically sustainable. It is very important to emphasize that achieving a sustainable society is not simply achieving targets to ensure ecological sustainability. Ecological sustainability cannot be done at the expense of social sustainability. As societies strive to achieve ecological sustainability it must not be done in a way that punishes or hurts segments of the community. This can cause deep alienation and lead to a backlash. Rather an economic growth that is socially and environmentally sustainable needs to arise out of the aspirations of citizens, communities, organizations, corporations and institutions working together. This social, human dimension is emerging as the key to whether societies achieve ecological sustainability or not. In reality these two dimensions are intimately related but for clarity I will consider the environmental dimension of sustainability first followed by

146 Jasper, W. (2003) The global school board: by rejoining UNESCO, the U.S. government is aiding the UN's grab for power and boosting the Earth Charter crusade to paganize our children. New American. Available at http://findarticles.com/p/articles/mi_m0JZS/is_10_19/ai_n25067806/pg_1?tag=artBody;col1
the social and economic dimensions of sustainability. A sustainable society is *socially sustainable*, if at the very least it:

- Eradicates poverty and homelessness as an ethical, social, and environmental imperative. The nations of the world have committed to the UN Millennium Development Goals which seeks to halve world poverty by 2015. (Chapter 6, Subsection 6.1.1)
- Stabilises global population to assist both poverty reduction and the achievement of environmental sustainability. (Chapter 6, Subsection 6.1.3)
- Ensure universal access to education (Chapter 6, Subsection 6.1.4)
- Ensure universal access to health care (Chapter 6, Subsection 6.1.5)
- Invests in ecologically forms of sustainable development that both reduce poverty and achieve environmental sustainability. (Chapter 6, Subsection 6.1.6)
- Guarantees the right to potable water and safe sanitation. (Chapter 6, Subsection 6.1.6)
- Eliminates corruption in all public and private institutions (Chapter 6, Subsection 6.1.10)
- Promotes the equitable distribution of wealth within nations and among nations. (Chapter 6, Subsection 6.2.1)
- Is built on the principles of social justice and equal opportunity where equal opportunity ensures equal access to high levels of education, information, employment and health care. (Chapter 6.2.3)
- Seeks to achieve as close to full employment as possible. (Chapter 6, Subsection 6.2.4)
- Ensures basic labour standards and rights. (Chapter 6, Subsection 6.2.5)
- Ensures gender equality and equal opportunity for woman (Chapter 6, Subsection 6.2.7)
- Gives expression to human potential through creativity and innovation. (Chapter 6, Subsection 6.2.8)
- Encourages tolerance and cultural diversity (Chapter 6, Subsection 6.2.10)
- Is strengthened by democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision-making, and access to justice. (Chapter 6, Subsection 6.3)
- Promote a Culture of Tolerance, Non-violence, and Peace (Chapter 6, Subsection 6.3.2)

Many of these social sustainability goals are discussed in detail in Chapter 6 of this thesis. Such a strong social sustainability foundation would greatly assist societies to achieve ecological sustainability. But in practise what does the process of achieving ecological sustainability look like? To achieve, for instance, the ecological sustainability goals of the Earth Charter such as ensuring the right of all living things to live (ensuring no more species extinction) what needs to be done? The
following is a list of key stretch goals which would need to be achieved to achieve ecological sustainability. Some of these goals may seem excessive but ecological sustainability is based on the precautionary principle. The precautionary principle states where there are likely threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Whilst ambitious, the following targets surely are necessary if humanity is to ensure it avoids irreversible adverse effects and lives within the ecological limits of the planet forever:

- A Factor 4-10 dematerialisation (for developed countries), and then maintenance of a capped quantity of materials and energy for all purposes. The Netherlands, Sweden, and Austria governments have all committed to achieving Factor 4. (Chapter 5, Subsections 5.3.4-5.3.5)
- Achieve a natural stabilisation of global population through ending extreme poverty and reducing infant mortality rates in the 3rd world. (Chapter 6)
- Decouple economic growth from greenhouse gas emissions on a scale and speed fast enough to avoid dangerous climate change. Numerous organisations and businesses are now adopting goals of achieving climate neutrality as quickly as possible. UNEP has created a global climate neutral network which includes four nations which have committed to becoming climate neutral: New Zealand, Norway, Costa Rica and Iceland. (Chapter 7)
- Nations to reduce oil dependence as soon as possible. Sweden and Iceland have committed to transform their economies to become free of needing any oil imports. Sweden has committed to be independent of oil imports by 2020. (Chapter 7, Subsection 7.3.5)
- Renewable resources be used efficiently and their use not be permitted to exceed their long-term rates of natural regeneration. Harvesting rates in industries such as forestry and fisheries must not exceed ecologically maximum sustainable yield. (Chapter 3, Subsection 3.1 and Chapter 8, Subsections 8.1.6 and 8.1.8-8.1.10)
- Major restoration of habitat for threatened species. Protecting the world’s biodiversity hotspots as soon as possible. Most OECD countries have biodiversity hotspot programs. These existing programs need to be expanded. (Chapter 8, Subsection 8.1.8 – 8.1.10)

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150 See UNEP Climate Neutral Network at http://www.climateneutral.unep.org/cnn_frontpage.aspx?m=49


• Ensure ecologically sustainable management the remaining forests of the world. China, New Zealand, the Philippines, Sri Lanka, Thailand, and Vietnam all have total or partial bans on deforestation.\textsuperscript{153} (Chapter 8, Subsection 8.1.8-8.1.10)

• Ensure rangeland protection and restoration. (Chapter 8, Subsection 8.1.10)

• Restore soil fertility and improve global soil conservation practices as an ethical, economic, food security and climate change imperative. (Chapter 8, Subsection 8.1.8-8.1.10)

• Restore oceanic fisheries through establishing of a worldwide network of marine reserves, which would cover roughly 30 percent of the ocean. (Chapter 8, Subsections 8.1.6)

• Wilderness corridors need to be restored to allow species to migrate north or south during climate change over the coming centuries. (Chapter 8, Subsection 8.1.8-8.1.10)

• Reduce air pollution levels below that recommended by the World Health Organisation (Chapter 8, Subsection 8.2)

• Reduce freshwater extraction below rates that ensure renewable use of water for future generations. (Chapter 8, Subsection 8.3)

• Shifting linear material flows to a closed-loop economy (encourage recycling) to get as close as thermodynamically and economically possible to zero waste. Japan has committed to becoming a closed loop recycling society. Numerous governments have committed to zero waste targets. The Australian Capital Territory government in Australia has committed to zero waste by 2010. (Chapter 8, Subsection 8.4)

• Facilitate and encourage good product stewardship which involves responsible product design, use, re-use, recycling and disposal. The EU has embraced product stewardship for many products. (Chapter 8, Subsection 8.4)

• Adopt national sustainable consumption programs in line with recommendations from the 2002 UNEP Sustainable Consumption and Production report.\textsuperscript{154} Recommendations from this report have been adopted by a number of EU countries. (Chapter 8, Subsection 8.4)

Chapters 7 and 8 consider these goals and targets in more detail and how they correlate with economic growth and prosperity. This is because a sustainable society’s economic goals are also equally important. It is vital that a society achieves the social and environmental goals without damaging the economy but rather strengthening it. Hence to achieve economic goals governments should seek to


\textsuperscript{154} UNEP (2002) Sustainable Consumption: Global Status Report 2002, UNEP, Paris (report written by Professor Chris Ryan, RMIT University, Melbourne, Australia, and the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden)
develop and implement a robust fiscal framework and effective economic policy to help ensure the achievement over time of

- Decoupling economic growth from environmental pressures absolutely without significantly harming economic growth rates or the competitiveness of business. (Chapter 5 and Chapter 4 respectively)

- Achieving “green” growth through encouraging investment in eco-efficiency initiatives and still more substantive transformations to sustainability whilst reducing negative rebound effects. (Chapter 5, Subsection 5.3.7)

- Ensuring non-declining inclusive wealth and well being for future generations but ideally aim to ensure greater choice and opportunity for future generations to achieve higher well being. (Chapter 5, Subsections 5.5 and 5.6)

- Creating meaningful employment. (Chapter 6, Subsection 6.2.4.1)

- Providing information. Adam Smith’s ‘Invisible hand’ works only under certain criteria that include the markets having perfect information. But who has perfect information? One of the key roles of government is to supply relevant information to help markets more efficiently allocate resources.

- Facilitating and encouraging innovation for sustainability through investing in research, development & demonstration (RD&D).

- Internalising externalities with minimal harm to business’s competitiveness through eco-taxes, feebates, levies, market based instruments, ie: tradeable permits and caps and other creative market signals. (Chapter 4, Subsection 4.2)

- Taxing social and environmental ‘bads’, whilst providing effective non-inflationary incentives to social and environmental ‘goods’. (Chapter 6, Subsection 6.2.4.1)

- Reduce and remove perverse subsidies.

- Measure what matters. It is vital that decision makers have feedback on the effectiveness or otherwise of their decisions to help them make better decisions in the future. (Chapter 5, Subsections 5.5 and 5.6)

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• Maintain the GDP measure but also phase in additional measurements of national well being and progress. (Chapter 5, Subsections 5.5 and 5.6)

The Earth Charter plus the above list of targets would be seen by most as an ambitious list of things to do by even the most radical NGO. Whilst any one of these goals can be achieved many would doubt that all these goals and targets could be achieved simultaneously by a nation. If any nation achieved all the above goals and targets it would be historic. Yet the above list, is created by combining targets either recommended by respected scientists or already committed to be leading governments.

1.3 Exploring the Ecological Modernisation Discourse - Is it Possible to “Have It All”?

It is still contested whether or not sustainable development with no major trade offs can be achieved. For instance, 1987 Brundtland Commission report *Our Common Future* claimed that it was economically and technologically feasible for the world economy to grow fast enough to reduce poverty without increasing environmental damage. But, in the Brundtland Commission report this was asserted rather than demonstrated.\(^\text{160}\) *Our Common Future* was heavily criticised for this. In 1994, Dunchin and Lange\(^\text{161}\) did undertake such modelling. They modelled whether or not it was possible to reconcile the required economic growth to dramatically reduce poverty without increasing environmental damage. Their modelling showed that it was not. This thesis argues that Dunchin and Lange’s assessments of what was economically and technically possible were too pessimistic. Twenty years on from the publication of *Our Common Future* this key assumption of *Our Common Future* and the field of ecological modernisation is still contested. Similarly *Our Common Future* argued that was not a significant trade off between jobs and the environment. Yet this claim was backed up by very few studies, and as the world recession hit in the early 1990s, the media and the conservative right-wing side of politics challenged this claim that there was not a major trade off between environment and jobs. The vested interests often utilising and funding right wing think tanks ran a significant campaign in the early 1990s arguing that sustainable development would lead to significant loss of jobs, harm business competitiveness and the economy. Their campaign resonated with many in the early 1990s due to the global recession of the time. These weaknesses are listed here to demonstrate to what extent there is still a need now, twenty years after *Our Common Future* was first published to

a) Begin to stock-take empirical studies from the last twenty years to examine whether or not it is possible to achieve sustainable development with no major trade offs.


b) Begin to review empirical studies from the last 20 years which help to back up or disprove the central claims of *Our Common Future* regarding the compatibility of economic growth and environmental and social sustainability.

This is the central goal of this thesis. Twenty years on from *Our Common Future* is a good time to begin to review the empirical evidence to test the claim from *Our Common Future* regarding whether or not it is possible, as Brundtland stated to have “a new form of growth, one that is forceful but also environmentally and socially sustainable?” From the mid-1980s onwards, the changing nature of environmental policies and politics in a number of European and non-European countries has provided a better empirical foundation for the development of a more systematic analysis of this question.

This question also goes to the heart of ecological modernisation. As Dryzek stated “Much of its (ecological modernisation’s) appeal lies in its promise that “we can have it all: economic growth, environmental conservation, social justice” 162. This thesis examines in Chapters 5-8 whether we indeed can have it all as Dryzek described it. This thesis contends that new empirical studies assessing developments in institutional, policy, and technical change from the late 1980s onwards allows this central assertion of ecological modernisation to begin to be tested. Thus this thesis, by addressing one of the key contested assertions of *Our Common Future*, also addresses one of the central claims of ecological modernisation as well. Hence this theses claim to be part of and building on the ecological modernisation tradition.

This thesis is a defence of and a contribution to the discourse of strong ecological modernisation. This thesis in Chapter 3 and Chapter 5 especially seeks to address the main criticisms of ecological modernisation. Critics of ecological modernisation argue either that

a) Economic growth cannot be decoupled from physical growth and environmental pressures or

b) If decoupling can be achieved, that it will be insufficient to achieve environmental sustainability on the scale or speed required or

c) That negative rebound effects will undermine efforts to decouple economic growth from environmental pressures through eco-efficiency and resource productivity improvements.

Chapter 5 of this thesis addresses these criticisms. Critics of ecological modernisation also argue that even if sufficient decoupling can be technically achieved; vested interests and political realities will make it very hard for such changes to occur. Chapter 3 discusses the nature and challenge of vested interests and discusses strategies to address them. Chapters 4 to 9 develop these strategies.

Since this thesis is a defence of strong ecological modernisation theory, before proceeding further it is important to address the following:

a) what is ecological modernisation and what are its common elements?

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b) the historical context within which ecological modernisation developed

c) some of the key debates and advances in the four phases so far of ecological modernisation.

d) What is strong ecological modernisation and how is it different from weak ecological modernisation?

1.3.1 What is Ecological Modernisation?

Whilst it is commonly acknowledged\textsuperscript{163} that there is no single definition of the theory of ecological modernization, the majority of contributions in this discourse distinguish contemporary processes of environmental reform in new ways from its predecessors during the 1970s. The concept of ecological modernization originated in Germany in the early 1980s, within the context of an overall sense of failure of 1970s environmental policy (to effectively address the scale and urgency of the environmental crisis) and an NGO environmental movement of which a significant proportion was anti-growth, anti-technology, anti-modernisation, anti-business and largely reactive in its campaign strategies to any development project. The NGO environment movement of the time Mol argues “can be labelled as largely embracing de-modernization or de-industrialization perspectives among their central ideology.”\textsuperscript{164}

1.3.2 Evidence of Decoupling of Economic Growth from Environmental Pressures – 1970s and 1980s.

In the 1980s academics, working within the environmental and resource studies fields, began to see significant changes emerging in technological eco-innovations and the social practices and institutions that actually dealt with environmental problems. This started to change the discourse. From the debates about these changes the theory of ecological modernisation emerged. For example, some empirical studies showed that in the 1970s, with the OPEC oil crisis, a decoupling of economic growth and oil consumption was identified for the first time. In countries such as Germany, Japan, the Netherlands, the USA, Sweden and Denmark decoupling was found to be beginning across a number of environmental indicators, As Mol writes

“In a number of cases (countries and/or specific industrial sectors and/or specific environmental issues) it was actually claimed that an environmental reform resulted in an absolute decline of emissions and use of natural resources, regardless of growth in financial or material terms. However, although these sometimes controversial empirical studies lie behind the idea of ecological modernisation, they do not form the core. Central stage in ecological modernisation is given to the associated social practices and institutional transformations, which are often believed to be at the foundations of these physical changes. In the debate on the changing character of the social practices and institutions since the


\textsuperscript{164} Ibid.
1980s, adherents to the theory of ecological modernisation positioned themselves by claiming that these transformations in institutions and social practices could not be explained away as mere window-dressing or rhetoric, but should indeed be seen as structural transformations in industrial society’s institutional order, as far as these concerned the preservation of its sustenance base.\textsuperscript{165}

1.3.3 Common Elements of Ecological Modernisation – a response to new realities.

Ecological modernization therefore grew out of real changes both to social practices and institutional responses to the environmental crisis which existing environmental discourses had trouble explaining. Ecological modernisation (EM) was an attempt to acknowledge the new emerging reality that

a) The severity of environmental problems and the loss of ecosystem resilience threatens the ability of many parts of the economy to be productive. EM recognises the economic and business costs of not undertaking environmental protection. EM also recognises the positive financial benefits of utilising resources more productively and innovating new “greener” products. EM thus is able to demonstrate that inaction on environmental protection will have significant economic costs. EM’s innovation is thus developing a new framework that turns the environmental crisis into positive sum games so that greening business and greening the economy can provide better overall social, environmental and financial outcomes long term compared to inaction on environmental protection. EM theory explicitly describes environmental improvements as being economically cost effective; indeed, business actors and economic/market dynamics are seen as key factors in enabling needed ecological changes.

b) Decoupling between economic growth and environmental pressures is possible across many environmental indicators. Decoupling of economic growth from environmental pressures was starting to occur across a number of environmental indicators as early as the 1970s. This was a significant historical development. As Dr Jim MacNeil, inaugural head of the OECD Environment Directorate from 1977-1984 and Director of the UN Commission of Sustainable Development from 1984-1987 explained\textsuperscript{166} that until the 1970s economic growth and environmental pollution had been strongly coupled. Hence Dr MacNeil said that all economists and environmentalists until the 1970s had assumed that significant decoupling was not possible. The potential for decoupling offered a new way to reconcile economic growth with environmental sustainability. The OECD Environment Directorate was the first to explore this opportunity and published a major report on it as early as 1984.\textsuperscript{167}

\textsuperscript{165} Ibid.

\textsuperscript{166} Private Communication, 5, April, 2006.

c) Whilst technology and design choices had contributed to, and in many cases directly caused, environmental and health problems it was understood that technology could be harnessed to help prevent and stop pollution, recycle materials, manufacture renewable energy technologies and make more eco-efficient lighting, appliances, and industrial equipment. One of the most important contributions of ecological modernisation has been the reframing of the role of technology in the social-environment relationship. As Fisher and Freaudenburg comment “Before ecological modernisation theory, most of the established theories of environment–society relationships, tended to view technological development and economic growth as being antithetical to environmental preservation”\(^{168}\)…Unlike theorists who see technological development as being generally problematic\(^{169}\)—pointing to a potential need to stop capitalism and/or the process of industrialization to deal with ecological crises -- ecological modernisation argues that environmental problems can best be solved through further advancement of technology and industrialization.”\(^{170}\) The ability of the private sector to innovate rapidly alternatives to pollutants such as sulphur dioxide and ozone depleting CFCs and the multi-lateral ratification of the Sulphur and Montreal Protocols respectively were seen as models of rapid ecological modernisation in the 1980s and 1990s.

d) The net harm to jobs growth from environmental protection was minimal and with wise policy settings jobs growth could be enhanced. By 1984, already it was recognised that measures to protect the environment, rather than harming jobs growth could stimulate it. In 1984, the OECD Environment Directorate\(^{171}\) published the first major study on this topic arguing this.

e) Whilst economic and government policy and incentives to date were seen as a key driver for unsustainable development they were also recognised as a potential key driver for a transition to sustainable development.\(^{172}\) It was recognised that to achieve the shift to sustainability fast

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enough, the capacity of business and the market to innovate rapidly would be crucial. It was recognised that economic and government policies provided many useful tools to help design more effective market based price signals and incentives (eco-taxes, cap and trade emissions trading markets, replacing perverse subsidies with subsidies that enhanced sustainability outcomes) to drive and reward eco-innovations in the market place enabling a transition to sustainable development.\textsuperscript{173}

f) Given the failure in government environmental policy in the 1970s it was recognised that the central agencies of government, and not simply the Environmental Protection Agencies (EPAs), were needed to take a whole of government approach to sustainable development. As \textit{Our Common Future} stated,

"Governments, pressured by their citizens, saw the need to clean up the (environmental) mess...and established agencies (EPAs) to do this...but much of their work has... been after-the-fact repair of the damage. The mandates of the central economic and sectoral ministries are also often too narrow, too concerned with quantities of production or growth. The present challenge is to give the central economic and sectoral ministries the responsibility for the quality of those parts of the...environment affected by their decisions, and to give the environmental agencies more power to cope with the effects of unsustainable development."\textsuperscript{174}

g) The reality that the environmental performance of governments correlates with increasing activism among economic actors, active nongovernmental organizations and a scientifically literate population. The reality that the potential for improved ecological outcomes is dependent on changes in the institutional structure of society.\textsuperscript{175} This point is re-enforced by recent studies that establish the linkage between ecological modernization and political modernization.\textsuperscript{176}

h) Given the sense of inadequacy to date of government environmental regulation and policy, it was recognised that new models of regulatory approaches were needed such as independent 3\textsuperscript{rd} party certification of products.

\textsuperscript{173} Ibid.
i) Given the scale and speed of change needed to address the global environmental crisis, it was recognised that it was vital that as many stakeholders are involved in the process as possible. The greater the scale of change required in a society the more important it is for all the key stakeholders of that society to be engaged meaningfully in that change process. As Fisher and Freudenberg wrote, “Ecological modernization depicts political actors as building new and different coalitions to make environmental protection politically feasible.”

Thus, Ecological Modernisation in the 1980s and 1990s was a new environmental discourse, a new middle way, recommending a shift in the environmental strategies of the 1970s whilst at the same time seeking to provide a new rigorous and inclusive framework for the many crucial actors – business (including key actors such as entrepreneurs, CEOs, accountants, engineers), government, R&D institutions and also the NGO environmental movement - without abandoning the key message of the need for urgent and radical action to avert environmental catastrophe.

There has been considerable diversity and internal debate among the contributors to the ecological modernization theory. Without giving an extensive analysis and overview of the ecological modernization literature up to the present, I believe that it makes sense to distinguish at least four stages in the development and maturation of ecological modernization theory. This overview of the development of ecological modernization theory in four phases is important to show that ideas of ecological modernization have developed in the course of constant debate and with critical evaluations involving those within and without this school of thought. The overview reveals that ecological modernization theory is still developing. This overview concludes by emphasizing that, whilst there is ongoing disagreement with proponents of ecological modernisation and its critics, there is an emerging consensus, on what conditions, best enable ecological modernisation to flourish.

1.4 Four Phases of Ecological Modernisation

1.4.1 The First Stage of Ecological Modernisation Theory

Mol characterises Ecological Modernisation in its early stage “As a normative claim of a desired environmental reform path, failing to identify widespread empirical references of such processes in the societies of West Europe.” The Brundtland Commission’s Our Common Future is a good example of an ecological modernisation publication which, as discussed above at times, made significant assertions of a desired environmental reform path without always being able to provide adequate empirical data, comprehensive modelling or detailed policy description to back it up. As discussed previously, the 1987 Brundtland Commission report Our Common Future claimed that it was economically and technologically feasible for the world economy to grow fast enough to reduce

178 Ibid.
poverty without increasing environmental damage. But, in the Brundtland Commission report this was asserted rather than demonstrated.\textsuperscript{179} Twenty years on from the publication of \textit{Our Common Future} this key assumption of \textit{Our Common Future} and the field of ecological modernisation is still contested. Other major weaknesses of \textit{Our Common Future} included the fact that it provided no detailed policy prescription and it ignored the role of vested interests blocking efforts to achieve sustainable development. These weaknesses of \textit{Our Common Future} mirror the weaknesses of the ecological modernisation discourse of this first phase.

Another important characteristic of early ecological modernisation was a heavy emphasis on the role of technological innovation in bringing about environmental reform, especially by Huber\textsuperscript{180}. Mol describes Huber’s writing in the mid-1980s as being

“characterized by a heavy emphasis on the role of technological innovations in bringing about environmental reforms, especially in the sphere of industrial production; a rather critical attitude towards the (bureaucratic and inefficient) state, also shared by the early writings of Janicke\textsuperscript{181}, a very favourable—if not naive—attitude towards market actors and market dynamics in environmental reforms (later glorified by neo-liberal scholars); a system theory perspective with a relatively underdeveloped notion of human agency and social struggles; and an orientation to the nation state level. Some of the more critical remarks on ecological modernization theory still refer to these initial contributions.”

Critics today of ecological modernisation still criticise the heavy emphasis on technological innovation. Murphy & Bendell\textsuperscript{182}, as recently as 1997 summarized ecological modernization (eco-modernism is the term they use for it) as:

“the perspective that treats the environment as another technological problem to be overcome in the pursuit of progress. To the eco-modernist, pollution is an economic opportunity for prevention and clean-up technologies and certainly not an indication of fundamental problems with the current economic system.”

This summary and its implicit criticism identify some of the shortcomings in the earlier development of ecological modernization theory. More recent writings have addressed those shortcomings.\textsuperscript{183}

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Despite these writings, however, it is fair to criticise writings of ecological modernisation today for still presenting a narrow conception of the scale, speed and type of technological innovations needed to achieve adequate decoupling of economic growth from environmental sustainability. For instance, respected environmental economist Dr Paul Ekins simply recommended the tool of eco-efficiency as the main technological tool to achieve decoupling of economic growth and environmental sustainability in the main theme papers for the UN Asia Pacific Green Growth program launched in 2006. This thesis argues that whilst eco-efficiencies and tools like cleaner production are a good start, they are just that, a start. To achieve sustainability requires a much greater shift to truly eco-modernise production and consumption systems to sustainability and ensure that new unforseen problems do not arise.

Technologies have caused significant environmental harm in the past because they often have unexpected side effects or second order consequences that were not originally understood by the designers of the technology. Another key reason why technologies in the past have so often created problems is that their environmental effects have been a secondary consideration. For instance, the reason plastics do not degrade in the environment is because they are designed to be persistent; similarly fertilisers were designed to add nitrogen to soil so it is not an accident that they also add nitrogen to waterways as well as leading to algae blooms. Part of the problem Commoner argued in his book, The Closing Circle was that designers make their aims too narrow: historically they have seldom aimed to protect the environment. He argued that technology can be successful in the ecosystem, ‘if its aims are directed toward the system as a whole rather than some apparently accessible part.’

Sewerage technology is an example which illustrates this point. In 1972 Commoner argued that engineers designed their technology to overcome a specific problem: when raw sewerage was dumped into rivers it consumed too much of the rivers oxygen supply as it decomposed. Modern secondary sewerage treatment plants are designed to reduce the oxygen demand of the sewerage. However, the treated sewerage still contains nutrients which help algae to bloom, and when the algae die they also deplete the river of oxygen. Instead of this piecemeal solution,

Commoner argued that engineers should look at the natural cycle and reincorporate the sewerage into that cycle by returning it to the soil rather than putting it into the nearest waterway. Commoner advocated a new type of technology, that is designing with the full knowledge of ecology and the desire to fit in with natural systems. This requires tools, in addition to eco-efficiency, such as Whole System Approaches to Sustainable Design (often called simple Design for Environment or Design for


Sustainability), Biomimetic Design, and Green Chemistry Design combined with a detailed knowledge of natural systems to enable a rapid leapfrog to benign by design industrial and built environment systems. On the policy side there is a wide range of initiatives needed such as Sustainable Technology Assessment. These will be discussed in detail in Chapter 7 of this thesis.

Another important criticism of ecological modernisation comes from Jevons Paradox, often known as rebound effects as outlined in 1980 by economists Daniel Khazzoom and Len Brookes. Negative rebound effects from technology and eco-efficiencies are real and will be discussed in detail in this thesis. This thesis will argue that to address rebound effects a broad policy portfolio approach is needed of economic incentives, regulation, sustainable technology assessment and the creation of Sustainability or Future Funds. This thesis will attempt to show that unless such policy measures to dramatically reduce rebound effects are implemented much of the environmental gains of eco-innovation and eco-efficiencies will be undone over time. This thesis’s discussion of rebound effects is covered mainly in Chapters 1,4,7 and 8 whilst Jevons Paradox is discussed briefly in Chapter 2 as part of a discussion of the history of the great sustainability debates. Thus this thesis, in these chapters, will address a number of the main criticisms of the first phase of ecological modernisation.

1.4.2 The Second Stage of Ecological Modernisation

Ecological modernization studies from the late 1980s to the mid 1990s placed less emphasis on and had a less simplistic deterministic view regarding technological innovations as the main driver for ecological modernization. In addition, these contributions from this second stage, presented a more balanced view on the role of government and policy reform as well as market dynamics and mechanisms in ecological transformation processes.

Another major criticism of ecological modernization in this second period was that it was too Eurocentric because of the focus on European Organization for Economic Co-operation and Development (OECD) countries. Critics argued that ecological modernization theory had evolved through analysis of a small number of EU countries, most notably Germany, the Netherlands and the UK but, at the same time, sustainability is not something that can be achieved in just one country. International trade and the fact that pollution such as greenhouse gas emissions is truly global means

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that all countries need to be engaged in the process of ecological modernisation to achieve sustainable development. Many of the economies of the world growing the fastest such as China by the mid 1990s were achieving very little decoupling of economic growth and environmental pressure.

Research has shown that nations do appear to vary in the degree to which institutions and outcomes of ecological modernization are evident and\textsuperscript{191}

During this phase, more attention is also paid to the institutional and cultural dynamics of ecological modernization, and the role of human agencies in environment-induced social transformations\textsuperscript{192}.

Thanks largely to the momentum built from *Our Common Future* and the Rio World Summit on Environment and Development new and significant international conventions were agreed upon in 1992, such as the Convention on Biological Diversity and the UN Framework Convention on Climate Change.

But probably the main and most serious criticism of EM in this period was, whilst decoupling was being achieved in a number of European OECD countries across many environmental indicators, the level of decoupling of economic growth and environmental pressures was woefully insufficient. Rebound effects (as discussed briefly above), the spread of western consumerism globally, and the failure to significantly decouple economic growth from greenhouse gas emissions have overwhelmed the gains, that have been made, from technological eco-innovation.

Hence critics focused on the neglect of some ecological modernisation writers of consumption and life-styles and rebound effects. Critics also focused on ecological modernisation’s overly optimistic idea of environmental reforms in social practices, institutional developments. Ecological modernisation by the mid 1990s was criticised for not addressing realistically the level of sustainability policy, regulatory and institutional reform needed to achieve the required level of decoupling fast enough to achieve sustainable development. Critics argued that the “policy reforms” recommended by ecological modernisation to date were inadequate to create genuinely green businesses let alone green economies. Much of these criticisms were brought to the fore and addressed next in the third phase of ecological modernisation by scholars outside the ecological modernization tradition such as Christoff\textsuperscript{193}, Blowers\textsuperscript{194} and Dryzek\textsuperscript{195}. We consider these important advances next in


a discussion of the third phase and 4th phase of ecological modernisation and then we consider further how this thesis will addresses some of the main criticisms of ecological modernisation and in so doing advance some of the great sustainability debates.

1.4.3 Third Stage of Ecological Modernisation

The advances put forward in studies, papers and book publications of the third period, from the mid-1990s to the 2002 World Summit or Sustainable Development in Johannesburg are very significant and need to be understood to understand the context to which this thesis is a contribution. This period of ecological modernisation theory is very important in that EM contributors in this period

- lay a better conceptual foundation for ecological modernisation and address many of the major criticisms of the field.
- focus on developing and integrating technological and design innovations that achieve large and rapid resource productivity improvements (Factor 4 or better) to make it technically and economically possible for stronger and more rapid decoupling of economic growth and environmental to occur.
- develop new sustainable consumption and production frameworks within the EM philosophy and
- target the key actors through publications and the building of sector, professional and business forums and networks needed to create the social conditions to enable the achievement of EM.

Also this period sees ecological modernisation’s central principles and strategies formally adopted by more and more mainstream institutions and organisations. This period also sees many nations develop Agenda 21 blueprints for their nation based on an ecological modernisation approach.

1.4.4 Major Criticisms of EM Addressed: A Stronger Form of EM is Proposed

The first significant advance in this third phase of evolution in ecological modernisation comes from the work of Dr Peter Christoff. In 1996 Christoff 196 addressed the main criticism of what he called the “weak” form of ecological modernisation namely that it is only about marginal change and technical innovation. The “weak” form of ecological modernisation uses the language of sustainability and modernisation but proposed only minor changes to policy, institutions and participatory approaches to address vested interests. Christoff proposed a new “strong” form of ecological modernisation to address the main criticism of ecological modernisation and provide a more realistic way forward to genuinely achieve sustainable development.

Christoff’s “strong” ecological modernisation still recognises the importance of technological innovation, but recognises that technological change is not a panacea on its own. Strong ecological modernisation recommends radical change to technology and consumption patterns but also recognises that achieving social justice is just as important.

Strong ecological modernisation recommends a comprehensive policy, regulatory and institutional reform agenda to achieve rapid and significant decoupling of economic growth and environmental pressure. In Australia, a significant example of such comprehensive policy package, was Krockenberger et al’s *Natural Advantage: Blueprint for a Sustainable Australia*. This 2000 publication was published as the official Australian NGO recommended Agenda 21 strategy for Australia. It was deliberately based on the strong ecological modernisation framework of Christof who has been a long time policy advisor to the Australian Conservation Foundation.

Strong ecological modernisation also recognises the risks of strong policy settings leading to heavily polluting industries relocating overseas. As York and Rosa point out dematerialisation of industry in one country will achieve little if it simply leads to heavily polluting industries being exported to another country. Strong EM adopts a more reflexive policy approach that works with industry to achieve larger de-materialism targets and commits to extending public participation and deliberation in policy settings. Strong EM addresses the need for more active public policy processes and participation in the development and implementation of sustainability policy and institutional change. By 2003, some aspects of strong ecological modernisation could be seen in Germany.

Other major areas of criticism of ecological modernisation were addressed through clarifying and expanding the ecological modernisation discourse in this third phase. In the third phase, traditional ecological modernisation studies of industrial production are increasingly complemented by paying attention to ecological transformations related to consumption processes.

The criticism that ecological modernisation, of the second period, was too Euro-centric was addressed in the third period by numerous studies on EM reforms in non-EU countries (new industrializing countries and the transitional economies in East Central Europe, but also for instance the USA and Canada). Besides studies referring to the European countries like Germany, the UK and the

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197 Ibid.
As discussed above, one of the main criticisms of ecological modernisation is that there has been insufficient decoupling of economic growth and environmental pressures to date. Thus some non-EM environmentalists argue that this shows that economic growth and environmental pressures are coupled and that it is naively and dangerously optimistic to pretend that significant decoupling is


213 Frijns, J., Kirai, Malombe, J. et al. (1997) Pollution Control of Small Scale Metal Industries in Nairobi. Wageningen:Wageningen: Department of Environmental Sociology WAU:WABRI.


possible. In the mid 1990s-2002 EM academics and EM practitioners acknowledged that despite innovations increasing eco-efficiencies in recent decades, the net resource and energy flows were still increasing. They acknowledged that this was due to a range of factors such as increasing globalization of production, global uptake of Western consumption patterns in the East and South, and global population growth. EM academics, practitioners and government programs sought to address the challenge of the scale and speed required for achieving sustainability.

Using the Ehrlich and Commoner formulae and other methodologies more and more EM experts and sustainability practitioners calculated that at least factor 10-20 improvements from technical eco-innovation and sustainable consumption is now needed to achieve sustainable development. In 1993 a number of leading sustainability thinkers formed the Factor 10 Club to promote understanding of the scale and speed now required for ESD and to provide detailed assessment of how to achieve it. Members of the Factor 10 Club also sought to help catalyse the technical change needed and complimented this with renewed efforts to encourage and create better incentives for sustainable consumption. Members of the Factor 10 Club from the mid 1990s to 2002 published a number of important new books outlining ways to achieve at least Factor 4, namely a 75 per cent improvement in resource productivity. This assessment of the scale needed to sustainable development has since been backed up by leading government studies in the ecological modernisation tradition, i.e. the Netherlands Government in their Inter-ministerial Sustainable Technology Development Programme (Sustainable Technology Development Programme). The programme is one

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221 Commoner, B. (1971) ‘The Environmental Cost of Economic Growth’ in Shurr, S. (1971) *Energy, Economic Growth and the Environment*, John Hopkins University Press, Baltimore/London, pp 30-65. [It should be noted clearly though that the ‘T’ for technology in The Commoner-Ehrlich equation uses the word technology in the broadest sense of the word. The variable T in the Commoner-Ehrlich equation refers to two forms of reductions to environmental impact namely those due to economic structure (changing the composition of output towards less damaging products, changing the production-consumption system.) and technical change (substituting less damaging factor inputs for more damaging ones such as using renewable energy, and increasing the resource productivity)]


223 See Factor 10 Club Declarations 1994 and 1995 and Statement to Leaders in Government and Business, 1997 Factor 10 Institute, F-83660 Carnoules, France


of the first to both work out the scale and speed of change required to achieve nationwide ecological and social sustainable development over the next 50 years.

In setting a time-horizon of 50 years – two generations into the future – it was found that ten to twenty-fold eco-efficiency improvements will be needed to achieve meaningful reductions in environmental stress. It was also found that the benefits of incremental technological development could not provide such improvements.

Leo Jansen, Chairman, Dutch Inter-ministerial Sustainable Technology Development Program, 2000

The governments of Austria, the Netherlands, Norway have publicly committed to pursuing Factor 4, or 75 percent efficiencies. The same approach has been endorsed by the European Union as the new paradigm for sustainable development. Austria, Sweden, and OECD environment ministers have urged the adoption of Factor Ten goals, as have the World Business Council for Sustainable Development and the United Nations Environment Program (UNEP). The concept of Factor 10 (a target of reducing environmental pressures by a factor of 10) is not only common parlance for most environmental ministers in the world, but such leading corporations as Dow Europe and Mitsubishi Electric see it as a powerful strategy to gain a competitive advantage. Universities like ANU organised forums and symposiums on Factor 10 to raise awareness amongst the public, students and decision makers of these issues.

But Factor 10 style eco-innovation will not be enough on its own to achieve sustainable development. History has shown that globally the spread of western consumption patterns are swamping gains made from eco-efficiencies and eco-design. Also studies show that it will be physically impossible for all countries globally to adopt current western consumption patterns. For instance the UNEP (2002) Sustainable Consumption – A Global Status report stated that,

If China were to match the US for levels of car ownership and oil consumption per person it would mean producing approximately 850 million more cars and more than doubling the world output of oil. Those additional cars would produce more CO₂ per annum than the whole of the rest of the world’s transportation systems. If China were match US consumption per head of paper, it would need more paper than the world currently produces. If China were to consume seafood at the per capita rate of Japan, it would need 100 million tonnes, more than today's total catch. If China’s beef consumption was to match the USA's per capita consumption and if that beef was produced mainly in feedlot, this would take grain equivalent to the entire US harvest.

It is vital that the world embraces sustainable consumption patterns to reduce environmental impact rapidly. Professor Ryan charts the history of the discussion of sustainable consumption and production in UNEPs 2002 Sustainable Consumption – A Global Status report written for and launched at the 2002 World Summit for Sustainable Development. This report, clearly positioned in the EM tradition, outlined a comprehensive framework for governments and other key actors to assist societies make the shift to sustainable consumption.

Ecological modernisation outlines a desired path towards sustainability. But the success of this path depends on the actions of numerous actors throughout society. Ecological modernisation cannot be achieved without the active engagement of these actors. In this third phase of ecological modernisation we see a range of academics and practitioners begin to publish new books which provide significant new resources to enable these actors to more easily act as effective change agents. These books provided significantly new resources for the key actors of ecological modernisation such as business leaders and managers, accountants, engineers, economists, government policymakers and regulators, actors operating in national systems of innovation, urban and transport planners, and NGOs.

226 UNEP (2002) Sustainable Consumption: Global Status Report 2002, UNEP, Paris (report written by Professor Chris Ryan, RMIT University, Melbourne, Australia, and the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden)
These books helped to provide the foundation for many mainstream organisations not simply endorse sustainability but actively work on either implementing sustainable solutions, lobbying governments and business for change or creating education and training materials in sustainable development. These books helped to inspire people to form many cross sectoral networks to work on sustainable development. Also this period sees ecological modernisation’s central principles and strategies formally adopted by more and more mainstream institutions, organisations and professional bodies in especially Europe and Asia. For instance, the OECD’s 2001-2011 Environmental Strategy, agreed to by all OECD environmental ministers, adopts formally much of the “weak” ecological modernisation paradigm in its stated goals and design. Decoupling economic growth from environmental pressures is adopted as one of the five main goals of the OECD’s 2001-2011 Environmental Strategy. For instance new business industry groups adopt the “weak” form of ecological modernisation agenda such as the World Business Council for Sustainable Development. This period also sees many nations develop Agenda 21 blueprints for their nation based on an ecological modernisation approach. The OECD, for instance, published “Sustainable Development Strategies: A Resource Book” in 2002 to assist all OECD nations develop Agenda 21 Blueprints and national sustainability strategies along ecological modernisation lines. Overall the trend is clear that more and more countries around the world are adopting many aspects of an ecological approach. As the 2007, World Ecological Modernisation report stated

“In the 1970s, seven countries including the Netherlands entered the period of ecological modernization. In the 1980s, 11 countries including Italy entered the period of ecological modernization. In the 1990s, 40 countries including South Korea entered the period of ecological modernization.”

These signs of significant progress made during the 3rd phase of ecological modernisation did not result in the hoped for outcomes of the Johannesburg 2002 World Summit for Sustainable Development. The governments of especially the USA and Australia continued to play an undermining role for international multi-lateral sustainable development agreements. As we will discuss in Chapter 3 much of the energy generated by the 2002 World Summit for Sustainable Development was subsequently lost through resources being focused on the war on terror and the war in Iraq instead of sustainable development. Nevertheless some important results were achieved from the 2002 World Summit for Sustainable Development such as the formation of a regional government network for sustainable development modelled on ICLEI and the agreement for a UN Decade of Education in Sustainable Development from 2005-2015. Advances like these will help create the conditions to make it easier for ecological modernisation to flourish.

1.4.5 Fourth Stage of Ecological Modernisation

Between 2002 and 2008, there has been a significant shift in the debates and discourse on aspects of ecological modernisation such as climate change and water policies globally. There is in 2008 now far stronger political, business and community will for action to decouple economic growth from greenhouse gas emissions in particular. A significant shift has occurred in 2006-7 driven by the latest IPCC 4th Assessment, the UK Stern Review, Al Gore’s *An Inconvenient Truth* and the change of government in late 2007 in Australia. As Dr Pachauri, the chair of the IPCC, argues this shift in commitment on climate change is finally ensuring that nations move from paying lip service to sustainable development and now start understand its importance,

“The concept of sustainable development was really enunciated and popularized through the report of the Brundtland Commission, and it is appropriate that we are focusing today on a report that was released 20 years ago. However, the importance of sustainability in development policies and practice has not been realized until recently. As is often the case it is only the occurrence of the threat of a crisis that spurs human society to unusual actions and changes in pathways. In the case of sustainable development, I think the wake up call has really come from the sudden growth in awareness and understanding on the scientific realities of climate change.”

The shift in the climate change discourse in Australia for instance has been historic. In fact, it could be argued that 2006 - with the launch of Al Gore’s film *An Inconvenient Truth* and the *Stern Review* - was an historic tipping point; when the majority of Australians finally understood the seriousness of human induced climate change. This shift in the climate change debates is discussed in detail in Chapter 8 of this thesis.

However it is pertinent to note that this is not the first time historically there has been an upsurge in interest, awareness and good intentions regarding environmental and social sustainability. As Chapter 2 shows as far back as 1908 in the USA there was an upsurge of interest in environmental sustainability led by President Theodore Roosevelt. Similarly, there was a significant wave of interest and concern in the late 1980s and early 1990s. This thesis argues that it is important to understand why in the past such upsurges did not result in a rapid shift to sustainability to better understand the lessons for today.

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In this 4th phase of ecological modernisation (EM), EM writers have drawn attention to one of the key reasons why, in the past, significant shifts in environmental debates and community interest did not lead to strong ecological modernisation – namely the reality of vested interests and blocking coalitions. In 2004 Janicke made a key insight, namely that, to date, ecological modernisation had not distinguished clearly enough between ecological restructuring and ecological modernisation, the latter requiring considerably more political, social and industrial change, risk and cost. It is important to distinguish between intrinsically unsustainable industries that would need to be restructured with those industries which can be modernised ecologically relatively easily. This distinction is important to make as it helps explain why an “environmental problem” for which there is a readily available, marketable and cost effective technical solution is relatively easy to solve (Ozone, Acid Rain etc) compared to where either industries need to be restructured (fishing, forestry, coal and forestry, unsustainable agriculture) or where there are not yet commercially viable or cost effective solutions (geo-sequestration for the coal industry).

There have always been some industries that need to be restructured and not simply modernised to achieve sustainable development. These industries have traditionally opposed and fought any sign of ecological modernisation initiatives in many countries. These vested interests in the USA, Europe, and Australia have utilised an increasingly sophisticated network of industry funded right wing think tanks and media contracts to run effective campaigns against any ecological modernisation. This is discussed in detail in Chapter 3.

This thesis discusses in Chapter 3 the fact that purposeful ecological modernization policy and institutional reform has rarely occurred without a fight from those vested interests who either will be, or perceive that they will be, negatively affected. These vested interests have historically formed politically conservative blocking coalitions to sustainable development. As Chapter 3 shows this anti-sustainability conservative blocking coalition have demonstrated themselves to be effective and powerful at preventing change towards sustainable development. The anti-sustainability conservative movement have utilized the media effectively to spread doubt, for instance, about the science of climate change and spread fear amongst the general population that sustainable development will harm business competitiveness, jobs and economic growth. One of the main reasons that the upsurge in interest and commitment in sustainability in the late 1980s and early 1990s failed to realize its early promise was due to the success of a concerted campaign against sustainable development based on the argument that it would harm jobs, business competitiveness and economic growth. These vested interests working with right wing think tanks and the media have been extraordinarily effective at convincing the general public that anyone who is pro sustainable development is anti growth, anti-jobs

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and anti-business competitiveness. (Chapter 3) This is the other key reason why this thesis focuses on these three key sustainability debates (Chapters 4-8).

This thesis argues in Chapter 3 and 9 that, to help create the conditions under which ecological modernization is more likely to flourish, there is a need for new institutions, new campaign strategies and new anti-blocking coalition style “think tanks” that are networked with progressive industry groups, innovation/R&D and educational institutions. Such new strong anti-blocking coalitions are needed to provide confidence to other progressive business, government and civil society organizations to publicly commit and implement strong ecological modernization actions and measures.

This thesis concludes that since we live in a world where business, government and civil society all have power new institutions like National Councils for Sustainable Development and new sustainability focused boundary organizations and think tanks are needed to bring together representatives and leaders across all the key sectors and stakeholders of any nation to build consensus for action on environmental and social sustainability which is inclusive. Such strategies are vital to countering efforts from vested interests to undermine and even block efforts to achieve a transition to a sustainable society.

This thesis is not simply theoretical. As part of the practice of the thesis, the author has co-founded a new “anti-blocking coalition” sustainability think tank, The Natural Edge Project (TNEP) ([www.naturaledgeproject.net](http://www.naturaledgeproject.net)) with Karlson ‘Charlie’ Hargroves. This think tank is not unique. All around the world other sustainability orientated think tanks have formed such as the Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA).

This thesis thus seeks to not simply be of interest to the academic community, but also those looking for new frameworks with which to build consensus for action on sustainable development across the silo’d institutions of society whether from within (through cross institutional structures like National Councils for Sustainable Development) or from outside traditional institutions (through these relatively new environmental and social sustainability orientated think tanks).
Chapter 2 Historical Overview of the Sustainability Debates and Discourses

As Chapter 1 showed, current unsustainable development patterns now have reduced the resilience of the earth’s ecosystems significantly. According to the 2005 UN Millennium Ecosystem Assessment, humanity is faced with significant risks of tipping points occurring beyond which irreversible loss of ecosystem services will occur. Chapter 1 highlighted how humanity has a small window of a few decades to transition global development onto a more sustainable trajectory. Debates about sustainable development in the media and even in many publications tend to talk about sustainable development and the environment movement as though it is a very recent developments starting with the publication of Our Common Future and Rachel Carson’s The Silent Spring respectively. Certainly the modern environment movement and the institutional approach to sustainable development recommended by Our Common Future are historic. But there is a growing body of evidence which shows that there have been earlier efforts to create a more ecologically sustainable future. Twenty years on from the publication of Our Common Future there has been more historical research which shows that concerns and debates about the lack of sustainability of development have a long history.

To emphasize how important these debates about the sustainability of development are and how long they have been going on, this chapter begins by over viewing briefly Jared Diamond and Joseph Tainter’s publications. Their publications show that the sustainability of development has been a significant issue for many past human civilisatons. Their publications show that a failure to understand and identify environmentally unsustainable trends in development by past civilisations was a significant factor in their demise. This chapter thus begins by showing that concerns and debates about the lack of sustainability of development have been central to the history of many past civilisations. This chapter shows that the term sustainability was used in the modern sense as early as 1713. This thesis argues that this is very important because a major barrier, which undermines


243 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008


progress on sustainable development today, is that the environment is still not something which the central agencies of government and enough CEOs see as core to the way they govern or do business respectively. One of the reasons why the environment and sustainable development are still seen as an add-on, by many decision makers, is that they are seen to be relatively new issues and concerns. Politicians and business leaders are able to excuse lack of progress to achieve sustainable development by arguing that sustainable development is something that is “new” that they are “working on.” On the other hand economic development, security, democracy, social justice, the need for education and health are seen as ideals and activities which have a long history. But, as this chapter seeks to show, the ideals of democracy and justice where not the only legacy left by ancient Greece. Unsustainable rates of deforestation were seen as a major concern in ancient Greece which used timber as its main source of fuel both for peaceful and military purposes. The changes from deforestation made a considerable impression on Aristotle’s biographer and botanical gardener Theophratus of Erasia, Theophrastus, from his observations of local forest changes, developed a theory which firmly linked deforestation to the decline in rainfall, which he believed was taking place in Greece and Crete. The Ancient Greeks pioneered passive solar design of their whole cities so all homes had access to sunlight during winter to reduce the need for wood to heat their homes and thus better sustain their timber resources. Evidence such as this, helps to move the sustainability debates forward by showing busy politicians and decision makers more generally that they cannot use the excuse that such ideals and concerns are relatively new.

This chapter will briefly overview recent publications which show that the environmental sustainability of development has been a central issue since at least 4000 BC for many human civilisations. This chapter does this because this relatively new environmental history is important to show decision makers that the issue of environmental sustainability deserves to be a central part of government and business decision making along with issues of social justice, economic development and security.

Another reason for considering the history of sustainable development ideas is because this thesis is about how to advance and resolve the great sustainability debates. Thus it is vitally important for this chapter to investigate when these sustainability debates began in a modern historical context. Taking an historical approach provides a rich empirical context from which this thesis can analyse and then discuss the common patterns and characteristics of sustainability debates. Taking an historical perspective enables an analysis of the relative merits of the different sides of the sustainability debates. In addition, there is much that can be learnt from this history of sustainability debates to better understand them and thus help to inform and progress the sustainability debates today.


249 Ibid.
Diamond's\textsuperscript{250} and Tainter's\textsuperscript{251} work shows that whether or not past civilisations avoided collapse often depended on whether they foresaw and acted in time to avoid passing ecosystem resilience thresholds and tipping points. Their work shows that civilisations which identify and pro-actively act to address unsustainable development trends early tend to be those that avoid such tipping points and the vicious cycles that lead to collapse.

As Chapter 1 showed, humanity has a small window of a few decades to transition global development onto a more sustainable trajectory. It behoves us then to learn, not just from the lessons of ancient civilisations, but also from more modern history the lessons of past debates about the sustainability of development. Thus this chapter then asks the question: when did humanity in more modern times have a chance to start on a global scale to define and pursue sustainable development? This chapter shows that these debates have not only been going on for a long time but have crucially mattered to the course of modern world history for over a hundred years. Taking an historical perspective also enables the thesis in Chapter 3 to ask: what factors have prevented a transition to sustainable development?\textsuperscript{252} Appendix 2.1 of this thesis provides a detailed timeline of the history of sustainable development ideas to provide further evidence to support the thesis presented here in Chapter 2.

\textbf{2.1 When did Concerns about the Sustainability of Development Begin?}

Most of us think of the concerns about environmental degradation undermining development as a recent phenomenon, however, concerns about such issues goes back thousands of years.

In trying to understand our current environmental difficulties, it is helpful to look at earlier civilizations that suffered environmentally induced economic decline. Our early twenty-first century civilization is not the first to face that prospect.

Almost all past civilizations, even the very first civilisation, the Sumerians from Mesopotamia, have declined and eventually collapsed partly due to unsustainable resource management or unsustainable resource depletion or climate change or combinations of these. Indeed, a society's decline may begin only several decades after it reaches its peak population, wealth, and power. This is because peak population, power, resource consumption and, wealth, are accompanied by peak environmental impact from which declines of societies can follow swiftly.

Archaeological evidence reveals such courses of decline and eventual collapse in a diverse array of ancient civilisations as the Maya in the Yucatán, the Anasazi in the American Southwest, the Cahokia mound builders outside St. Louis, the Garamantian Empire of the Sahara, the Greenland Norse, the

\textsuperscript{250} Diamond, J (2006) \textit{Collapse: How Societies Choose to Fail or Succeed}. Random House


\textsuperscript{252} To the best of this author’s knowledge no one has brought this evidence of the history of sustainability debates together in this way before.
statue builders of Easter Island, the Nazca civilization in Peru, Great Zimbabwe in Africa, Angkor Wat in Cambodia and even the great Roman Empire.

These past civilizations succumbed partly due to environmental degradation and resource depletion due to deforestation, flooding, soil degradation and salinity, exhaustion of water supplies, changes in weather patterns, overpopulation or combinations of these. These led to food shortages and overall the environmental degradation and resource depletion resulted in diminishing returns on investments in energy and resource extraction. Weakened by this, ancient civilisations became more vulnerable to foreign invasions and were taken over or simply collapsed and dispersed in search of more fertile and productive lands. Table 1 summarises a few examples of this vicious cycle which contributed to the decline of so many past civilisations.

Table 2.1: Patterns of Decline – Environmental Factors in Civilisations Collapse

<table>
<thead>
<tr>
<th>Civilization</th>
<th>Environmental Factor</th>
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<tbody>
<tr>
<td>Sumerian Civilisation</td>
<td>Agricultural irrigation systems were used in regions where underground drainage was not good. This raised the water table. As the water came close to the surface it evaporated leaving salt behind. Wheat yields declined as the salt accumulated. The Sumerians changed to a more salt-tolerant plant, barley. Doing so postponed Sumer’s decline. As salt concentrations continued to build, the yields of barley eventually declined also. As land productivity declined, so did the civilization. Salinisation of agricultural lands combined with changes in the climate contributed to the decline in this civilization. 253</td>
</tr>
<tr>
<td>Garamantian Empire</td>
<td>The Garamantian empire was made possible in the Sahara by a 3,000-mile network of underground irrigation canals to exploit ancient groundwater. Overexploitation of groundwater resulted in its collapse. 254</td>
</tr>
</tbody>
</table>
| Roman civilization,   | The Roman civilization was the most successful of the “Iron Age”. To make iron, charcoal is needed to be burnt. Making charcoal requires significant quantities of timber resources. This resulted in deforestation and degradation of land, soils and water resources. The Roman Empire’s expansion was largely driven by this need for more land for both wood resources and new fertile farming land. By the 3rd century AD in some parts of North Africa and

through the Mediterranean, up to one half of the arable land had been abandoned due to environmental degradation. With half of the arable land abandoned by 300 AD neglect led to the spreading of swampland which became breeding grounds for diseases like malaria. These factors contributed to the weakening of the once greater empire making it vulnerable to attack and contributed to its eventual defeat.255

Mayan civilization, Loss of soil fertility and drought from deforestation and climate change led to a crisis from lack of sufficient food and rising levels of internal and external violence.256

Ankor Wat, Khmer Empire. Cambodia Deforestation to extend their farmland up to the slope of Kulen mountain, 80 kilometres to the north, led to flooding and huge amounts of sediment and sand were washed down to fill up their extensive canal water system – ruining the cities water supply.257

Diamond found the following have been factors in the collapse of many civilisations:
- Environmental damage, such as deforestation and soil erosion
- Climate change
- Dependence upon long-distance trade for needed resources.
- Increasing levels of internal and external violence, such as war or invasion
- Societal responses to internal and environmental problems (which depend on whether or not the vested interests will be affected by environmental problems).

According to Diamond258 and other experts of ancient civilisation collapse, past civilisations have also suddenly collapsed because their economies, (and importantly the wealth and privilege of the decision makers of the day), depended on constantly physically growing in ways that the local natural environment could not sustain.259

Diamond is not the first to come to these sorts of conclusions. As far back as the first half of last century, famous environmentalist Richard St Barbe Baker was arguing in broad terms this overall thesis as well in his books. In his 1944 publication, I Planted Trees he writes,

“The great Empires of Assyria, Babylon, Carthage and Persia were destroyed by floods and deserts let loose in the wake of forest destruction. Erosion following forest destruction and soil depletion has been one of the most powerfully destructive forces in bringing about the downfall of civilizations and wiping out human existence from large tracts of the earth’s surface. Erosion does not march with a blast of trumpets or the beating of drums, but its tactics are more subtle, more sinister”.

One of the most respected academic publications in this field is Joseph Tainter’s book *The Collapse of Complex Societies*. In this book, Tainter argued that societies that collapse usually adhere the following three models in the face of collapse:

1. The Dinosaur: The best example is a large scale society in which resources are being depleted at an exponential rate and yet nothing is done to rectify the problem because the ruling elite are unwilling or unable to adapt to said changes. In such examples rulers tend to oppose any solutions that diverge from their present course of action. They will favour intensification and commit an increasing number of resources to their present plans, projects and social institutions.

2. Runaway Train: An example would be a society that only functions when growth is present. Societies based almost exclusively on acquisition, including pillage or exploitation, cannot be sustained indefinitely. The society of the Assyrians and Genghis Khan and the Mongols, for example, both fractured and collapsed when no new conquests were forthcoming.

3. House of Cards: In this aspect of Tainter’s model societies that grow to be so large and include so many complex social institutions that they are inherently unstable and prone to collapse.

Tainter argued that often these three models co-exist and reinforce each other leading to civilisations collapse. Considering Easter Island as an example, it could be said that the leaders (the ruling elite) on Easter Island saw a rapid decline of trees but ruled out change (i.e. The Dinosaur). Timber was used as rollers to transport and erect large statues called moai as a form of religious reverence to their ancestors. Reverence was believed to result in a more prosperous future. So they intensified moai production (i.e. Runaway Train). Easter Island also has a fragile ecosystem because of its isolated location (i.e. House of Cards). Deforestation led to soil erosion and insufficient resources to build boats for fishing or tools for hunting. Competition for dwindling resources resulted in warfare and many casualties.

Jared Diamond argues that the history of these ancient civilisations has important lessons for civilisation today. The lesson from Diamond’s and Tainter’s theses is that advanced and complex civilisations, like our one today, stand the best chance of thriving long term if they identify and address unsustainable aspects of their development as early as possible rather than later. Thus their


261 Ibid.
research shows that it is wise to take a precautionary approach to development whereby warnings from scientists are taken seriously and acted upon.

Many are aware that scientists have been warning humanity about the consequences of unsustainable forms of development since the 1960s. It is almost four decades since the 1972 UN Summit on the Human Environment in Stockholm and the publication *Limits to Growth* issued global warnings to this effect. But few decision makers would be aware that in fact the first warnings from modern scientists about the unsustainability of different modern aspects of development go back over one hundred years. Even fewer would be aware that the first chance humanity had to define and pursue sustainable development globally was well before the 1972 UN Summit on the Human Environment in Stockholm.

### 2.2 When Did Humanity Have The First Chance To Define and Pursue Sustainable Development Globally?

In answer to this question, most would say 1992, when the nations of the world gathered in Rio for the 1992 UN Conference on Environment and Development. Some may say 1972 at the first UN Summit on the Human Environment in Stockholm. Most would assume that this period from the 1960s-1990s was the first time humanity had the necessary scientific knowledge, eco-technological solutions, political and community will and global communications to define and pursue sustainable development globally.

But humanity actually had its first real opportunity to strive to achieve global sustainable development as far back as 1909. In 1909, US President Theodore Roosevelt asked the leaders of the world to meet at the Hague to consider the conservation of the natural resources of the world.\textsuperscript{262} Echoing many of the key themes and actions recommended for each nation by *Our Common Future* and the 1992 Rio Earth Summit, between 1907-1909 US President Theodore Roosevelt:

- convened the first Conference of Governors at the White House to consider problems of conservation and develop a national plan of action for the USA\textsuperscript{263}
- set up a National Conservation Commission to look at the use, wastage and conservation of natural resources to prepare first inventory of natural resources for the entire USA.\textsuperscript{264}
- convened the first North American Conservation Conference at the White House.\textsuperscript{265}

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\textsuperscript{263} See the Full Proceedings of the 1908 Conference of Governors at the White House Available at [http://memory.loc.gov/cgt-bin/query/r?ammem/consrv:@field(DOCID+@lit(amrvvg16)):@@@SREF](http://memory.loc.gov/cgt-bin/query/r?ammem/consrv:@field(DOCID+@lit(amrvvg16)):@@@SREF) Accessed 1 July 2008


\textsuperscript{265} Ibid.
• encouraged a regional approach to conservation of natural resources with the USA, Canada and Mexico.\textsuperscript{266}

In Roosevelt’s opening address\textsuperscript{267} (See Appendix 2.1) at the Conference for the Governors in 1908, he outlined many of the themes which were subsequently covered in the publications \textit{Limits to Growth}, \textit{Our Common Future} and the 1992 Rio Summit for Environment and Development many years later. Firstly, Roosevelt was clear that the conservation of natural resources should be seen as the highest national priority. He stated that;

“This Conference on the conservation of natural resources is in effect a meeting of the representatives of all the people of the United States called to consider the weightiest problem now before the Nation; and the occasion for the meeting lies in the fact that the natural resources of our country are in danger of exhaustion if we permit the old wasteful methods of exploiting them longer to continue…I have asked you to come together now because the enormous consumption of these resources, and the threat of imminent exhaustion of some of them, due to reckless and wasteful use, once more calls for common effort, common action. We want to take action that will prevent the advent of a woodless age, and defer as long as possible the advent of an ironless age.”\textsuperscript{268}

He went on to highlight the problem of exponential physical growth in humankind’s use of natural resources. He made it clear in this speech that the current development trajectory was unsustainable stating:

As peoples become a little less primitive, their industries, although in a rude manner, are extended to resources below the surface; then, with what we call civilization and the extension of knowledge, more resources come into use, industries are multiplied. With the rise of peoples from savagery to civilization, and with the consequent growth in the extent and variety of the needs of the average man, there comes a steadily increasing growth of the amount demanded by this average man from the actual resources of the country…The mere increase in our consumption of coal during 1907 over 1906 exceeded the total consumption in 1876, the Centennial year. This is a striking fact: Thirty years went by, and the mere surplus of use of one year over the preceding year exceeded all that was used in 1876—and we thought we were pretty busy people even then. The enormous stores of mineral oil and gas are largely gone; and those Governors who have in their States cities built up by natural gas, where the natural gas has since been exhausted, can tell us something of what that means. Our natural waterways are not gone, but they have been so injured by neglect, and by the division of responsibility and utter lack of system in dealing with them, that there is less navigation on them now than there was fifty years ago. Finally, we

\begin{footnotesize}
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\item \textsuperscript{267} See Proceedings of a 1908 Conference of Governors: Opening Address by the President at \url{http://memory.loc.gov/cgi-bin/query/r?ammem/consrv:@field(DOCID+@lit(amrygvg16div19))} Accessed 1 July 2008
\item \textsuperscript{268} Ibid.
\end{itemize}
\end{footnotesize}
began with soils of unexampled fertility, and we have so impoverished them by injudicious use and by failing to check erosion that their crop-producing power is diminishing instead of increasing. In a word, we have thoughtlessly, and to a large degree unnecessarily, diminished the resources upon which not only our prosperity but the prosperity of our children and our children's children must always depend.269

Roosevelt emphasized his generation’s responsibility to future generations to conserve natural resources. The importance of leaving a good legacy to future generations to ensure intergenerational equity runs throughout his speech.270 Roosevelt interpreted the idea of a democratic society to include both present and future citizens. His belief was that a democratic society should protect and conserve natural resources for future generations. He argued that it was undemocratic to exploit and squander a nation's natural resources for present profit. Roosevelt emphasized the ability of humankind to use its unique foresight to conserve these resources for future generations and and responsibility to do so:

One distinguishing characteristic of really civilized men is foresight; we have to, as a nation, exercise foresight for this nation in the future; and if we do not exercise that foresight, dark will be the future! We should exercise foresight now, as the ordinarily prudent man exercises foresight in conserving and wisely using the property which contains the assurance of well-being for himself and his children. We want to see him exercise forethought for the next generation. We need to exercise it in some fashion ourselves as a nation for the next generation.271

Until the turn of the 20th century, Roosevelt explained, the United States had built its economic and political strength by exploiting the nation's natural resources. But Roosevelt, like other leading conservationists of the time, no longer believed that these natural resources were infinite in their abundance. In this speech he even distinguished between those resources which are renewable and non-renewable

The natural resources I have enumerated can be divided into two sharply distinguished classes accordingly as they are or are not capable of renewal...The minerals do not and can not renew themselves. Therefore in dealing with the coal, the oil, the gas, the iron, the metals generally, all that we can do is to try to see that they are wisely used. The exhaustion is certain to come in time. We can trust that it will be deferred long enough to enable the extraordinarily inventive genius of our people to devise means and methods for more or less adequately replacing what is lost; but the exhaustion is sure to come. The second class of resources consists of those which can not only be used in such manner as to leave them undiminished for our children, but can actually be improved by wise use. The soil, the forests, the waterways come in this category. We began with soils of unexampled fertility, and we have so impoverished them by injudicious use and by failing to check erosion that their crop-producing power

269 Ibid.
270 See Proceedings of a 1908 Conference of Governors: Opening Address by the President at http://memory.loc.gov/cgi-bin/query/r?ammem/consrv:@field(DOCID+@lit(amrvgvg16div19)) Accessed 1 July 2008
271 Ibid.
is diminishing instead of increasing. In a word, we have thoughtlessly, and to a large degree unnecessarily, diminished the resources upon which not only our prosperity but the prosperity of our children and our children's children must always depend. We have become great in a material sense because of the lavish use of our resources, and we have just reason to be proud of our growth. But the time has come to inquire seriously what will happen when our forests are gone, when the coal, the iron, the oil, and the gas are exhausted, when the soils shall have been still further impoverished and washed into the streams, polluting the rivers, denuding the fields, and obstructing navigation. These questions do not relate only to the next century or to the next generation.  

The end of the nineteenth century brought the closing of the US frontier and the near extinction of the buffalo and the passenger pigeon. Both species had been symbols of America's seemingly endless natural abundance. Their parlous state caused many Americans to question that myth. Among them was Roosevelt who felt that the nation's dependency on its natural abundance could become the nation's weakness if its reckless and wasteful exploitation continued. To ensure the future availability of the nation’s natural resources, it was necessary as a matter of urgency to conserve and manage them. Roosevelt went on to say in his speech to the Governor’s conference on conservation, "It is equally clear that these resources are the final basis for national power and perpetuity." Roosevelt saw the land as an economic resource. It should be conserved and managed to ensure the economic and political strength of the nation in the long term. While President of the USA, he created five National Parks, fifty-one National bird Reservations, four Game Refuges and the National Forest Service.

Roosevelt believed that environmental conservation was critical to achieve sustained economic growth. Roosevelt was also aware of the barriers to achieving this. For instance he highlighted the problem of how cut off from nature many people had become by living in cities;

And yet, rather curiously, at the same time that there comes that increase in what the average man demands from the resources, he is apt to grow to lose the sense of his dependence upon nature. He lives in big cities. He deals in industries that do not bring him in close touch with nature. He does not realize the demands he is making upon nature.  

Roosevelt was not alone in presenting such a complete and sophisticated case for environmental conservation and intergenerational equity around this time. Svante Arrhenius wrote in 1919 a publication called Chemistry in Modern Life where he clearly identified the sustainable developments concerns of intergenerational equity, the finiteness of resources and the need for a new

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272 Ibid.  
274 See Proceedings of a 1908 Conference of Governors: Opening Address by the President at [http://memory.loc.gov/cgi-bin/query/r?ammem/consrv:@field(DOCID+@lit(amryvg16div19))] Accessed 1 July 2008  
form of environmentally sustainable development. Arrhenius argued that the industrial world had given rise to a new kind of international warrior, who Arrhenius called the “Conquistador of waste.” Arrhenius wrote eloquently

“Like insane wastrels, we spend that which we received in legacy from our fathers. Our descendants surely will sensor us for having squandered their just birthright...Statesman can plead no excuse for letting development go on to the point where mankind will run the danger of the end of natural resources in a few hundred years.”

Having lived against a backdrop of rampant imperialism and the First World War, Arrhenius, then in a position of scientific authority as the Director of the Nobel Institute in Sweden, was deeply concerned about the direction that the European economies had taken as a result of WW1. He feared after the end of the First World War a return to dark times. Arrhenius writes:

“Concern about our raw materials casts its dark shadow over mankind. Those states which lack [them] throw lustful glances at neighbors, which happen to have more than they use. Still more tempting is the desire for gain from lands on the other side of the seas, inhabited by uncivilized natives, with interest unawakened in guardianship.”

Arrhenius invoked the chemist’s commandment “Though Shall Not Waste” to argue that legislation be enacted aimed at both reducing consumption and promoting conservation. Arrhenius’s political hero was Theodore Roosevelt. If Roosevelt had managed to hold the world’s first environmental summit in 1909 then no doubt Svent Arrhenius would have attended, as a huge fan of Roosevelt and at the time head of the Nobel Institute in Sweden. Arrhenius also outlined in this book a clear vision for eco-innovation through engineering sustainable development. Arrhenius argued that

“Since half a tonne of coal is lost during the burning of energy to transport the coal the building of power plants should be in close proximity to the mines. All lighting with petroleum products should be replaced with more efficient electric lamps, while aluminium, the virtually limitless metal should be substituted for iron, whose ore reserves are finite and rapidly dwindling. Engineers must design more efficient internal combustion engines capable of running on alternative fuels such as alcohol, and new research into battery power should be undertaken. Wind motors and solar engines hold great promise and would reduce the level of CO$_2$ emissions. Forests must be planted...”

Arrhenius above all believed in humanity’s capacity for innovation and foresight to solve these problems.

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277 Ibid. p143
278 Ibid p144
“Doubtless humanity will succeed eventually in solving this problem....Herein lies our hope for the future. Priceless is that forethought which has lifted mankind from the wild beast to the high standpoint of civilized humanity.”\(^\text{279}\)

Unfortunately, this first world summit on the environment did not happen in 1909. Roosevelt had promised to resign after two terms in office and he was true to his word.\(^\text{280}\) There was no coup, no sense at all that his views on environment were too radical for the Republican Party of the time. Unfortunately the subsequent President, Taft, did not share Roosevelt’s environmental passion and dismantled Roosevelt’s environmental programs. Roosevelt was so disappointed with this that he ran again for President in 1912 gaining a significant percentage of the vote to come a reasonably close second to Woodrow Wilson whilst significantly outpolling Taft who came third in the poll.

Since few today receive any environmental history education, few today realise what a lost opportunity it was when the world leaders did not take Roosevelt up on his idea to have the first world summit on environment in 1909. Environmental history shows that by 1908 many of the key understanding that inform the call for sustainable development and many of the necessary sustainable solutions and eco-innovations were available and being actively promoted and discussed. Consider the following evidence of this;

The word “sustainable” appears to have been coined in 1713 by Hanns Carl von Carlowitz, head of the Royal Mining Office in the Kingdom of Saxony, when the challenge arose of a predicted shortage of timber. The term “sustainable development” originated 1713 in a paper by Carlowitz.\(^\text{281}\) The roots of that concept can be found in the early ‘European Enlightenment’, when, inspired by the English author John Evelyn and the French statesman Jean Baptist Colbert, German Kameralists, began to plan their dynasties’ woodlands with a view to handing them on undiminished to future generations.

Central ideas and understandings that inform the call for sustainable development like “the tragedy of the commons”, which was discussed in Section 1, were first articulated not in 1968 by Hardin\(^\text{282}\) but in 1833 by William Forster Lloyd in his Oxford lectures.\(^\text{283}\) Economists like John Stuart Mill articulated the desirability to decouple economic growth from physical throughput of the economy in his writings on the stationary state economy in the 1850s.\(^\text{284}\) Other economists articulated the need to address problems of market “externalities” such as environmental degradation as early as the 1880s when the

\(^{279}\) Ibid. p144

\(^{280}\) The statutory two term limit was not in place at this time.


term externality was first used\textsuperscript{285}. There was even an understanding of the economic value of natural resources and ecosystem services which nature provided evidenced by books like Economics of Forestry; a Reference Book for Students of Political Economy and Professional and Lay Students of Forestry, published by Bernhard E. Fernow in 1990\textsuperscript{286} and Edward Howe Forbush’s Useful Birds and Their Protection published in 1907. Forbush’s book discussed the economic value of birds and strategies for their protection.

Economists of the time were also focused on social sustainability issues too. Professor Alfred Marshall, founder of the Cambridge University School of Economics, mentor to the great economist John Maynard Keynes, and undisputed leading economist of his generation in England in the early 20\textsuperscript{th} century chose economics as his field of study out of a desire to better understand and reduce poverty. Marshall was impelled to economics because 'the study of the causes of poverty is the study of the causes of the degradation of a large part of mankind.'\textsuperscript{287}

### 2.3 Debates about the Need for a Precautionary Approach.

Another key understanding, from which the call for sustainable development has partly come, is the fact that environmental pressures can push ecosystem’s resilience past a threshold and into irreversible decline. This was understood and articulated in 1864 by George Perkins Marsh who emphasized that some acts of destruction exceeded the earth's recuperative powers and thus, implicitly, humankind needs a precautionary approach:

"The ravages committed by man subvert the relations and destroy the balance which nature had established between her organized and her inorganic creations; and she avenges herself upon the intruder, by letting loose upon her defaced provinces destructive energies hitherto kept in check by organic forces destined to be his best auxiliaries, but which he has unwisely dispersed and driven from the field of action. When the forest is gone, the great reservoir of moisture stored up in its vegetable mould is evaporated, and returns only in deluges of rain to wash away the parched dust into which that mould has been converted." He continued, "The earth is fast becoming an unfit home for is noblest inhabitant, and another era of equal human crime and human improvidence ......would reduce it to such


\textsuperscript{287} Pigou, A. (1920) The Economics of Welfare. London. MacMillan & Co. p3. In this publication and in his Wealth and Welfare (1912, 1920), Pigou brought social welfare into the scope of economic analysis. In particular, Pigou is responsible for the famous distinction between private and social marginal products and costs and the idea that governments can, via a mixture of taxes and subsidies, correct such market failures - or "internalize the externalities." Arthur Cecil Pigou (1877-1959) developed earlier work by fellow English philosopher Henry Sidgwick(1838-1900) and economist Alfred Marshall (1842-1924) into externalities.
a condition of impoverished productiveness, of shattered surface, of climatic excess, as to threaten the
depredation, barbarism and perhaps even extinction of the species.”

Marsh could also see that now that humankind had explored the world, there were no more new Edens
to migrate to if humankind continued such destruction of nature.

“...Man, who even now finds scarce breathing room on this vast globe, cannot retire from the Old World
to some yet undiscovered continent, and wait for the slow action of such causes to replace, by a new
creation, the Eden he has wasted.”

The idea of needing a precautionary approach to complex systems is not new. By the 1860s in
medicine the Hippocratic Oath – which is analogous to the precautionary principle through its
notion of “First, Do No Harm” had been mainstream medical practice for hundreds of years. The
principle comes from the recognition that when dealing with a complex system such as a human body,
despite the best of intentions, there are risks of negative side effects with any action. But the
Hippocratic Oath does not simply acknowledge that with complex human health one or two things can
go wrong, it acknowledges the fact that when one thing fails there can be a cascade of functions of the
body failing leading to death. This precautionary approach in medicine when dealing with a complex
system could easily have been translated and applied to complex natural systems and humankind’s
interaction with them. The EU 2002 study “Late Lessons from Early Warnings: the Precautionary
Principle 1896–2000” shows that there have been many early warnings over a hundred years ago
calling for a precautionary approach.

2.4 Debates about Deforestation.

Most of us think of the concerns about the environment as a recent phenomenon, however, concerns
about these issues go back thousands of years. Deforestation was seen as a major concern as far back
as ancient Greece which used timber as its main source of fuel both for peaceful and military purposes.
The changes from deforestation made a considerable impression on Aristotle’s biographer and
botanical gardener Theophratus of Erasia, Theophrastus, from his observations of local forest changes,
developed a theory which firmly linked deforestation to the decline in rainfall, which he believed was

288 Marsh, G.P. (1864) Man and Nature: Or, Physical Geography as Modified by Human Action. Edited,
with a new introduction, by David Lowenthal. Foreword by William Cronon. Weyerhauser Environmental

290 See Hippocratic Oath at http://news.bbc.co.uk/2/hi/7654432.stm

(//reports.eea.eu.int/environmental_issue_report_2001_22/en)
taking place in Greece and Crete\textsuperscript{292}. Hence the first theories of human induced climate change were articulated over 2000 years ago. By 1760 this theory had been proven to be true by a broad consensus of the Academies of Sciences of the day. Scientists had been gathering knowledge about botany and nature systematically for a century by then. In 1681 the Dodo became extinct on Mauritius. This was widely reported in Europe. The awareness that humankind’s activities could lead to extinction of species especially on islands, like Mauritius that have relatively unique species, was already widely acknowledged in Europe. This emerging consensus on the science of desiccation and the growing understanding of the threat of extinctions lead to the first comprehensive environmental policies to conserve forests, soil and fisheries being adopted implemented in 1767-1772 in Mauritius. The British, based on this scientific consensus, also implemented forest conservation and other environmental policies in the Caribbean from the 1780s.

Numerous countries adopted forest conservation laws based on this new scientific knowledge and consensus concerning desiccation and threat of extinctions. The British, for instance, enacted sweeping Forestry Conservation legislation in India by the 1850s which inspired the USA from the 1870s to investigate and implement extensive forest conservation from the early 1880s onwards. F.B. Hough\textsuperscript{293}, the main consultant and advisor on this topic in the US, proposed German, French and above all Indian methods of forest conservation as models that were worthy of imitation. Gilford Pinchot, another key US campaigner for North American Forest conservation, was similarly influenced by the Indian example and the India Forest Service. Pinchot then went on to be instrumental in helping Roosevelt to develop his understanding of the need for conservation. Importantly by 1872, already in the USA. Yellowstone National Park had been declared, the first national park in the world. This was the start of many new national parks being created by 1909. Yellowstone National Park is now a World Heritage Site.

2.5 By 1900 Many of the Great Environmental Sustainability Debates Had Begun.

If world leaders had taken up Roosevelt’s call for a world summit on environment this may have created the political will for such a shift earlier. Already by 1908 the risks of asbestos (first warning 1898), PCB’s (first warning 1899), benzene (first warning 1897), and radiation (first warning 1896) were known and being debated. In addition by 1908 the risks of extinctions (1681), tragedy of the commons (1833), over-fishing (1865), pushing beyond ecological thresholds (1864), dry-land salinity


(1864), soil degradation (B.C), deforestation (~300 B.C), damming rivers (1906), acid rain (1872) were known and whether action should be taken was being debated. Other evidence that the world was ready for the challenge of achieving sustainable development by 1909 comes from the fact the Sierra Club had formed. The Sierra Club was formed in 1892 and was dedicated to the preservation and expansion of the world's parks, wildlife, and wilderness areas. From 1903-1913 the Sierra Club campaigned, for instance, to stop the damming of the Hetch Hetchy valley within Yosemite National Park. Roosevelt's chief forester, Gifford Pinchot, argued,

"the object of our forest policy is not to preserve the forests because they are beautiful or the habitat of wild animals; it is to ensure a steady supply of timber for human prosperity. Every other consideration comes as secondary."\(^\text{294}\)

But others viewed nature as an aesthetic resource that should be preserved simply because it looked good and represented a unique natural environment that would be lost with the intrusion of human beings. The chief advocate of this view was John Muir, a respected writer and naturalist and Sierra Club founder. Pinchot's pragmatic view of conservation collided with Muir's instinct for preservation over the fate of the Hetch Hetchy valley within Yosemite National Park echoing debates normally associated with more recent times.

Other sustainability debates, which matter today, also have their origins over one hundred years ago. As early as 1811 the social movement known as the Luddites questioned the blind faith of the time in technological progress.\(^\text{295}\) In 1865 Jevons warned of the risks of rebound effects from industrial efficiency gains.\(^\text{296}\)

Jevons asserted that the more efficient use of coal in engines doing mechanical work actually increased the use of coal, iron and other resources, rather than “saving” them.\(^\text{297}\) Jevons, in *The Coal Question*, showed that cutting the amount of coal used to produce a ton of iron by over two thirds, was followed, in Scotland, by a tenfold increase in total consumption, between the years 1830 and 1863. This has become known as the Jevons Paradox. History has shown Jevons to be correct. As George Monbiot writes,

"(Greater efficiency of processes, products and services has) two effects. The first is that money you would otherwise have spent on energy is released to spend on something else. The second is that as processes, which use a lot of energy, become more efficient, they look more financially attractive than they were before. So when you are deciding what to spend your extra money on, you will invest in more


energy-intensive processes than you would otherwise have done. The extraordinary result is that, in a free market, energy efficiency could increase energy use."^{298}

Many assume that a 50 per cent improvement in energy efficiency will result in a 50 per cent reduction in energy usage and greenhouse gas emissions. Yet this is not what tends to happen in practice. In practice what tends to happen, as Jevons pointed out in 1865 and Monbiot more recently, is that as efficiency increases, people or companies can use the same amount of energy to produce more services. This is because greater energy efficiency has reduced the cost of energy for any one service. Therefore, a major misconception made by some engaging in sustainable development today is to assume that the level of an efficiency saving is equivalent to the net reduction of energy and materials used. It is therefore an important part of the sustainability debates today. For instance, The Stern Review^{299}, has been criticised for ignoring the Jevons Paradox.^{300} Jevons, back in 1865, provided an important insight, which once understood, enables business, government and the community to use economic incentives, policy tools, market mechanisms plus incentives for behaviour change to reduce negative rebound effects significantly. This will be discussed in detail in Chapter 7.

Despite the wealth of evidence for the Jevons Paradox and a wealth of literature on how to address it, almost 150 years on, few governments formally recognise, let alone have explicit policies to address the Jevons Paradox. As the UK Energy Research Centre states in 2007

"Rebound effects tend to be almost universally ignored in official analyses of the potential energy savings from energy efficiency improvements. A rare exception is UK policy to improve the thermal insulation of households, where it is expected that some of the benefits will be taken as higher internal temperatures rather than reduced energy consumption. But the direct rebound effects for other energy efficiency measures are generally ignored, as are the potential indirect effects for all measures. Much the same applies to energy modelling studies and to independent estimates of energy efficiency potentials by energy analysts. For example, the Stern Review of the economics of climate change overlooks rebound effects altogether, while the Fourth Assessment Report from the Intergovernmental Panel on Climate Change simply notes that the literature is divided on the magnitude of this effect."

Table 2.1 highlights the significant time lag between the first authoritative scientific warnings of the lack of sustainability of an aspect development and an adequate political response to each specific

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early warning. It is important to note that there is an inevitable communication lag between one person realising something and it becoming widely known, understood and acted upon politically. But Table 2.1 shows that debates on these sustainability topics failed to be resolved sufficiently over many decades for political action to be taken. This suggests that other explanations are needed, such as potentially the role of vested interests, to explain why it has taken so long for purposeful political action to take place on sustainable development.

The history summarised in Table 2.1 also provides evidence for the cost benefits of a precautionary approach to development. The costs of inaction on asbestos and other chemicals alone have been significant to the environment and humanity the last century. Similarly inaction on the tragedy of the commons, deforestation, and over-fishing, have pushed many ecosystems passed the point of irreversible collapse, impoverishing the poor and vulnerable now for future generations. Yet as Table 2.2 shows scientists have been trying to warn of such risks and move the debate forward to achieve political action on such issues for over one hundred years.

Table 2.2: Not Believing Cassandra. Early Warnings, Late Action.

<table>
<thead>
<tr>
<th>Issues of Ecological Sustainability</th>
<th>First warning of a threat to ecological or human health and resilience.</th>
<th>How long before effective action was taken?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation</td>
<td>During the Peloponnesian War 431 B.C – 421 B.C large tracks of forested countryside were transformed into barren waste and there are indications that much increased soil erosion and flooding resulted. These changes made a considerable impression on Theophratus of Erasia, Aristotle's biographer and botanical gardener. Theophrastus was led by his observations of local forest changes to develop a theory which firmly linked deforestation to the decline in rainfall, which he believed was taking place in Greece and Creto.303</td>
<td>Botanist Pierre Poivre, Commissaire-Indendant of Mauritius from 1767-1772, was responsible for initiating and implementing the most complex and integrated environmental policy to date.</td>
</tr>
<tr>
<td>The Precautionary Principle</td>
<td>Another key understanding, from which the call for sustainable development has partly come, is the fact that environmental pressures can push ecosystem’s resilience past a threshold and into irreversible decline. This was understood and articulated as early as the 1864 such as George Perkins Marsh. The notion of needing to take a precautionary approach has existed in medicine since The Hippocratic Oath – First do no harm.</td>
<td>Many countries in the EU have embraced the precautionary principle in the post 1987. In Australia, the 1992 Intergovernmental Agreement on the Environment adopted the precautionary principle as one of its four guiding principles.</td>
</tr>
</tbody>
</table>

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303 Hughes, J.D (1985) *Theophrastus as ecologist*, Environmental Review, 4, 296-307
| Threat of Extinctions | 1681 The Dodo becomes extinct on Mauritius. This was widely reported in Europe. The awareness that humankind’s activities could lead to extinction of species especially on islands like Mauritius that have relatively unique species is widely acknowledged.  

| --- | --- |
| Tragedy of the Commons | Aristotle observed, “what is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest.” William Forster Lloyd in his Oxford lectures of 1833 describes the Tragedy of the Commons idea, describing what happened to pasturelands left open to many herds of cattle. Lloyd pointed out that, with a resource available to all, mutual ruin was just around the corner; for the greediest herdsman would gain initially, but demand would grow and, as it grew (along with population) supply remained fixed. Therefore, a time would come when the herdsman would be trapped by their own competitive impulses, and helpless to prevent the ruin of the unmanaged commons by overgrazing.  

1911: Fur Seal Treaty was developed in response to severe over harvesting of fur seals from the North Pacific.  

| Fisheries | 1865: In 1865 James Bertram documented inshore Scottish herring catches between 1818 and 1863, when the catch fell from 125 to 82 crans (barrels) while the area of drift nets carried per boat rose from 4 500 to 16 800 square yards. He wrote ‘I have always been slow to believe in the inexhaustibility of the shoals, and can easily imagine that overfishing, which some people pooh-pooh so glibly, could easily be possible.’  

1995: FAO Code of Conduct for Responsible Fisheries and the UN Agreement on Straddling Fish. Stocks and Highly Migratory Fish Stocks are negotiated and published. |
| Acid Rain | 1872: Robert Smith, Britain’s first air pollution officer, discovered that the rain approaching his town contained sulphuric acid. He coined the term "Acid rain". In his book "Air and Rain" he outlined the effects acid rain might have on the urban fabric, writing: "When the air has so much acid that two to three grains are found in a gallon of the rain-water, or forty  

1994 Second sulphur protocol, adopted to reduce sulphur emissions to that required to be ecologically sustainable. |

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305 Lloyd was also clear that this meant that Adam Smith’s invisible hand did not work in this instance: The commons will be doomed by overgrazing. The argument was used by Lloyd to dispute Adam Smith's idea of the "invisible hand".  


parts per million, there is no hope for vegetation... galvanized iron is valueless... stone and bricks of buildings crumble". 308

1881: Norway tracked the first signs of acid rain on its western coast

| Salinity and Dry Land Salinity in Australia | 1864: Salinity was first identified as a problem in Australia. Problems of rising water tables and soil emerged soon after the establishment of the first irrigation schemes: along the South Australian Murray in the 1890s; in parts of the Murrumbidgee Irrigation Area in the 1920s; in the Curlwaa Irrigation Area, NSW, in the mid-1930s. Now, few irrigation areas are free of the problems and all the indications are that, without major remedial measures, they will get worse |
| Radiation | 1896: Thomas Edison, Tesla and Grubbe noted eye and skin injuries and the former, particularly, cautioned about excessive exposure to X-rays. In 1899 John Dennis, a New York journalist, campaigned for controls by state licensing on radiologists and radiographers, and argued that injury to a patient was a criminal act. It was many decades before action was taken |
| Benzene | 1897: Benzene has been known to be a powerful bone marrow poison since the 1897 report of Santessen. He observed aplastic anaemia among young women engaged in the manufacture of bicycle tyres in Sweden due to benzene exposure. In the same year, LeNoir and Claude reported the observation of haemorrhaging in a young man engaged in a dry-cleaning operation in France, where the young man was exposed to benzene. |
| Asbestos | 1898: The earliest account of the health hazard of working with asbestos was provided by Lucy Deane, one of the first Women |

Inspectors of Factories in the UK. Writing in 1898, Deane observed that: ‘the evil effects of asbestos dust have also instigated a microscopic examination of the mineral dust by HM Medical Inspector. Clearly revealed was the sharp glass-like jagged nature of the particles, and where they are allowed to rise and to remain suspended in the air of the room in any quantity, the effects have been found to be injurious as might have been expected.’

PCBs

1899: Polychlorinated biphenyls (PCBs) are chlorinated organic compounds. They were first synthesised in a laboratory in 1881. By 1899 a painful disfiguring skin disease that affected people employed in the chlorinated organic industry was identified. Monsanto, the US producer of PCBs, was certainly aware of adverse health effects in workers exposed to PCBs; for in 1936 several workers at the Halowax Corporation in New York City exposed to PCBs, and related chemicals were affected by chloracne. Three workers died. Autopsies of two revealed severe liver damage.

Rebound Effects

In 1865 Jevons warned of the risks of rebound effects from industrial efficiency gains. Jevons asserted that the more efficient use of coal in engines doing mechanical work actually increased the use of coal, iron and other resources, rather than “saving” them. Jevons, in The Coal Question, showed that cutting the amount of coal used to produce a ton of iron by over two thirds, was followed, in Scotland, by a tenfold increase in total consumption, between the years 1830 and 1863. This has become known as the Jevons Paradox.

2.6 Debates about Reducing Inequality, Social Capital, Trust and Democratic Participation.

Achieving sustainable development involves much more than simply achieving environmental sustainability. Another key goal of sustainable development is the reduction of global inequality and ending extreme poverty. Debates about what causes inequality and extreme poverty and what are the most effective methods of alleviation are not new. Governmental action in Britain for the welfare of the poor goes back to the 16th century. The first UK statute dealing specifically with poor relief was

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that of 1601, which gave local justices the power to license “aged and poor persons” to beg within their own neighbourhood. These “Poor Laws” were the forerunners to the welfare state. The slavery debates famously achieved resolution in 1807 in Britain when the British Parliament passed an Act prohibiting British subjects from engaging in the slave trade after March 1, 1808—16 years after the Danes had abolished it.

Rev. Thomas Malthus 1798 Essay on the Principle of Population arguing that poverty and famine would be the result of man’s overproduction of offspring was partly a response to the implementation in Britain in 1796 of the Speenhamland System which declared that wages below what was considered to be an absolute minimum should be supplemented by local parishes up to the appropriate level, according to the number of children that the individual had and the price of bread. Malthus’s essay was arguing against such welfare to the poor because he argued it would lead to a population explosion which would undermine the original goal of the increase in welfare to the poor. In 1830, Tory MP Michael Thomas Sadler, published The Law of Population, arguing against Malthus's population doctrine, argued that fertility actually declines with rising income and greater security of economic welfare.

Understanding of the benefits and importance of equity to community trust, social capital, civic participation and the health and vibrancy of society also has a long history. Interest in the links between social equity, social trust, strength of community life and civic participation rates goes back at least to Alexis de Tocqueville’s Democracy in America, in which he describes his visit to the US in 1831. Academics and social commentators writing on the now very popular issue of social capital often quote his book and its coverage of the strength of community life in the US at the time. Preempting Putnam’s writings on social capital in the late 20th century, Tocqueville’s Democracy in America introduces the notion of "American Associationalism." This concept highlights the role played by institutions of civil society—such as families, voluntary associations, schools, businesses, churches and other religious organizations—and their connection to democracy. Tocqueville writes that

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"the strength of free peoples resides in the local community. Local institutions are to liberty what primary schools are to science; they put it within the people’s reach; they teach people to appreciate its peaceful enjoyment and accustom them to make use of it."\textsuperscript{320}

However, they often fail to acknowledge that de Tocqueville made this linkage explicitly with the importance of reducing inequality, even though he does this on the first page of the book where he writes:

"Among the new objects that attracted my attention during my stay in the United States, none struck me with greater force than the equality of conditions. I easily perceived the enormous influence that this primary fact exercises on the workings of the society. It gives a particular direction to the public mind, a particular turn to the laws, new maxims to those who govern and particular habits to the governed."\textsuperscript{321}

Tocqueville elucidated why he believed that greater equity led to a stronger civic life:

"When the chroniclers of the Middle Ages, who all, by their birth or their habits, belonged to the aristocracy, report the tragic death of a noble, they express infinite sorrows; whereas they recount in one breath and without batting an eye the massacre and tortures of the common people... [However,] [w]hen ranks are almost equal among a people, with all men having more or less the same manner of thinking and feeling, each of them can judge in an instant the feelings of all the others. There is thus no misery that he cannot easily conceive of and whose dimensions are not revealed to him by a secret instinct. It does not matter whether it is a question of strangers or enemies: his imagination puts him immediately in their place. It mixes something personal into his pity and makes him shudder himself when the body of his fellow man is torn apart."\textsuperscript{322}

Wilkinson notes the fact that today’s commentators ignore this part of Alexis De Tocqueville’s work

"is particularly ironic given that the growing interest today in social capital is itself the result of a decline in the quality of social relations and in community life reflecting in large part the effects of increasing inequality."\textsuperscript{323}

Wilkinson also discusses how early Christian socialists advocated greater equality not, as now, simply on the grounds that it is a fairer sharing-out of goods between people whom we have come to see as self interested consumers, but because they saw it as a crucial step on the road to greater human harmony and a fuller realisation of our inherent sociality. Often calling each other “brother” “sister”, they saw differences in wealth and income as a major cause of social divisions in society.\textsuperscript{324}

\textsuperscript{320} Ibid.
\textsuperscript{321} Ibid., p. 249.
\textsuperscript{322} Ibid., p.251.
\textsuperscript{324} Ibid p35
Also by 1909, Herbert Croly’s important work The Promise of American Life was published, which emphasized many ideas in harmony with the current modern literature on social capital. Croly’s book profoundly influenced two generations of political leaders such as Presidents Theodore Roosevelt, Woodrow Wilson and F.D Roosevelt with its rejection of Jeffersonian individualism and its argument that in an age of corporations and industry, continued American progress required a stronger federal government, a sense of community, and loyalty to a shared vision of nation. The term “social capital” first appeared in print in 1916 in the context of academic debates on the decline of America’s cities and close-knit neighbourhoods.

2.7 What Capacity, Knowledge and Enabling Technologies Existed to enable Ecological Modernisation by 1920?

The most compelling evidence that by the early twentieth century humanity had the potential to achieve sustainable development and embark on ecological modernisation derives from the clear capacity and knowledge assembled by this time of how to achieve sustainable development in practice. By the early 20th century the world had most of the scientific understanding, enabling technologies and methodologies needed to start to achieve sustainability. It was mentioned earlier that many of the key ideas in the field of economics needed to tackle the sustainable development questions were understood. Already there were many books on what we would call sustainable agriculture by this time. George Washington Carver published How to Build Up Worn Out Soil in 1905 promoting the use of peanut trees to rehabilitate soils. At the same time F.H. King was writing prolifically on sustainable agriculture issues. In 1912, King, a US Department of Agriculture official, published a study called Farmers of Forty Centuries. King had been sent to China by the US government on a fact-finding trip between 1907-1909 to learn how Chinese methods of farming had stood the test of time. Thus the West had documentation of farming methods that showed that if you farm in certain ways, and obey certain basic rules you can farm the same piece of land sustainably for thousand’s of years. It outlined how farmers can practise intensive agriculture over thousand’s of years sustainably. The Chinese farmers knew what their inputs and outputs were and had a 5000 year old system that balanced the two. When landscape is converted into a cropping landscape to bring about a change the productivity, one has to do it in certain ways. Across East Asia everyone understood and implemented this much for thousand’s of years. FH King’s book, without calling them as such, described most of the principles of sustainability in agriculture. King had been sent forth to learn from the rest of the world how to better manage soils because serious problems were already emerging in the USA.


Carver,G.W. (1905) How to Build Up Worn Out Soils, Tuskegee Experiment Station, Bulletin Six, Tuskegee, p. 4

Shortly after this Steiner developed biodynamic farming in 1924 and Lady Balfour began her work on sustainable agriculture.

In the case of energy, wind-driven mills were operating in Persia from the 7th century AD for irrigation and milling grain. Wind powered all sea faring ships and transport for thousands of years. Clarence Kemp patented the first solar water heater in 1891. By 1897, solar water heaters serviced 30% of houses in Pasadena, California. In 1895 Rudolf Diesel (1858-1913) developed the first ‘diesel’ engine to run on peanut oil. This was featured in 1990 in Paris at the World Exhibition. Diesel famously stated around this time that,

"The use of vegetable oils for engine fuels may seem insignificant today. But such oils may become in the course of time as important as the petroleum and coal tar products of the present time."

France and Great Britain were the first nations to support the widespread development of electric vehicles in the late 1800s. In the USA, in 1899 and 1900 electric cars outsold all other types of cars. At the turn of the twentieth century, they were produced by Anthony Electric, Baker Motor Vehicle, Detroit Electric, Woods Motor Vehicle and others. Electric vehicles had several advantages over gasoline cars at the time. They did not have the vibration, smell, and noise associated with gasoline cars. Changing gears on gasoline cars was difficult, while electric vehicles did not require gear changes. Later in 1916, Woods invented a hybrid car that had both an internal combustion engine and an electric motor.

All major cities at this time of 1909 had train and light rail systems connecting the suburbs to places of work. Cars were a novelty at this stage. As early as 1892 Ebenezer Howard published “Garden Cities of To-Morrow” which launched the Garden City movement.

As mentioned above, the Ancient Greeks pioneered passive solar design of their whole cities so all homes had access to sunlight during winter. Many green buildings today are actually modelled on 19th century building design that needed to keep buildings cool in summer and warm in winter without air conditioners and heaters to assist. The famous 60L Green Building in Melbourne is

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333 Howard, E. (1892) *Garden Cities of Tomorrow* MIT Press (March 15, 1965) Originally published in 1898 as *To-Morrow: A Peaceful Path to Real Reform* and reissued in 1902 under its present title, *Garden Cities of To-Morrow* holds a unique place in town planning literature. The book was responsible for the introduction of the term Garden City, and set into motion ideas that helped transform town planning.
modelled on a 19th Century English arcade in many of its design features. 19th century engineers and architects knew how to design buildings to stay at roughly the same temperature without today’s powerful air-conditioning and heating systems.

A major area of current activity to help create green buildings is the re-discovery of geo-polymers\textsuperscript{334} which are a low carbon dioxide producing form of cement. Geo-polymers were the main type of cement used by Ancient Rome. Hence the knowledge of how to create and use low carbon cements is ancient.

Another important area of sustainable technology innovation in the 21\textsuperscript{st} century is Biomimicry-innovation inspired by nature. The idea being that, since nature has evolved over 3.4 Billion years, it is wise when considering an engineering or architecture problem to ask: how would nature do this? There is already a great deal of evidence to suggest that asking this question and investigating it will help develop more sustainable technologies. Again biomimicry is not a new idea or practice. Leonardo Da Vinci stated that

“Human ingenuity may make various inventions, but it will never devise any inventions more beautiful, nor more simple, nor more to the purpose than Nature does; because in her inventions nothing is wanting and nothing is superfluous.”

Aristotle saw biomimicry as the ultimate path stating that

“If one way be better than another, that you may be sure it is Nature's way.”

The famous architect Antonio Guidi in the late 19\textsuperscript{th} century and early 20\textsuperscript{th} century practiced biomimicry deliberately in his designs of buildings and cathedrals. The columns, inside his famous Sagrada Familia, look like trees and its bell-towers are shaped shell-like spirals. The exterior balconies of Casa Mila undulate like the ocean's waves, as does the bench above the room of columns in Park Güell. Surrounded by the geometric, hard-edged shapes of most architecture, Gaudi's organic forms stand out as a reminder of the natural world. He consciously integrated nature's organic shapes and the fluidity of water into his architecture.\textsuperscript{335}

In the case of health, already by 1908 there had been the significant public health movement of the 19\textsuperscript{th} century where doctors and educated middle class managed to convince the wealthy that investment in public health for the poor was needed, just as today scientists and NGOs try to convince the rich and governments to invest in sustainability.\textsuperscript{336} The 19\textsuperscript{th} century saw a revolution in water sanitation and treatment in many European cities greatly improving public health and well being. Louis Pasteur and other bacteriologists in the 1870s and 1880s discovered the role of micro-organisms in infectious

\textsuperscript{334} See Geopolymers at \url{http://www.abc.net.au/catalyst/stories/2244816.htm} Accessed 29.06.08
diseases, thus laying the scientific basis for water sanitation and sewerage management. In the 1890s further impetus for better sanitation arose from interdisciplinary research that showed that typhoid was partly due to pathogens in sewerage water.

Also by 1908, the Occupation, Health and Safety movement was well underway having been led by pioneers such as Amédée Lefevre (1798-1869), and many regulations had been enacted. Today almost 100 years later sustainability experts argue that a way to mainstream sustainability is to embed it in OH&S programs which are now often called Occupation, Health, Safety and Environment programs (OHS&E). There is no reason why this could not have been done 100 years ago as well.

In the 21st century, ethical investment is looked to as one of the major potential leverage points through which to help drive the shift to sustainable development for the 21st century. The roots of modern ethical investment may be traced to the anti-trust and 19th century child labour debates which hinged on the same basic issues. It can be also traced back to the 19th century Quaker and Methodist Church movements.

In the early 1900s the Methodist Church in North America decided to invest in the stock market, having previously viewed it as a form of gambling. However, they wished to exclude certain types of companies, specifically those involved in alcohol or gambling. Laws and rules on how to invest ethically go back to biblical times and were a part of Jewish Law. Rabbi Yossi Ives has brought together remarkable evidence to show that many modern sustainable development ideas are actually enshrined in the Jewish Torah thousands of years ago. This is significant because both the Christian and Islamic faiths build on from the Jewish tradition of Torah law.

2.8 Corporate Social Responsibility

The debate about corporate social responsibility (CSR) has been said to have begun in the early 20th century, amid growing concerns about large corporations and their power. The ideas of charity and stewardship helped to shape the early thinking about CSR in the US. Ida Tarbell’s 1904 work The History of the Standard Oil Company lead to the Supreme Court of the United States decision to break up the company on anti-trust grounds. This eventually led to the break-up of the Standard Oil Company in 1911. Tarbell revealed, after years of research, the illegal means that John D. Rockefeller
used to monopolize the early oil industry. The significance of *The History of the Standard Oil Company* is shown by the fact that it was listed number five among the top 100 works of twentieth-century American journalism by the New York Times in 1999. Similarly, Upton Sinclair’s 1906 book *The Jungle* led to the passage of the Pure Food and Drugs Act and the Meat Inspection Act by the United States Congress. These can be seen as early attempts to mandate socially responsible corporate behaviour.

Given this, it begs the question why humanity made such little progress to achieve ecological sustainability and social sustainability in the last one hundred years? It was not that people of the early 20th century did not have a clear vision of what sustainability could look like. It also was not because people did not understand the role vested interests can play in holding back progress which benefits the majority.

2.9 What understanding was there of how to Overcome Vested Interests and Blocking Coalitions at the Start of the 20th Century?

Machiavelli summed up the essential problem of vested interests blocking efforts to achieve genuine progress in chapter 6 of *The Prince* in 1513 stating that

“There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success, than to take the lead in the introduction of a new order of things. For the reformer has enemies in all those who profit by the old order, and only lukewarm defenders in all those who would profit by the new order, this luke-warmness arising partly from fear of their adversaries … and partly from the incredulity of mankind, who do not truly believe in anything new until they have had actual experience of it.”

Already by 1908 there was a significant history of social change and social movements that had created and spread parliamentary democracy, ended slavery, enabled female suffrage and ensured water sanitation for increasing parts of Europe. Stephen Boyden and others have written eloquently on how much the modern environmental movement can learn from the water sanitation movement of the 19th century.

Any social movement going up against powerful vested interests also needs the help of at least some of the leading writers, playwrights and journalists of the day to raise awareness, interest and understanding of the need for and overall benefits of change. As far back as 1882 Henrik Ibsen wrote a world famous play entitled *The Enemy of the People* which elegantly illustrates how, if a precautionary principle is not applied, and developers do not address environmental risks at the design phase, then it is very costly to retrospectively address environmental problems. The play is set in a

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small coastal town in Norway. The central character of the play is Dr Stockmann, a scientist and brother of the Mayor of the town.

He and his brother led a project to develop baths with healing powers in the town. A large amount of public and private money was invested in the hope that it would lead to an increase in tourism and greater prosperity for the town. The baths started to succeed but Dr. Stockmann discovered that waste products from the town's tannery were contaminating the baths and causing serious health problems for visitors using the baths. Dr Stockmann produced a detailed report containing a proposed solution, which would be costly for the town and sent it to his brother, The Mayor. He was surprised that there was no follow up and that it was difficult to speak to his brother or to talk to the authorities. The Mayor and the authorities appeared unable to appreciate the seriousness of the matter and unwilling to acknowledge or address the problem because they believed that it could financially ruin the town. The Mayor eventually warned his brother to drop the issue. Dr Stockmann declined and organised a town meeting to convince the people to close the baths.

The townspeople turn on him and denounce him as an "Enemy of the People." In this play, Dr. Stockmann is defeated by corporate and government interests, the press turns against him, as do the citizens fearing higher taxes to fix the problem. Even though he was revealing the "truth," Dr. Stockmann was condemned. It is significant, however, that the "truth" that is rejected is a scientific truth. The play therefore has very modern overtones about how vested interests combined with a lack of general scientific literacy can get in the way of environmental and public health. Ibsen’s play illustrates well the importance of undertaking comprehensive environmental risk assessment before development projects are undertaken. The play highlights how often it is costly to make changes to development projects after they have been built to retrospectively address environmental pollution problem. The play provides many insights into why it takes generations for some “early warnings” to be acted upon politically. If a literary giant of the time such as Ibsen was writing play’s such as this in 1882, it begs the question of what were other popular fiction and social commentaries of the time saying about sustainable development issues and aspirations. Since this thesis is mounting the case that by 1908 enough was known to begin to pursue and define sustainable development it is important to see if there was real passion for sustainable development aspirations reflected in the popular literature of the time.

2.10 Were aspirations for sustainable development reflected in pre-1908 literature?

Many of the core ideas and aspirations of sustainable development were reflected in the popular literature, poetry and art of the period leading up to 1908. The most popular book in England in 1908 was the classic tale Kenneth Grahame's *Wind in the Willows*, which warns of the potential negative
effects on community and the environment, from people’s obsession with having the latest technology, irrespective of personal, social or environmental cost.  

Beatrix Potter was the other most popular and famous children’s writer in the UK in the first decades of the 20th century. Beatrix Potter is the most commercially successful ever English speaking children’s writer, selling 155 million books. But Beatrix Potter is remembered also for the fact that she used the profits, from the sale of her books, to purchase farming land in the Lake District of England that would have otherwise been sold to developers. In her will, Potter left almost all of her property interests to the National Trust — 4,000 acres thus ensuring that the beauty of the Lake District will be sustained forever as the Lake District National Park.

To this day, Wind in the Willows and Beatrix Potter’s books can lay claim to being still the most beloved books. Sotheby’s recently estimated that the most valuable first edition books are Beatrix Potter’s The Tale of Peter Rabbit (1901) and Kenneth Grahame's Wind in the Willows (1908), which could both fetch £50,000.

Not just in children’s books were concerns for the environment expressed. The 19th century romantic artistic movement tried to raise awareness of the risks to the environment of the first industrial revolution. There was also a keen awareness of the value of sustaining cultural diversity and heritage. Vaughan Williams, one of the great English composers of the turn of the last century, travelled all of England recording and writing down British folk music and songs to ensure that they were not lost and were kept alive during the mass migration to the cities. Percy Grainger, Australia’s greatest composer of this period, did the same thing in Australia at the time. He travelled throughout Australia recording Australian folk tunes and songs to ensure they were not lost.

Aspirations for greater social justice motivated some of the greatest writings in English literature in the century before 1908. Some of the great social commentators and literary giants pre-1908 included Johnathon Swift, Jane Austin, Charles Dickens and Mark Twain.

- In the 1700s, Swift exposed and decried the appalling poverty in Ireland at the time.
- Jane Austin, writing from 1790-1814, filled her books with social commentary combined with a sense of social justice and reform. Austin was staunchly anti-slavery.

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343 The tension in the story is created due to the fact that Toad of Toad Hall is obsessed with having the latest automobile, having crashed six cars, been hospitalized three times, and spent a huge sum on fines. Toads friends feel they must protect him from himself, since they are, after all, his friends. They make him a prisoner in his own house. But Toad is obsessed and escapes and steals a car only to be caught by the authorities and thrown in goal for 20 years. Toad finally realises the error of his ways and peace is restored as Toad, once released from goal, spends the rest of his life making an effort to atone with everyone that he had ever caused harm to. Concern and love for the environment is explicit in Wind in the Willows, which is widely regarded as a pantheistic novel, devoting a whole chapter simply to describing the wonders of the environment and its spirit.


345 Despite the value of her work as a historical document, much of it is still relevant to readers today. Austen is one of the most effective writer’s ever at ridiculing what she considered reprehensible traits in her generation - hypocrisy, avarice,
Charles Dickens, (1812–1870), was the foremost English novelist of the Victorian era, as well as a vigorous social campaigner. Considered one of the English language's greatest writers, he achieved massive worldwide popularity in his lifetime. Dickens's novels were, at one level, works of social commentary. He fiercely criticised the way the poor were treated and the social stratification of Victorian society. His novel, *Oliver Twist*, shocked readers with its images of poverty and crime and led to the clearing of Jacob’s Island, the London slum that was the basis of the story. If Dickens was regarded as the foremost English novelist of the 19th century, then Mark Twain was regarded as such by many Americans.346

Mark Twain embodied many values and beliefs one hundred years ago normally associated with more modern times. He was a vegetarian who believed that no sentient being should be made to suffer for another without consent. He was pro-unionist who campaigned for the end of slavery and the emancipation of African Americans. From 1901 until his death in 1910, Twain was vice-president of the American Anti-Imperialist League, which opposed the annexation of the Philippines by the United States, and had tens of thousands of members. He describes his transformation and political awakening, in the context of the Philippine-American War, from being "a red-hot imperialist":

“I wanted the American eagle to go screaming into the Pacific ...Why not spread its wings over the Philippines, I asked myself? ... I said to myself, here are a people who have suffered for three centuries. We can make them as free as ourselves, give them a government and country of their own, put a miniature of the American Constitution afloat in the Pacific, start a brand new republic to take its place among the free nations of the world. It seemed to me a great task to which we had addressed ourselves. But I have thought some more, since then, and I have read carefully the treaty of Paris [which ended the Spanish-American War], and I have seen that we do not intend to free, but to subjugate the people of the Philippines. We have gone there to conquer, not to redeem. It should, it seems to me, be our pleasure and duty to make those people free, and let them deal with their own domestic questions in their own way. And so I am an anti-imperialist. I am opposed to having the eagle put its talons on any other land.”347

2.11 Was World War One Inevitable?

1908 was also a time where the world should have pursued peace. Many experts at the time argued that the global economy was already so integrated that there was no longer any rational justification for war between nations. In 1908 certainly no rational European leader would ever consider taking

346 American author William Faulkner called Twain "the father of American literature.”

their nation to war. In 1910, British economist and lecturer Norman Angell wrote *The Great Illusion*.348 Angell argued that national economies had become so interdependent; so much part of the global division of labour, that war among the economic leaders had become unimaginably destructive. His central argument was that war between modern powers was futile in the sense that no matter what the outcome, he thought both the losing and the victorious nations would be economically worse off than they would have been had they avoided war. Angell reasoned that thanks to deepening economic ties among powers, war would cost the aggressors more than any hoped-for gains. States, understanding this, would conclude that war was not a worthy option. Global peace would now ensue.

In *The Guns of August*, Barbara Tuchman349 described the remarkable impact *The Great Illusion* had on contemporary European intellectuals and statesmen. The book became, in Tuchman's words, "a cult." It was circulated at universities and inspired study groups "devoted to propagating its dogma." In a testament to its surreal power, the book's most "earnest disciple" was Viscount Esher, an advisor to the King of England and Chairman of the War Committee charged with rejuvenating the British army after the Boer war. Tuchman recounts that Escher even believed that Germany was "as receptive as Great Britain to the doctrine of Norman Angell." As Jeffrey Sachs writes,

> "It is especially sobering to realize that before August 1914, globalization and the march of science seemed assured, as they seem to many today. A bestseller of the time, *The Great Illusion*, had correctly emphasized that war as a tool of European policy was passé because no country could possibly benefit from outright conflict. Yet distrust and failed European institutions brought war just the same, with catastrophic effects that reverberated for the rest of the century. The war itself was unmatched in ferocity and death. And in its wake emerged bolshevism, the 1919 flu epidemic, the Great Depression, the rise of Hitler, the Chinese civil war, the Holocaust, and consequences that extend till now. The world was truly torn asunder in 1914, it still has not fully healed. It may seem impossible to conceive of such a cataclysm today, yet the widening arc of war and vituperation, often pitting U.S. foreign policy against global public opinion, reminds us daily of a growing threat to global peace... In future years the rising power of China and India could further wound US pride and self-confidence, and further ratchet up global tensions."350

Clearly then, 100 years ago in 1908 the world leaders had a chance to choose environmental sustainability and peace but within 6 years most of them had chosen war. Also, given that most of the most advanced ancient civilisations have collapsed partly due to environmental factors, it is important to investigate why humanity continues to make such little progress in achieving sustainable development. Only through understanding our history can we ensure that we do not repeat it. Through

understanding these patterns of past civilisations and past generations we may hope to empower our generation to not repeat these mistakes in this century.

Our well being depends, not just on our financial wealth, but our quality of life and our relationships, the vitality of our communities and the health of our environment. Achieving multiple goals such as improved economic, social and natural capital simultaneously with no major trade offs is clearly a noble goal worthy of humankind’s aspiration. Yet today the assumption that major trade offs exist between jobs, the economy and the environment are still remarkably common. Why is it that today the same debates seem to have evolved so little despite the fact that today we are told that we live in the information age? Today more people are more highly educated than ever globally and so why is it that the level of informed debate on these topics seems to have progressed so little in the last 100 years ago? Chapter 3 now addresses these questions.
Chapter 3: Why Do the Same Modern Sustainability Debates Continue after 100 years?

Chapter 2 showed that many ancient civilisations have collapsed due the lack of environmental sustainability of development. Given this fact and the lack of progress on sustainable development over the last 100 years, it is important to investigate why humanity has made such little progress to achieve sustainable development. Why do so many of the same sustainability debates outlined in Chapter 2 continue after 100 years? It is widely recognized that there are many barriers to achieving sustainable development and hence only by understanding how to address them is it possible to develop a realistic strategy to achieve sustainable development. Here in Chapter 3, I consider some of these barriers and start to discuss strategies to address them. Chapters 4-9 further explore these strategies to address such barriers.

3.1 Nature Often Exhibits Delayed Feedbacks: The Problem of Overshoot and Positive Feedbacks

The fact that nature is a complex system which often has a delayed feedback to environmental pressures is a key factor in why ancient civilisations have collapsed from environmental factors and why insufficient progress has been made on sustainable development over the last 100 years. It is often difficult to immediately see how pollution and development are reducing the resilience of natural ecosystems until it is often too late and the ecological system has been pushed past a particular irreversible threshold. Jared Diamond showed in his publication *Collapse*[^351] that this delayed feedback has been a factor in the collapse of many past civilisations. Richard St Barbe Baker’s quote first outlined in Chapter 2 is even more pertinent here:

“The great Empires of Assyria, Babylon, Carthage and Persia were destroyed by floods and deserts let loose in the wake of forest destruction. Erosion following forest destruction and soil depletion has been one of the most powerfully destructive forces in bringing about the downfall of civilizations and wiping out human existence from large tracts of the earths surface. Erosion does not march with a blast of trumpets or the beating of drums, but its tactics are more subtle, more sinister.”


In addition, many decision makers, untrained in ecology, have mistakenly believed that humankind can pull back once humanity’s environmental pressure starts to cause serious ecological collapse. However, often by then the ecosystem may have already passed the ecological threshold and the collapse is either irreversible or the environmental pressure (pollution, system change) will need to be

reduced by a factor of ten or more to allow the ecosystem to recover. This phenomenon is known as hysteresis. How is it that so many ecosystems are close to collapse or have already collapsed? This chapter will show that there are many factors that have both led to past civilisations collapsing and have led to current unsustainable forms of development today. One factor has been the fact that humanity has based its management of natural resources on flawed assumptions. Take the paradigm of maximum sustainable yield management of natural resources. In most cases the maximum sustainable yield was very close to the thresholds for collapse of that ecosystem.

The mounting evidence of overshoot is covered in detail in numerous publications such as *The State of the World reports*[^353], *Limits to Growth- The Twenty and Thirty Year Update*[^354] and Paul Ekin’s *Economic Growth and Environmental Sustainability*[^355]. All over the world there is evidence that ecosystems and their services already are collapsing from Australia’s Blue Fin Tuna stocks, to the wheat fields of Western Australia being overcome by salinity, to the algae blooms suffocating lakes in the Northern Hemisphere. There are now significant global efforts to better understand where these ecological limits and tipping points are.[^356]

Also in the past some have expected change will be incremental and linear when in fact with ecosystems change is often non-linear and hence ecological collapse can occur suddenly.

Natural ecosystems are complex. Therefore it is often hard to determine what safe levels of emissions of pollutants are. It is also difficult understand the causal links between pollutants and negative environmental effects. There is usually significant uncertainty. Faced with uncertainty political and business leaders often call for more research to be done. This is often in areas where there will always be uncertainty because the systems are either so complex or it would take years and many people to collate enough data and analyse it to reduce the uncertainty significantly. Take the issue of sustainable management of fisheries. Government estimates of the state of fish stocks rely on the catch that fishers report. It is too expensive and difficult for governments themselves to go out into the oceans and take enough samples to know what the state of fish stocks are. Hence often by the time scientific consensus is built on an issue it is decades after the concerns were raised by the original scientist. By this time it is often too late and the ecological system is in irreversible decline or at best to solve the problem will require a dramatic reduction of environmental pressures for the ecosystem in question to have a chance to recover. The catch history shown in Figure 3.1 illustrates this.

Ignorance of ecological limits, thresholds and overshoot regarding greenhouse gas emissions has delayed action on climate change for many decades. Chapter 2 showed that by 1908 scientists had warned on many aspects of the unsustainability of development but in 1908 no one knew what the thresholds of greenhouse gas emissions were. Most assumed that the seas and forests would absorb any additional CO2 from fossil fuels. So during the first decades of last century, when worldwide use of oil was rising exponentially from a mere 500,000 barrels of oil in 1900 to 4 million by 1929, most scientists and engineers assumed that the carbon dioxide produced would not be a problem. It was not until the 1950s that scientists realised that the burning of fossil fuels could create significant ecological problems. By then the economy, industry, transport systems and the military of all nations were designed and built to be powered by the burning of cheap fossil fuels. Hence it would not be easy for modern civilisation to stop using oil and coal to reduce greenhouse gas emissions. A fact which illustrates to what extent humanity had been ignorant of greenhouse gas ecological thresholds and tipping points came in 1987 when scientists discovered that the burning of fossils fuels had meant that the carbon dioxide and methane levels had exceeded the “natural” peak atmospheric levels for the last 400,000 years. The Vostok ice core results showed that humanity is actually adding man-made greenhouse gases to a peaking of the natural cycle of CO2 and CH4. CO2 levels in the atmosphere are now over 380 parts per million. They have not been above 300 parts per million for at least 400,000 years. (Figures 3.2-3.4)

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Figure 3.2: Plot of CO₂ Concentrations and Temperature from 400,000 years ago to 1950.
(Source. Petit et al., 1999)

Figure 3.3: Plot of CH₄ Concentrations and Temperature from 400,000 years ago to 1950.
(Source. Petit et al., 1999)


3.2 Unforeseen Environmental Impacts from Technology Development

Many technologies have caused significant environmental impact in the past because they often have unexpected side effects or second order consequences that were not originally understood by the designers of the technology. Ignorance of ecological thresholds and the problem of overshoot has meant that often technologies were developed without understanding of their environmental consequences.

In Chapter 2, it was explained how unforeseen and unexpected problems with salinity arose due to irrigation technologies leading to the decline and collapse of the Sumarian civilisation. By about 2300 B.C., agricultural production in Mesopotamia was reduced to a tiny fraction of what it had been. Many fields were abandoned as essentially useless. Mesopotamian cuneiform tablets tell of crop damage due to salts.

In more modern times, this has been certainly true of a wide range of technologies such as adding lead to petrol or CFCs to air-conditioners. Thomas Midgley, the man responsible for these decisions did not appreciate or understand the negative effects that lead would have on public health or the effect that CFCs would have on the ozone layer. Thomas Midgley, Jr. (May 18, 1889 - November 2, 1999) Climate and Atmospheric History of the Past 420,000 years from the Vostok Ice Core, Antarctica, Nature, 399, pp429–436


1944), an American mechanical engineer turned chemist, developed both the tetra-ethyl lead additive to gasoline and chloro-fluorocarbons (CFCs). Midgley died believing that CFCs were of great benefit to the world, and a great invention.\textsuperscript{362} While lauded at the time for his discoveries, today he bears a legacy of having engineered two of the most hazardous and destructive inventions ever in human history. Fundamentally, Midgley’s failure reflected a more general failure of specialised scientists and professionals to take a whole systems approach to their problem solving and thereby consider the broader system effects of their technological choices. A lack of appreciation of the need to take the broader environmental and social systems approach when addressing problems has not simply been an issue in engineering and technical professions, but also in many other disciplines, i.e. medicine. The following case study illustrates what can go wrong when the whole system is not taken into consideration when designing solutions to problems.

### 3.3 Why an Understanding of Systems Matters Case Study: Operation Cat Drop

In the 1950s, in Borneo, malaria was a significant health issue. In response to this problem, the World Health Organization (WHO) decided to take measures to significantly reduce the mosquito population, since mosquitoes are carriers of malaria. To achieve this they used the insecticide DDT, which effectively reduced mosquito populations and significantly reduced the incidence of malaria.

However, the WHO failed to appreciate the full scope of their actions. DDT not only successfully killed mosquitoes - it also attacked a parasitic wasp population, which had previously kept in check a population of thatch-eating caterpillars. So with the unforeseen removal of the wasps, the caterpillar population blossomed, and soon building roofs started falling all over Borneo.

Additionally, there were other unforeseen effects. Insects, poisoned by DDT, were consumed by geckoes (the biological half-life of DDT is around 8-years, so animals like geckoes do not metabolise it very fast, and it stays in their system for a long time). Those geckoes, carrying the DDT poison, were in turn hunted and eaten by the cat population. With more cats dying prematurely, rats took over and multiplied, and this in turn led to outbreaks of typhus and sylvatic plague (which are passed on by rats).

At this stage the effects on the health of the people of Borneo was worse than it had been previously with the malaria outbreak. So the World Health Organization (WHO) resorted to the extraordinary step of parachuting live cats into Borneo. The event has become infamously coined ‘Operation Cat Drop’.\textsuperscript{363}


The WHO had failed to consider the full implications of their actions on the delicate natural systems of Borneo. Because they lacked understanding of the basic effects of DDT (now banned in many countries) a high cost was paid for this mistake.

By considering only the straightforward, first-level relationship between mosquitoes as carriers of malaria and humans as recipients of malaria, the WHO unrealistically assumed this relationship could be investigated or acted upon independently of any other variables or relationships. They considered one tiny aspect of the system, rather than the whole system (the entire ecology).

This example demonstrates the incredible importance of whole systems thinking and analysis. In the real world one relationship strand (e.g. mosquito-human) cannot be separated from the rest of the system. All of the parts of the system are tied together in a complex fabric of inter-relatedness, and changing one part of the system can lead to profound changes throughout the rest of the system, which may not at first glance appear at all connected to the point of action.

Environmental and Systems Engineering, Green Architecture, Green Chemistry and Green Engineering, Cleaner Production, Industrial Ecology and the global appropriate technology movement is a response to this past failure of technologists to adequately consider the whole of system consequences of technological design choices. These new areas of technical practice have evolved out of this understanding of the need to consider and take into account the complex inter-relationships of systems.

These new fields recognise that systems exist throughout the natural and man-made world - wherever there is complex behaviour arising from the interaction between things. This behaviour can only be understood by considering ‘complete systems’ as they interact within their ‘natural’ environment. The goal of these new technological fields is to consider the whole-system, in its environment, through its whole life cycle.

The viability of an engineered system/design/product generally relies upon interactions outside of its immediate (product) boundary. These new technical fields simultaneously focus on the specific product to be designed, while considering how that product fits within the context of one or more ‘containing systems’, including the natural environment, as shown in Figure 3.5.
Figure 3.5. The systems engineering goal is to consider the whole system, in its environment, through its whole life.

Systems are engineered within the context of one or more ‘containing systems’

(Source: Honour, E.C. (2002))

Historically, the failure to understand adequately the environment and its thresholds has led us today to be in the situation where humanity has already overshot many ecological thresholds.

3.4 Vicious Cycles: The Tragedy Of Conflict and War.

Jared Diamond’s book *Collapse* shows that once civilisations are beset with environmental failure, reduced crop yields and poorer population health, they are both

a) weakened and more vulnerable to external enemies and

b) more vulnerable to conflict within the society for what scarce resources remain.

Diamond shows in *Collapse* that, once weakened by environmental factors, 41 civilisations collapsed partly due to internal or external conflict. In Tainter's view, while invasions, crop failures, disease or environmental degradation may be the apparent causes of societal collapse, the ultimate cause is diminishing returns on investments in social complexity (in contrast, Jared Diamond's 2004 book, *Collapse: Trainter’s How Societies Choose to Fail or Succeed*, focuses on environmental mismanagement as a cause of collapse). And as Trainter points out war, conflict and continual conquest of your neighbours is always subject to diminishing returns.

The costs from the diminishing returns of war and conflict have not just negatively effected ancient civilisation. Moving to more modern times, the repercussions of World War 1 (WW1) have been felt

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for the rest of the 20th century. The financial debt incurred by these wars, the costs of these wars in terms of people’s lives, the lives of families left behind, and finally the damage to innocent civilians was immense. Jeffrey Sach’s stated that

“Another great consequence of World War I was the prolonged financial instability it created in Europe after the war. The war created a morass of interlocking financial and economic problems, including the mountain of debt incurred by combatant countries, the destruction and dismembering of the Ottoman and Hapsburg empires and their displacement by small, unstable and feuding successor states, and the Allied claims for reparation payments from Germany, which embittered the next generation of Germans and was one of the rallying points for Hitler’s rise to power…..The economic instability that followed World War I led to the Great Depression of the 1930s and then to World War II.”

The economic instability, casualties and hardships suffered by Russia during to WW1 plus a very well organised Bolshevik party resulted in a revolution to form the first socialist state. From this evolved the cold war conflict between capitalism and socialism that dominated the second half the 20th century. This caused an escalating arms race that further diverted scarce resources over these years thus reducing the capacity of nations to instead invest in a transition to sustainable development. It is sobering to note that the 20th century saw two world wars, the cold war plus numerous local conflicts and now in the 21st century the global war on terror is already seven years old. Thus it is impossible to underestimate the significance of the decision of the European powers to go to war in 1914.

Any realistic foundation for hope of a world wide resource conservation and environmental commitment envisaged by Theodore Roosevelt in 1908 appears to have evaporated with the world at war from 1914-1918. The diversion of resources – human, capital and material resources – to the war efforts diminished the potential of nations to afford the necessary up front investments to transition to an ecologically sustainable economy.

In Chapter 5 we will discuss how in the past, estimates of the costs of achieving sustainable development have tended to often be grossly exaggerated. On the other hand, historically, governments have tended to underestimate the economic, social and environmental costs of war. When the respective national governments and their militaries began WWI, they and their citizens all believed it would not last for more than 3-5 months. Similarly, the Coalition of the Willing assumed that the war in Iraq would only last a short time. Five years later and potentially as many as 600,000 Iraqis and, according to official US data, 4960 coalition soldiers have died. In addition, the war so

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far has cost the US alone between US$1 and US$3 trillion and counting. The Iraq occupation is the third longest war in US history behind only the War of Independence and the Vietnam war. Almost a century since 1909, it is sobering to reflect that the world had the potential to choose sustainable development instead. Instead there was just four years of relative peace between the WW2 ending and the cold war starting. Between the end of the cold war and now the war on terror there was only twelve years of relative peace for the Western Allies. But since the cold war ended during the 1990s, there has been numerous regional conflicts in different parts of the world.

Historically warfare usually leads to several things, all of which do not help build capacity within society to achieve sustainable development:

Firstly warfare usually leads to the loss of civil liberties. Political philosophers have for centuries recognised this. James Madison stated in 1795:

“Of all the enemies to public liberty, war is perhaps, the most to be dreaded, because it comprises and develops the germ of every other. War is the parent of armies: from these proceed debts and taxes; and armies, and debts and taxes are the known instruments for bringing the many under the domination of the few....No nation could preserve its freedom in the midst of continual warfare.”

Or from Alexis de Tocqueville:

“...All those who seek to destroy the liberties of the democratic nation ought to know that war is the surest and the shortest means to accomplish it.”

Secondly, war can lead to the a strengthening and the enlargement of the state: by fostering a sense of crisis and suspension of normal social norms; by undermining traditional structures in society; by creating the context within which leaders can begin to repress opposition within the nation; and by enlarging armies and giving the state the option to significantly raise taxes. Thirdly, wars have historically often led to authoritarian rule, whilst undermining civic institutions and reducing and in some cases destroying civil rights.

Fourth, wars have also been the catalyst for ongoing uncertainty and revolution even once peace has been achieved. The French involvement in the American War of Independence helped create the financial problems that helped to precipitate the French Revolution of 1789. The Franco-Prussian War led to the Paris Commune of 1848. Defeat in the Russo-Japanese War lead to the uprisings in Russia in 1905. None of these historical lessons seem to have been learnt by the European powers in 1914.

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And fifth, war historically has almost always led to significant national debt and the raising of taxes to meet such debt. Throughout modern history, defence spending has consumed a large percentage of most state budgets and in some instances over 90 per cent. The extra money spent on the war is money that will not be spent elsewhere. The war can be funded by either increasing taxes, decreasing spending in other areas, or by borrowing money and increasing the debt. Increasing taxes reduces consumer spending, which does not help the economy improve at all. Decreasing government spending on social programs hurts often those who are the most vulnerable who lose access to vital services and welfare support. The recipients of those programs will now have less money to spend on other items, so the economy will decline as a whole. Increasing the debt levels means higher interest repayments which means governments will either have to decrease spending or increase taxes in the future. This is why wars are not good for the economy.

The decision of the European powers to go to war in 1914 was therefore an example of history repeating itself in many respects. What occurred from the decision to go to war in 1914 was utterly predictable for any student of history and war.

Another of the major consequences of WWI was a shift in the focus of geopolitics. Just as in the 19th century European powers had competed for their colonies and empires, in the 20th and 21st centuries the industrial powers have competed for the best regions of oil. In 1908, Britain started to convert its entire navy from coal to oil powered ships. Western governments followed suit and over the coming decades with their able assistants, the oil companies, vied for control over those states with oil such as Venezuela, Mexico, Sumatra, Borneo and especially the Middle East. Ever since then, OECD nations have become more and more dependent on overseas oil. As a British Official stated about the first world war, “The Allies had floated to victory on a wave of oil” in the first world war. They learnt, as one French diplomat put it, “He who owns the oil will own the world.” In a remarkably short space of time at the end of the 19th and the early 20th century oil had moved to the very epicentre of geopolitics. This major shift to oil in the early part of the 20th century has sown the seeds for conflict over increasingly scarce oil resources in the 21st century. Increasingly economies are dependant on oil, largely from the Middle East, for their economic success. By 2000 US oil imports cost US$109 billion, accounting for a full 25 per cent of the US trade deficit, which has become such a major issue

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372 Ibid.


that it is eroding the value of the US dollar which in turn raised the price of oil. Alan Greenspan pointed out that “All economic downturns in the US since 1973 have been preceded by sharp increases in the price of oil.” In addition, the US spends two to three times as much to maintain military forces poised to intervene in the Gulf as it pays to buy oil from the Gulf. Al Quaeda stated that the September 11 terrorist attack were partly motivated (but of course not justified) by anger at the US presence in Saudi Arabia. Hence the shift by nations at the start of the 20th century of their military to oil 100 years later has had significant repercussions.

The choice of the world’s powers to go to war in 1914 also accelerated the militarisation of the economy of many nations. War is not simply a transient phenomenon, an unfortunate mistake on the inevitable historical path to progress and enlightenment as Hegelian philosophers would hope. From the Renaissance to World War II, one of the main consequences of war has been the increase in size and power of central national governments. War transforms and builds whole nations and industries. War focuses the government of the day in employing large scale organisation and co-ordination to harness the nation’s resources in nothing else but physical destruction of the enemy. No other national priority requires such significant co-ordination, co-operation and organisation of a nation. By fighting to end war and impose peace the price is often very high, including the loss of political freedoms and weakening of the rule of law. The Swiss economist J.C.L Simonde de Sismondi spoke of this in a letter to a friend in 1835:

“As war becomes more sophisticated it continuously increases government authority and decreases the power of the people.”

The result is what Harold Lasswell called “garrison states,” political systems obsessed with national security, where perpetual war or the perceived threat of war leads to the concentration of all political power in the hands of an elite devoted to protecting their interests through fear, threats and violence. Carried to an extreme, the logical culmination of increasing state power through wars is an authoritarian state. This effect of war in the 20th century to sow the seeds for the formation of authoritarian states has been shown over and over again.

In one nation today, the USA, the military-industrial complex has reached unparalleled heights. Military expenditure in the USA in 2006 was roughly equal to the military expenditure of the whole rest of the world combined. President Eisenhower articulated his concerns about how this vicious cycle of war has affected the USA as far back as 1961:

"We now stand ten years past the midpoint of a century that has witnessed four major wars among great nations...Until the latest of our world conflicts, the United States had no armaments industry. American makers of plowshares could, with time and as required, make swords as well. But now we can no longer risk emergency improvisation of national defense; we have been compelled to create a permanent armaments industry of vast proportions. Added to this, three and a half million men and women are directly engaged in the defense establishment. We annually spend on military security more than the net income of all United States corporations. This conjunction of an immense military establishment and a large arms industry is new in the American experience. The total influence -- economic, political, even spiritual -- is felt in every city, every State house, every office of the Federal government. We recognize the imperative need for this development. Yet we must not fail to comprehend its grave implications. Our toil, resources and livelihood are all involved; so is the very structure of our society. In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist. We must never let the weight of this combination endanger our liberties or democratic processes. We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together."

In 2008, Secretary of Defence Robert Gates has asked the US Congress for US$700 billion to fund the Pentagon and the war in Iraq. If he gets it, he will preside over the equivalent of the 10th-largest economy in the world. In 2003, all the nations of the world spent in total US$956 billion on the military. To put this in historical perspective, when adjusted to 2007 dollars, spending on the Revolutionary War of Independence was about a hundredth of one percent of total Iraq and Afghanistan war spending since 2003. 379

Whilst there is recognition post September 11 of the need to address the root causes of terrorism through ending extreme poverty and addressing sustainable development issues, more resources are being spent on security and the military by the US than ever before. After September 11 the then President of the World Bank, James Wolfensohn, wrote that essential to increasing global security was the need to “address some of the root causes of terrorism: those of economic exclusion, poverty and under-development”. 380 US President George W. Bush committed the US at the United Nations Financing for Development Conference in Monterey, Mexico, in 2002 to an extra US$10 Billion in aid and development over three years. 381 Yet the US in 2004 spent over 26 times on military spending

than it did on overseas development aid. The choice between war or sustainable development could not have been more poignant than at the 2002 World Summit on Sustainable Development. Just 11 months after September 11 the Summit would have been an ideal place the Bush Administration to set out a clear dual track strategy to fighting terrorism. Not only did George W. Bush not attend, not only did the US turn its back on the Kyoto Protocol, but during the Summit the US Bush administration began arguing for the Iraq war. Since that point in time the US Bush administration has put almost all of its emphasis, energy and finances to fight terrorism through a single track military approach. Whilst the US debates the wisdom of that policy, 2005 figures show over a third of the world’s population was involved with conflict. Hence the vicious cycles and opportunity costs of conflict and war are clearly one major factor that has led to lack of progress in achieving sustainable development. The seriousness of this was recognized in December 2001, on the 100th anniversary of the Nobel prize, 100 Nobel laureates issued a brief but dire warning of the “profound dangers” facing the world. The Nobel laureates named two goals: countering a weaponized world and mitigating climate change.

But this alone is not sufficient to explain why there has been so little overall progress on sustainable development and why we still have the same sustainability debates 100 years on. In 2006, I got the chance, to interview Jim MacNeil, lead co-author and editor of The Brundtland Commission’s Our Common Future. In that interview, he volunteered that he and the team involved had failed to adequately discuss the problem of vested interests and anti-sustainable development blocking coalitions. For Jim MacNeil, based on his decades of experience, the biggest barrier to achieving sustainable development are anti-sustainable development vested interests. Hence we explore why this is the case over the next part of this chapter.

3.5 The Problem of Vested Interests

Chapter 2 showed that, as far back as Machiavelli, people have understood that change is often difficult because those that benefit under the current system will resist it. The relative strength of these vested interests helps explain why some societies fail to address obvious problems. Diamond’s book Collapse shows, for instance, that when many societies have faced the obvious problem of deforestation, some have been able to successfully respond to the challenge - Highland New Guinea, Japan, Tikopia, Germany and Tonga – whilst other civilisations failed - Easter Island, Mangareva, and Norse Greenland and collapsed as a result. How can we understand such differing outcomes? Diamond argues in Collapse that

382 Ibid. p330
“A society’s responses depend on its political, economic, and social institutions and on its cultural values. Those institutions and values affect whether the society solves (or even tries to solve) its problems.”

Diamond argues that there’s a mixture of traits that lie behind these success stories. The success stories tend to be countries that have easier problems to deal with than other countries. It helps if you’re in a robust environment like Japan or Germany, which are high-rainfall environments with heavy soil. On average, it helps if you have easier problems. The other things are the social factors—what people do. It helps if you can minimize insulation of the elite, those in power, from the rest of society. If the political elite and vested interests cannot avoid the environmental problems themselves then those societies tend to adapt quickly to at least try to address the problem. One of the main reasons that the Netherlands leads the world in environmental performance is that even economically richest elite was affected by the floods of the 1950s and 60s. Thus the elite and vested interests in the Netherlands know that they cannot escape sea level rises from climate change and thus have proactively pushed for stronger environmental performance. Conversely, Diamond argues

“If the political leaders, (the elite and vested interests) can wall themselves off from the rest of society—for example, here in southern California, if you live in a gated community and drink bottled water, and you've got your private security patrols, and you send your kids to private schools, and you've got your private pension and your private medical insurance, then of course you don't have a personal investment in Medicare, Social Security, public schools, the police force and the public water supply—that's a blueprint for trouble.

Conflicts of interest are another blueprint for trouble, where a small fraction of society can enrich itself by doing things that are bad for the rest of society—like the Enron syndrome, or what mining companies have done, enriching themselves by simply dumping waste into a river. It's cheaper to do that, for them, but it's billions of dollars more expensive for everybody else. Those are some of the ways to achieve success: Minimize conflicts of interest and minimize the insulation of the elite. ”

In more modern times, there are still very strong vested interests working against efforts to achieve sustainable development. In Chapter 2, it was shown that scientists had, in many cases, as long as one hundred years ago, sounded the alarm of the dangers regarding the consequences and use of asbestos, PCBs, radiation, benzene, lead, soil degradation and salinity from deforestation, and risks of overshoot from over-fishing and over-harvesting of natural resources. Chapter 2 showed that corporations and their industry group representatives often fought regulation by government that would have forced them to reduce these risks to human health and the environment. Corporations have become significant modern vested interests usually working against the transition to sustainable development, hence it is important to explore why this is so often the case.
3.6 Modern Vested Interests - The Rise of the Corporation and Anti-Sustainability Blocking Coalitions

Since the early 20th century, corporations have grown significantly in size and scale. They are the most common legal vehicle for business activity in Australia and around the world. Governments have legislated to enable corporate structures to be used to carry out business activities. They have a separate legal identity and rights afforded to 'natural' persons. In addition, corporations have 'perpetual succession' and so do not have a defined life span. The financial and legal liability of a company's directors and shareholders are also limited and companies generally operate under tax regimes which are different from and often more beneficial than those that apply to individuals. A traditional view has been that corporations operate for the single purpose of obtaining profits for the company's shareholders. At times this view has carried with it the implication that they can operate without regard to moral values and without regard for environmental and wider social issues. Many corporations have opposed anything that they perceived may raise costs and reduce profits and reduce their return to shareholders. This helps explain why many corporations have historically opposed action on most early warnings of environmental sustainability issues as well as social justice and equity issues. It also explains why many corporations have invested significantly in seeking to oppose pro-sustainable development government policies and regulations either through funding political party campaigns, PR campaigns, political lobbyists, or think tanks.

The commonly held belief that a corporation’s primary responsibility was to make profits for its shareholders has legal precedent. In the book, *The Corporation*, Bakan quotes the famous case brought against Henry Ford by the Dodge brothers. Henry Ford, who was one of the earliest proponents of aspects of corporate social responsibility, believed that his company should be more than simply a profit-making machine. He paid his workers substantially more than the going rate at the time and rewarded customers with yearly price reductions on his Model T Ford. ‘I do not believe that we should make awful profits on our cars’, Henry Ford is reported to have said. ‘A reasonable profit is right, but not too much.’ Henry Ford believed that workers should be able to afford the cost of a car.

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John and Horace Dodge invested US$10,500 in Henry Ford’s car company to establish it. They were major shareholders and John Dodge was appointed a director of the company. John and Horace Dodge decided to build their own car company. John resigned from the Ford board. They had assumed that they could rely upon their quarterly dividend from their Ford shares to finance their own venture. Henry Ford, however, decided to cancel the dividend and use the money to benefit customers with further price reductions on Model T automobiles. The Dodge brothers sued arguing that profits belong to shareholders and that Henry Ford had no right to give their money away to customers. The judge upheld that argument and re-instated the dividend. He rebuked Ford, who had said in open court that ‘Business is a service, not a bonanza’. Dodge vs. Ford has stood as authority for the legal principle that managers and directors of corporations have a legal duty to put shareholders’ interests above all others and no legal authority to serve any other interests. This has become known as ‘the interests of the corporation’ principle. This has historically made corporations very sensitive to anything that may add costs to their business and thus reduce profits. Bakan argues that this focus on maximising profits arises because of the unique legal structure of corporations. Whether this is still true or not is addressed in detail in Appendix 4.1.

3.6.1 Party Political Donations

Political contributions can enable corporations to gain political access. Corporate political donations are given on occasions with a view to furthering their immediate commercial interests but sometimes for broader reasons of ideology or policy.

Corporations gain political access through their political contributions. Corporate political donations are not always given with the simple goal of furthering their commercial interests.

Sometimes the aim will be more generalised; supporting a particular ideology or a range of issues and policies, or winning favour with a particular party. President George W. Bush’s election campaigns were paid for by key industries - finance, real estate, communications, fossil fuel, timber, pharmaceutical, tobacco, fast food and the airlines. In return for their support, Bush has consistently rewarded these industries with tax breaks, legislative favours and bestowed plum appointments on their executives.

Julian Borger showed that since moving into the White House, George Bush has had only one concern - returning the favours. Real estate developers are permitted to build on wetlands and other

393 Ibid.
sensitive areas, electric and mining companies are allowed to continue emitting carbon dioxide, oil and gas exploration is given the go-ahead on public land including protected national parks, corporate executives are given top jobs in the US Interior Department, and the pharmaceutical industry receives the drug legislations it wants.

In the USA donors of more than US$200,000 are called “Rangers” and donors of more than US$100,000 are called Pioneers. Between them, the Rangers and Pioneers raised US$60 million for George W. Bush’s 2004 election campaign. Businesses contributed nearly three quarters of all political donations. Communication between the State and all sectors of society is necessary for good government, but corporations can enjoy a greater level of influence than others through their donations. Sometimes the leverage they exert borders on corruption.

The laws regulating donations and the public funding of political parties and election expenses varies between countries. In the US, donations are an established part of the political process. They are more strictly regulated in the UK. In France they are banned. As a result, the type and extent of lobbying and political influence will vary between countries. In his former role as Clinton's labour secretary, Robert Reich had frequently complained that corporate America seemed to gain the upper hand more often than not in the corridors of power. Now, in the New York Times he says, there is not even a fight

"There's no longer any countervailing power in Washington. Business is in complete control of the machinery of government. It's payback time, and every industry and trade association is busily cashing in. With political resistance gone, the business community can, paradoxically, no longer discipline itself. Every business lobbyist on K Street is under enormous pressure from clients to reap something from the new bonanza. Every trade association must demonstrate to its member's large returns from their investments in getting an all-Republican business-friendly government. And the pressure only ratchets upward: Every time one company or one industry receives its reward, other Washington lobbyists, representing other firms or industries, come under even more pressure to score victories."394

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3.6.2 Corporate Lobbying Against Sustainable Development

The lobbying industry varies in significance around the world. In the USA, US$2.1 billion was spent by interest groups in 2004 on lobbying, a growth of 30 per cent since 2000.\textsuperscript{395} As Jeffrey H. Birnbaum wrote in the Washington Post in 2005

“The number of registered lobbyists in Washington has more than doubled since 2000 to more than 34,750 while the amount that lobbyists charge their new clients has increased by as much as 100 percent. Only a few other businesses have enjoyed greater prosperity in an otherwise fitful economy. The lobbying boom has been caused by three factors, experts say: rapid growth in government, Republican control of both the White House and Congress, and wide acceptance among corporations that they need to hire professional lobbyists to secure their share of federal benefits.”\textsuperscript{396}

In the USA, corporations argue that they should have greater input into the policy process because they are large taxpayers with an obligation to serve the interests of their shareholders, and responsibilities to their employees and customers. Thus, they have fought for their self-interest. Historically, corporations have tended to lobby to block or weaken proposed environmental protection legislation and improvements in social equity and justice.\textsuperscript{397}

Corporations are clearly the major employer of lobbyists. They may engage them independently or jointly with corporations with the same interests to protect. They create and contribute to industry associations that collectively pull their economic weight together creating politically very powerful bodies.

In Australia, a blocking coalition made up of coal, oil, gas, mineral processing especially aluminium and steel, cement, plastics and chemicals and paper and pulp companies, right wing think tanks and media plus the Howard Government have similarly been widely judged to have effectively blocked action on climate change.\textsuperscript{398} The extent, to which, Australia climate and energy policy was dictated by these vested interests, has been revealed in 2007 publications by Hamilton\textsuperscript{399} and Pearse.\textsuperscript{400}


\textsuperscript{396} Ibid.


\textsuperscript{398} Hamilton, C (2001) Running From the Storm. UNSW Press.


Similarly George Monbiot\footnote{Monbiot, G (2006) Heat: Hot to Stop the Planet Burning. Penguin Press. London.} has exposed to what extent the similar networks in the USA of conservative think tanks, organisations, individual scientists and media outlets have systematically worked together to deny climate change science in the USA. Monbiot describes well how effectively this network in the USA has worked to create uncertainty of the climate change science and assist the Bush Administration delay action on climate change and thus on ecological modernisation in the USA. In the USA, the blocking coalition of a range of corporations like Exxon Mobile, the religious right, the right wing media and the Bush administration has not simply held back real action on climate change, they have worked actively to roll back what few advances had been made on the environment in the USA over his term in office. In the first one hundred days in office, President Bush rolled back campaign promises on clean air, reversing Clinton administration initiatives on drinking water, and promoting new oil exploration in previously protected regions such as Alaska whilst also categorically removing the USA from the Kyoto Protocol Process.

Because of their political influence, many corporations are able to promote their narrow interests and cause serious environmental damage around the world.\footnote{Beder, S. (2006) Suiting Themselves: How Corporations Drive the Global Agenda, Earthscan, London.} Corporations and their lobbyists closely inspect the setting of environmental regulations, mining restrictions, competition and anti-trust laws and import quotas. Contrary views to those of corporations and their lobbyists can and will be put by environmental and social justice NGO groups but they have nowhere near the resources needed to influence policy makers.\footnote{Beder, S. (1997) Global Spin: The Corporate Assault on Environmentalism, Green Books, Devon, UK.}

In 2004 Janicke\footnote{Janicke, M (2004) Industrial Transformation between Ecological Modernisation and Structural Change. In K. Jacob. M. Binder eds. Governance for Industrial Transformation. Proceedings of the 2003 Berlin Conference on the Human Dimensions of Global Environmental Change. Berlin: Environmental Policy Research Centre.} offered a key insight, namely that ecological restructuring compared to ecological modernisation, requires considerably more political, social and industrial change, risk and cost. It is important to distinguish between intrinsically unsustainable industries that would need to be restructured with those industries, which can be modernised ecologically relatively easily. This distinction is important to make as it helps explain why an “environmental problem” for which there is a readily available, marketable and cost effective technical solution is relatively easy to solve (Ozone, Acid Rain etc) compared to where either industries need to be restructured (fishing, forestry, fossil fuel and coal and forestry, unsustainable agriculture, mining, tobacco ) or where there are not yet commercially viable or cost effective solutions (geo-sequestration for the coal industry). Those industry sectors that will need significant restructuring, as part of a transition towards environmental sustainability have traditionally lobbied hard against environmental protection and ecological modernization:
• During the 1980s, the oil industry campaigned to keep lead in petrol. In more recent times, the oil industry lobbied against the Kyoto Protocol and legislation directed to reducing greenhouse gases. Millions of dollars were contributed by the oil industry to support the election campaign of George Bush. It was allowed to drill for oil in the Alaskan wilderness.405

• Some mining companies have lobbied governments to ease environmental regulation, reduce rights of indigenous populations and for increased mining quotas.406

• Some of the agriculture lobby has argued for a relaxation of policies such as those relating to pesticide and chemical fertilisers and those which protect drinking water and wildlife. Some have also lobbied for the promotion of genetically modified (GM) crops and to prevent GM labelling. Some have also argued for government subsidies even when this has created vast quantities of unwanted produce that are dumped on developing countries to the detriment of their own struggling agricultural progress.

• The automobile lobby traditionally argues against tighter fuel standards, stricter emissions control, congestion taxes and for fuel prices to be kept low, and for the building of more roads and freeways instead.407

• The building industry lobbies against cost elective energy efficient initiatives such as insulation and has argued that land use regulations be relaxed including those relating to green belts and infrastructure. It is also argued for low interest rates.

• Parts of the energy utility sector have lobbied for privatization and relaxation of greenhouse gas reduction targets.408

• In Australia, ABC 4 Corners program “City Limits” revealed that there were significant vested interests preventing recycling storm-water and other sustainable water options as they would reduce the bottom line of existing water utilities. Ticky Fullerton, the Four Corners reporter and author of the book "Watershed", asked

“whether the political will exists to make the tough decisions needed to sustainable urban water usage in Australia’s capital cities – especially when hundreds of millions of dollars are made for governments by selling as much water as possible to the public.”409


• In Australia, ABC Four Corners in 2003 exposed the extraordinary influence of supermarkets, packaging and drink companies on government policies and how these groups have even managed to compromise green campaigns - all to one end - dodging responsibility for the waste these industries produce.  

• The nuclear lobby has argued for the building of nuclear power plants on the basis that they can produce a lot of energy and their waste will not cause global warming. They underplay the incredibly long period that radioactive waste must be stored before it is safe and the related immense financial cost of that storage.

• Despite the fact that thousands of innocent people are killed in the USA each year by guns, the gun lobby in the USA argues for the right of individuals to own guns.

• Despite the fact that scientific evidence has established that tobacco smoking causes morbidity and mortality on a large scale, the tobacco lobby argues for the right of individuals to smoke in public places. They have also fought against legislation to hold them liable for the harm caused by their tobacco products.

• The pharmaceutical industry lobby has opposed free national health care programs for all people and has argued for privatised medical markets. It has also argued against proposals to provide cheaper generic medicines to the poor in developing countries with illnesses such as AIDS.

In addition, corporations and their coalitions of vested interest have lobbied hard against government initiatives to improve genuinely social and economic equity, equal opportunity, and social justice. Whilst most European countries have instituted, enhanced and at least maintained core social democratic values and institutions such as the welfare state with free medical health coverage, taxation to prevent extreme inequity, the same cannot be said for the USA. Professor Paul Krugman’s 2007 publication The Conscience of a Liberal is a detailed history of the politics and economics of inequality in the USA. This publication shows the level of corporate and vested interest opposition to efforts to create greater economic and social equity and equal opportunity in the USA. Krugman shows that significant inequality existed in the USA until Roosevelt’s New Deal was passed into law during the 1930s. Krugman brings together the latest research, which shows that it was Roosevelt’s New Deal, which spelled the end of a long period of significant inequality in the USA and not other factors.


Three decisions by the Roosevelt’s government stood out. The first was raising taxes on the rich. The wealthiest Americans went from paying a top rate of 24 percent in the 1920s to 63 percent during FDR's first term and 79 by his second. By the mid-1950s, it was 91 percent (today's top rate is 35 percent). Corporate and estate taxes went up as well. The average federal tax on corporate profits rose from less than 14 per cent in 1929 to more than 45 percent in 1955. The top estate tax rose from 20 per cent to 45, then 60 per cent, then 70 and then 77 per cent. As a result of these changes the ownership of wealth became significantly less concentrated. The richest 0.1 percent of Americans owned more than 20 per cent of the nation's wealth in 1929, but only 10 per cent in the mid 1950s.

The second decision was to make it easier for workers to unionise: in consequence, union membership tripled from 1933 to 1938, and then almost doubled again by 1947. The third decision was made after Pearl Harbour to use the National War Labour Board to encourage employers to raise the wages of the lowest-paid workers. And after the war ended, "the amazing thing is that the changes stuck.” Krugman demonstrates that

"These decisions dramatically reduced inequality and, far from having the cataclysmic effects on the economy predicted by conservatives at the time, they led to the post-war boom. [He emphasizes that the rich then were far less rich than they are today, a point to which he returns several times throughout the book] And then, because they were so successful, the decisions he describes became widely accepted after the war.”  

This demonstrable decline in inequality plus the post-war economic boom, which partly led from it, resulted in a dramatic decline in political polarization. President Roosevelt had not only successfully led the USA out of the Great Depression but also had led the USA well in the WW2. The contrast of the post-war economic boom versus the Great Depression could not have been starker. So when Harry Truman won the 1948 election, the Republican GOP dropped its project of trying to repeal the New Deal. After that election, "the Republican Party survived—but it did so by moving toward the new political centre.”

Krugman cites the work of three political scientists—Keith Poole, Howard Rosenthal, and Nolan McCarty—who have studied the different degrees of polarization and cooperation in every Congress since the nineteenth century and who found, sure enough, that the Congresses of the 1950s saw far more ideological overlap between the parties than did the Congresses of the 1920s or the current decade. Things were looking almost too good. In sum, between 1948 and sometime in the 1970s both parties accepted the changes that had taken place. To a large extent the New Deal changed the relative power relations in the USA significantly enough to create the political conditions that sustained this consensus. A highly progressive tax system limited wealth at the top, and the rich were too weak politically to protest. Social Security and unemployment insurance were untouchable programs, and Medicare eventually achieved the same status. Strong unions were an

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413 Ibid.
414 Ibid,
accepted part of the national scene. The New Deal, in the post-war decades of the 1950s and 1960s changed the relative political power of corporate vested interests enabling these progressive reforms to survive. In the 1950s Eisenhower described those in the Republican Party who still opposed the new deal as nothing more than a tiny splinter group.

Krugman shows that this started to changed in the 1960s and 1970s. Over the course of the 1970s especially, radicals of the conservative right determined to roll back the achievements of the New Deal by taking over the Republican Party, opening a partisan gap with the Democrats. In 1984, Thomas Edsall of the Washington Post, published *The New Politics of Inequality*, that provided the first detailed analysis of this right wing radicalisation and renewal of the Republican Party, which he argued occurred from the mid to late 1970s

> "Such previously hostile and mutually suspicious groups as the corporate lobbying community; ideological right-wing organizations committed to a conservative set of social and cultural values, sunbelt entrepreneurial interests, particularly independent oil; a number of so-called neo-conservative or cold war intellectuals with hard-line views on defense and foreign policy...economists advocating radical alteration of the tax system, with tax preferences skewed toward corporations and the affluent-all these groups found that the republican Party offered enough common ground for the formation of an alliance."\(^{415}\)

Krugman demonstrates that

> "The empowerment of the hard political right in the USA, emboldened US corporations to launch an all-out attack on the union movement, drastically reducing workers' bargaining power; freed business executives from the political and social constraints that had previously placed limits on runaway executive paychecks; sharply reduced tax rates on high incomes; and in a variety of other ways promoted rising inequality."\(^{416}\)

Ronald Reagan was the first new radical conservative President. Reagan taught the conservative US movement how to clothe right wing ideology in populist rhetoric leading to election victory. With election victory came the large scale funding of the Republican Party and right wing think tanks by corporate USA. This coalition of vested interests, with the White House as their ally, did their best in the 1980s to roll back the New Deal through cutting taxes, supporting corporations systematic attacks on the rights and conditions of workers and unions, and slashing the budget of Federal Government Agencies like the Environmental Protection Agency. In the US Ronald Reagan invented the myth of a Cadillac-driving Welfare Queen who, of course, did not exist. Reagan used such myths to lead a roll back of social welfare in the USA.

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When the Republicans lost the White House and the House of Representatives in 1992, this coalition of vested interests nevertheless actively fought anything that would suggest that governments had a positive role to play in addressing the market failures and helping to improve national well being and the public good. This is best illustrated by the ferocity and systematic way the US conservative movement backed by corporations fought Clinton's health plan in the 1990s. Krugman outlines in detail the obstacles to health reform in the USA due to corporate vested interests and the conservative movement in Chapter 11 of *The Conscience of Liberal*.417 Mike Moore’s 2007 film *Sicko* has done much to raise public awareness of the opposition by vested interests to universal health care in the USA. But Krugman also shows through quoting conservative strategists like William Kristol to what extent right wing conservatives are systematically opposed to anything that may give the people a sense that, through government, their conditions in life could be cost effectively improved. In this aspect Krugman’s analysis takes the analysis of most others further. Krugman adds to the analysis as follows:

“Let’s start with the enduring obstacles, of which the most fundamental is the implacable opposition of movement conservatives (in the USA). William Kristol, in the first of a famous series of strategy memos circulated to Republicans in Congress, declared that Republicans should seek to “kill” the Clinton plan. He explained why in the Wall Street Journal: “Passage of the Clinton health care plan in any form would be disastrous. It would guarantee an unprecedented federal intrusion into the American economy. Its success would signal the rebirth of centralised welfare-state policy.”418 He went onto argue that the plan would lead to bad results, but his main concern, clearly was that universal health care might work – that it would be popular, and that it would make the case for government intervention. It’s the same logic that led to George W. Bush’s attempt to privatise Social Security: The most dangerous government programs, from the movement conservative point of view, are the ones that work the best and thereby legitimise the welfare state.”419

After Ronald Reagan left office, the Republican Party has been completely radicalised by the right wing of the Party. Krugman provides the example of the Texas Republican Party’s 2004 platform as an idea of what the Republican Party faithful, and their corporate backers really want. It calls for the

“Elimination of Federal Agencies including but not limited to, the Bureau of Alcohol, Tobacco, and Firearms; the position of Surgeon General; the Environmental Protection Agency; the Departments of Energy, Housing and Urban Development, Health and Human Services, Education, Commerce and Labour.” The platform also calls for the privatisation of social security and the abolition of the minimum wage. In other words Texan Republicans want to repeal the New Deal completely.”

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417 Ibid. Chapter 11.
3.6.3 The Rise of the Anti-Sustainability Right Wing Conservative Movement

The rise of the anti-sustainable development right wing conservatives in the USA, the UK and Australia has had significant repercussions for global efforts to achieve sustainability in the last 20 years. The conservative movement in the USA and Australia has often systematically worked to undermine many of the major sustainability and sustainability related global treaties and goals over the last three decades such as the Kyoto Protocol and Agenda 21 at the 2002 World Summit or Sustainable Development. Whilst this is not the focus of this thesis, as it is well covered by others, it is important to discuss briefly this shift politically to the right over the last three decades in the USA, Australia, the UK and other countries and look at the factors that have caused it.

Many experts have described in detail how the shift to the right politically from the late 1970s has occurred in the US, UK and Australia due to a new coalition of corporations, industry groups, intellectuals, economists, media moguls, think tanks, religious conservatives and security experts. The individual members of this renewed conservative movement were motivated by different factors-

- The economic recession of the 1970s and phenomenon of stagflation motivated many economists, business leaders and politicians such as Margaret Thatcher, to turn to Nobel Laureates in economics Hayek and Friedman who advocated a rapid shift to neo-classical economics from Keynesian economics.
- Increasing globalisation of the corporation enabled businesses tired of dealing with rising wage pressures, powerful unions and increasing environmental government regulations in the late 1960s and 1970s to invest (or threaten to invest) in developing countries if regulations where not changed in OECD nations.
- Fervent anti-communists and security “hawks” feared the anti-Vietnam movement of the 1960s and 1970s and were motivated to ensure that communism was defeated.
- The New Deal in the USA and social democratic parties in Europe did raise taxes, corporate taxes and estate taxes on the rich from the period of 1935-1950. This inevitably created a backlash. For instance, any CEO could easily report an increased profit results for their corporation, thereafter reductions in corporate tax rates were achieved.

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Higher taxes also led to more people being outraged by the idea of other people receiving public welfare from their hard-earned money, believing that government should be smaller. The success of the New Deal and the Welfare State in both achieving greater social outcomes and enhancing economic growth in the 50s and 1960s nevertheless also created the opportunity for free rider problems – those who don’t "deserve" the benefit but cheat and get it anyway. In the welfare debate there are those who could easily get work but choose not to – "job snobs" preferring to surf all day at Byron Bay. Academic research shows that the conservative movement has played up the phenomenon of welfare cheats to argue for a winding back of the welfare state. As Dr Greg Marston’s, Australia’s leading commentator on the subject comments

“You’d be led to believe reading the press and newspaper reports that it's very widespread amongst unemployed people, but in fact it’s about 0.01 per cent of the total Centrelink customer base actually commits fraud and is convicted of fraud. So that's tiny compared to the attention it gets.” 422

The shift to the right politically in the USA, UK and Australia was also enabled by additional factors:

- Allies in the media such as the Murdoch global media empire. The documentary “OutFoxed”423 presented significant evidence to demonstrate to what extent there is systematic daily aligning of the main conservative messages and political spin for the day between the Bush administration, the Republican Party and Murdoch media. Monbiot, Hamilton, Burton, and Beder have demonstrated similar linkages in the UK and Australia.424

- The nexus of lobbyists and politicians. Krugman demonstrates that in the USA the Republican Party has systematically worked to drive out Democrats from paid lobbyist positions and ensure that all lobbyists jobs go to loyal Republicans. Until his defeat in 2006, republican Senator Rick Santorum held a meeting every Tuesday with about two dozen top lobbyists. Nicholas Confessore described those meetings in 2003 as follows:

“Every week, the lobbyists present pass around a list of the jobs available and discuss whom to support. Santorum’s responsibility is to make sure each one is filled by a loyal Republican - a

422 See Dr Greg Marston at [http://www.abc.net.au/pm/content/2005/s1419671.htm](http://www.abc.net.au/pm/content/2005/s1419671.htm) Accessed 30 January 2008
Senators chief of staff, for instance, or a top White House aide, or another lobbyist whose reliability has been demonstrated. After Santorum settles on a candidate, the lobbyists present make sure it is known whom the Republican leadership favours. 

Equally important is the fact that the takeover of the lobbyists' jobs created a pool of highly paid jobs through which the Republican Party could reward party loyalty. The Republican Party, however, doesn't just reward those who toe the line, they punish dissenters within their ranks. The Club of Growth is a right wing think tank that focuses on disciplining Republicans who are not sufficiently in favour of cutting taxes. They have given millions to conservative Republican candidates to run campaigns against sitting moderate Republicans.

All of these factors would not have guaranteed success without also the advent and rise of the right wing conservative think tank. A think tank is a research institute providing advice and ideas on problems of policy, commerce, and military interest. They are often associated with military laboratories, corporations, academia, or other institutions. Usually the term “think tank” refers specifically to organizations which support multi-disciplinary theorists and intellectuals who endeavor to produce analysis or policy recommendations, often consistent with a particular political ideology. Think tanks are financed by corporations and individuals who hope to give more credibility to their ideas. They are usually comprised of ex-politicians, academics and industry leaders. They produce reports on various issues and seek to gain large publicity for them.

Until around 1970, there were very few think tanks. After 1970, the number of think tanks grew rapidly with the vast majority of them described as right wing conservatives based on laissez-faire economic theory. Bob Burton’s work in his book Inside Spin describes how right wing think tanks have acted as the front line shock troops of conservatives. Such think tanks have been extraordinarily successful in the USA, Europe and Australia in changing the debates on numerous sustainability issues. A review of environmental scepticism literature from the past 30 years has found that the vast majority of sceptics, often identified as independent, are directly linked to politically oriented, conservative think tanks. The study analysed books written between 1972 and 2005 which

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deny the urgency of the need for environmental protection. The authors of this study concluded that more than 92 percent of the sceptical authors were affiliated to right wing think tanks which promote conservative ideas. Co-author of the study Professor Dunlap states that

“The U.S. conservative movement has led opposition to international environmental regulation since the 1992 Earth Summit in Rio de Janeiro. In the years since, the movement has succeeded in undermining the credibility of many environmental issues, from the [political] right, there’s no longer a sense of neutral, objective science - only liberal or conservative - and that’s an unfortunate trend.”

Many sceptics say that they form their opinion despite their affiliation to think tanks or industry. The authors say environmental sceptics have every right to voice their opinion. But the statements of a few think tank-supported experts should not be regarded as equal to scientific findings that have been vetted through an intense peer-review process. The co-authors stated that

“We want to allow a cacophony of voices in public policy. Where we get into problems is where we fail to evaluate the voices; we fail to evaluate the merit of the claim.”

They have been greatly assisted in this by the nature of the media. As Peter Jaques, lead author of the study states,

“The popular media often regard environmental sceptics as independent experts, despite their connection to industry-funded campaigns that seek to de-legitimize sound environmental science reports, especially on climate change.”

3.6.4 The Nature of the Media

A significant obstacle to sustainability debates maturing and being resolved is the nature of the media. The media wants debate, argument and conflict. The TV media industry views the idea of people agreeing as “boring” television. TV based arguments allow little room for consensus or shared frameworks. Though great for ratings, such media-devised wrangling ignores the possibility that innovative, pragmatic solutions might exist that can satisfy the vast majority and make these media debates irrelevant.

Historically, there has been a very clear pattern that plays out in the media. Firstly, science discovers another negative human impact on the environment or chemical that could harm human health. Secondly, business and their representatives - whether as industry bodies, think tanks, or lobbyists – counter this disputing the veracity of the scientific claims, arguing that action would cost jobs and harm the economy. Thirdly, the media reports both sides in such a way as it often leaves audiences confused in the name of “balanced” coverage.

By definition there is always uncertainty in the science of complex systems such as nature, ecosystem thresholds, risks to human health and modelling to assess how actions will affect the economy. So, even if business and their representatives cannot effectively argue that there is uncertainty in the
science, they can easily raise uncertainty about the cost-benefit analysis to the community of acting on a scientific warning. They can raise concerns and fears in the community about whether action will harm economic growth and jobs, because there is always inherent uncertainty in modelling complex systems. The modelling of such complex systems as the economy inevitably involves making assumptions which can significantly influence the conclusion of the modelling. Voters are increasingly sensitive to issues of how economic growth and jobs will be affected because, due to market and competition orientated policy, people are less secure about their future employment. With mortgages also having increased significantly over the last two decades in most OECD countries, voters are very concerned about whether economic growth and employment rates are going up or down. Some think tanks play on these fears and concerns in the media.

The media also is happy to feature the representatives of these think tanks because they provide much needed “debate” to ensure lively higher rating television. The media wants debate, even if an issue is resolved amongst all independent scientists and economists. This has been seen with climate change. Now that there is overwhelming consensus within the independent scientific and economic community concerning human induced climate change the media increasingly has to go to think tanks, often funded by industries responsible for significant greenhouse gas emissions, to find anyone who is willing to “debate” the issue. Such debates in the media make good fodder for reporters and while they can help expose gaps in knowledge, it does not help to move forward and resolve debates. It also presents a false impression to citizens that there is still significant debate in the independent environmental questions such as the basic science of climate change. Studies reviewing the peer reviewed climate science literature show that

"1,372 climate researchers and their publication and citation data to show that the overwhelming majority of the climate researchers most actively publishing in the field support the tenets of anthropogenic climate change as outlined by the Intergovernmental Panel on Climate Change."

The rest of the literature on atmospheric and climate science simply does not take a position one way or the other usually because it is irrelevant to the research focus of their paper. Despite this level of scientific consensus in the peer reviewed literature, “a survey of 636 articles from four top United States newspapers between 1988 and 2002 found that most articles gave as much time to the small group of climate change doubters as to the scientific consensus view.”

The commitment, in the media, to allow both sides of an argument equal time is very important most of the time. However as the late IPCC lead author Professor Stephen Schneider explains


“In science, it’s different. A mainstream, well-established scientific consensus may be ‘balanced’ (by the media) against the opposing views of a few extremists, and to the uninformed, each position seems equally credible.”

Extreme examples help to make the point. Is it appropriate to give equal time on the media to one scientist arguing for the existence of gravity versus some arguing that gravity does not exist? Is it valid or appropriate for the media to give equal time to those that do not think AIDS exists, to those that do and wish the public to be informed so they can take appropriate steps to avoid contracting the disease?

Just as there is a significant and remarkable level of consensus on the science of anthropogenic climate change and the economics of action on climate change in the peer reviewed literature, this thesis will show, in chapters 4-8, that there is a growing consensus on many of the other broad sustainability issues and debates within academia, scientists and increasingly amongst economists who publish in the peer reviewed literature. However, it remains to be seen whether the general public will ever know this because of both the nature of the media and the fact that there are now hundreds of well funded neo-conservative neo-classical think tanks willing to represent relentlessly anti-sustainability positions without basis in the peer reviewed scientific literature.

Until around 1970, there were no more than several dozen think tanks. This number has exploded since 1970 and the vast majority of the new think tanks, that have formed, would be described as conservative based on simplistic interpretations of neo-classical economic theory. Krugman has shown that such think tanks oppose any form of government intervention that in any way could be construed as helping to rebuild the welfare state or improving workers rights and conditions. Monbiot, Beder, Burton and Hamilton have shown that such right wing think tanks and vested interests also oppose most attempts to address the market failure of environmental degradation. But many right wing think tanks go further and argue that there is no market failure and hence dispute the role of government intervention more broadly. Such is their fundamental belief in the market, as the best means to address most problems, that they disagree with government investment and policy changes to achieve a better world. They argue against the fact that there is any scientific evidence or ethical foundation for the need for new paradigm of sustainable development as was outlined in detail in Chapter 1. As long as corporations fund such right wing think tanks and they have allies in the media


they will systematically work to ensure that the sustainability debates are never truly resolved. Hence next, in this chapter, we consider in more detail whether there is a basis for market fundamentalism.

After that, in this chapter, we begin to discuss the great sustainability debates namely whether a transition to sustainable development will help or harm economic growth, jobs and business competitiveness. It is widely acknowledged that the upsurge in interest and commitment in sustainability in the late 1980s and early 1990s, thanks in large part to the Brundtland Commission’s *Our Common Future*, failed to realize its early promise in the 1990s globally. There are different theories on why this is the case. But most acknowledge that one factor in this has been the success of a concerted campaign by the conservative movement globally against sustainable development based on the argument that sustainable development would harm jobs, business competitiveness and economic growth. These largely corporate vested interests working with conservative think tanks, politicians and allies in the media have been extraordinarily effective at convincing many citizens that a transition to sustainable development is going to increase costs to business and the community and therefore is anti-economic growth, anti-jobs and anti-business competitiveness. This is one of the major reasons why this thesis focuses on these sustainability debates here in chapter 3 and then in more detail in chapters 4-8. Underpinning conservative right wing conservative claims about the costs of a transition to sustainable development is their faith in the “invisible hand” of the market and their belief that government intervention will not assist and be costly.

Hence, before discussing some of the classic sustainability debates in the rest of the thesis (Chapters 3-8), it is important to recognise that the debates about the role of market and state also have significant implications for the progress of sustainable development in general. Is the market the best way to allocate scarce resources. Can markets fail? Is there a role for government intervention to assist a transition to sustainable development or should it all be left to the market? Debates have continued on these fundamental questions for over a century. Hence this debate about the role of market and state is considered next.

### 3.6.5 The Rise of Market Fundamentalism

Already this thesis has outlined some of the core assumptions and beliefs that have prevented the successful operationalising of sustainable development. Another important reason why so little progress has been made on sustainable development has been rise of influence of market fundamentalism and the right think thanks that have promoted it. Up until the 1970s, government intervention based on Keynesian economics had proved remarkably successful at helping economies to grow and smooth out the extremes of the traditional boom bust cycle. But in the 1970s, through a range of factors including the OPEC oil crisis, Western economies were faced with a serious challenge. By the late 1970s and early 1980s many economies were faced with both a stagnant economy and high inflation. This phenomenon was called stagflation. Many saw this as a failure of government intervention and Keynesian economics. The crisis of stagflation in the 1970’s, and the
fall of Soviet Empire in 1989 has led economic policy to shift to more laissez-faire approaches which have idealized the market whilst belittling the role of government and the need for regulation. This sentiment was summed up by Bill Clinton in 1996 in his January 27 radio address on CNN when he said that ‘The era of big government is over.’ The most ardent free market proponents believe that the market is the best way to address environmental degradation, unemployment and issues of social inequity, arguing that the market and innovation on their own will solve these problems and that governments would best get out of the way as much as possible. Behind this is a belief in unfettered or unregulated markets. Adam Smith, in 1776, crystallized this view when he wrote about an invisible hand that works through the markets. No idea has had more power than that of Adam Smith’s invisible hand. It is said that free markets, as if by an invisible hand, lead to the most efficient, and fair, allocation of scarce resources and that each individual in pursuing his or her own self-interests, advances the greater good. The relevant passage is probably the most famous (and selectively cited) passage in Smith’s classic *An Inquiry into the Nature and Causes of the Wealth of Nations*.

> “But the annual revenue of every society is always precisely equal to the exchangeable value of the whole annual produce of its industry, or rather is precisely the same thing with that exchangeable value. As every individual, therefore, endeavours as much as he can both to employ his capital in the support of domestic industry, and so to direct that industry that its produce may be of the greatest value; every individual necessarily labours to rend the annual revenue of the society as great as he can. He generally indeed, neither intends to promote the public interest, nor knows how much he is promoting it. By preferring the support of domestic to that of foreign industry, he intends only his own security, and by directing that industry in such a manner as its produce may be of the greatest value, he intends only his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention. Nor is it always the worse for the society that it was no part of it. By promoting his own interest he frequently promotes that of the society more effectually than when he really intends to promote it.”

Thus, what he in fact said was that each individual, pursuing his or her own self-interest, led by an invisible hand, frequently promotes the interests of society. Markets do bring enormous benefits. They have been responsible for lifting more people out of poverty faster than any other economic mechanism in history. In a well-functioning market, prices provide information about the demand and supply conditions in that market, both buyers and sellers can observe and act upon the information embodied in the price. The economist Friedrich Hayek described the interconnectedness of markets as follows:

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“Suppose that someone has found a new use for tin, so that the demand for tin increases and its price rises. Then the effect will rapidly spread throughout the whole economic system and influence not only all the uses of tin but also its substitutes and the substitute of these substitutes, the supply of all things made of tin, and their substitutes and so on; and all this without the great majority of those instrumental in bringing about these substitutions knowing anything about the original causes of these changes. The whole acts as one market, not because any of its members survey the whole field, but because their limited individual fields overlap so that through many intermediaries the relevant information is communicated to all.”

It would be foolish in the extreme, therefore, for any government to seek to even attempt to replace this role of the market. Actually, it is extreme folly to suggest that even the most benevolent of centrally-planned states could acquire the amount of information necessary to replace the market. We saw in the Soviet’s case the disastrous results of such a policy. Some strongly influenced by Hayek concluded that for the most part the market is best and formed think tanks to promote such beliefs. But one of the great intellectual achievements of the mid-twentieth century (by Gerard Debreu of the University of California at Berkeley and Kenneth Arrow of Stanford, both of whom received Nobel prizes for this achievement) was to establish the conditions under which Adam Smith’s ‘invisible hand’ did in fact work:

- information had to be either perfect, or at least not affected by anything going on in the economy
- whatever information anybody had, others had the same information; and
- competition was perfect and, for instance, one could buy insurance against any possible risk.

Arrow and Debreu’s Nobel Prize winning work also showed that for Smith’s invisible hand to apply it implicitly assumed that information is fixed, costless and perfect. We know that information is not fixed, costless, or perfect. The amount, nature and distribution of knowledge within a society change over time. Individuals and organisations must invest time and money in order to acquire new information. Even though everyone recognized that these assumptions were unrealistic, it was hoped that the real world did not depart too much from such assumptions and that Adam Smith’s invisible hand theory would still provide a good description of the economy. Subsequent Nobel Prize winning

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work has shown that this was a hope based on faith not science. Sometimes, knowledge lies with parties who have an incentive to conceal it, so that information is unevenly or ‘asymmetrically distributed’ between buyers and sellers. Economists such as George Akerlof, Joseph Stiglitz and Carl Shapiro have emphasised that the kinds of assumptions economists make about information is important, because changing these assumptions results in significantly different economic models. In the 1970s and 80s, these and other pioneering economists set about including information distribution in their models. Rather than producing more complicated models making essentially the same predictions, the explicit inclusion of information distribution resulted in models capable of predicting and explaining behaviour in many different markets.

Importantly, in these and other new models, the market mechanism was shown to be inefficient in the face of imperfect information. Bruce Greenwald and Joseph Stiglitz\(^{437}\) analytically demonstrated in 1986 that this conclusion is a general one. Differences in the levels of access to information within the market will affect the distribution of resources, and better information may actually lead to a more efficient distribution. Greenwald and Stiglitz found that these asymmetries of information are pervasive throughout the economy and found them to be endemic, and especially in developing economies, where the market for information does not work as well. In fact, these advances in economics show that the invisible hand of Adam Smith is termed ‘invisible’ for good reason, as it does not exist in the real world.\(^{438}\) Moreover, in simple situations involving a market with a single informational problem, there is in many cases a government intervention which could make everybody in the market better off. In more complicated settings involving complex multiple informational problems it may be the case that clear opportunities for government interventions to improve welfare will not necessarily exist. In addition to providing a better picture of the economy, the work of Greenwald and Stiglitz also has recast the old debate about whether or not there is a role for government in a market economy in a new light. The theorem shows that market failure is endemic and that there is indeed a role and that the relevant debate is not the existence of this role but its precise nature.\(^{439}\) As Common et al write

“Rational Expectations Models assume that all market participants have the same information and act perfectly rationally. Stiglitz comments that the fact that such models were for many years the received wisdom in neoclassical economics, and “especially in America’s graduate schools”, “bears testimony to a triumph of ideology over science.” \(^{440}\)


\(^{439}\) Ibid.

3.6.6 Market, Informational and Institutional Failures – Drivers in Unsustainable Development.

These economic results are profound because they analytically demonstrate that laissez faire market fundamentalism no longer has any foundation in modern economics. Their results provide a foundation from which it will be possible to re-frame the market versus state debates.

Their results significantly weaken the argument of those economists in think tanks which believe that information failures and market failures are insignificant compared to government failures. The World Bank released the World Development Report 1997: The State in a Changing World incorporating this new understanding of market and informational failures. The report argues that an “effective state” is the cornerstone of successful economies. World Bank Group President James D. Wolfensohn said "Many have felt that the logical end point of all this was a minimalist state. Such a state would do no harm, but neither could it do much good. The report explains why this extreme view is at odds with the evidence of the world's development success stories."

This result is also profound as it shows that market and information failures are endemic and significant. Hence this enables the sustainability “growth” debates to be reframed on a much stronger foundation.

Using these results from modern economics this thesis proposes that the current unsustainable nature of economic growth could be a symptom of more fundamental causes of un-sustainability. This thesis, using the current literature for support, proposes that the current form of economic growth is unsustainable due to market, informational and institutional failures, rebound effects, a failure to mainstream sustainable design, rising global population and a rapid expansion of unsustainable western consumption patterns globally and a lack of sufficient global co-operation. This thesis argues that, only by recognising this and focusing on the necessary sustainability design, policy and institutional changes to address these barriers to sustainability can the current unsustainable forms of development be turned around to become sustainable. Once it is understood that economic growth per se is not the problem then this helps to clarify what market, information and institutional failures government, business and society needs to focus on to achieve the goal of sustainable development. The conservative right wing movement’s main arguments against sustainable development initiatives are that

a) the problems sustainable development seeks to addressed are not caused by market informational or institutional failures and hence should be left to the market

b) that government intervention will only make such problems worse

c) that government intervention will significantly harm economic growth

This thesis proposes that this is one of the key reasons why reframing of the “growth” debates is vitally important. This thesis proposes that those that previously assumed that economic growth is the main cause of unsustainable development have played into the hands of the conservative movements agenda and the very vested interests that they are seeking to overcome. To date right wing conservative think tanks, politicians and media have been able to use quotes and reports by the environment movement itself to argue both that economic growth is the cause of environment degradation and a transition to sustainable development would harm the economy. Environmentalists and right wing conservatives have not agreed on much historically, but many have agreed that there are fundamental trade offs between economic growth and the environment and this has provided conservative think tanks with one of their main arguments to stop progress on sustainable development.

A relative failure by the environment movement to pay attention to and see the state versus market debates and discourses as important has also played into the hands of vested interests and right wing think tanks.

These results from Stiglitz et al that show that market and information failures are endemic and significant and have profound implications also to what steps are needed to change the current drivers of unsustainability into drivers for sustainability.

Modern economics now demonstrates on a rock solid footing, that governments have a role to address externalities as the market tends to produce too little of positive externalities like education and R&D whilst producing too much of negative externalities like pollution and environmental degradation. The literature to date also shows that to achieve decoupling of economic growth from environmental pressures, purposeful government policy and actions are essential. Another area where government intervention will be required is to drive the next waves of innovation in sustainability. Modern economics shows that governments can greatly assist firms lead new waves of innovation through their unique position in society to help co-ordinate the multiple initiatives needed, often over decades.

This thesis argues in Chapters 4-8 that to achieve the goal of sustainable development governments, business and society need to focus on overcoming market failures through good governance to address the tragedy of the commons, advanced eco-efficiency/design for sustainability approaches supported by purposeful sustainability policy, economic incentives, regulatory and institutional reforms, corporate law reform plus sustainable consumption and lifestyle changes. All of these initiatives will require differing degrees of government intervention.

Neo-classical economists represented by many think tanks globally argue against such measures. They strongly oppose unnecessary government intervention. They argue that government failure is

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almost always worse than market failure. So strong is their conviction that they oppose efforts by governments to recognise and address market failures of many sorts such as negative environmental externalities or inequality of income. This core belief in the idea that market failures do not exist or if they do they are not as bad as government failures underlines the role taken in the sustainability debates by most of these conservative neo-classical think tanks. Hence to understand the sustainability debates we need to also understand market fundamentalism. If we are to move the sustainability debates forward it is vital that we understand that they are occurring in the context of other debates such as debates about the role of the market and the state.  

Stiglitz’s recent popular books have been largely polemical and have not taken the time to explain the basics of market efficiency and failure to the layperson so that they can fully understand the significance of these results. These results put much of Keynesian economics on the solid theoretical footing that Keynes, not being a gifted mathematician, was unable to do. These results, for which the economists responsible won the 2001 Nobel Prize in Economics, reframe these old debates about market and state forever. Few publications have appreciated the significance of these results. For instance major publications on this old debate of state versus the market such as The Commanding Heights: The Battle Between Government and the Marketplace That Is Remaking the Modern World and the PBS documentary series based on this book missed completely these recent developments in economics. Professor Michael Common and Sigrid Stahel’s Ecological Economics: An Introduction is one of the few economics text books that has recognised the importance of these results for the economics of sustainable development.

These important economic results demonstrate that market fundamentalism, which underpins the global conservative movement, and right wing think tanks arguments, no longer has any foundation in modern economics. The rest of this thesis now is an analysis of whether their claims about the prohibitive costs of a transition towards sustainable development have any foundation either? Chapters 6-8 in particular look at whether the costs of action outweigh the costs of inaction on sustainable development.

3.7 The Perception That Environmental Sustainability Will Always Increase Costs To Industry Or Any Organisation.

One of the main reasons for inaction on warnings on ecological sustainability issues has been the perception of increased costs to industry or for that matter any organisation. Repeatedly corporations have argued that the costs of acting on early warnings would be prohibitive. This has been a key factor in many of the early warnings, and even some of the loud and late warnings, being deliberately ignored by decision makers, governments and politicians. The EU study “Late Lessons from Early Warnings: the Precautionary Principle 1896–2000”\textsuperscript{447} states that

“Information [about asbestos, PCBs, radiation, benzene, lead, soil degradation and salinity from deforestation, and risks of overshoot from over-fishing and over-harvesting of natural resource] was not used, or ignored: or we were all taken by ‘surprise.’ In many of the case studies, adequate information about potential hazards was available well before decisive regulatory advice was taken, but the information was either not brought to the attention of the appropriate decision-makers early enough, or was discounted for one reason or another. It is also true that in some of the case studies, early warnings — and even ‘loud and late’ warnings — were effectively ignored by decisionmakers because of short-term economic and political interactions.”\textsuperscript{448}

If problems are addressed early on then the costs involved can be significantly reduced. But in many cases business and government have not acted early to address sustainability issues. Instead, by the time governments decide they have to act, the scale and speed required of industry to change practices to solve these problems may have grown significantly. Whether it be phosphate fertilisers and algae blooms in the northern hemisphere lakes, sulphur dioxide and acid rain, CFC’s and the destruction of the ozone layer, or greenhouse gases and climate change, the scale and speed required of industry to change practices to solve these problems has and will require significant reductions of these pollutants. Industry has historically time and again argued that the cost of addressing the sustainability issues outlined in Table 1.4 would cost too much and harm competitiveness.\textsuperscript{449} Is this true? Or have initial cost estimates by industry and business been incorrect or biased? Estimates about the cost of environmental regulations are used in analyses to set public policy, and they influence the public sentiment that in turn influences political decisions. If estimates are biased and overstate the costs, the public may conclude that the regulations are too expensive when, in fact, the actual cost might be acceptable. Or policy analysts may decide that the benefits do not justify the costs, when the benefits


\textsuperscript{448} Ibid p168

\textsuperscript{449} Ibid.
may actually exceed the costs ultimately paid. It is therefore critical to explore how effective past efforts have been in forecasting regulatory costs.

Hodges has undertaken a detailed economic analysis of past projections of environmental regulatory costs as they relate to a variety of industries. (See Table 3.1) His examples range from asbestos to vinyl, and in all but one instance the estimated cost flowing from regulatory change was at least double the actual cost paid, while in some cases the estimates were wildly exaggerated. This inflation of estimated costs holds regardless of whether industry itself or an independent assessor did the work, which suggests a systematic source of error.

Table 3.1. Industry original estimates of the cost of particular forms of environmental protection versus the actual costs. (In $US)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Ex-Ante Estimate</th>
<th>Ex-Post or Revised Ex-Ante Estimate</th>
<th>Overestimation as a Percent of Actual Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asbestos</td>
<td>$150 million (total for mfg. and insulation sectors)</td>
<td>$75 million</td>
<td>100%</td>
</tr>
<tr>
<td>Benzene</td>
<td>$350,000 per plant</td>
<td>Approx. $0 per plant</td>
<td>Infinite</td>
</tr>
<tr>
<td>CFCs-Auto Air Conditioners</td>
<td>$650-$1,200 per new car</td>
<td>$40-$400 per new car</td>
<td>63%-2,900%</td>
</tr>
<tr>
<td>Coke Oven Emissions OSHA 1970’s</td>
<td>$200 million – billion</td>
<td>$160 million</td>
<td>29%-1,500%</td>
</tr>
<tr>
<td>Coke Oven Emissions EPA 1980s</td>
<td>$4 billion</td>
<td>$250-400 million</td>
<td>900%-1,500%</td>
</tr>
<tr>
<td>Cotton Dust</td>
<td>$700 million per year</td>
<td>$205 million per year</td>
<td>241%</td>
</tr>
<tr>
<td>Halons</td>
<td>1989: phase out not considered possible</td>
<td>1993: phase out considered technologically and economically feasible</td>
<td>n/a</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th></th>
<th>Mid-1980’s: $14.8 billion</th>
<th>1990: $5.7 billion</th>
<th>159%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Landfill Leachate</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sulphur Dioxide</strong></td>
<td>1980s: $1,000–1,500 per</td>
<td>1996: $90 per tonne of sulphur dioxide</td>
<td>~750% 452</td>
</tr>
<tr>
<td></td>
<td>tonne of sulphur dioxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Surface Mining</strong></td>
<td>$6-$12 per ton of coal</td>
<td>$0.50-41 per ton</td>
<td>500%-2,300%</td>
</tr>
<tr>
<td><strong>Vinyl Chloride</strong></td>
<td>$109 million per year</td>
<td>$20 million per year</td>
<td>445%</td>
</tr>
</tbody>
</table>


The reason for this discrepancy, Hodges argues, is that business groups and economists find it nearly impossible to predict the innovative ways in which industry goes about complying with new regulations. In some instances, they dump the old processes altogether and adopt new, cost-effective ones, while in others they radically transform their entire business.

The projections, in contrast, generally assume a business-as-usual approach that must directly absorb the burden of costs. The Stern Review explains Hodges result 454 as follows,

“When such numbers (Hodges' work) come to light, companies are often accused of inflating initial cost estimates to support their lobbying efforts. But there is a more positive side to the story. The dramatic reduction in costs is often a result of the process of innovation, particularly when a regulatory change results in a significant increase in the scale of production. And the process of complying with new policies may reveal hidden inefficiencies which firms can root out, saving money in the process.” 455

In a curious corollary to this, Goodstein 456 analysed projected versus actual costs for environmental clean-ups, and discovered that they were almost always underestimated—in some instances grossly so—which shows a systematic anti-environment bias. Goodstein has shown, therefore, that environmental regulations have not caused massive costs to business nor job losses, nor have they caused companies to flee to pollution havens. His book also shows that efforts to control global warming will probably have little impact on the total number of jobs.

Again and again, as Goodstein 457 has shown, companies have responded to proposed environmental rules by threatening either moving off-shore, huge layoffs, foreign inroads into domestic markets, and these impacts have not eventuated. Part of the problem has been that historically business has taken a

454 Ibid
455 Ibid
457 Ibid.
reactive, rather than a proactive, approach to environmental management. This reactive approach has resulted in corporations and businesses generally focusing on end-of-pipe approaches to pollution control and waste clean-up which do add to costs. The key point here is that this reactive approach to environmental management does add to costs and is the reason why traditionally corporations and business have associated all environmental initiatives as increasing costs. But as Professor Michael Porter and Claus Van Der Linde explain a proactive approach to pollution prevention can open up ways to reduce costs rather than add to costs.

“Environmental improvement efforts have traditionally overlooked these [whole] systems costs. Instead, they (corporations) have focused on pollution control through better identification, processing, and disposal of discharges or waste – costly approaches. In recent years, more advanced companies and regulators have embraced the concept of pollution prevention, sometimes called source reduction, which uses such methods as material substitution and closed-loop processes to limit pollution before it occurs. But, although pollution prevention is an important step in the right direction, ultimately companies must learn to frame environmental improvement in terms of resource productivity. Today, managers and regulators focus on the actual costs of eliminating or treating pollution. They must shift their attention to include the opportunity costs of pollution – wasted resources, wasted effort, and diminished product value to the customer. At the level of resource productivity, environmental improvement and competitiveness come together.”

Some of businesses’ most significant costs are capital and inputs, such as construction, raw materials, energy, water and transportation. Other significant costs to some business include pollution control and waste management. The chemical industry sector in many countries now spends more on pollution and waste management than on R&D. It is therefore in businesses’ interests to minimise these costs, and hence the amount of raw materials and other inputs that they need to create their product or provide their service. Business produces either useful products and services or unsaleable waste. How does it assist a business to have plant equipment and labour tied up in generating waste? The wise implementation of resource efficient and pollution prevention strategies can be cost-effective in both the short and longer terms. By reducing, remanufacturing, recycling, and reclaiming or on-selling, businesses can realise immediate cost savings. In addition to providing new ways to cut costs and improve productivity, the challenge of improving resource productivity also provides firms with a new opportunity to differentiate their products and gain market share, based on the environmental attributes of their products and processes. Efficiency gains can either come from energy, water and resource efficiencies. The word ‘efficiency’ was first used by the World Business Council for Sustainable Development (WBCSD) in their 1992 publication 'Changing Course'. It sought to

encapsulate the idea of using fewer resources and creating less waste and pollution whilst providing the same or better services. According to the WBCSD\textsuperscript{459}, efficiency entails the following:

- A reduction in the material intensity of goods or services
- A reduction in the energy intensity of goods or services
- Reduced toxic materials
- Improved recyclability
- Increased durability of products, and
- Greater service intensity of goods and services.

As the Stern Review commented

“A growing number of private and public sector organisations are discovering the potential to reduce the cost of goods and services they supply to the market through energy efficiency. A study of 74 companies drawn from 18 sectors in 11 countries including North America, Europe, Asia, and Australasia revealed gross savings of US$11.6 billion from reducing greenhouse gas emissions through energy efficiency.”\textsuperscript{460}

Such energy-efficiency savings can be equal to a company’s current profit margin. When viewed with this perspective, the value of such savings suddenly becomes attractive to busy CEO’s. Governments increasingly are running eco-efficiency\textsuperscript{461} programs or providing incentives to encourage business to invest in such measures. The Australian Federal Government’s Eco-Efficiency Program\textsuperscript{462} involved over 200 businesses, all demonstrating significant eco-efficiency and financial savings.

Now also numerous studies\textsuperscript{463} and empirical evidence\textsuperscript{464} has demonstrated that firms can achieve further competitive advantage through greater eco-design of products (reducing process costs) to


produce ‘cleaner and greener’ goods and services (product/service differentiation). Porter et al feature a number of examples of this in their papers.

Several authors have studied the relationship between productivity and eco-efficiency and have found a direct relationship using different methodologies and datasets. Productivity gains can come in a variety of ways, including lower capital costs and operating costs, increased yields, and reductions in resource and energy use. Eco-Efficiency improvements lead to productivity improvements for companies through achieving lower capital costs and operating costs, increased yields, and reductions in resource and energy use. Any eco-efficiency improvement will incorporate one or more of these improvements. Some eco-efficiency improvements may primarily be aimed at one goal, but also generally include beneficial impacts on other aspects of a production process. For instance, certain technologies that are identified as being ‘energy-efficient’ because they reduce the use of energy will bring a number of additional enhancements to the production process. These improvements, including lower maintenance costs, increased production yield, safer working conditions, and many others, are collectively referred to as ‘efficiency benefits’ or ‘non-energy benefits’ because in addition to reducing energy, they all increase the efficiency of the firm.

Further significant opportunities to cost effectively to reduce environmental impact have been missed by business through not taking a more proactive approach to the design of technologies, buildings and infrastructure, products and services. As Hawken et al wrote in Natural Capitalism

“by the time the design for most human artifacts is completed but before they have actually been built, about 80–90 percent of their life-cycle economic and ecological costs have already been made inevitable. In a typical building, efficiency expert Joseph Romm explains, "Although up-front building and design costs may represent only a fraction of the building's life-cycle costs, when just one percent of a


The project's up-front costs are spent, up to 70 percent of its life-cycle costs may already be committed. When seven percent of project costs are spent, up to 85 percent of life-cycle costs have been committed. That first one percent is critical because, as the design adage has it, "All the really important mistakes are made on the first day."

Designs such as infrastructure, buildings, cars and appliances have long design lives. The size and duration of infrastructure and building developments for instance means that the most cost effective leverage point to reduce environmental impacts is during their design phase. Senator Robert Hill, when talking about the new Parliament House, sums the lost of opportunities from a lack of a design for environment approach.

"Across Lake Burley Griffin is one of Australia's most famous houses - Parliament House. Built at considerable cost to the Australian taxpayer, it was officially opened in 1988. Since 1989, efforts have been made to reduce energy consumption in Parliament House, resulting in a 41 per cent reduction in energy use with the flow-on effect of reducing greenhouse gas emissions by more than 20,000 tonnes annually. This has also brought about a saving of more than AUD$2 million a year in running costs. But the new wave of environmental thinking would have us question why these measures were not incorporated in the design of the building in the first place and what other opportunities for energy saving design features were missed? It is a simple example of how the environment is still considered an add-on option as opposed to being central to the way we do business."

Currently significant opportunities are being missed at the design phase of projects of reducing negative environmental impacts significantly. There are significant opportunities here for business and government to reduce process costs, and achieve greater competitive advantage through greener product design. As a previous Former Minister for Environment, Senator Robert Hill stated:

"Building construction and motor vehicles are two high profile industry sectors where producers are utilising Design for Environment (DfE) principles in their product development processes, thereby strategically reducing the environmental impact of a product or service over its entire life cycle, from manufacture to disposal. Companies that are incorporating DfE are at the forefront of innovative business management in Australia. As the link between business success and environmental protection becomes clearer, visionary companies have the opportunity to improve business practices, to be more competitive in a global economy, and increase their longevity."

Many of the top companies in the world are investing significantly in the better environmental design of their products as they know that this will help to make their products more appealing to customers.

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In May 2005, General Electric announced ‘Eco-magination’, a major new business driver expected to double revenues from cleaner technologies to US$20 billion by 2010. In May 2006, the company reported revenues of US$10.1 billion from its energy efficient and environmentally advanced products and services, up from US$6.2 billion in 2004.

Why is it then that despite eco-efficiency and design or environment strategies making companies a good return on investment, the environment is seen as overall as cost to most businesses? To call money spent on the environment a cost, when spending that money results in even more money coming back to you, is wrong. Could it be that such arguments are consciously seeking to hide this truth from the general public to protect vested interests? As this thesis will show in Chapters 5-8 the world is now brimming with evidence that very many expenditures to keep our environment cleaner, help prevent climate change, and provide a good return on investment and thus can help profits in the long run.

Despite the evidence in Chapters 5-8 the perception that ecological sustainability issues will increase costs goes wider than simply for business. Many people still associate better environmental outcomes with increased costs and therefore often in their organization do not even consider investing in them. This applies to government, schools, universities, churches, and even people’s homes.

Of all these sectors perhaps the university sector overall has been one that has significant and competing financial pressures. Universities have many financial demands from their staff, research budgets and teaching requirements. In addition in this sector funding has often been reduced over the last 20 years by governments and hence there has been not a dollar to spare. Ironically, because of this, many universities have finally started to address broad environmental impacts of their campus operations not because of a moral duty but because they need to explore every cost saving option possible. Recent studies suggest that an average university can save between AU$1-$3 million through a wide range of environmental initiatives. The first comprehensive report analyzing financial savings from environmental initiatives in Universities was released in by the National Wildlife Federation (NWF).\footnote{National Wildlife Federation (1998) \textit{Green Investment, Green Return: How Practical Conservation Projects Save Millions on America’s Campuses.} National Wildlife Federation. Washington. DC.} NWF President Mark Van Putten stated that

“This study proves that you don't have to choose between a healthy environment and healthy bottom line. The fact is, the actions being taken on these campuses are actually improving the environment and the financial condition of the institution, often in very dramatic ways.”\footnote{Ibid.}

\textit{Green Investment, Green Return}, sponsored by NWF’s Campus Ecology program, highlights 23 cost-saving conservation initiatives at 15 public and private post-secondary institutions across the United States. Savings per project ranged from little more than US$1,000 to an impressive US$9 million. As
shown in Table 3.2, the savings across the 23 individual best practice projects covering energy, water, waste and transport issues from 23 universities totaled together amounted to US$16.8 million. In principle, for one large university in the US existing programs prove that it may be possible to achieve up to US$16.8 million per annum in savings from environmental initiatives.

Table 3.2: List of Actual Greening of University Projects across the USA and their Annual Revenues and Savings.
(Source: Green Investment, Green Return, National Wildlife Foundation, 1998)

<table>
<thead>
<tr>
<th>Conservation Projects</th>
<th>Annual Revenues and Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation</td>
<td></td>
</tr>
<tr>
<td>Getting Students and Staff Out of the Car at Cornell University, NY</td>
<td>$3,123,000</td>
</tr>
<tr>
<td>Creating a Bus-Riding Campus at the University of Colorado-Boulder, CO</td>
<td>$1,000,000</td>
</tr>
<tr>
<td>Energy Conservation</td>
<td></td>
</tr>
<tr>
<td>Creative Strategies for Saving Energy at SUNY-Buffalo, NY</td>
<td>$9,068,000</td>
</tr>
<tr>
<td>Lighting and Equipment Retrofits at Elizabethtown College, PA</td>
<td>$247,000</td>
</tr>
<tr>
<td>A Four-Campus Energy Reduction Strategy at Brevard Community College, FL</td>
<td>$2,067,000</td>
</tr>
<tr>
<td>Laboratory Renovations and More at Brown University, RI</td>
<td>$15,500</td>
</tr>
<tr>
<td>Burning Better Lights in Dorm Rooms at Dartmouth College, NH</td>
<td>$75,000</td>
</tr>
<tr>
<td>Solar Panels Generating Savings at Georgetown University, Washington, DC</td>
<td>$45,000</td>
</tr>
<tr>
<td>Water Conservation</td>
<td></td>
</tr>
<tr>
<td>New Toilets and Water Fixtures at Columbia University, NY</td>
<td>$235,000</td>
</tr>
<tr>
<td>Cleaning Up with Water-Saving Showerheads at Brown University, RI</td>
<td>$45,800</td>
</tr>
<tr>
<td>Dining Services</td>
<td></td>
</tr>
<tr>
<td>Washable Cups in the Freshman Union at Harvard University, MA</td>
<td>$186,500</td>
</tr>
<tr>
<td>Saving on Refillable &quot;Red Mugs&quot; at the University of Wisconsin-Madison, WI</td>
<td>$11,400</td>
</tr>
<tr>
<td>Re-Use</td>
<td></td>
</tr>
<tr>
<td>Sale of Surplus Property at the University of Wisconsin-Madison, WI</td>
<td>$241,800</td>
</tr>
<tr>
<td>Maintaining Vehicles with Re-Refined Motor Oil at the University of Illinois-Urbana-Champaign, IL</td>
<td>$3,500</td>
</tr>
<tr>
<td>Second Time Around for Chemicals at the University of Washington, WA</td>
<td>$14,400</td>
</tr>
<tr>
<td>Project Description</td>
<td>Annual Savings</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------------------</td>
<td>----------------</td>
</tr>
<tr>
<td>Management of Hazardous Chemicals Cutting Out the Weed-Killers at Seattle University, WA</td>
<td>$1,300</td>
</tr>
<tr>
<td>Chemistry Classes with Fewer Chemicals at the University of Minnesota, MN</td>
<td>$37,000</td>
</tr>
</tbody>
</table>

**Composting**

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating Fertilizer with Kitchen Food Waste at Dartmouth College, NH</td>
<td>$10,000</td>
</tr>
<tr>
<td>Composting Landscape Waste and Scrap Wood at the University of Colorado-Boulder, CO</td>
<td>$1,300</td>
</tr>
</tbody>
</table>

**Recycling**

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Annual Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Award-Winning Materials-Recovery Program at the University of Colorado-Boulder, CO</td>
<td>$107,000</td>
</tr>
<tr>
<td>Dining Services Recycling at Harvard University, MA</td>
<td>$79,000</td>
</tr>
<tr>
<td>Getting Top Dollar from Paper Recycling at the University of Wisconsin-Madison, WI</td>
<td>$120,000</td>
</tr>
<tr>
<td>Analysing Wastes to Cut Costs at the University of Wisconsin-Madison, WI</td>
<td>$21,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$16.8 Million</strong></td>
</tr>
</tbody>
</table>

While serving on the Australian National University’s (ANU) Environmental Planning and Management Committee I showed that ANU could save up to AUD$3 million per annum in 2000.\(^{472}\)

In the process of developing this, I developed a similar table of fully costed Australian University programs. Whilst these Australian programs (See Table 3.3), to date, have yet to yield as large savings as the USA data, progress to date was promising.

**Table 3.3: List of Actual Australian Greening of University Projects and their Annual Actual or Potential Revenues and Savings.**\(^{473}\) (Source: Smith, M., Waldron, L.(2001)\(^{474}\))

<table>
<thead>
<tr>
<th>Project Description</th>
<th>Calculated Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Conservation:</td>
<td></td>
</tr>
<tr>
<td>University of Wollongong: Audit showed potentially 30% of energy usage could be saved.</td>
<td>$420,000 (P)</td>
</tr>
</tbody>
</table>

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UNSW: Turning off half of the campus computers at night. $60-70,000 (P)

<table>
<thead>
<tr>
<th>Water Conservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANU 1996 Water Audit showed that there were significant potential savings. $255,000 (P)</td>
</tr>
<tr>
<td>Chilled water for process cooling at RSC placed onto closed loop. $25,000 (A)</td>
</tr>
<tr>
<td>Electric diaphragm pumps replacing water aspirators to generate vacuums in laboratories. (Across Campus) &gt; $60,000 (P)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reuse:</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNSW 1996 Paper Audit. Encouraging photocopying and printing double sided, and minimising paper usage generally. &gt; $100,000 (P)</td>
</tr>
<tr>
<td>UNSW: Purchasing recycled toilet paper campus wide rather than non-recycled. $70,000 (A)</td>
</tr>
<tr>
<td>ANU: Research School of Chemistry. Recycling of precious metals $20,000 (A)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANU. Encouraging usage of public transport and bicycles could potentially prevent/delay vertical car parks needing to be built. &gt;$100,000 per annum.</td>
</tr>
</tbody>
</table>

In addition, a broader strategy to water conservation on campus\(^{475}\), and retrofitting the campus’s old brown science buildings can be shown to provide significant returns on investment.\(^{476}\) Yet, despite this evidence still on most university campuses globally such environmental initiatives are not being pursued because those in charge still perceive the environment as a cost. Why is this belief so strong? The reason is this arises not simply from a misconception between the terms “investment” and “cost.” The reason that sustainable development is associated with increased costs is that there will be areas where costs to government and the tax-payer increase such as structural adjustment packages for unsustainable industries and their workers. Clearly there will be areas where significant up front investment is needed to rapidly achieve sustainable development globally. Just some of the significant up front investments needed to achieve sustainable development include investments in

- Ending extreme global poverty
- Ensuring all have access to clean water
- Ensuring all have access to universal health care and education
- Ensuring access to immunisation
- Rebuilding democratic institutions
- Avoid dangerous climate change


- Protect biodiversity and restore ecosystem resilience
- Ensure global water availability
- Reduce oil dependency rapidly.

One of the significant government failures in Australia and many nations is that governments have never calculated how much this will cost but we will assume for this thesis that the up-front investment cost even for a relatively small economy like Australia is likely to be significant. Chapters 5-8 will look at strategies to reduce these up-front investment costs and also outline strategies to help finance the required global investment in sustainable development. To date, lack of adequate finance to enable the required investment in a transition to sustainable development has been a significant barrier to achieving sustainable development.

3.8 The Jobs and Economic Growth Trade Off Debates

In re-assessing why it is that so little progress has been made in the last 100 years, it is also vital to note that the environmental debates today are still largely debates about whether sustainable development will help or harm jobs and economic growth just as they have been for over 100 years.

Perhaps the single most significant barrier to the mainstream acceptance of sustainable development has been the predominance of the belief that the more one does to help the economy the worse off the environmental and social outcomes will be, and the more one does for the environment or society the worse off the economy will be. This debate has special relevance to not just the USA and Australia but all countries. As Frances Cairncross, recently retired editor of The Economist magazine, wrote in her book Green Inc. in 1995:

"Traditionally many leaders of developing countries have been reluctant to embrace sustainability because they fear it will slow development, growth and business investment in their country ... [The assumption that an inevitable] compromise [is needed between sustainability and economic growth] is especially important in the case of developing countries, where the trade-off between economic growth and greenery often seems particularly stark. Not only are their people the poorest; their numbers are growing the fastest. Their governments are unlikely to welcome policy proposals that appear to deprive them of the chance to improve living standards." 477

Whilst for much of the last century businessmen/economists and environmentalists/social commentators have not agreed on much, many of them have at least shared this belief. Many have assumed that significant trade-offs between economic growth and social and environmental outcomes are inevitable. This thesis challenges this assumption in detail in chapters 5-8 because these beliefs which still dominate debates about achieving ecological and social sustainability. Consider, for

instance, the climate debates. In late 2005, Tony Blair has stated that he does not think nations will sign up to a Post Kyoto Framework because he believes that it will significantly harm nation’s economic growth. George Bush has blamed the effect on the economy and jobs for his decision not to ratify Kyoto: ‘You know, look, there was a debate over Kyoto, and I made the decision - as did a lot of other people in this country, by the way - that the Kyoto treaty didn't suit our needs. In other words, the Kyoto treaty would have wrecked our economy, if I can be blunt’. Similarly at the UN Summit in Bali in late 2007, the USA, Australia and others were not ready to commit to legally binding short term greenhouse gas targets due to concerns over how these targets would effect economic growth. In 2008, these concerns in the USA are real and important to address as there are real concerns the US economy is heading into a recession. What do the economists say now in the 21st century? Chapters 5-8 of this thesis will show that the debate amongst economists on sustainable development issues has shifted significantly in the last thirty years.

Consider also the lack of progress on the environment versus jobs trade off debates. In the 21st century, politicians and business leaders can still simply tell the electorates that large trade-offs exist between jobs, business competitiveness and the environment with no further explanation needed. During the Australian 2004 federal election campaign, when Prime Minister John Howard stated that he was not going to sacrifice timber jobs ahead of saving the environment, it resonated with many Australians. A 1990 nationwide poll, conducted in the USA found that 33 per cent of those polled felt themselves “likely” or “somewhat likely” to lose their job as a consequence of environmental regulation. Studies show that most people still believe that higher environmental standards and tougher environmental regulation and penalties have led to many companies fleeing to developing countries to escape these tougher environmental regimes. Many believe that at the macroeconomic level, higher environmental standards and environmental regulation has contributed to long term unemployment. It is a common perception that environmental protection has been responsible for plant shutdowns and layoffs in certain industry sectors such as coal mining, forestry, fishing, chemical and manufacturing industries. It is a common belief amongst workers that they may lose their jobs in the future as a result of environmental protection.

Goldstein has studied the jobs-environment debates in detail. He concludes that virtually all economists who have studied the jobs-environment debate over the last thirty years agree that the three propositions identified above are false. In reality, at the economy wide level, Goldstein concludes

480 Ibid.
481 Ibid.
that there has simply been no trade off between jobs and the environment.\textsuperscript{483} “And at the local level, in sharp contrast to the conventional wisdom, layoffs from environmental protection have been very, very small. Even in the most extreme cases, such as protection of forests or closing down fisheries or steps to address acid rain, job losses from environmental protection have been minute compared to more garden-variety layoff events.”\textsuperscript{484} The real economy wide effect of environmental regulation is to shift jobs without increasing the overall level of unemployment. Globally there are now significant numbers of people who work in the “environmental industry sector” as a result of these regulatory changes. In fact, regulation-induced plant closings and layoffs are very rare. Goldstein shows that in the USA, about one million workers are laid off each year due to factors such as import competition, shifts in demand, or corporate downsizing. In sharp contrast, annual layoffs in manufacturing due to environmental regulation are in the order of one hundred to 3000 per year.\textsuperscript{485}

There is significant evidence to suggest that a transition to ecological sustainable economy can help create significantly higher employment. Employment (a social good) is currently taxed in a variety of ways, such as payroll taxes, whilst environmental pollution (a social bad) receives almost no taxation in OECD countries. In 1994, DRI and other consultancies commissioned by the European Commission modelled a scenario where all the revenues from pollution taxes were used to reduce employer’s non-wage labour costs, such as social security payments, superfund payments, and payroll tax. The study showed that employment in the United Kingdom would be increased by 2.2 million through such tax shifting.\textsuperscript{486} Goldstein has covered the jobs versus environment debate in detail and how this relates to the climate debates already.\textsuperscript{487} So this thesis does not devote a whole chapter on the jobs versus environment debate. However, since the jobs versus environment debates are very important in the context of moving these sustainability debates forward they are addressed further in a sub section in Chapter 6. In Chapter 6 we investigate issues such as the need for structural adjustment

\begin{itemize}
\end{itemize}

\textsuperscript{483} The real economy wide effect of environmental regulation is to shift jobs without increasing the overall level of unemployment. Globally there are now significant numbers of people who work in the “environmental industry sector”.

\textsuperscript{484} Ibid.p15

\textsuperscript{485} Ibid.p46.


and retraining packages to help enable industry leaders and workers to leave unsustainable industries with dignity. The chapters that follow focus in more detail on:

a) the business competitiveness versus sustainable development

b) and economic growth versus social and environmental sustainability debates to compliment and build on from Goldstein’s work.

3.9 The Business Competitiveness versus Sustainable Development Debate.

Since the mid-1990’s, business corporations have constituted the majority of the 100 largest ‘economies’ in the world.\(^488\) It will be impossible, therefore, to achieve sustainable development without their involvement. Since the late 1980s many have put forward a compelling case that businesses can gain competitive advantage from pursuing sustainable development. This has become known as the “Business Case for Sustainable Development.”\(^489\) Numerous others have argued this case over the last two decades.

Counter to this has been the argument that environmental regulation and labour costs are a significant cost and therefore it is inevitable that corporations will pursue globalization to ‘get around them’, and have no choice but to move to countries, with the lowest labour and regulatory costs, known as ‘pollution havens’.\(^490\) Similarly the argument has gone that nations have no choice but to offer tax exemptions and lower labour and environmental costs to attract corporate investment. If the majority of companies in a sector were doing this then to be competitive many business people have wondered if they would have a real choice not to seek lowest cost locations. There are many within governments today who assume that if OECD nations tighten their environmental regulation, then companies will be compelled to move operations to countries with the lowest regulatory costs. Furthermore the argument goes; if developing nations were ‘burdened’ with environmental regulation then this would hinder their development and remove opportunities for achieving competitive advantage. This perceived dilemma is emerging as the crux of the debate regarding sustainable development: namely, can businesses be both competitive and achieve sustainable development in an increasingly globalised, competitive world? Can nations attract investment and jobs and create higher labour and environmental standards?


Chapter 4 of this thesis is dedicated to this topic. Clearly, sustainability debates are part of broader debates on globalisation, and it would be negligent to discuss sustainability debates in isolation from globalisation debates. In Braithwaite and Drahos’s *Global Business Regulation* they argue that globalisation debates revolve around three central questions - will nations and companies raise standards in accordance with the principle of best practice or will nations and companies lower them? Do nations and companies want a race to the top based on the principles of world’s best practice, continuous improvement, wise economics and adoption of best available technologies? Or will the principles of lowest-cost location and reluctant compliance (multinationals investing in regions with the lowest standards) dominate and lead to a race to the bottom? Braithwaite and Drahos show that the most important contest (debate) is between the principles of Lowest Cost Location (including regulatory, labour costs) vs. World’s Best Practice. If firms and nations adopt the principle of lowest cost location then firms in relocating to these lowest cost states set in motion a race to the bottom. Nations reduce standards in the hope of attracting investment and a vicious cycle ensues. Alternatively, nations can pursue best practice and virtuous cycles. Whilst it is true that companies in certain sectors such as manufacturing have been moving to locations with lower labour costs, as I will show in Chapter 4, this is not ideal and certainly not the only way for companies to achieve competitive advantage. In addition, there is absolutely no significant evidence or trend to show that companies are moving to pollution havens to avoid environmental protection. The assumption that it is inevitable that business will have to relocate to lowest regulatory cost havens, is disputed by mounting evidence to the contrary. Few firms are fleeing industrial countries for instance to take advantage of loose environmental regulations in poor countries. As Eban Goodstein states

“Economists have been looking quite hard for exactly this effect for some twenty years….Beyond a couple of high profile cases, firms have not been fleeing the developed world to escape environmental regulations. The reasons? Regulatory costs, even in heavily regulated industries are a small percentage of total sales for companies (ie.; only rarely rising above 2 per cent); costs are only one factor affecting a location decision; and much of pollution control technology is embedded in plant design.”

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Since the 1980’s, there has been a rapidly growing body of work showing that win-win outcomes are not just possible, but are already happening.494 Evidence is also mounting that demonstrates that companies and nations which pursue best practice in sustainable development wisely, far from reducing the productivity and competitive advantage of their firms, can in fact improve it. As Michael Porter wrote

“[Countries should] establish norms exceeding the toughest regulatory hurdles or product standards. Some localities [or user industries] will lead in terms of the stringency of product standards, pollution limits, noise standards and the like. Tough regulatory standards are not a hindrance but an opportunity to move early to upgrade products and processes. [And that firms should] find the localities whose regulations foreshadow those elsewhere. Some regions and cities will typically lead others in terms of their concern with social problems such as safety, environmental quality and the like. Instead of avoiding such areas, as some companies do, they should be sought out. A firm should define its internal goals as meeting or exceeding, their standards. An advantage will result as other regions and ultimately other nations modify regulations to follow suit. Firms like governments are often prone to see the short term cost of dealing with tough standards and not their long term benefits in terms of innovation. Firms point to foreign rivals without such standards having a cost advantage. Such thinking is based on an incomplete view of how competitive advantage is created and sustained.495

In Chapter 4 of this thesis there are many examples provided of where such an approach can lead to greater competitive advantage. The most elegant example of this is the story of the Montreal Protocol, and how it achieved the phasing out of ozone destroying chemicals internationally. Early adoption, in the USA, of regulations to reduce the emissions of ozone depleting chemicals, had given American based firms a head start on the rest of the world in innovating alternative chemicals. Rather than resisting the US regulations, companies harnessed their innovation to develop alternative chemicals to those that destroy the ozone layer. Dupont and other leading US companies then successfully lobbied the Reagan administration to take the lead in establishing the Montreal Protocol. The Reagan administration could see the moral, scientific and economic benefits for the USA in the globalisation of their legislation, and played a significant role in generating the political will for the Montreal Protocol’s establishment. Sixty US embassies were instructed to lobby for a strong ozone Protocol, firstly by issuing information and media kits to convince other nations of the validity of the science


and the risks. At the 1987 G-7 Summit in Venice, President Reagan successfully influenced the meeting to make protection of the ozone layer the highest priority environmental issue. Through the adoption of the Montreal Protocol, Dupont achieved a significant increase in global market share for its alternative ozone friendly chemicals.

In a globalised world, where nations and firms are seeking lowest cost locations and regulation, companies who then simply comply with that lowest common denominator regulation, reinforce the race to the bottom. On the other hand, in a world where firms and nations recognize the competitive advantage benefits of being ahead of the next waves of innovation and seek best practice, a philosophy of continuous improvement leads to standards rising, not falling. Companies like Dupont, for instance, are committed to building plants in developing countries to at least the same standard as that in the USA whether the developing country requires this high standard or not. Overall the work of Braithwaite and Drahos shows that, contrary to what some would assume with globalization, the principle of best practice is more prevalent than the principle of lowest cost location. Braithwaite and Drahos's book also outlines in detail strategies for NGOs to help improve wise regulation and standards globally. Braithwaite and Drahos’s research therefore provides a key part of the overall argument for the business case for sustainable development.

3.10 Conclusion

Their work shows that, more often than not, the business case for sustainable development that pursues best practice is currently valid in the context of the globalisation debates. Chapter 4 of this thesis will show why this is. Chapter 4 shows why firms can achieve greater and more sustainable competitive advantage from pursuing the principle of best practice than from pursuing the principle of lowest cost location. Chapters 5-8 show that the economic and jobs growth benefits of nations pursuing the principle of best practice rather than the principle of lowest cost location are immense.

497 Ibid.
Chapter 4: The business competitiveness versus corporate social responsibility /sustainable development debates

4.1 Why are business and industry important to advancing the sustainability debates and ecological modernisation?

In Chapter 2, it was shown that scientists had, in many cases, as long ago as one hundred years ago sounded the alarm of the dangers regarding the consequences and use of asbestos, PCBs, radiation, benzene, lead, soil degradation and salinity from deforestation, and risks of overshoot from over-fishing and over-harvesting of natural resources. In Chapter 3 it was shown that business and their industry group representatives often fought regulation by government that would have forced them to reduce these risks to human health and the environment. There is great concern that increasing global competition and short-term market pressures to deliver quarterly profits, are making it harder for corporations today to take the time required to transform themselves into sustainable and socially responsible corporations. As outlined in Chapter 3, the Dodge versus Ford case in 1913 and the legal structure of the Corporations Act in many countries has led many corporate boards to believe that they had no choice but to pursue profits for shareholders above everything else. There is significant evidence published each year by the Multinational Monitor\(^{498}\) and CorpWatch in the USA\(^{499}\) and Corporate Watch in the UK\(^{500}\) showing that many in business are working to maximise profits even if it means breaking the law. In the 2000 book, *Global business regulation*\(^{501}\), Braithwaite and Drahos highlighted that there is still an attitude amongst many business leaders that regards environmental and labour regulation as something that globalisation will provide ways to ‘get around’: that globalisation will make it easier for businesses to move to countries with the lowest environmental, regulatory and labour costs. If the majority of companies in a sector were doing this to be competitive, many business people would wonder if they would have a real choice not to move to these regions of the world as well. Publications like *The Corporation*\(^{502}\) and *When Corporations Ruled the World*\(^{503}\) have given voice to these concerns. The evidence these books and corporate watch dog NGOs bring together leads some to question whether the corporation can ever realistically be an agent to help bring about a transition to sustainable development.

As outlined in Chapter 1, business and industry are key agents in the strategy recommended by ecological modernisation to achieve sustainable development. Ecological modernisation has been

\(^{498}\) See Multinational Monitor at [http://multinationalmonitor.org/](http://multinationalmonitor.org/) Accessed 11.01.08

\(^{499}\) See CorpWatch (USA) at [http://www.corpwatch.org/](http://www.corpwatch.org/) Accessed 11.01.08

\(^{500}\) See CorpWatch (UK) at [http://www.corporatewatch.org/](http://www.corporatewatch.org/) Accessed 11.01.08


criticised for this by Foster and York and Rose and by those in the NGO environmental movement. For many years now many NGO environmental groups and academics have been highly suspicious of and argued against any alliances with the corporate sector. This history is overviewed well by Beder. This chapter is a defence of ecological modernisation’s recommended role for business actors as part of a broader strategy to ecologically modernise policy and institutions. This chapter argues that a strategic engagement is needed with corporations, business and industry groups to achieve sustainable development for the following reasons.

First, a key strategy to overcome anti-sustainability vested interests is to build pro-sustainability business coalitions. Just as it is naive to expect all business leaders to embrace sustainable development quickly, it is even more naive to assume that existing business anti-sustainability vested interests can be overcome without the creation of new pro-sustainability business vested interests. Of all the barriers to sustainable development outlined in Chapter 3, this thesis argued in Chapter 3 that the greatest is powerful corporate and industry group-style vested interests and their anti-sustainability blocking coalitions. Chapter 3 overviewed a range of literature and publications which shows that corporate vested interests have been remarkably successful at undermining and stopping many aspects of sustainable development now for at least 100 years. In the late 20th and early 21st century, in many countries pro-sustainability coalitions of progressive businesses and environmental industry groups are forming to represent and lobby for the interests of pro-sustainability businesses. These include The International Business Leaders Forum in the UK convened by Prince Charles, Environment Business Australia and the National Business Leaders Forum for Sustainable Development in Australia and the Chicago Climate Exchange in the USA. There are now significant numbers of businesses in sectors whose direct interests align with sustainable development, such as businesses in the following global sectors: re-insurance and insurance, renewable energy and energy efficiency, waste management and recycling, green building/built environment development, water management, sustainable investment and carbon trading markets, and eco-tourism. In the last two years globally we have seen new and significant coalitions of business form to represent this “environmental business sector” demanding action on sustainability issues especially climate change. A significant example of this was business’ intervention in the UN Bali Summit in late 2007. On 30th November 2007, the business leaders of 150 global companies published a communiqué to world leaders calling for a comprehensive, legally binding United Nations framework to tackle climate change calling for a rapid reduction of greenhouse gas emissions and at least 50 per cent cuts by 2050. It has been led by The Prince of

Wales’s UK and EU Corporate Leaders Groups on Climate Change, which are developed and run by the University of Cambridge Programme for Industry.\(^{508}\)

Secondly, compared to many governments, and civil society, business has the resources to innovate to achieve sustainable development if required to operate in institutional and policy frameworks that provide incentives in this direction. From an ecological modernisation perspective, the private sector has an important role to play in commercialising the eco-innovations the world needs to achieve ecological sustainable development. If a corporation or business has already developed cost-competitive alternatives to, for instance, a harmful chemical or industrial process that is causing environmental or social problems, then this is often the critical factor in whether the debate, regarding use of this chemical or process, is resolved and ecological modernisation through the enacting of new regulations relatively swiftly occurs. In chapter three, this was shown through the example of where DuPont had already developed cost-effective replacement chemicals to many of those that destroy the ozone layer was critical in shifting the debate on whether or not the US Government should pro-actively support the Montreal Protocol.

Thirdly, every medium to large sized business’ attitudes matter because it only requires a few medium to large corporations with significant resources to form effective blocking coalitions. A good example of this has been the lack of progress on both the climate debates and as a result the necessary government policy and institutional change to co-ordinate a rapid ecological modernisation to decarbonise the economy. The scientific consensus on the basic science of human-induced climate change is now significant. Now it is mainly conservative right wing think tanks in the USA that write articles and papers disputing the IPCC consensus on science of climate change. In the USA it has been shown that most of the remaining ‘expert’ climate change sceptics’ work are either directly or indirectly paid through think-tanks by Exxon Mobil\(^{509}\). The Royal Society, Britain's premier scientific academy, has taken the unprecedented step of writing to Exxon Mobile to demand that the company withdraws support for dozens of groups that have "misrepresented the science of climate change by outright denial of the evidence".\(^{510}\) It referred to the Society’s survey which found that Exxon Mobil distributed US$2.9m to 39 of such groups in the previous year including the International Policy Network (a London think-tank), and the George C Marshall Institute (Washington DC). In 2004, the George C Marshall Institute published a report with the Scientific Alliance (UK) asserting that rising global temperatures and carbon dioxide levels in the atmosphere were not connected. The Royal Society also criticised Exxon Mobil’s public statements on global warming, as "inaccurate and misleading".

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\(^{508}\) See Bali Communique at [http://www.balicommunique.com/communique.html](http://www.balicommunique.com/communique.html)


In the USA, the blocking coalition of a few corporations like Exxon Mobile, the religious right, the right wing media and the Bush administration has not simply held back real action on climate change they have worked actively to roll back what few advances had been made on the environment in the USA over his term in office. In the first one hundred days in office

“President Bush has placed a distinctive mark on U.S. environmental policy, rolling back campaign promises on clean air, reversing Clinton administration initiatives on drinking water, and promoting new oil exploration in previously protected regions such as Alaska whilst also categorically removing the USA from the Kyoto Protocol Process.”

In Australia, a similar blocking coalition made up of coal, oil, gas, mineral processing especially aluminium and steel, cement, plastics and chemicals and paper and pulp companies, right wing think tanks and media plus the Howard Government have similarly been widely judged to have effectively blocked action on climate change. The extent to which Australia climate and energy policy was dictated by these vested interests has been revealed in 2007 publications by Hamilton and Pearce. The effectiveness of these anti-sustainability blocking coalitions in both the USA and Australia is seen as one of the main reasons these countries have made relatively little progress compared to Europe.

The fourth reason industry has such a key role in the achievement of sustainable development is due to the role industry group lobbying has on government policy. Achieving sustainability will involve significant institutional and policy reform of government. As part of the process of developing policy, government often consults with business. Politicians’ careers can be affected at the ballot box by the extent to which they are attuned to the attitudes and wishes of business and the community. A key strategy, therefore, to move the sustainability debates forward is for NGOs, professional institutions and community groups to partner with progressive corporations to create a broader coalition to more effectively push governments for change. In chapter three, the case study of how NGOs and DuPont successfully lobbied the Reagan Administration to gain Ronald Reagan’s active support on the Montreal Protocol illustrates this point. In Australia, this strategy used has been used effectively by NGOs and business to shift the climate debates and put pressure on governments to adopt stronger climate change policy. A significant recent example demonstrating the value of alliances with progressive business leaders has been the work of The Australian Conservation Foundation (An Australian NGO) and six leading Australian businesses, who formed the Australian Business Roundtable on Climate Change in 2005. The Business Roundtable on Climate Change was made up of CEOs from BP, Insurance Australia Group, Origin Energy, Swiss Re, Visy Industries and Westpac.

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with The Australian Conservation Foundation. They commissioned studies by respected organisations like CSIRO and Allen Consulting which found that early action on climate change is far better for business than delaying it. They found that early action on climate change, to achieve a 60 percent reduction in greenhouse gas emissions by 2050, can still achieve strong economic growth.

A similar strategy was used by the World Wildlife Fund Australia who partnered with the Clean Energy Group business coalition. This coalition of business groups, too, commissioned research to investigate whether it was technically and economically possible to achieve significant greenhouse gas emissions reductions in Australia by 2050. This study concludes deep cuts to Australia’s greenhouse gases emissions were technically and economically possible.  

These reports shifted the climate debates in Australia within the business community. Such reports helped inspire the National Business Leaders Forum for Sustainable Development (NBLFSD) to publicly endorse and support the recommendations of the Australian Business Roundtable on Climate Change. The media coverage of the NBLFSD’s endorsement of the Australian Business’s Roundtable on Climate Change’s work on the front page of the Australian Financial Review, further built support amongst business leaders for deep cuts by 2050. Significantly, the National Business Leaders Forum for Sustainable Development (NBLFSD) not only called for a 60 per cent reduction target by 2050 but also publicly called for a short term target of 20 per cent greenhouse gas emissions from 2000 levels by 2020. This helped to catalyse formal support for these same targets by September 2007, by Environment Business Australia which formally represents over 700 leading businesses in Australia. This very public support for deep cuts to greenhouse gas emissions from a section of the Australian business community has assisted NGO lobbying of government which has now resulted by late 2007 all state governments and the Federal government of Australia committing to a 60 per cent greenhouse gas reduction target by 2050. This public support from significant members of the Australian business community, backed up by significant research, is seen to have played a critical role in driving the shift in Australian climate change government policy and institutional change from early 2006 onwards.

Fifth, historically industry groups representing individual businesses have been amongst the leading representatives of vested interests that have blocked efforts to address sustainable development issues.
Industry groups often represent many businesses across either one or many sectors of the economy. In Australia, the Business Council of Australia, the Australian Chamber of Commerce and the Australia Industry Group are regarded as the most representative and powerful industry groups. As the business case for eco-efficiency and green/clean technology has become more widely understood, business associations and representative industry bodies are looking at ways they can assist their members to constructively address sustainable development. Now in Australia three major industry groups have published Sustainability Action Plans for their sector - The Australian Council of Infrastructure and Development Council’s Sustainability Framework, Australian Timber Products, Processing and Paper Council (A3P) Sustainability Action Plan and the Plastics and Chemicals Industry Association Sustainability Framework - and several other industry groups have Sustainability Action Plans in the pipeline. Governments and Industry Groups are realising that industry groups can play a key role to mainstream sustainability rapidly through entire sectors of any economy, through their ability to cheaply co-ordinate and run education and training, identification and implementation of sustainability goals and targets across their respective sectors. It also helps government to bring in policy changes if industry groups have already undertaken thorough consultation with their membership on sustainable development issues to identify opportunities, risks and barriers to change. Hence governments are now funding industry groups to undertake such a process with their members to develop sustainability action plans. The Victorian Environmental Protection Agency (Vic EPA) is seeking to develop sustainability covenants with more industry groups to undertake this sort of work. This will also help to shift the debates through more and more industry groups committing meaningfully to sustainable development. For instance, the Plastics and Chemicals Industry Association has adopted a zero waste goal for plastics to landfill as part of their sustainability process. Plastics make up a significant landfill waste stream. This is but one example of how these sustainability processes being undertaken by industry groups can lead to bolder targets which can help shift specific sustainability debates over coming years.

Finally, as discussed in Chapter 3, the attitudes and actions of business matter because, since the mid-1990s, business corporations have constituted the majority of the 100 largest ‘economies’ in the world. Therefore due to business’ sheer global scale and the size of their current ecological

footprint, whether or not business decides to support sustainability will be a significant factor in whether ecological sustainable development is achieved.

Thus this thesis argues that, whether business genuinely embraces issues like climate change and more broadly sustainable development directly effects

a) whether or not ecological modernisation is able to be enacted by governments

b) whether the sustainability debates move on and are resolved.

Due to limited space in this chapter, I will not focus on specific debates on specific issues. Rather, I will devote this chapter to the issues that influence whether companies genuinely embrace and truly walk the talk on corporate social responsibility/sustainable development or not. I have tried to cover as many of the important aspects of these debates as possible. But, since there are many aspects to this debate, part of the discussion of this topic is covered in Appendices 4 and 5.

4.2. Will Purposeful Policy Action by Governments on Sustainable Development Harm Business’s International Competitiveness?

As discussed in chapters 2 and 3, historically many businesses have been concerned that sustainable development or corporate social responsibility is a threat to their competitiveness, profitability and shareholder value. The first issue which is a significant factor in whether or not corporations and businesses embrace sustainable development is their perception and understanding of what makes them competitive? Business’ perception of this issue can significantly influence whether sustainability debates move forward and whether or not governments have enough political will for ecological modernisation policy and institutional reform. For instance, in Australian from 1996-2007, one of the main arguments, from a number of businesses against Australia ratifying Kyoto, committing to deep cuts to greenhouse gas emissions and policy change has been the perception that it would harm international competitiveness of those businesses. A paper by the Australia Institute analysed this issue in depth.525 It found that a company’s competitiveness could be disadvantaged internationally by the imposition of a carbon tax or an emissions trading scheme if all the following conditions exist:

- The industry is particularly emissions-intensive

- The industry is trade exposed

- The trade exposure is with companies in developing countries that do not have to meet emissions caps under the Kyoto Protocol.

This paper by the Australia Institute526 showed that creating a carbon signal either through a carbon tax or an emissions trading scheme would effect a very small part of the Australian economy which contributes only 1.5 per cent to GDP and 19 per cent of merchandise exports. The vulnerable exports


526 Ibid.
included aluminium and alumina, steel and non-ferrous metals, liquefied gas and gold. Their research showed that not even half of these exports went to developing countries. This paper recommended that Australia ratify the Kyoto Protocol and implement a carbon tax or an emissions trading scheme. It examined all the options for dealing most effectively with the competitiveness problem including wholesale exceptions, negotiated agreements, offsetting tax deductions and financial incentives for energy efficiency improvements.

There is a great deal of experience in Europe of these different options for dealing with the competitiveness problem. The UK was one of the first countries to implement a national emissions trading scheme and a carbon tax, and they have done so in such a way that it has helped business competitiveness overall rather than harming it. In the UK, heavy energy using companies can apply to sign a Climate Change Agreement (CCA) Program\footnote{House of Commons Environment, Food and Rural Affairs Committee (2004–2005) Climate Change: looking forward, Ninth Report of Session. Available at \url{www.publications.parliament.uk/pa/cm200405/cmselect/cmenvfru/130/130i.pdf}. Accessed 14 April 2007.} whereby a company agrees to commit to achieving a certain carbon reduction target or improving their energy efficiency, and in return receives exemption from 80 percent of the carbon tax. Over 12,000 large energy using UK companies have\footnote{Kirby, A. (2007) UK Industry Succeeding: UK Beats Greenhouse Gas Targets, BBC News Online. Available at \url{www.defra.gov.uk/environment/ccl/pdf/cca_aug04.pdf}. Accessed 14 April 2007.} performed far better than expected in cutting emissions of carbon dioxide. In 2002, thousands of companies achieved cuts totalling nearly three times above the agreed targets. The CCAs have been very successful in improving energy efficiency in the existing sectors. In aggregate they have beaten their targets by the equivalent of 1 million tons of carbon (MtC) a year in the first target period (to 2002) and by 1.4 MtC a year in the second target period (to 2004).\footnote{UK Government (2006) Explanatory Memorandum to the Climate Change Agreements (eligible facilities) (amendment) Regulations. Available at \url{http://www.opsi.gov.uk/SI/cm2006/uksiem_20061931_en.pdf}. Accessed 14 April 2007.} Through this process these businesses in the UK are saving over US$650 million from reducing greenhouse gas emissions.\footnote{Kirby, A. (2007) UK Industry Succeeding: UK Beats Greenhouse Gas Targets, BBC News Online. Available at \url{www.defra.gov.uk/environment/ccl/pdf/cca_aug04.pdf}. Accessed 14 April 2007.}

Economic modelling by the UK Treasury Department has found that the UK’s sophisticated approach to addressing climate change which has encouraged business to become more energy efficient has helped economic growth rather than harmed it.

The 2001 paper by The Australia Institute made the case for a different approach from the UK whereby a carbon price signal is maintained in full within the domestic economy, but instead compensated through a border tax adjustment. This means that the government would pay the exporter of say aluminium exports a rebate to offset the increased costs in production caused by the carbon tax or emissions trading scheme. But the rebate would only be paid at the point of export thus ensuring that all companies producing and selling within Australia would be subject to the carbon price signal. Border tax adjustments are not a radical idea. They are already in use in a number of tax
systems in a number of countries including in the Australian GST system and the European value added tax. OECD studies of the effects of border tax adjustments on the cement and steel industries show that they can result in carbon taxes having a negligible effect on the international competitiveness of the steel and cement industries.\textsuperscript{531}

There are other ecological modernisation policies that can assist business’ competitive advantage and help encourage environmental sustainability. Two examples of note are ‘feebates’,\textsuperscript{532} and Germany’s Best Available Technology legislation.\textsuperscript{533} The Germans have developed an ingenious form of regulation that helps drive better environmental outcomes whilst making German industry more competitive. The rest of Europe, including Eastern Europe, have now followed Germany’s lead. The German Best Available Technology legislation does not involve mandating specific technologies as many in the US assume. Rather, the German Government upwardly adjusts standards that industry has to meet based on the standards met by the best and most cost effective available technologies. In theory then, whenever a new and improved technology is created globally, German industry is expected to meet the environmental standard achieved by that technology. Of course, regulatory practice is more flexible, ambiguous and much less instantaneous. However, it is sufficient to provide significant incentive for German firms to develop new technologies that make it cheaper for them to meet the competition from the best available technologies globally.

Feebates, very simply, combine both a fee on the most environmentally harmful brands of a certain product, whilst providing income to governments, allowing them to provide a rebate to encourage consumers to purchase the most environmentally benign products.

Operationally feebates are very simple. Take the example of the car. If you bought a new car, you would pay an extra fee if it were an inefficient user of fuel, or alternatively get a rebate if it were energy-efficient. The neutral point would be set so that fees and rebates balanced, so it becomes neither an inflationary measure nor a disguised tax.

The key benefit of feebates is that they would ensure that industry knows that there will be clear market signals to the consumer to purchase more efficient products, thereby stimulating innovation in the right direction for sustainability. But government would still need to work with industry to phase in feebates to ensure industry has time to respond. To reduce administrative costs, feebates can be targeted at those consumer products that have the largest ongoing environmental impacts, such as cars and, within the home, refrigerators and washing machines.


When feebates are coupled with best available technology regulation, eco-taxes and the emissions trading schemes, this can give business significant potential long-term competitive advantage in the field of environmental technologies. As Professor Michael Porter, Harvard Business School, wrote as far back as 1991:

“As other nations have pushed ahead, US trade has suffered. Germany has had perhaps the world’s tightest regulations in stationary air-pollution control, and German companies appear to hold a wide lead in patenting and exporting air-pollution and other environmental technologies. As much as 70% of the air pollution-control equipment sold in the US today is produced by foreign companies. Britain is another case in point. As its environmental standards have lagged, Britain’s ratio of exports to imports in environmental technology has fallen from 8:1 to 1:1 over the past decade. In contrast, the US leads in those areas in which its regulations have been the strictest, such as pesticides and the remediation of environmental damage. Such leads should be treasured and extended. Environmental protection is a universal need, an area of growing expenditure in all the major national economies and a major export industry. The strongest proof that environmental protection does not hamper competitiveness is the economic performance of nations with the strictest laws.”

These are just a taste of the range of options and approaches available to governments to allow them to take a lead with industry, and the community, to achieve sustainable development in a way that does not harm competitiveness of industry but rather helps it. This discussion shows how easily business’ fears of international competitive disadvantage from sustainable development can be fairly addressed by effective ecological modernisation of policy. Other examples of how smart regulation and policies like this will be outlined in the Appendices for Chapter 7 and 8. But business leaders and industry groups have been very slow to accept and recommend such ecological modernisation policy changes. This is because of deeply ingrained perceptions of what determines business competitiveness and a range of pressures and incentives in the market place that currently reward the status quo and a short-term focus on profit results for corporations. Hence we will explore these issues now in more detail and demonstrate the rationale for a ensuring corporate incentives reward environmentally and socially sustainable behaviour rather than the other way around.

4.2 What determines business competitiveness?

As discussed in chapters two and three, historically many businesses have been concerned that sustainable development or corporate social responsibility is a threat to their competitiveness, profitability and shareholder value. Historically, business and industry groups have often fought the implementation of environmental regulation and attempts to raise the wages and standards of workers out of fear that it would reduce shareholder returns. These actions have arisen out of a belief about

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what makes companies competitive. Business managers have often been taught that the way to improve the competitiveness of a company is to grow to a large scale and through scale ensure access to the lowest cost inputs—whether they are capital, labour, energy or raw materials. This has been true in the past. Because technology changed slowly in the past, a comparative advantage of a business could be achieved through low-cost inputs, cheap resources, and wages and so on. This is known as the theory of comparative advantage, developed by the famous 19th century economist David Ricardo. In today’s increasingly complex world of globalisation and the rapid development of new technologies, Ricardo’s theories of comparative advantage are no longer sufficient to understand competitive advantage. The globalisation of companies, trade, communications and regulations, in conjunction with economic deregulation and tariff reduction, has created intense competition in the marketplace. This has meant that cheap raw materials, components and technology are now available from many sources globally. Since the fall of the iron and bamboo curtains, hundreds of millions of low-paid workers have been added to the world’s workforce. Hence, competing on low wage and resource costs is a race more difficult to win in the long term.

The sole focus on competitive advantage from cheap labour, cost cutting and cheap natural resources is no longer a strategy to guarantee lasting competitive advantage of firms. This occurs for several reasons. First, it is relatively easy for other companies in other resource-rich developing nations to imitate companies based on resource extraction. Firms competing on low labour and resource costs also leave themselves exposed if there are changes in other countries that result in even lower labour and resource costs. For instance, a rival firm may be granted subsidies by the government of another country which enables them to beat your price in the marketplace, no matter how efficient you are. Secondly, technology has delivered greater options to firms in the developed world for reducing the relative advantage of cheap labour and resource conditions in the developing world. As Porter explained in detail in Competitive Advantage: Creating and Sustaining Superior Performance and The Competitive Advantage of Nations, In the 1980’s, manufacturing firms often moved production to high labour-cost locations to be close to markets, not the reverse. The usage of materials, energy and other resource-based inputs has been substantially reduced or synthetic substitutes developed. Modern materials such as engineering plastics, ceramics, carbon fibres, and the silicon used in making semiconductors are made from raw materials that are cheap and ubiquitous. In The Competitive Advantage of Nations, Porter demonstrated that there are firms which have succeeded in achieving international competitive advantage whilst doing the exact opposite of these standard assumptions.

Table 4.1: Traditional assumptions of what creates competitiveness are not always true

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Cheap and abundant Labour

Germany, Switzerland and Scandinavian countries have done well for decades with high wages and shortages of labour.

Interest rates, government deficits, and exchange rates

There are many nations that have enjoyed rising living standards with budget deficits (Korea, Italy and Japan), appreciating currencies (Germany and Switzerland), and high interest rates (Italy and Korea) over the last 30 years.

Possessing abundant, cheap raw resources

From the 1970s to the 1990s resource poor nations like Singapore, Japan, Korea, Switzerland, and Germany prospered. Singapore achieved a rise in per capita GDP, in the 15 years from 1980 to 1995, that resource rich USA needed 50 years to accomplish.

Labour-Management relations

It is not easy to generalise here, as unions are very strong, for instance, in Germany and Sweden with representation by law in management (Germany) and on boards of directors (Sweden). Both nations over the last 30 years have prospered, contradicting the view that strong unions will lead to loss of competitiveness.

Source: Adapted from Porter, M (1990)

Over the past three decades there has been a significant change in understanding of what creates lasting competitiveness of the firm. Porter showed, in Competitive advantage: Creating and Sustaining Superior Performance and The Competitive Advantage of Nations, that globalisation, the shortening timeframe of technical innovation and the rise of the multinational corporation mean that the ability to innovate processes in advance of one’s competitors is the key to increasing productivity gains and competitive advantage today:

“Competitiveness is not merely greater efficiency based on working harder or even working smarter. It is not merely doing things better, but doing better things. It requires firms with the know-how to capture greater value in the market place not just by being more efficient at what they do, but also in choosing where to compete. The new paradigm of international competitiveness is a dynamic one, based on innovation. Competitiveness at the industry level arises from superior productivity; either in terms of lower costs than rivals or the ability to offer products with superior value (value adding) that justifies a premium price. Detailed case studies of hundreds of industries, based in dozens of countries, reveal that internationally competitive companies are not those with the cheapest inputs or the largest scale, but those with the capacity to improve and innovate continually. Competitive advantage, then, rests not
Increasingly therefore, the companies that are most competitive, achieving the greatest productivity gains, are not those with access to the lowest-cost inputs. Rather, they are those firms who constantly innovate to become the best in the world.

Because technology is constantly changing, the new paradigm of global competitiveness requires the ability to innovate rapidly for new emerging markets. This is evidenced by the fact that the most competitive companies are those that employ the most advanced technology and methods in using their inputs. A major study by McKinsey & Co of over 1,000 companies in 15 sectors over 36 years, found that innovating to become the best in new emerging markets was a key element of success. Companies that have simply stuck to ‘business as usual’ appear to under-perform the market.

For example, faced with the threat of the personal computer, IBM continued to insist on picturing tomorrow as an extrapolation of today and assumed the demand for the PC would not be great enough to warrant a change in strategy. In doing so, the company’s market value fell by an estimated US$70 billion. As capital markets become less forgiving of long-term under-performance this has led to corporate life-spans shrink. The average life of companies on the Standard & Poor’s index fell from over 65 years in the 1920s and 1930s to around 10 years by 1998. Too often, corporations are slowed down by their fears about cannibalising their own markets, potential customer channel conflicts, or the dilution of earnings. As Foster and Kaplan write

“The market has no lingering memories or remorse. It has no mental models. The market does not fear cannibalisation, customer channel conflict or dilution.”

McKinsey and Company’s work also showed that newer companies that had seized these new opportunities tended to exhibit higher profit rates than established companies (See Figure 4.1).

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David White and Philip Stern\textsuperscript{539} found a similar trend in the Australian marketplace in their report \textit{Creation and Destruction: Sustaining Corporate Growth}. Their report showed significant changes with the composition of Australia's top 100 companies from 1990 to 2002. White and Stern wrote in the introduction to their report

"We show that corporations have surprisingly short lifespans. Of all the companies that were listed on the original Dow Jones Industrial Average stock index of 1896, only one survives today. And the turnover of companies on Australia's top 100 list since 1990 has been nothing short of astounding."\textsuperscript{540}

\textit{Figure 4.2: Of Australia's top 100 companies (measured by market capitalisation) in 1990; only 39 were still in the top 100 list in March 2002, (Source Grady, K 2002\textsuperscript{541})}


\textsuperscript{540} Ibid p5

\textsuperscript{541} Grady, K (2002) \textit{Climate Change - A Business Perspective} Karen Grady, General Manager Business Council of Australia
The 61 newcomers\textsuperscript{542} to the top 100 significantly out-performed the older public companies. They delivered returns\textsuperscript{543} to shareholders of 29 percent a year for five years between 1997 and 2002. Those companies that continued in the top 100 from 1990 delivered returns of only 14 percent a year over the same period.

![Diagram: Comparison of revenue for companies that have climbed into, survived in or slipped from the Top 100 BCA companies. (Source Grady, K 2002\textsuperscript{544})]

Figure 4.3: Comparison of revenue for companies that have climbed into, survived in or slipped from the Top 100 BCA companies. (Source Grady, K 2002\textsuperscript{544})

Why can newer companies perform so well while older companies decline? The explanation – as put forward in The Alchemy of Growth\textsuperscript{545} – is that the companies that grow have the ability to create new businesses that create new sources of profit. They do so by innovation in their existing businesses and building new ones. In addition, as revenue streams mature, businesses must have others ready to take their place and the pace of replenishment must exceed the pace of any decline in existing businesses if growth is to continue.

\begin{itemize}
\item They included IPOs, privatisations, demutualisations, restructurings and ‘climbers’\textsuperscript{542}
\item Comprising dividend and capital gains\textsuperscript{543}
\item Ibid.\textsuperscript{544}
\end{itemize}
Another critical study in this area is Collins and Porras’s\textsuperscript{547} \textit{Built to Last: Successful Habits of Visionary Companies}, which showed that the stock prices of visionary companies were up to 15 times more profitable than the market average when compared with their major competitors. Such companies, which included 3M, Boeing and General Electric, all out-performed their major competitors in stock price, often by a factor of ten or more. Significantly, all these companies had a strong culture and principled ideology, stable management and tended to recruit CEOs from within the company who knew the company backwards. The Collins and Porras study compared 18 pairs of visionarly and comparison companies. Their detailed analysis found that visionary companies were generally driven more by ideas and innovation than by purely profit than the comparison companies in 17 out of the 18 pairs. Collins & Porras do not suggest that visionary companies ignore profitability. Rather they suggest that, over the long term, companies that have been driven more by ideas and innovation, as well as profit, achieve greater success.

The Collins and Porras study it was found that through a detailed pair-by-pair analysis the visionary companies have generally been more idea and innovation driven and less purely profit driven than the comparison companies in 17 out of 18 pairs. This is one of the clearest differences they found between the visionary and comparison companies. What we can draw from the Collins & Porras study is at least the suggestion that, taken on a very long-term view, companies that have been more idea

\textsuperscript{546} Grady, K (2002) \textit{Climate Change - A Business Perspective} Karen Grady, General Manager Business Council of Australia

and innovation driven, as well as profit driven, reap greater success. Collins & Porras do not suggest that visionary companies ignore profitability rather that it is not their sole aim or guide.

The Collins & Porras study\(^{549}\) is one which supports the 'benefits over the long run' argument so often advanced by proponents of corporate social responsibility. Collins & Porras’ visionary companies were not apparent in a ten year view of profitability or ‘most admired’. However, they yielded markedly better returns than their peers did over the long term (50+ years). This suggests we should be extremely careful with our understanding of the role of time in our assessment of sustainable development/corporate social responsibility practices and business success.

4.3: What will the next wave of innovation be?

For these reasons there is increasing awareness that companies can not afford to miss the next waves of innovation. Many people are asking what will be the next wave of innovation. In order for a wave of innovation to occur there needs to be a significant array of relatively new and emerging technologies and a recognised genuine need and potential for expansion in the market that is leading to a market expansion.

A range of publications from 1997-2005 have brought together significant evidence to suggest that sustainable development will be a significant part of the next waves of innovation\(^{550}\). These publications have argued that it was possible to achieve significant decoupling of companies’ profits from their environmental load. There are many reasons why it is in businesses interests to decouple

\(^{548}\) Ibid.

\(^{549}\) Ibid.


profits from their use of resources and their environmental load. The main benefits of seeking to achieve increasing profits whilst reducing environmental pressures for a company are now identified.

4.4 Benefits of Decoupling Profits from Environmental Pressures

First, there is significant evidence that there are many available opportunities for greater resource productivity in the economy. Some of business’ most significant costs are capital and inputs, such as construction, raw materials, energy, water and transportation. It is therefore in business’ interests to minimise these costs, and hence the amount of raw materials and other inputs that they need to create their product or provide their service. Business produces either useful products and services or unsaleable waste. How does it assist a business to have plant equipment and labour tied up in generating waste? Table 4.2 below lists numerous ways that companies can profitably reduce waste through identifying an implementing resource productivity opportunities. Addressing such opportunities therefore gives businesses numerous options to reduce production and process costs and create new product differentiation.

Table 4.2: Design for Environment can assist a firm’s competitive advantage both by reducing process costs and through helping the firm to create product differentiation.

(Source: Adapted from Porter, M and van der Linde, C (1995a).\textsuperscript{551})

<table>
<thead>
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<th>Design for Environment can improve Processes and reduce costs through</th>
<th>Design for Environment provides benefits to reduce costs and create product differentiation</th>
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<tr>
<td>• material savings from better design</td>
<td>• higher quality, more consistent products</td>
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<tr>
<td>• increases in process yields and less downtime through designing-out waste and designing the plant and process to minimise maintenance and parts</td>
<td>• lower product costs (for instance, from material substitution, new improved plant efficiencies)</td>
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<tr>
<td>• better design to ensure that by-products and waste can be converted into valuable forms</td>
<td>• lower packaging costs</td>
</tr>
<tr>
<td>• greater resource productivity of inputs, energy, water and raw materials to reduce costs</td>
<td>• more efficient resource use by products</td>
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<tr>
<td>• reduced material storage and handling costs through ‘just in time’ management</td>
<td>• safer products</td>
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<tr>
<td>• improved OH&amp;S</td>
<td>• lower net costs to customers of product disposal</td>
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<tr>
<td>• improvements in the quality of product or service.</td>
<td>• higher product resale and scrap value products that meet new consumer demands for environmental benefits.</td>
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The literature contains convincing empirical evidence of widespread and significant inefficiencies within firms in the modern economy\(^{552}\). This area of writing is known as x-efficiency literature. Empirical research in the approach to measuring x-efficiency has shown that the actual performance of firms in many industries falls significantly below that of the observed efficiencies of the most efficient firms in those industries, typically 65–97%. The wise implementation of resource efficient strategies can, therefore, be cost-effective in both the short and longer terms. By reducing, remanufacturing, recycling, and reclaiming or on-selling, businesses can realise immediate cost savings. Porter’s key point here is now backed-up by books such as *Factor 4: Doubling Your Wealth and Halving Your Resource Usage*\(^{553}\) and *Natural Capitalism: The Next Industrial Revolution*.\(^{554}\) As the Stern Review commented

"An increasing number of private and public sector organisations are discovering the potential to reduce the cost of goods and services they supply to the market. A study of 74 companies drawn from 18 sectors in 11 countries including North America, Europe, Asia, and Australasia revealed gross savings of US$11.6 billion, including:

- BASF has reduced GHG emissions by 38% between 1990 and 2002 through a series of process changes and efficiency measures which cut annual costs by 500 million euros at one site alone;
- BP established a target to reduce GHG emissions by 10% on 1990 levels by 2010, which it achieved nine years ahead of schedule, while delivering around US$650 million in net present value savings through increased operational efficiency and improved energy management. Between 2001 and 2004, the organisation contributed a further 4MtC of emission reductions through energy and flare reduction projects.\(^{555}\)

Such eco-efficiency savings can be equal to a company’s current profit margin. When viewed with this perspective, the value of such savings suddenly becomes attractive to busy CEO’s. Governments increasingly are running eco-efficiency\(^{556}\) programs or providing incentives to encourage business to invest in such measures. The Australian Federal Government’s Eco-Efficiency Program\(^{557}\) involved over 200 businesses, all demonstrating significant eco-efficiency and financial savings.

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Now also numerous studies\textsuperscript{558} and empirical evidence\textsuperscript{559} has demonstrated that firms can achieve further competitive advantage through greater eco-design of products (reducing process costs) to produce ‘cleaner and greener’ goods and services (product/service differentiation).\textsuperscript{560} Porter et al feature a number of examples of this in their papers.\textsuperscript{561}

Secondly, numerous experts recognise that there is now a critical mass of enabling eco-innovations that make integrated approaches to sustainable development economically viable. And finally, increased environmental regulation, markets and levies driven partly by the ratification of the Kyoto Protocol is creating new markets in many areas of the economy.

![Figure 4.6: A critical mass of innovations meeting real market needs creates new waves of innovation (Source: TNEP\textsuperscript{562}, 2005)](image)


If the last wave of innovation, ICT, was driven by market needs such as reducing transaction costs, there is significant evidence that the next waves of innovation will be driven by the twin needs to simultaneously improve productivity whilst lightening our environmental load on the planet. (See figures 4.6 and 4.7.) According to The State of the World 2008 report “Clean tech” has rapidly grown to be the world’s third-largest recipient of venture capital, trailing only the Internet and biotechnology…Around the world, innovative responses to climate change and other environmental problems are affecting more than US$100 billion in annual capital flows as pioneering entrepreneurs, organizations, and governments take steps to create the Earth’s first “sustainable” global economy.

The scale of change needed to genuinely achieve large scale greenhouse gas reductions and sustainable development this century may see ‘creative destruction’ in traditional sectors in how they deliver services. As Philip Stephens recently wrote in the UK’s Financial Times, ‘Business is about to discover that the shift towards a low-carbon economy is irreversible. Going green is about staying

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The steady trickle of companies signing up to do their bit to reduce carbon emissions is turning into a sizeable river.565 The Stern Review concurs stating that:

“Tackling climate change may also have far reaching effects on the efficiency and productivity of economies. Schumpeter developed the concept of creative destruction to describe how breakthrough innovations could sweep aside the established economic status quo, and unleash a burst of creativity, investment and economic growth which ushers in a new socio-economic era. Historical examples of this include the introduction of the railways, the invention of electricity and more recently, the IT revolution.”

We are already seeing this occur in many industries where there is a significant expansion of markets for sustainable solutions (See Table 4.3).

<table>
<thead>
<tr>
<th>Climate Change Mitigation</th>
<th>The Stern Review states that “Markets for low carbon energy products are likely to be worth at least US$500bn per year by 2050, and perhaps much more. Individual companies and countries should position themselves to take advantage of these opportunities.”566 In 2006, an estimated US$52 billion was invested in wind power, biofuels, and other renewable energy sources, up 33 percent from 2005. Preliminary estimates indicate that the figure soared as high as US$66 billion in 2007. Carbon trading is growing even more explosively, reaching an estimated US$30 billion in 2006, nearly triple the amount traded in 2005.567</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment with environmental and social sustainability criteria.</td>
<td>Over 180 investment firms, totalling US$8 Trillion worth of investments, have now signed the UN Principles of Responsible Investment568. Three of the four largest fund managers in Australia have also signed up in early 2007. These include BT Financial Group, AMP Capital Investors and Colonial First State Global Asset Management. 54 banks, representing 85 percent of global private project finance capacity, have endorsed the Equator Principles, a new international standard of sustainability investment. Another sign of dramatic change is the 575 environmental and energy hedge funds now in existence, most of them formed in the last few years.569</td>
</tr>
</tbody>
</table>

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569 Ibid.
Greener Building Design

In the USA, by 2004 the Green Building market is already worth US$300 billion and features everything from environmentally sound New York skyscrapers to homes and shopping malls. There is much more to this, however, than simply environmentally sound buildings; namely the lifespan of the built environment as a whole.

Renewable Energy

Since 2003, Clean Energy Technologies - solar, biofuels, geothermal, tidal and hydropower – produced more electricity globally than nuclear energy ever has. With a global market of AUS$74 billion, which is forecast to grow fourfold by 2015. The global market for wind energy has averaged 40% growth annually in cumulative capacity over the last five years. The global turnover of wind generation equipment is estimated at US$1.5 billion per year, and total industry turnover is estimated to reach between US$5 and $10 billion.

The global wind turbine market is expected to grow, driven by improved cost structures and supportive government policies. Both Germany and the UK have renewable energy targets of 10% by 2010, and California has a renewable energy target of 20% by 2017. The annual export market for wind manufacturing products from Asia has been estimated at $110 million.

China’s Tenth Five Year Plan (2001 – 2005) calls for a nearly five-fold increase in wind capacity to 1.5 GW. The Philippines plans to introduce over 3,500 MW of renewable capacity by 2012, and New Zealand has introduced a renewable energy target similar in scale to the Mandatory Renewable Energy Target in Australia.

Recycling and Remanufacturing

In the USA the re-manufacturing market is now worth almost US$53 billion dollars. The USA recycling sector is worth over US$250 billion per annum. A recent report by the Recycling Coalition Group found that the industry created more than 56,000 public and private sector recycling facilities, with 1.1 million jobs, US$236 billion in gross, annual sales, US$37 billion in annual payroll.

Eco-Tourism

Eco-tourism involves responsible travel to natural areas that helps conserve the environment whilst improving the well-being of local people. It is growing at around 30% per annum, which is significantly higher than the annual rate of growth of 4% for tourism as a whole. Also, studies show that tourists are more willing to pay extra for eco-tourism than standard tourist packages.

Take the car industry, for instance, where companies that have innovated for sustainable development, like Toyota with their hybrid car the Prius, are increasing market share compared to GM and Ford who backed the high energy SUV market to continue. With high oil prices the SUV market in the US has

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collapsed whilst demand for hybrid cars has never been higher. This has led to Standards and Poors downgrading the share rating of GM and Ford in the US to ‘junk bond’ status. Toyota’s profits for 2004-5 are significantly higher than for GM and Ford. GM and Ford have just announced plants will close whilst Toyota has announced record profits. The success of the Toyota Prius Hybrid car, which has exceeded 1 million in global sales, and Toyota’s fuel efficient cars is an example of first mover advantage. There is significant evidence throughout recent history that companies gain lasting competitive advantage if they are the first movers. Early movers reap long-term benefits from having built significant positive brand recognition, loyalty, and having been the first with a product to build relationships with suppliers and distribution chains. By innovating for new and emerging markets in sustainability, companies can position themselves for long-term competitive advantage from this first mover advantage. There are many rapidly growing markets related to sustainability in many countries. (See table 4.3.) Those companies that miss these opportunities risk yielding significant competitive advantage to their competitors. So whilst any company can benefit from investments in eco-efficiencies at any time, companies will benefit more from green product differentiation if they are amongst the first to market. As the McKinsey study, highlighted earlier, Innovating for New Emerging Markets, demonstrated, new market segments are crucial to the success of a firm. Porter showed, in The Competitive Advantage of Nations, that being the first into a new market is one of the best ways to create lasting competitive advantage, both in domestic and international markets. Those companies that first perceived a new opportunity and seized it have since gone on to be industry leaders. This is true of a remarkable number of organisations globally, and applies to many industries including automotive (Ford), aircraft (Boeing), cosmetics (Max Factor, Body Shop), men’s razors (Gillette), recycling (Visy Industries), and motorcycles (Honda). In addition to Toyota, now other major companies are seeking to gain early mover advantage in this new wave of innovation in sustainability

- Wal-Mart announced in 2006 a US$500 million climate change commitment including initiatives to increase truck fleet fuel efficiency by 25 per cent in three years and double it in 10. They project that such efficiency improvements will reap significant bottom line benefits, making it even tougher for their competitors. Wal-Mart has also developed a strategy to influence its 60,000 suppliers to produce lower-carbon products.
- BP has exploited its marketing and technology management capabilities, developed through the fossil fuel businesses, to build a market leading position in renewable energy technologies, particularly solar cells. BP’s differentiation has been heightened by:
- the decisions by all the other major US energy companies, except Amoco, to divest their alternative energy businesses

- the decision by many of the oil companies to play a visible role in resisting the adoption of effective climate change policies.

Similarly, two carpet companies, Interface, Inc. and Collins and Aikman have chosen to differentiate their products by investing in materials that can be almost completely recycled into new carpets. These are not isolated case studies, nor do they apply only to billion-dollar companies. All businesses can benefit from eco-efficiency investments. Many studies and reports have consistently shown that eco-efficiencies and cleaner production provide numerous ways to improve the triple bottom line, and thereby enable companies across all sectors begin the journey to genuine sustainable development.

These are not isolated case studies, nor do they apply only to billion-dollar companies. As we will show, actual experiences reported in many studies and reports have consistently shown that eco-efficiencies, eco-innovation and cleaner production provide numerous ways to improve the triple bottom line, and thereby begin the journey to genuine sustainable development. These offer great hope that it is now possible to end the stalemate and for companies and boards of directors to see sustainable development as an opportunity for new profit rather than as a new cost that has to be opposed. Professor Michael Porter summarises the key insight that are still not being seen by many:

“Environmental improvement efforts have traditionally overlooked these (whole) systems costs. Instead, they have focused on pollution control through better identification, processing, and disposal of


discharges or waste—costly approaches. In recent years, more advanced companies and regulators have embraced the concept of pollution prevention, sometimes called source reduction, which uses such methods as material substitution and closed-loop processes to limit pollution before it occurs. But, although pollution prevention is an important step in the right direction, companies must ultimately learn to frame environmental improvement in terms of resource productivity. Today managers and regulators focus on the actual costs of eliminating or treating pollution. They must shift their attention to include the opportunity costs of pollution—wasted resources, wasted effort and diminished product value to the customer. At the level of resource productivity, environmental improvement and competitiveness come together. This new view of pollution as resource inefficiency evokes the quality revolution of the 1980s and its most powerful lessons. Today, many business people have little trouble grasping the idea that innovation can improve quality while actually lowering cost. But as recently as 15 years ago, managers believed there was a fixed trade-off. Improving quality was expensive because it could be achieved only through inspection and rework of the ‘inevitable’ defects that came off the line. What lay behind the old view was the assumption that both product design and production processes were fixed. As managers have rethought the quality issue, however, they have abandoned that old mind-set. Viewing defects as a sign of inefficient product and process design—not as an inevitable by-product of manufacturing—was a breakthrough. Companies now strive to build quality into the entire process. The new mind-set unleashed the power of innovation to relax or eliminate what companies had previously accepted as fixed trade-offs.”

There are several more critical reasons, in addition to those listed above, why innovating for sustainability is so important for companies’ competitive advantage in addition to the two reasons already covered.

### 4.5 Additional benefits of decoupling profits from environmental pressures and negative social outcomes

There are numerous other drivers, in addition to pressures to innovate, for business to pursue sustainable development and considered collectively, they provide significant drivers for change. (See Table 4.4)

<table>
<thead>
<tr>
<th>Economic and Business Opportunities</th>
<th>** Increase Productivity, Create Product Differentiation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>** Lean Thinking, Total Quality Management</td>
</tr>
<tr>
<td></td>
<td>** Ethically/Socially Responsible Investment</td>
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<tr>
<td></td>
<td>** Reduce Risk of Consumer Boycott, NGO Activism</td>
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<tr>
<td>People and Populations</td>
<td>** ↑ Population in Developing Countries</td>
</tr>
<tr>
<td></td>
<td>** ↓ Population in the Developed World</td>
</tr>
</tbody>
</table>
Urbanization and Migration

** Enabling Technologies

** ICT, ET, Spatial Data, Renewable Energy,

** Environmental Crisis

** Need to restore Natural Capital

** Environmental Disasters

** Climate Change, Desertification

** Toxics, Insurance Blowouts

** Global Inequality, Deep Divide

** Access to Clean Water, Sanitation

** Trade Barriers, Free vs. Fair Trade

** Environmental Refugees

** Staying Ahead of Regulation

** Global, National and Local

Source: Adapted from a table developed by the RMIT Global Sustainability Institute, Australia.

An example of one of these additional drivers is that the multi-billion dollar reinsurers, such as Swiss Re, are reviewing their provision of CEO’s professional indemnity insurance, based on their efforts to reduce greenhouse gas emissions.

“With all the talk of potential shareholder lawsuits against industrial emitters of greenhouse gases, the second largest re-insurance firm, Swiss Re, has announced that it is considering denying coverage, starting with directors’ and officers’ liability policies, to companies it decides aren’t doing enough to reduce their output of greenhouse gases.”

Jeffrey Ball, Wall Street Journal, 7 May 2003

‘Emissions reductions are going to be required. It’s pretty clear’, Christopher Walker, managing director for a unit of Swiss Re recently told The Wall Street Journal.578 ‘So companies that are not looking to develop a strategy for that are potentially exposing themselves and their shareholders’. In addition, many companies are adopting sustainable development as part of their strategic planning to improve intangible assets, such as reputation for adhering to basic standards and basic community expectations. Reputations that have been built over decades can, fairly or unfairly, be ruined in a matter of days through the internet, email, global communications and media. With the internet there is nowhere left to hide.

“Information technology has empowered civil society to be the true guardians of democracy and good governance everywhere. In a sense, [civil society] has been the new superpower—the people determined to promote better standards of life in larger freedom.”

578 ibid
Kofi Annan, United Nations Secretary-General

The three year campaign by the US’s Rainforest Action Network against Citibank’s policy of loaning to projects that directly or indirectly harm the environment is an example of this. It has led to 19 large banks signing onto the new Equator Principles. These principles require potential projects over a prescribed gross project amount to undergo an environmental assessment to produce an environmental impact statement (EIS) and an environmental management plan (EMP) before being approved for a loan. This list of banks includes ABN AMRO Bank, N.V, Bank of America, Barclays plc, CIBC, Citigroup Inc., Credit Suisse Group, ING Group, Royal Bank of Canada, The Royal Bank of Scotland, and the Westpac Banking Corporation. These “Equator” banks are based in Europe, North America, Japan and Australia. In the year to October 2003, they arranged over 78% of project finance lending. The Equator Principles have rapidly set a new market standard and transformed project financing. The Equator Principles will achieve a global coverage as more financial institutions adopt them. While that is proceeding, some of those banks that have not signed are, nonetheless, following its procedures, because they know that they set the new standard against which they will be measured. In addition the promoters of the projects are anticipating and prepare to meet the requirements of the Equator Principles in their planning to raise funds in the project finance market. With the present coverage, the success of project borrowing is likely to depend increasingly on the extent of the compliance of projects with the Equator Principles. Many companies are concluding that they cannot afford not to invest in being socially responsible. Business-as-usual is becoming a high-risk occupation, due to the potential for:

- consumer boycotts and bad publicity
- higher insurance premiums or withdrawal of coverage
- regulatory requirements, fines and penalties
- competition from more eco-efficient producers
- class-action law suits and legal expenses
- personal liability for corporate negligence.

It is not surprising then, that the Financial Times/Price Waterhouse Coopers’ Most respected companies survey of 750 CEO's across Europe listed increasing pressure for social responsibility and increased environmental demands as two of their top three concerns. As well as providing companies with strategic insurance against numerous risks, a pro-active sustainable development strategy delivers a range of benefits to business, such as attracting the highest talent in the job market. Harvard Business School’s experts have long proven that most important area to ensure long-term business success is human capital. A recent book by Stanford Professor Jeffrey Pfeffer carefully reviewed the

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research evidence on the characteristics of high performing organizations. He concluded that the most critical factor was human resource practices. Global studies indicate that better employers have higher revenue, higher profit growth and higher investment returns. Westpac Australia, for instance, has found that 50 per cent of graduates chose Westpac over other Australian banks explicitly because of its proactive Corporate Social Responsibility approach. This is not unique to Westpac Hayes Best Employer Survey found that 61 per cent of 20 year olds will not apply for a job if they are uncomfortable with the company values. The survey also found that a company's reputation as an employer is important in a candidate's decision to work for them in almost 9 out of 10 cases, and 86 per cent would not work for a company with a bad employer reputation which offered a higher salary than a company with a good reputation.

4.6 Critics of the Business Case for Sustainable Development

One of the weaknesses of Porter et al’s work and many authors arguing for a business case for sustainable development to date, however, was that their arguments were based on a small number of case studies and not thorough statistical sectoral analysis. However, since Porter’s 1995 paper there have been numerous more systematic studies done that have, overall, confirmed Porter’s basic argument A wide range of studies have in the last 10 years shown that companies that perform better, environmentally and socially, than the market average actually can perform as well or out-perform the market financially as well. The research literature has demonstrated clear links between improved environmental and social sustainability performance and a company’s financial results.

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583 Ibid
593 Natural Capitalism: The Next Industrial Revolution can be freely downloaded from www.natcap.org, Ernst von Weizsäcker,
In 2007, at the United Nations summit on corporate responsibility, Goldman Sachs released a report which found that sustainability leaders outperformed the general stock market by 25 per cent over the previous two years and outperformed their same sector peers by almost 75 per cent over the same period. Innopec’s 2004 extensive report, Corporate Environmental Governance: a Study Into The Influence of Environmental Governance and Financial Performance, stated:

“The literature review found strong evidence for the existence of a positive relationship between environmental governance and financial performance. In 51 of the 60 studies reviewed, a positive correlation was found between environmental governance and financial performance ‘…results from fund, sector and company analysts are all generally positive.’

As of 2004, Innovec’s extensive study clearly shows that, sector by sector, companies that are environmental leaders are financially outperforming the laggards. Companies with good corporate environmental governance and proactive stances on greenhouse gas reductions generally outperform the rest of the sector, according to data across numerous sectors.

“How companies perform on environmental, social, and strategic governance issues is having a rapidly-growing impact on their competitiveness, profitability, and share price performance.”

Dr. Matthew Kiernan, founder and CEO of Innovest Strategic Value Advisors


Ibid.
There is evidence that the average share price movement of firms with strong environmental governance responses out-perform the lagging companies (i.e.: those with below average carbon rating). In the forest and paper products sector, the performance difference was 43% over a four-year period. (See Figure 4.8)

![Figure 4.8: Percentage change in total return of environmental leaders vs. laggards in the forest and paper products sector 1999-2003](image)

The same is true in the oil and gas industry, where companies with a pro-active climate/carbon management strategy out-performed their peers by 11.8% over a three-year period. (Figure 4.9)

![Figure 4.9: Percentage change in total return of environmental leaders vs. laggards in the oil and gas sector 1997-2002](image)

590 ibid, p12
591 ibid, p13
592 ibid, p13
Sectors such as pulp and paper and oil and gas both have significant greenhouse gas emissions, but it is the energy supply sector (electric utilities) that is the largest single source of global greenhouse gases. In this sector, over three of the last four years for which there are figures available, the percentage change in total return of environmentally leading electric utilities was 39% above that of below average environmental energy utility performers. Electric utilities in the United States exhibited the same pattern according to Innovest over this same period.

Research by AMP Capital is suggests similar trends are emerging in Australia.594 A number of studies by AMP Capital regarding the performance of Socially Responsible Investment (SRI) managers in Australia show that the median SRI fund out-performs the ASX200595 over the medium term596. (See Figure 1 below) Of the top 5 performing fund managers in Australia last year, 3 of them were SRI funds597.

Figure 4.10: Financial Performance of CSR firms versus ASX200 (Source: AMP Capital598)

In addition, there is a new literature showing clear links, in companies in the emerging economies of the world, between improved sustainability performance on the environmental and social dimensions,

593 ibid,p43
595 ASX200 refers to the Australian Stock Exchange Top 200 companies
596 Medium term refers to one, two, three and five years to 31 March 2006
597 Taken from the universe of all 66 active managed funds
and a company’s financial results. As WestLB Panmure investment analysts write in relation to Corporate Social Responsibility (CSR):

“Many companies now regard CSR as an important value driver and are willing to allocate resources to the internal development of this topic. CSR has found its place in management theory. It is now not only regarded as compatible with the idea of shareholder value according to Alfred Rappaport and with Michael Porter’s theory of competitive advantage, but also are exemplary implementations of them.”

WestLB Panmure refer to numerous empirical studies done over the last 30 years to back this up, including a report from Margolis and Walsh in 2001, which focused on the US equity market and covered 95 studies that overall showed a high correlation between CSR and financial performance.

In 2003, globally there were four stock-market indexes that tracked ‘sustainable businesses’: the Domini 400 Social Index in the US, the NPI Social Index in Britain, the Janizi Social Index in Canada, and the Dow Jones Sustainability Group Index for international shares. Three of these indexes, the Domini 400, the NPI and the Dow Jones Sustainability Group, have all been around long enough to now have a track record which can be compared to the main markets. In the five years to August 2001, the Dow Jones Sustainable Index (DJSI) out-performed the Dow Jones Global Index, with an annualised return of 15.8%, compared with 12.5%. This is profoundly significant as they have out-performed their ethically neutral counterparts.

4.6.1 Neo-Classical critiques of the Business Case for Sustainable Development

Another important area of debate occurs over to what extent significant resource efficiency opportunities still exist throughout the economy? Neo-classical critiques of Porter et al.’s work identifies correctly a key assumption; namely that the validity of the business case for sustainable development rests on the assumption of “pre-existing opportunities for cost savings or profitable product enhancements that have, for some reason, gone unrealized”. Such unrealized efficiencies should not be significant under the traditional microeconomic assumptions of profit maximization and perfect competition. However, as the evidence thus far in this chapter has shown, eco-efficiency opportunities appear to be pervasive in actual practice.

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602 Ibid.


Detailed technical analysis by energy efficiency experts\textsuperscript{604}, such as Hawken et al\textsuperscript{602}, von Weizsacker et al\textsuperscript{606}, and Smith et al\textsuperscript{607} and numerous government eco-efficiency programs\textsuperscript{608} show that 30-75 per cent eco-efficiency opportunities commonly exist throughout most sectors of the economy due to design, market, informational and institutional failures.\textsuperscript{609}

Some economists, without the benefit of engineering technical training, are understandably suspicious of such claims. The key point here is that, even if the global average eco-efficiency potential is half this value, existing within a range of 15-37.5 per cent, this is still significant. Yet some neoclassical economists question whether or not even these modest efficiency gains exist. Hence we now briefly overview this important debate.

### 4.6.2 Neo-Classical Microeconomic Assumptions

Classical microeconomic theory, which assumes that firms maximize profits and that they operate in perfectly competitive markets, struggle to explain the success of private initiatives or voluntary government partnership eco-efficiency initiatives\textsuperscript{610} referenced so far in this chapter. This is because the success of eco-efficient strategies rests on the fact that pre-existing opportunities for cost savings or profitable product enhancements that have, for some reason, gone unrealized. As Paton explains,

> "Classical microeconomic theory assumes that the firm maximizes profits by incorporating an optimal mix of labour, capital and other inputs in accordance with a standard production function, using fixed technologies freely available to all industry participants. It assumes that under perfect competition any in-efficiencies will be eliminated. Under these assumptions, efforts to reduce pollution then would be expected to add costs to an idealized firm, which has already maximized its profits, through already implementing any cost effective cost cutting strategies. This highly stylized picture of the firm in conventional microeconomic analysis denies what may be the most significant motivation for pursuing sustainable development strategies, namely eliminating economic inefficiencies within the firm."

As outlined in Chapter 3, market, information and institutional failures have been shown by Stiglitz to be more endemic that previously thought. The results concerning whether or not market failures are


endemic or not, which were summarised in Chapter 3, are important for these debates about microeconomic assumptions.

Debates due to the use of classical microeconomic assumptions, which play down such market failures, arise in two contemporary debates in energy and environmental policy — concerning the “Porter hypothesis” and the “energy efficiency gap debate” — which focus on the potential for voluntary and mandatory regulatory environmental initiatives to increase economic efficiency within the firm, and the barriers preventing many companies from addressing these opportunities.

4.7 The Porter Hypothesis

The “Porter hypothesis” argues that the relationship between environmental improvements (including energy conservation) and economic efficiency has been improperly framed as a conflict. Porter has suggested that pollution is generally associated with a waste of resources, or with lost energy potential:

“Pollution is a manifestation of economic waste and involves unnecessary or incomplete utilisation of resources... Reducing pollution is often coincident with improving productivity with which resources are used”

From this reasoning, Porter argues that

“properly designed environmental regulation can trigger innovation that may partially or more than fully offset the costs of complying with them.”

This has come to be known as the Porter Hypothesis (PH). In other words, it is possible to reduce pollution and costs at the same time, resulting in “win-win” situations, contrary to the traditional paradigm.

Jaffe and Palmer present three distinct variants of PH. In their framework, the “weak” version of the hypothesis is that environmental regulation will stimulate certain kinds of environmental innovations, although there is no claim that the direction or rate of this increased innovation is socially beneficial. The “narrow” version of the hypothesis asserts that flexible environmental policy instruments such as pollution charges or tradable permits give firms greater incentive to innovate than prescriptive

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regulations, such as technology-based standards. Finally, the "strong" version posits that properly designed regulation may induce innovation that more than compensate for the cost of compliance.\footnote{Lanoie, P. Laurent-lucchetti, J. Johnston, N. Ambec, S. (2007) Environmental Policy, Innovation and Performance: New Insights on the Porter. Available At \url{http://www.hec.ca/iea/cahiers/2007/iea0706_planoe.pdf} Accessed 2.02.2008}

Under the Porter hypothesis, companies acting to improve their environmental performance may — under appropriate circumstances — simultaneously increase profits. Similarly, economic inefficiencies imbedded in organizations provide opportunities for appropriately designed policy interventions to improve economic efficiencies, while simultaneously increasing environmental efficiency.

Porter and van der Linde detailed evidence from a wide range of industries to indicate that firms often gain competitive advantage from their efforts to improve environmental performance.

The key element of Porter and van der Linde’s argument is the concept of product and process innovation offsets. Product improvements occur when resource productivity improvements increase revenues through product differentiation or lower costs, whether on product inputs or reducing customers’ costs, — for instance by lowering product-related waste disposal or energy costs.

Process offsets occur when environmental improvements reduce costs by raising process yields, reducing machine downtime and maintenance or reducing the cost of process inputs. Porter and van der Linde argue that “offsets will be common because reducing pollution is often coincident with improving the productivity with which resources are used”.\footnote{Porter, M. and C. van der Linde (1995) “Towards a New Conception of Environment-Competitiveness Relationship” Journal of Economic Perspective 9, 97-118.} Palmer et al\footnote{Palmer, K. Oates, W. E, Portney,. P. R. (1995) Tightening Environmental Standards: the Benefit-Cost or the No-Cost Paradigm? Journal of Economic Perspectives 1995;9(4):119–32} counter Porter and van der Linde’s empirical studies with a model that predicts that such inefficiencies should be relatively rare. Palmer et al’s model is a classic example of how the assumptions of an economic model inevitably lead to a certain conclusion. Palmer et al adopts the conventional microeconomic assumptions that firms maximize profits and that they operate in perfectly competitive markets. Under these assumptions a firm cannot reduce emissions without raising marginal costs. The importance of Palmer et al’s work is that it identifies (correctly) a key assumption, that the validity of the Porter hypothesis rests on “pre-existing opportunities for cost savings or profitable product enhancements that have, for some reason, gone unrealized”. Such unrealized efficiencies should not be significant under the traditional microeconomic assumptions of profit maximization and perfect competition, but as the evidence outlined thus far in this chapter has shown, eco-efficiency opportunities appear to be pervasive in actual practice.

4.7.1 The Energy Efficiency Gap Debate

The “energy efficiency gap” is the second important debate in this area. It focuses on the underlying factors causing unrealized opportunities to reduce energy consumption to persist in companies. This
debate seeks to understand why many individuals and firms forego energy-saving investments with potentially high positive rates of return while others undertake energy efficient investments and achieve significant cost savings. This work is important because there should not be a different response to the same economic opportunities if firms’ behaviour fit the conventional economic assumptions. The “energy efficiency gap” literature has focused on barriers to change that inhibit firms from undertaking energy-saving investments with potentially high positive rates of return. This literature identifies behavioural barriers arising from principal-agent problems, other information asymmetries, and bounded rationality.

The debate over the energy efficiency gap is fundamentally important to current debate concerning the potential economic impacts of policies to reduce global greenhouse emissions. Topdown economic modelling estimates, based on conventional microeconomic assumptions, assume that existing energy demand patterns are optimally adjusted to prevailing market prices. As a result, “reductions in greenhouse-gas emissions can only be purchased at the expense of a reduction in the output of other goods and services”. Therefore, under conventional microeconomic assumptions and policy measures, must harm the economy.

On the other hand, bottom-up technological engineering approaches recognize barriers that may have inhibited firms from taking advantage of potentially profitable energy-saving opportunities. Bottom-up estimates typically predict that policy initiatives can induce reductions in energy consumption. As a result, bottom-up estimates typically suggest less economic disruption from programs to reduce global greenhouse gas reductions.

The controversies over the “Porter hypothesis” and the “energy efficiency gap” illustrate the critical role of underlying assumptions about economic efficiency within firms in the formulation of environmental policy. The latest advances in analysis of the Porter Hypothesis debate have been synthesized in papers by Paten, Lanois et al, Wagner, and Osang et al and Mohr. They

\[\text{DeCanio SJ. (1993) Barriers within firms to energy-efficient investments. Energy Policy;21(9):906–14.}\]
\[\text{Lanois et al, Wagner, and Osang et al and Mohr.}\]


rightly point out that given the mixed nature of the empirical results obtained thus far, assessment of the hypotheses remains an open research question.

However this more recent literature points ways forward both empirically and theoretically to resolve the debates on the Porter Hypothesis.

For instance, Lanois et al625 empirical study tested the significance of the three different variants of the Porter Hypothesis using data on environmental policy, research and development, environmental performance and commercial performance. Their analysis was based upon a unique database which included observations from approximately 4200 facilities in seven OECD countries. In general, they found

- strong support for the “weak” version that stringent but efficient regulation stimulates innovation
- qualified support for the “narrow” version that flexible environmental policy instruments give firms greater incentive to innovate than prescriptive regulations
- and qualified support for the “strong” version as well.

Theoretically, Alpay626, Mohr627 and Oseng et al628 have made significant contributions demonstrating, with their models, conditions under which the Porter Hypothesis does apply. Also theoretically Paten, has shown that neo-classical critiques of the Porter Hypothesis629 use overly simplistic microeconomic assumptions that fail to acknowledge significant market, informational and organisational failures630. Paton’s defence of Porter631 plus other modern studies of the Porter Hypothesis provides a new and significant body of work to help shift the Porter Hypothesis debates forward. We consider some of the key points from these papers next.

4.7.2 New economic perspectives on efficiency within the firm

In recent years, these same assumptions have become the focus of very extensive debates on the economic theory of the firm. Mainstream economic theory has evolved significantly in recent years in

631 Ibid.
its understanding of market failure which helps to explain why potential inefficiencies still exist. Lanois et al.\textsuperscript{32} summarise this key point well stating that

"Indeed, Ambec and Barla\textsuperscript{633} argue that, analytically speaking, for the Porter Hypothesis to be valid, at least one market imperfection is required in addition to the environmental externality. Examples of such market failures include spillovers in knowledge or in learning-by-doing\textsuperscript{634}, or market power.\textsuperscript{635} Alternatively, they may arise out of systemic organisational failures within the firm, such as contractual incompleteness\textsuperscript{636}, asymmetric information,\textsuperscript{637} and agency control problems.\textsuperscript{638}

Advances in microeconomic theory have begun to relax some basic assumptions of conventional neoclassical theory in ways that leave room for inefficiencies within firms. As Paten explains

"Kreps\textsuperscript{639} argues that a “somewhat revolutionary shift in the economic paradigm has begun”, based on a partial abandonment of three “canonical principles” — farsighted rationality, purposeful behaviour, and equilibrium. These principles have allowed economists to build a powerful system of deductive reasoning to predict or explain the behaviour of firms and markets. Modifying or abandoning these “canonical principles” has become necessary to increase the ability of economic theory to predict or explain commonly observed economic behaviours. In short it provides a richer picture. One result of these recent advances has been to provide potential explanations for why inefficiencies within firms are so prevalent."\textsuperscript{640}

1) The far-sighted rationality assumption

The far-sighted rationality assumption requires that each economic actor base his or her actions on a “detailed probabilistic picture of the future”. Teece\textsuperscript{641} argues that this “rational” behaviour really constitutes super or hyper-rational thinking. Behavioural arguments suggest that relaxing the far-sighted...
rationality assumption allows us to incorporate human cognitive limits into calculations concerning decision making.\textsuperscript{642}

This recognition allows us to take into account the simple fact that there is not perfect information all the time upon which our decisions are made. If you do not know how to identify and implement eco-efficiencies or sustainable design chances are you will not do it. Most business leaders and engineers in Australia have no (or at best a little) formal training in how to identify and implement eco-efficiencies or sustainable design opportunities. Also the field of energy, water and materials efficiency moves so quickly that every 12 months best practice has moved on. Hence, unless the corporation has a team of engineers expert in these fields then there is a reasonable chance that the corporation will miss opportunities to further improve their eco-efficiency performance and product design.

These limits also include behaviours motivated by market failures, perverse incentives, political interests rather than economic rationality. Perverse incentives exist for corporations in many countries. There also can be significant institutional and regulatory barriers, disincentives and market failures that are often halt change. For instance, one of the best win-win opportunities for business comes from energy efficiency investment. Significant work has been done demonstrating the benefits in this area since the OPEC oil crisis of the early seventies. But even here there can be disincentives for firms adopting energy efficient best practise. For instance, at the November 2003 Sustainable Energy Authority Victoria (SEAV)/Business Council for Sustainable Energy (BCSE) energy efficiency conference in Melbourne, PricewaterhouseCoopers consultants presented on how the taxation system in Australia discourages investment in energy efficiency. Apparently, if a business maintains old equipment, it can claim 100\% of the cost as a tax deduction in that year, but if it improves the equipment (for example by making it more efficient) that is considered to be a capital investment, and the tax deduction can only be claimed over the estimated life of the improved equipment. Even worse, equipment purchased before 1999 is eligible for accelerated depreciation (a higher tax deduction each year) if it is upgraded: but purchase of new equipment is ineligible for accelerated depreciation. So the least attractive option financially for a business is to invest in a new, more efficient plant. Even upgrading efficiency is less attractive than just maintaining equipment. Of course, this does not necessarily mean we should change the tax system, because it is designed to take into account many issues. But where are the incentives for energy efficiency to overcome these disincentives?

2) The purposeful behaviour assumption

The purposeful behaviour assumption requires that each economic actor “acts purposefully, to achieve a well-defined goal”. Relaxing this assumption permits the firm to be considered as a collection of partially aligned interests, rather than a single, monolithic actor capable of acting purposefully.

The Australian Department of Industry Tourism and Resources Energy Efficiency Best Practice program found cases where there was a lack of communication leading to reduced efficiency. For instance at one of the diary companies, they were producing over third more steam than needed on average simply because those in the boiler room thought it was their job to produce at all times enough steam for peak usage periods. By simply requiring staff to ring the boiler room ahead of time to inform them when they would need extra steam is now saving this firm over 30% of its energy usage. In other words problems in vertical coordination, excessive hierarchy and the communication problems that go with it within a firm may create barriers to change. Directives from top management to focus on issues such as growing market share and nothing else, can prevent an organization from focusing efforts on potential savings from more efficient consumption of energy or other resources. BP globally have started to address this by reducing the number of levels within BP from thirty to four, making BP globally far more responsible to change and opportunities.

Problems in horizontal coordination within a firm may also limit its ability to achieve its intended purposes. For example, differences in priorities and incentives among research and development, marketing and manufacturing functions, competition for budgets often inhibit the design of environmentally sound products.

Short term market pressures on CEOs and boards of corporations can also prevent longer term investments in eco-efficiencies and “green productivity” gains. In 2004, the BCA published a major report calling for the share-market and shareholders to take a longer-term view of their investments and stop constantly demanding higher and higher profit results over shorter and shorter time spans.

The report argued that this constant pressure from the share-market and shareholders—for better quarterly profit results—was preventing even good blue chip companies in Australia from focussing on the investments needed to be competitive, profitable and to perform with good social and environmental outcomes in 2-5 years’ time. Importantly the Australian Shareholders Association supported the BCA, arguing that shareholder value could be undermined in the medium to long term by a focus on short-term returns. ASA chairman John Curry said that it was a a ludicrous situation that fund managers competed against one another for rankings on the basis of share price performance and profits and outlook—even over a period like a month, .... The pressure is there to get short-term results’. Mr Curry said that it was difficult to convince investors to take a long-term

outlook because this required a change to the fundamental psyche of investment decisions with investors liking to see strong returns quickly. He said that the immediate commercial pressures were often inconsistent with the creation of an environment that would support sustained growth.

“The problem is we are, most of us, members of managed superannuation funds and we look at those performances every quarter and we say they’re good or they’re bad, why doesn’t the company do something about it.”

Research shows that this pressure on companies from their shareholders and the super funds is currently having a critical effect on whether companies can pursue all that they would wish to do to achieve corporate social responsibility. Such a short-term immediate profit focus leads inevitably to companies being in a position where they feel they have no choice but to oppose any changes to regulation or community attitudes that will add costs to their bottom line. This creates a dynamic where companies feel they have no choice but to fund think tanks and experts to argue against even potential changes that might harm their bottom line. Such short-term profit focus also prevents boards and CEOs from making investments with anything more than a 3–12 month pay back, even though such investments may help the company save or make millions over a 3-5 year period. External pressure from investors and analysts is a serious problem, but it's only half the picture. The other half is the advent of stock options. Stock options are agreements between the company and its top executives that allow the executives to buy the company's stock at prices far below what the public pays. Companies do not pay anything to issue stock options, making it a form of ‘free money’. In Australia in 2001, 45% of an average CEO's compensation was in the form of variable compensation; of this, roughly 57% was in the form of bonuses and 43% was in the form of stock options. Bonuses are usually annual and pegged to short-term performance measures such as annual earnings per share or share price. This focuses CEOs on short-term thinking.

Voluntary initiatives, corporate law reform, better economic incentives, emission trading schemes, and regulations by governments can focus attention on opportunities to improve both economic and environmental performance by helping to overcome these problems in horizontal and vertical coordination an short term market pressures.

3) The equilibrium assumption

Let’s now assume that a corporation has hosen to pursue sustainable development. There is still no guarantee that they will choose the best options each step of the way. As Paten explains economic models in the past have often assumed the equilibrium assumption.

“The equilibrium assumption requires all parties to adopt their best alternatives, given that all actors will do the same. Relaxing this assumption allows researchers to explore industry dynamics that cannot be

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646 Ibid.
described adequately by static equilibrium assumptions. This allows economists to create models closer to what actually happens. These models include the following assumptions about the actors: First, the management team for each firm must attempt to optimize the mix of technologies, marketing programs, and production schedules to compete for current business. Second, it must choose an appropriate portfolio of investments in research and development, market research, process development, and capacity development to prepare to compete in future time periods. Different firms are likely to hold diverse beliefs about consumer desires and competitor strategies for future time periods. Finally, each firm must calculate the appropriate investments in environmental performance improvement and energy efficiencies to meet customer and investor expectations in future time periods. As a result, calculating the most efficient mix of current and future product offerings and production schedules is beyond human computational abilities. In response to this challenge, firms experiment and adjust offerings and production schedules iteratively.

This process then reveals that more often than not at best firms choose a better way but not the best way forward where there are potentially more efficient solutions which are, however, outside their experience and beliefs. This applies equally to decisions ranging from those about organizational structures and processes and research and development opportunities to energy efficiency and environmental performance. Industries that are not aware of the best solutions can be enormously wasteful in other ways. The pressure to move innovations quickly to market reduces management’s ability to focus on efficiency-improvements such as conserving energy and reducing polluting emissions. Consistently with modern economic theory, all recent advances provide explanations for inefficiencies persisting within firms. Research in management strategy complements these economic insights.

In this emerging view, firms are incapable of finding “the best” optimal way to maximize profits for many reasons, and instead tend to find “better” ways forward. While firms plainly seek profits, the cognitive limits of managers and the complexity of the task of developing the optimum plans prevent them from achieving the best outcome. Although many firms fail in such an environment, market competition is not always strong enough to eliminate some firms that are significantly less efficient than the industry leaders.

Under these conditions, opportunities for firms to harbour inefficiencies abound. Relaxing the key assumptions of conventional microeconomic theory allows now economists to provide potentially

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valuable methods for approximating the efficiency frontier against which the efficiency of actual firms could be estimated.

The recent advances in economic theory described above suggest that inefficiencies within firms are likely to be common and economically significant. This suggests that wisely devised government environmental policies not only can improve social welfare and well-being but also private benefits. The role of stringent, yet efficient, regulation to stimulate innovation in industry is central to the Porter Hypothesis. Hence the type of regulation affects the likelihood of the Porter Hypothesis holding. Specific and more flexible types of policy instruments for environmental regulation bring about more favourable conditions for innovation and make it more likely for the Porter Hypothesis to hold.650

“Integrating these recent advances in microeconomic theory into environmental policy can greatly enrich the ability of this field to understand current innovations in practice and to make significant contributions to the design and evaluation of efficiency-enhancing initiatives by public, private, and non-government actors.”651

Conclusion

As discussed in Section 1, historically many businesses have been concerned that sustainable development or corporate social responsibility as a threat to their competitiveness, profitability and shareholder value. Historically business and industry groups have often fought the implementation of stronger environmental regulation and attempts to improve conditions and training for workers out of fear that it would reduce shareholder returns, profits and thus economic growth. The evidence emerging around the world shows that this widely held view is incorrect and preventing companies from identifying and creating new sources of value. A wide range of studies have in the last 10 years have shown that companies that perform better, environmentally and socially, than the market average actually can perform as well or out-perform the market financially as well. The research literature shows clear links between improved sustainability performance on the environmental and social dimensions, and a company’s financial results652. Critics of this line of argument have argued that if

such profit making opportunities already exist, then companies would have already identified and implemented it. But recent developments in microeconomic theory and practice have shown that a range of organisational, technical and market failures have prevented companies in the past from realising the eco-efficiency and eco-innovation opportunities of this new wave of innovation in sustainable development for business. The body of evidence in this chapter shows the possibility for non-linear evolutionary, interactive processes (ie: “creativity”) in businesses to enable them to make a transition to sustainable development. For instance, one of the major factors in why eco-efficiency opportunities have been missed are “organisational failures”, which are by definition, non-linear and complex involving numerous people and variables. Chapter 4 also has pointed out that a focus on sustainability gives permission to staff to re-examine existing processes and be more creative. This again enables the possibility of non-linear creative processes of innovation in business. Finally, Chapter 4 has also discussed how new non-linear innovations in business are possible due to advances outside the business such as from breakthroughs in R&D institutions. Again, this is a non-linear process. A key change needed to help foster non-linear positive changes in business is the encouragement of It is also important in this conclusion to note that one of the most significant changes investment in longer term sustainability or orientated business initiatives. There are currently significant barriers to such investment in the financial sector. There are many drivers for short-termism in business including pressures from the stock market and investment funds as well as the current structures of CEO and corporate board remuneration packages. Appendix 4.1 outlines these current drivers for short-termism and how they can be addressed. Appendix 4.1 also considers changes to corporate law that would also assist the rapid mainstreaming of environmental and social sustainable practice into the decision making of corporations.

Finally, as the business case for eco-efficiency and green/clean technology has become more widely understood, business associations and representative industry bodies are looking at ways they can assist their members to constructively address sustainable development. Governments and Industry Groups are realising that industry groups can play a key role to mainstream sustainability rapidly through entire sectors of any economy, through their ability to cheaply co-ordinate and run education

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and training, identification and implementation of sustainability goals and targets across their respective sectors. This marks a significant shift in the debates on sustainability in the business and industry groups around the world. Appendix 4.2 provides a summary of what a number of Australian Industry groups are doing and publishing on sustainable development for their members.
Chapter 5: Addressing the limits to physical growth: prospects for an economic growth that is environmentally and socially sustainable

“What is needed now is a new era of economic growth—growth that is forceful and at the same time socially and environmentally sustainable.”

Gro Harlem Brundtland, Oslo, 20 March 1987 Chairman’s Forward Our Common Future.

5.1 Introduction: Rationale and Justification for this Chapter and Chapters 6-8.

The goal of this chapter, and chapters 6 - 8, is to see whether it is possible to have a form of economic growth that is socially and environmentally sustainable. To the best of my knowledge, no-one has attempted such a synthesis. This, I suspect, is for many reasons, three of which are worth commenting on.

The first one is the fact that the traditional academic system produces experts in specific disciplines who, whilst expert in socio-economic sciences or environmental sciences, are rarely encouraged to write about both. For instance, take Paul Ekin’s 2002 publication, Economic Growth and Environmental Sustainability: The Prospects For Green Growth. Ekin’s book is one of the first attempts to define the conditions under which a new ‘green’ form of economic growth could exist. But Ekin’s book, despite being a vast synthesis, did not comprehensively investigate the social dimension of sustainability. He did not examine the question: how does pursuing a broad array of socially progressive sustainability goals correlate with economic growth? This and chapter 6 address this issue.

The comprehensive treatment of how pursuing social sustainability correlates with economic growth in Chapter 6 is one of the novel aspects of this thesis.

The second reason that few have attempted such a synthesis before is that many of the empirical and theoretical studies drawn together here were only done in the last 10 years. During that time, due to such issues as climate change, a significant new body of work has developed modelling the economic and social affects of eco-restructuring an economy over 50-year timelines. Even ten years ago there were few economic and technical studies of the costs of achieving deep cuts to greenhouse gas emissions.

The third reason that few have embarked on such a synthesis has been the predominance of the belief that there are significant trade-offs between social, environmental and economic goals. Many have assumed that significant trade-offs between economic growth and social and environmental outcomes are inevitable. In the Limits to Growth summary report sent to the Club of Rome it stated that

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We have shown that in the world model the application of technology to apparent problems of resource depletion or pollution or food shortage has no impact on the essential problem, which is exponential growth in a finite and complex system. Our attempts to use even the most optimistic estimates of the benefits of technology in the model did not prevent the ultimate decline of population and industry, and in fact did not in any case postpone the collapse beyond the year 2100.654

As Jim MacNeil wrote in 1991 in Beyond Interdependence655,

“Ever since the Club of Rome report The Limits to Growth was published in 1972, an important part of the environmental debate has been rooted in the assumption that environment and development are irreconcilable. The Limits to Growth assumed a set of relationships between population, industrialisation, pollution, and depletion of natural resources that led inevitably to the collapse of world order. It gave birth to a widespread movement advocating zero or even negative growth. environmental sustainability and development with economic growth are irreconcilable.”

This thesis challenges this assumption, examining the ways different environmental discourses have responded to the topic of sustainability and economic growth and how to potentially advance and resolve the “growth” debates.

It is important to clarify the “growth” debates because arguments that low economic growth rates or even zero growth will help achieve sustainable development, as promoted by some survivalists, would prevent the necessary investment of capital to both transition to an ecologically sustainable economy and reduce extreme poverty globally. One of the most pressing arguments for continued economic growth is to meet the needs of poor people. Jim MacNeill, the secretary-general to the Brundtland Commission, argues that:

“The most urgent imperative of the next few decades is further rapid (economic) growth. A fivefold to tenfold increase in economic activity would be required over the next 50 years in order to meet the needs and aspirations of a burgeoning world population, as well as to begin to reduce mass poverty. If such poverty is not reduced significantly and soon, there really is no way to stop the accelerating decline in the planet’s stocks of basic capital: its forests, soils, species, fisheries, waters and atmosphere.”656

Achieving sustainable development will require significant new investment in reducing environmental pressures and extreme poverty, improving health and education outcomes and building stronger social and institutional capital. It is easier for governments and business to be able to afford financially and politically the upfront costs to make such investments during times of economic booms, and government’s budgetary situations are healthier.

654 See Abstract to 1972 Limits to Growth at http://www.ratical.org/corporations/limi2growth.html
Also it tends to be during periods of long economic boom and high job security that community attitudes support more government funding being spent on sustainable development. This was seen towards the end of the 1960s after a long period of economic boom, in the late 1980s after a period of high global economic growth and again in 2006-7 after a 10 year global economic boom since the 1997 Asian economic crisis. As Hatfield-Dodds explains, engineering a significant slowing of economic growth is unlikely to help achieve greater social and environmental sustainability.

‘Discouraging economic growth would do little to encourage a more sustainable society. Indeed, engineering a recession is likely to have perverse consequences, increasing unemployment, reducing the willingness of consumers and firms to adopt improved social and environmental practices, and encouraging farmers and resource based industries to eat into our natural capital to maintain cash flows and living standards’.657

The “growth” debates also matter politically. Concerns about sustainable development harming economic growth have, in the past, resonated with many politicians, business leaders and citizens who have strong commitments to maximising economic growth. Politicians, business leaders and citizens often see economic growth closely associated with ‘social goods’ such as political success, greater business opportunities, a less risky investment climate, less unemployment, greater job security and a favourable lending environment to help buy a house. For example, in Australia, until the recent 2007 election, the only changes of Federal government for the last 30 years have occurred after global economic downturns: Whitlam in 1975, Fraser in 1983 and Keating in 1996. Not achieving sufficient economic growth is therefore associated with grave political risk by politicians in rich and poor countries alike. As Frances Cairncross, recently retired editor of The Economist magazine wrote in her book Green Inc: in 1995:

“Traditionally many leaders of developing countries have been reluctant to embrace sustainability because they fear it will slow development, growth and business investment in their country ... [The assumption that an inevitable] compromise [is needed between sustainability and economic growth] is especially important in the case of developing countries, where the trade-off between economic growth and greenery often seems particularly stark. Not only are their people the poorest; their numbers are growing the fastest. Their governments are unlikely to welcome policy proposals that appear to deprive them of the chance to improve living standards”.658

Clearly there is a need to advance and bring greater consensus on the “growth” debates. Dryzek showed in The Politics of the Earth: Environmental Discourses659, that one of the core differences between the different environmental discourses and debates is how they respond to this question of


whether or not it is possible to reconcile economic growth with environmental sustainability. In *Environmental Discourses*[^660], Dryzek shows that there are three broad discourses which have responded differently to these trends.

- The Laissez-Faire discourse which recommends that environmental problems are left to the market, arguing that economic growth enables the improvement of environmental quality.

- The Survivalists discourse which argues that economic growth and environmental pressures are strongly coupled, and that the historic correlation between economic growth and environmental pressures demonstrates that economic growth is at least a factor in increasing environmental pressures. Some in the Survivalist discourse acknowledge that decoupling of economic growth and environmental pressures can be achieved but argue that such coupling will be insufficient to achieve environmental sustainability on the scale or speed required. One of the reasons that Survivalists doubt that decoupling could achieve the required amount is that they believe that negative rebound effects will undermine efforts to decouple.

- The Ecological Modernisation discourse which argues that it is important to reconcile economic growth and environmental sustainability as economic growth is a necessary, but by no means sufficient condition, for reducing poverty globally. Ecological modernisation proposes that economic growth can be reconciled with environmental sustainability by significantly decoupling economic growth from environmental pressures through addressing market, informational and institutional failures with purposeful policy, technical innovation and institutional reform. In this thesis, the strong ecological modernisation discourse is being considered that acknowledges that, to achieve sustainability, significant decoupling of the order of Factor 4-10 needs to be achieved. The strong ecological modernisation discourse also acknowledges that there are significant vested interests that will need to be addressed and structural adjustment of currently “unsustainable industries” to enable not just ecological modernisation but ecological restructuring to achieve sustainable development.

*This chapter’s focus then is on advancing and resolving the debates between these three discourses.* (italic for emphasis)

This chapter firstly discusses the Lassiez Faire discourse in isolation and shows that there is no evidence to suggest that leaving everything to the market and focusing on strong economic growth alone will lead to significant decoupling of economic growth from environmental pressures. The chapter addresses the Lassiez Faire discourse first because it can be addressed relatively simply. The chapter then addresses together the points of difference between the other two very important environmental discourses, which are relevant to the “growth” debates, namely the survivalist and ecological modernisation discourses. The survivalist’s discourse’s arguments on the “growth” debates

represent many of the important criticisms of the ecological modernisation discourse. Hence by addressing some of the key arguments of the survivalist discourse concerning the “growth” debates this chapter is also addressing some of the key criticisms of ecological modernisation.

The chapter does this by addressing the following questions

- Is economic growth or instead market, information, and institutional failure the main factor causing lack of sustainable development?

Some in the survivalist discourse argue that economic growth cannot be decoupled from physical growth and environmental pressures. If this is the case then when governments address market, informational and institutional failures there should be no evidence of decoupling. So next the thesis asks

- What evidence is there of decoupling of economic growth from environmental pressures when governments have addressed market, informational and institutional failures?

The chapter here shows that there is evidence of significant decoupling where market, informational and institutional failures have been addressed. Some survivalists argue that this cannot be possible as economic growth is so closely coupled with physical growth. Hence next the chapter looks at the question of

- What is economic growth and is it the same as the physical growth of the economy?

Some in the survivalist discourse acknowledge that decoupling is possible, but dispute that it will be sufficient to achieve environmental sustainability on the scale or speed required. So next this chapter asks

- What is the required level of decoupling to achieve environmental sustainability?

As chapter 1 showed, there is growing scientific consensus that environmental pressures need to be reduced globally quickly and significantly. Thus the level of decoupling required to achieve sustainable development is significant. This chapter re-affirms this. Hence next the chapter asks

- Can humanity achieve Factor 10 scale decoupling of economic growth from environmental pressures? The chapter also proposes some advanced strategies in sustainable design to assist achieve such an ambitious goal.

Some sophisticated critics of ecological modernisation, who acknowledge decoupling can be achieved, still doubt that it can be achieved sufficiently due to negative rebound effects. They argue that negative rebound effects will undermine efforts to decouple economic growth from environmental pressures through eco-efficiency and resource productivity improvements. This chapter considers the question of

- How large is the negative rebound effect and can it be reduced by effective policy, incentives?

As mentioned in chapter 3, one of the main arguments put forward by vested interests to oppose a transition to sustainable development has been that such a transition would significantly harm
economic growth. History shows that significant momentum for sustainable development was built before both the 1972 UN Stockholm Conference on the Human Environment and the 1992 World Summit on Sustainable Development in Rio. Yet global recessions hit after both events and the arguments of vested interests that sustainable development would harm economic growth resonated with many political leaders and workers who were losing their jobs. It reduced momentum for sustainable development very effectively. To date many environmentalists in the survivalist environmental discourse, which have advocated zero or even negative economic growth, have thus argued that economic sustainability and economic growth are not compatible. Thus ironically, many environmentalists have historically agreed with anti-sustainability vested interest’s key argument and reinforced government’s decision not to pursue and invest in sustainable development. Hence this chapter next examines the

- What are the Costs of Inaction versus Action on Sustainable Development?

This is next considered briefly towards the end of this chapter. This question is addressed in more detail in Chapters 6-8. This thesis in chapter 6, looks at how investment in environmental sustainability goals, such as ending extreme world poverty, reducing corruption, investing in education and public health correlates with economic growth long term?

In this chapter in sub-section 5.4 and then in chapters 7-8 the question of what are the costs of inaction versus action on environmental protection are addressed. Chapters 6, 7 and 8 also look at the question of

- How does economic growth correlate with strong ecological modernisation (strong social policy and environmental policy).

This is one of the novel aspects of this thesis. No one has before looked to see qualitatively how pursuing a comprehensive social and environmental sustainability agenda will correlate with economic growth.

We will now consider first the Laissez Faire discourse and then the Survivalist and Ecological Modernisation Discourses together. Most of the chapter seeks to identify possible common ground to help advance and resolve the debates between the Survivalist and Ecological Modernisation discourses.

5.2 The Laissez Faire Discourse and the “Growth” Debates

The last 200 years have seen significant increases in economic growth globally (Figure 1.1), while environmental pressures, material and energy flows and pollution have also increased substantially. Historically, economic growth and development has obviously depended on extractive industries such as mining, agriculture, fisheries, and forestry and the burning of fossil fuels which have had significant negative impacts on the environment. The laissez faire discourse argues that once a country has achieved a certain level of development and economic growth that country automatically aspires for
loftier environmental and social goals and standards. This is also known as the environmental Kruznets’ curve (EKC) hypothesis. This hypothesis proposes that rising living standards raise expectations about, for instance, air quality and water sanitation standards. There has been a wide range of research deriving relationships between income (measure of prosperity) and environmental quality. These studies have claimed to show that for many environmental indicators environmental degradation is seen to increase at low incomes, reach a peak and then decrease as income passes some threshold. In a chapter arguing that economic growth could be socially and environmentally sustainable it may be tempting to think this. But, in fact, it does not generally hold as Paul Ekin shows in chapter 7 of Economic Growth and Environmental Sustainability.

![Figure 5.1: Stylised view of economic growth and environmental pressure](source:Hatfield-Dodds, 2004)

Figure 5.1 illustrates what the academic literature has found, namely that environmental pressures which are out of sight and mind have not been addressed as quickly as those environmental issues the majority of the population sees every day such as polluted urban water and air. Hence full decoupling has to date largely been achieved with only some aspects of urban pollution and air pollution. As Ekin writes:

> Those environmental indicators for which the EKC hypothesis is most plausible, or least unconvincing, are various indicators of air pollution[—NO₂, CO, CO₂, suspended particles, dark matter. However, the principal conclusion of this investigation into the relationship between environment and income as revealed in various econometric studies is that the hypothesis that there is an environmental Kruznets’

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The evidence to date on the environment is overwhelming that the only cases of significant decoupling of environmental pressure to economic growth have occurred when there has been appropriate policy settings from government that have underpinned effective business, government and civil society partnerships and action. In the 1970s NGOs had to campaign, lobby and embarrass many companies into action on something as obviously helpful to companies as energy efficiency. It appears that powerful vested interests in any society can often see changes, even such positive ones outlined herein, as a threat to their interests. All the evidence points to the need for determined public policy developed through ‘good’ public policy processes—defined by Dovers in as being comprehensive, purposeful, open and informed. This is also the conclusion of those defending the Krużnet’s curve. To conclude, the laissez faire discourse does not stand up to empirical evidence. Shafik writes that, ‘The evidence suggests that it is possible to ‘grow out of’ some environmental problems. But there is not necessarily anything automatic about this—in most countries, environmental improvement has required policies and investments to be put into place to reduce degradation’. There is no evidence that the market and economic growth on their own can achieve significant and lasting decoupling of economic growth from environmental pressures. Even urban air and water pollution have required policy intervention from government to address. After the famous December 1952 smog in London, which killed thousands of people, new regulations were put in place restricting the use of dirty fuels in industry and banning black smoke. These included the Clean Air Acts of 1956 and of 1968, and the City of London (Various Powers) Act of 1954. Grossman and Krueger state: Even for those dimensions of environmental quality where growth seems to have been associated with improving conditions, there is not reason to believe that the process has been an automatic one. In principle, environmental quality might improve automatically when countries develop if they substitute cleaner technologies for dirtier ones, or if there is a very pronounced effect on pollution of the typical patterns of structural transformation … However, a review of the available evidence on instances of

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pollution abatement suggests that the strongest link between income and pollution in fact is via an induced policy response...668

Hence in the academic literature now there is no evidence to support the laissez faire’s discourse on the “growth” debates. The literature instead provides much evidence that purposeful government policy is often essential to reduce environmental degradation and pollution. This should not come as a surprise as governmental policy is accepted and seen as needed when faced with market failures. And environmental degradation and pollution are often caused by market, informational and institutional failures.

The overall trend of global environmental degradation and declining ecosystem resilience can be understood as an example of a market failure due to market externalities669, underpricing670, lack of markets for ecosystem services671 and the challenges in managing public goods summed up in 1968 by Hardin in ‘The Tragedy of the Commons’ paper.672 There is growing consensus within modern economics that market, information and institutional (such as government) failures, are key drivers of and factors which cause unsustainable development.673

Economists have explained for many decades that high pollution levels and current unsustainable development trajectories arise largely from the fact that the real environmental and social costs of development are externalised from the market. Externalities refer to a situation where effects (harmful or beneficial) of production or consumption are imposed on others but cannot be traced or charged back to the originator. The main characteristic of an externality is the separation between the affected individual and the source of the effects. Because of this it is difficult to get the perpetrator to pay for the costs of the harmful effects or the beneficiaries to reimburse those who create benefits to society. Thus, externalities are not built into the market price of a good or service. An example of a negative externality is environmental pollution.674 The famous British economist, Arthur Cecil Pigou, pointed out the hidden costs of externalities in his 1920 classic, The Economics of Welfare675. He described,

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for instance, how the externality of smoke pouring from factories and fireplaces in Manchester, England, had many hidden costs for the economy. Such costs, including extra laundry cleaning, repair of corroded buildings and the need for additional artificial lighting due to this smoke, were assessed at £290,000 annually. Through this basic estimation of costs, not even including health, Pigou showed that for every £100 steel makers earned, they were doing £200 worth of damage. In effect, pollution victims (taxpayers) were subsidizing pollution causers, whilst making society worse off as a whole.

Without these costs included in price signals, current goods and services are externalising the “real” costs which will have to be paid eventually by future generations. Underpricing⁶⁷⁶ occurs when all the costs of an input or activity are not included in the price of an output. This is generally due to the fact that markets only make provision for pecuniary costs and not environmental and social costs of production. A lack of information also leads to incorrect pricing because it gives a distorted impression of the scarcity of a resource. While insufficient information can lead to a commodity being overpriced, it is when it leads to underpricing that environmental degradation is most likely to occur.

Government policies can also cause underpricing. Through government subsidies for certain inputs, particularly in agriculture and fossil fuels, the consumer bears less cost and thus gains a false impression of the (non)scarcity of a resource. Furthermore, a lower cost will induce an individual to use more of a resource (which is after all the point of a subsidy) with the possible consequence of negatively affecting some other resource in the process. For example, excessive fertilizer use often leads to contaminated groundwater. The United Nations Environment Programme (UNEP) and the Worldwatch Institute have identified at least US$650 billion worth of perverse subsidies globally, per annum, that are either directly or indirectly contributing to the underpricing and degradation of the environment.⁶⁷⁷ Ken Henry, the Head of the Australian Treasury Department, summed up the problem of underpricing well stating (in referring to what he had encountered as an economist)

‘I learned about the importance of prices in guiding resource allocation. I came to the view that peoples’ behaviour had a lot to do with their pursuit of self interest, and that a lot of what I might have found objectionable about the things humans did could have had something to do with the opportunities and incentives established by governments.’⁶⁷⁸

It is becoming clear that environmental degradation occurs because the current form of our economy makes it cheaper to degrade nature than to care for it.⁶⁷⁹ As Ken Henry stated


‘We go about our lives making many decisions based on cost – all of us base decisions on a formal or informal cost benefit analysis. When externalities are not present, the market price does not reflect the true costs of our decisions.’

These issues are being widely discussed internationally. As a case in point, government policies, in keeping the price of water for farmers low, have led to wasteful use of water. In another example, in many countries, where much of the national timber lies on crown lands, the government, in making the land available, has paid less attention to concerns about long-term, economic efficiency than it has to the pleading of timber interest groups. Current market pricing, at present, does not reflect the true cost to the environment and society of production, industry, and general consumption.

Where such market failures exist there is a legitimate role for government to act to ensure that these costs are accounted for. As outlined in 3.6.5 and 3.6.6, economics now demonstrates that governments have a role to address externalities as the market tends to produce too little of positive externalities like education and R&D whilst producing too much of negative externalities like pollution and environmental degradation. The literature to date also shows that purposeful government policy and actions are essential to drive eco-innovation and the adoption of design for sustainability approaches throughout the economy.

Externalities can be categorized as either positive or negative, depending on whether individuals enjoy benefits they did not pay for, or suffer extra costs they did not incur. The above discussion has shown that markets tend to produce an overabundance of negative externalities, such as pollution, but markets also fail to produce enough positive externalities, like education and R&D. Research and development is a positive externality, as the majority of profits from most inventions do not go to the inventor but to the company that commercializes the invention. Because R&D and innovation for new emerging markets is inherently risky, the market on its own will often fail to produce the necessary technological innovation needed to achieve an environmentally sustainable economy. Economist Jeffrey Sachs writes,

“Markets alone will not develop the sustainable technologies that we will need for the twenty-first century. Scientific discovery, on which sustainable technologies depend, is a public good that is underprovided by market forces. This is because scientific knowledge is a non-rival good that can be used by anybody without lessening its availability to anyone else. With apples and oranges, more for you means less for me, but you and I can utilize scientific knowledge such as e=mc2 or the structure of DNA without diminishing the availability of the same knowledge for anybody else. Indeed, knowledge works most powerfully when it is widely shared, thereby giving a common base for understanding, action and

681 Ibid.
development of technological systems...It is one thing to develop high-sustainability technology and quite another to have it adopted on a widespread basis and in a timely manner. The central challenge is to create incentives for firms and households to adopt environmentally sustainable technologies instead of the unsustainable technologies that they now deploy. In many contexts, a high-sustainability technology exists but is more expensive than an environmentally damaging low-sustainability technology. The extra cost of adopting the sustainable technology may be small relative to the large benefit to society of reducing the environmental harm, but the market prices don't send the signal, since the environmental harm is not reflected in market prices and therefore in the incentives facing businesses and households."

As Chapter 4 showed, there are significant barriers to the uptake of investment in eco-efficiency by businesses. There are other market, informational and institutional barriers to eco-efficiency opportunities which also need to be addressed. Market failures, such as split incentives, can lead to energy efficiency opportunities being ignored. A split incentive occurs when there are two parties involved such as builder/tenant or manufacturer/customer. In the case of the builder/tenant relationship, many apartment blocks are not designed as energy efficiently as they could be, to save the builder money. There are additional up front costs in Australia for double glazed windows and extra insulation in the roof and walls, and the developer does not have to live in the building and pay the electricity bill. Hence the builder is not affected by the decision not to optimise the energy efficiency of the building. Rather, this cost is externalised to the tenant who has to pay for the ongoing electricity costs. The financial incentives for the builder and tenant are not aligned (split incentives).

Another common split incentive failure is shown by the fact that most appliances involved with heating or cooling – kettles, microwaves, fridges, dishwashers – are not as well insulated as they could be. If they were better insulated they would help reduce electricity costs for billions of people globally who use these appliances daily. This occurs because better insulating appliances adds up front costs to the manufacturing of these products while the manufacturer does not benefit financially from the cheaper running costs.

There have been a number of barriers like these to the uptake of energy efficiency opportunities, but around the world there are examples where governments, business and professional organisations have addressed and overcome such perverse barriers. Amory and Hunter Lovins summarised examples of where such barriers have been overcome to the implementation of energy efficiency opportunities in their seminal 1997 paper *Climate: Making Money, Making Sense*.683

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Another situation where markets fail to distribute resources efficiently is where it is impossible, or at least very costly, to deny access to an environmental asset. In a situation where many have access to the same limited resource (usually referred to as a common-pool resource), there is an incentive for each consumer to acquire as much of that limited resource as possible, before others do. If all users restrain themselves then the resource has the best chance of being sustained. However, if you limit your extraction of the resource and the others do not, then the resource will still run out and you will have been penalized by not getting your fair share. In these situations there is a tremendous incentive to overuse natural resources. In this case the market has failed to signal the real scarcity of the asset: the invisible hand of the market does not work to provide for the maximum social good for present and future generations. This has been understood for a long time, and was popularized by Garrett Hardin’s article entitled, ‘The Tragedy of the Commons’. Hardin asserted that users of a common resource will ultimately destroy the resource on which they depend unless the market failure is addressed. He described the process of writing the paper as follows:

With Adam Smith’s work as a model, I had assumed that the sum of separate ego-serving decisions would be the best possible one for the population as a whole. But presently I discovered that I agreed much more with William Forster Lloyd’s conclusions, as given in his Oxford lectures of 1833. Citing what happened to pasturelands left open to many herds of cattle, Lloyd pointed out that, with a resource available to all, the greediest herdsmen would gain … for a while. But mutual ruin was just around the corner. As demand grew in step with population (while supply remained fixed), a time would come when the herdsmen, acting as Smithian individuals, would be trapped by their own competitive impulses. The unmanaged commons would be ruined by overgrazing; competitive individualism would be helpless to prevent the social disaster. So must it also be, I realised, with growing human populations when there is a limit to available resources… I scribbled in the changes, most notably the suggestion that the way to avoid disaster in our global world is through a frank policy of ‘mutual coercion’, [that is] mutually agreed upon. Under conditions of scarcity, ego-centred impulses naturally impose costs on the group, and hence on all its members.

Clearly then leaving environmental protection to the market, as advocated by the Laissez Faire discourse is not going to be sufficient.

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686 Ibid.
5.3 Resolving the Debates between the Survivalist and Ecological Modernisation Discourses to Advance the “Growth” Debates.

5.3.1 Early Survivalist Literature Ignored Market Failure as a Cause of Environmental Degradation

The understanding of market, informational and institutional failure being a underlying cause of unsustainable development is also vitally important for resolving the debates between the survivalist and ecological modernisation discourses. The early survivalist discourse literature such as *Limits to Growth*, was remarkable in discussing the challenges to the sustainability of development without ever discussing the role of market failure, information or institutional failure. This is ironical because the issues, which the *Limits to Growth* team blame on “growth,”—environmental degradation, pollution and global inequality—are in fact seen by economists as examples of market, informational and institutional failures.

Therefore, another key reason why some do not see how economic growth and environmental sustainability can be reconciled is that they do not understand the role market, informational and institutional failures have in driving unsustainable development.

Economists have long understood that, whilst markets have many virtues, they also have tendencies to fail when there are negative externalities (like environmental degradation) or monopolies. As early as 1833, economists understood and outlined the ‘tragedy of the commons’ market failure. It is helpful, therefore, to acknowledge this obvious truth of how environmental degradation and global inequality are accepted forms of market, informational and institutional failure by economists because this helps to move the debate on from whether economic growth is good or not. The role of market failure in environmental degradation is acknowledged by most of the respected environmental discourses as outlined by Dryzek. For instance, other survivalists like Daly and Cobb acknowledged market failure as being a factor in the formation of monopolies, environmental degradation and the loss of social capital.

There is now a wealth of policy and institutional reform experience already known that can effectively address market, informational and institutional failures. A wide range of OECD and other

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publications\textsuperscript{691} have covered what policies, economic incentives and institutional arrangements\textsuperscript{692} tend to be more effective than others. There have also been significant reviews of advances in adaptive governance to help address the tragedy of the commons.\textsuperscript{693}

As explained above in the opening to this chapter, the Survivalist discourse argues that the historic correlation between economic growth and environmental pressures demonstrates a causal relationship. If economic growth is tightly coupled with rising environmental pressures then changes to policy, regulation, technologies and economic incentives to address market failures should make little difference. If economic growth is the cause of environmental problems, then when changes to policy and regulation and technologies are made to address market failures then there should still not be any significant decoupling of economic growth from environmental pressures. However, as Table 3.1 in Chapter 3 showed, when government does address the market, information and institutional failures through more effective policies and regulations, industry and R&D bodies have responded with innovations to develop less polluting and more environmentally sustainable technologies. If, as the Survivalists discourse argue, economic growth per se is the problem then such innovations should not achieve significant decoupling. Hence next we investigate whether strong and purposeful policies and technological innovation has made a difference and achieved significant decoupling of economic growth and environmental pressures in the past?

5.3.2 Is there Evidence of Decoupling Economic Growth from Environmental Pressures?

There are many examples of effective policy achieving both relative and absolute decoupling from the last 40 years around the world. (Figure 5.2) The 2002 OECD report\textsuperscript{694} on decoupling economic growth from environmental pressure indicators stated that for every indicator at least one OECD country had achieved absolute decoupling.

\textsuperscript{691} UNEP (2007) Global Environment Outlook: Environment for development (GEO-4) report. UNEP. Available At http://www.unep.org/geo/geo4  Accessed 23.03.08
\textsuperscript{694} OECD Secretariat (2002) “Indicators to Measure Decoupling of Environmental Pressure and Economic Growth” OECD. Paris
Relative and Absolute Decoupling

Growth of economy
Growth of resource use
Growth of environmental pressure
Decrease of resource use
Decrease of environmental pressure

Figure 5.2: The differences between relative and absolute decoupling. (Source: TNEP, 2006)

OECD countries like the Netherlands have made significant progress on decoupling economic growth from a range of environmental pressures. (See Figure 5.3)

Examples of decoupling economic growth from environmental pressures include global efforts to stop using asbestos, decrease ozone-depleting chemicals, reduce SO$_2$ emissions, and phase out lead in petrol. These “success stories” show that, with global political will and co-operation and appropriate policy and eco innovation, it is possible to achieve close to 100% reductions in specific types of pollution (100% decoupling) with negligible effect on economic growth (See Figures 5.3-5.8). In the last 20 years asbestos has been phased out and replacements phased in (Figure 5.4).
What about other hazardous materials and chemicals? In Massachusetts, USA government, business and universities working together have achieved a 70 per cent reduction in toxic chemicals use from 1989 to 1997 without harming profits and economic growth. In Chapter 3, it was shown that historically, where governments have addressed pollution with appropriate and effective policy mechanisms, industry has found significantly cheaper ways to reduce the costs of meeting such environmental regulation.

The programme of emissions control adopted by the Second Sulphur Protocol is an example of what could be done for all major pollutants. The environmental objective of the protocol—to eventually bring sulphur depositions in Europe within the capacity of receiving ecosystems—is a fundamental principle of ecological sustainability. The emission reduction required was of the order of a factor of ten, as is the estimated order of magnitude reduction required for other pollutants like CO$_2$. Initial perceptions were that it would be incredibly costly, but the removal of subsidies from coal industries and the arrival of cost-effective low sulphur fuel and technology changed the cost situation such that the sustainability standard was attainable for significantly less cost than anticipated. When the costs of sulphur to health and the environment are taken into account, this phase-out has had negligible net impact on economic growth (Figure 5.5). In this case economic growth and ecological sustainability have been quite compatible.

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It is more cost effective and easier for business to decouple profits from greenhouse gas emissions compared to reducing other pollutants because of the potential of fuel and energy efficiency to enable reductions in emissions which reduce business costs over time. Efficiency – doing more with less for longer – has one of the best rates of return of any investment. This is because it is cheaper not to use as much energy, water and materials, all of which are costs for a business or organisation. Businesses and organisations that have embraced efficiency have achieved remarkable reductions in environmental impact and also significant cost savings world-wide. The Climate Group’s 2005 report *Profits Up, Carbon Down* showed that 43 companies have increased their bottom line by a total of US$15 Billion whilst developing ways to reduce their greenhouse gas emissions by as much as 60%. Multinationals like IBM and Dupont have succeeded through such measures on reducing greenhouse gas emissions by over 60% since 1990 whilst saving over US$2 Billion each. This shows that significant microeconomic decoupling of profits and greenhouse gas emissions can be achieved.

Historically, the first evidence of macroeconomic decoupling of economic growth from greenhouse gas emissions came from the 1970s oil shocks where in the US, GDP rose by 27%, oil consumption fell by 17%, net oil imports fell by 50%, and net oil imports from the Persian Gulf fell by 87%. The entire world oil market shrank by one-tenth, OPEC’s global market share was slashed from 52% to 30%, and its output fell by 48%, breaking its pricing power for a decade. During 1977–85, U.S. oil intensity (barrels per dollar of real GDP) dropped by 35%. Recently Finland has also achieved relative decoupling in the transport sector.

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697 OECD Secretariat. (2002) Indicators to Measure Decoupling of Environmental Pressure and Economic Growth
As far back as 1987, the Brundtland report, *Our Common Future*, reported statistics which showed that over the period 1972-86 the relationship between energy use and economic growth in industrial countries had undergone a significant change from the broadly proportional relationship that had prevailed before. In the US, energy intensity from 1973-86 had decreased by 25%. Over the OECD nations, it decreased 20% from 1973-85. For the same period, in countries belonging to the International Energy Agency, GDP grew by nearly 32%, but energy use by only 5%.

Today the challenge of decoupling economic growth from greenhouse gas emissions is inspiring a new wave of eco-innovation in more fuel and energy efficient products which provide further opportunities to achieve greater levels of decoupling. Japanese engineers have designed a vacuum-sealed refrigerator that uses only one eighth as much electricity as those marketed a decade ago. Gas electric hybrid automobiles, getting nearly 50 miles per gallon, are twice as efficient as the average car on the road. Four major car companies claim that they will have commercially available plug in hybrids by 2010 enabling individuals to charge their cars from the solar panels of their homes.

As many companies have already learned, acting on this issue (climate change) is simply good business. Reducing our use of energy reduces costs...The debate is shifting from whether climate change is really happening to how to solve it. And when so many of the solutions make sense for us as a business, it is clear that we should take action not only as a matter of public responsibility, but because we stand to benefit.

Rupert Murdoch, Founder of News Corporation, 2007

The cost savings from energy and fuel efficiency can help individuals, business and government pay for the costs of investing in shifting energy production from fossil fuels to low carbon renewable technologies.

States like California, which have strong energy efficiency and demand management regulations and policies, have managed to decouple GDP from the typical rising electricity demand profile. Figure 5.6 shows that California through its strong policies has managed to achieve a significant reduction in electricity demand compared to the rest of the USA.

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Denmark today gets 20 percent of its electricity from wind and has plans to increase this to 50 percent. Some 60 million Europeans now get their residential electricity from wind farms. By the end of 2007, some 40 million Chinese homes will be getting their hot water from rooftop solar water heaters. Iceland now heats close to 90 percent of its homes with geothermal energy. In so doing, it has virtually eliminated the use of coal for home heating. Iceland, New Zealand, Norway and Costa Rica have committed to becoming net climate neutral - 100 per cent decoupling of economic growth from greenhouse gas emissions - over the next 30 years through energy efficiency, demand management, renewable energy, sustainable transport options and carbon offsets. The UK has achieved absolute decoupling of GDP growth (Figure 5.7), energy use and CO₂ emissions⁷⁰₃ as has Sweden⁷⁰⁴ (Figure 5.8). Over the last 30 years the UK’s GDP has doubled, but CO₂ emissions and energy use has not increased much at all. Sweden has achieved absolute decoupling of increasing GDP and greenhouse gas emissions from 1995 onwards⁷⁰⁵.

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⁷⁰³ UK Sustainability Strategy: Resource Productivity: Making More With Less Annex C: Sustainable Development in the UK:

⁷⁰⁴ Mollerston, K et al. (2005) ‘Swedish Report on Demonstrable Progress’, to the COP1/MOP 1 UNFCCC meeting

⁷⁰⁵ Ibid.
This thesis will show further in chapters 7 and 8 that this applies across other environmental issues. Consider the example of freshwater. In the US between 1980 and 1995 the amount of fresh water withdrawn per American fell by 21% and water withdrawn per dollar of real GDP fell by 38%.\textsuperscript{707} This trend is being seen worldwide in OECD countries (Figure 5.9). For instance, in 1995 world water

\textsuperscript{706} Mollerston, K et al (2005) ‘Swedish Report on Demonstrable Progress’, to the COP1/MOP 1 UNFCCC meeting.

withdrawals was only about half what planners had predicted thirty years earlier by basing their predictions on historical trends.\textsuperscript{708}

![Graph of Freshwater abstraction per unit of GDP, 1980-1998 (Source, OECD, 2001)](image)

\textbf{Figure 5.9: Freshwater abstraction per unit of GDP, 1980-1998 (Source, OECD, 2001)}\textsuperscript{709}

Effective policies and market based approaches which encourage the use of greater water efficiency and water recycling can help achieve decoupling of GDP from freshwater use. Most homes and commercial buildings can cost effectively reduce water usage by over 50 per cent through using water efficient appliances and utilising and recycling rain and grey water onto gardens. The use of fresh water on farms has halved in Israel since 1984, while the value of production has continued to climb. Farmers in India, Israel, Jordan, Spain and the US have shown that drip irrigation systems that deliver water directly to crop roots can reduce water use by 30–70 per cent and raise crop yields by 20–90 per cent.\textsuperscript{12} Rice farmers in Malaysia saw a 45 per cent increase in their water productivity through a combination of better scheduling their irrigations, shoring up canals, and sowing seeds directly in the field rather than transplanting seedlings. In the US between 1980 and 1995 the amount of fresh water withdrawn per American fell by 21 percent and water withdrawn per dollar of real GDP fell by 38 percent.\textsuperscript{710} This trend is being seen worldwide in OECD countries. For instance, in 1995 world


Clearly relative decoupling like this is not sufficient to achieve sustainability but it shows that OECD nations have made a start upon which they can build. The same is true of decoupling economic growth from waste production. In OECD counties in the mid-1990s, approximately 64% of municipal waste was sent to landfills, 18% for both incineration, and recycling.\footnote{OECD (2001) \textit{OECD Environmental Outlook}, OECD, Paris.} In 2005, only 49% of municipal waste being disposed of in landfills, 30% being recycled and 21% being incinerated or otherwise treated.\footnote{OECD (2008) \textit{OECD Environmental Data Compendium}, OECD, Paris.}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{figure510}
\caption{Decoupling of OECD GDP from OECD country municipal waste generation, 1980-2030 (Source: OECD, 2008\textsuperscript{714})}
\end{figure}

Volumes of waste produced have been relatively decoupled from economic growth. Municipal waste generation is still increasing in OECD countries, but at a slower pace since 2000. The OECD, one of the most respected advisory bodies in the world has not advised slowing economic growth to achieve further decoupling. Rather the OECD has advocated stronger waste reduction policies and better whole system approaches to sustainable design to achieve more significant decoupling in this area. As the OECD has stated:

\begin{quote}
New integrated approaches – with stronger emphasis on material efficiency, redesign and reuse of products, waste prevention, recycling of end-of-life materials and products and environmentally sound...
\end{quote}

\footnote{OECD (2008) \textit{OECD Environmental Outlook to 2030}. OECD. Available At \url{http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html}. Accessed 22.03.2008.}

\footnote{OECD (2001) \textit{OECD Environmental Outlook}, OECD, Paris.}

\footnote{OECD (2008) \textit{OECD Environmental Data Compendium}, OECD, Paris.}

management of residues – could be used to counterbalance the environmental impacts of waste throughout the entire life-cycle of materials.

Traditionally the notion of decoupling economic growth from environmental pressures has mainly focused on technical innovation but this is a narrow conception. Policy changes and eco-labelling to encourage a shift to sustainable consumption will also help achieve decoupling, as can more sustainable and local forms of agriculture like permaculture. Policy changes in natural resource management such as banning land clearing or deforestation, or ensuring fishery’s and forests are harvested at sustainable yields will achieve decoupling of economic growth from biodiversity and natural resource loss.

South Korea has had high economic growth rates for the last 30 years, and offers one of the best examples of reforestation to the rest of the world. When the Korean War ended, half a century ago, the mountainous country was largely deforested. Since around 1960 the South Korean government has invested in a major national reforestation effort utilizing village cooperatives involving overall hundreds of thousands of people to dig trenches and to create terraces for supporting trees on barren mountains. Se-Kyung Chong, researcher at the Korea Forest Research Institute, writes:

> The result was a seemingly miraculous rebirth of forests from barren land. Today forests cover 65 percent of the country, an area of roughly 6 million hectares. While driving across South Korea in November 2000, it was gratifying for me to see the luxuriant stands of trees on mountains that a generation ago were bare. We can reforest the earth!

South Korea is also showing that there is a vast unrealized potential in all countries to lessen the demands that are shrinking the earth’s forest cover. South Korea has one of the highest paper recycling rates in the world of 77 per cent. The South Korean example highlights the potential of nations to move beyond simple decoupling of economic growth from environmental pressures – doing less harm - to instead also restoring nature’s ecosystems.

The evidence outlined here in sub-section 5.3.2 suggests that market, informational, institutional, technological design failures and lack of international co-operation are major causes of unsustainable development. These results outlined above suggest that addressing such failures with effective and purposeful environmental policies, global co-operation plus technological eco-innovation does enable decoupling of economic growth from environmental pressures.

The evidence listed above has led all OECD governments to commit in 2001 to the goal of achieving decoupling of economic growth from environmental pressures as the 2nd of five objectives adopted in

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2001 by OECD Environment Ministers for the *OECD Environmental strategy for the first decade of the 21st century*.  

In Asia there is now genuine interest in how to decouple economic growth from environmental pressures and achieve “green growth”. The Chinese government has adopted a range of policies to assist the achievement of green growth and the adoption eventually of a Green GDP. The UN Economic and Social Commission for Asia and the Pacific have run a series of conferences on the prospects for green growth and have heavily promoted a decoupling framework and indicators. This Asia Pacific UN Initiative has published a number of documents on ways to reconcile economic growth and environmental sustainability. Economists such as Stern and Ekins have argued that it is theoretically and practically possible to decouple economic growth from greenhouse gas emissions and environmental pressures sufficiently to enable economic growth to continue to grow strongly. The Stern Review states:

> The world does not need to choose between averting climate change and promoting growth and development. Changes in energy technologies and in the structure of economies have created opportunities to decouple growth from greenhouse gas emissions. Indeed, ignoring climate change will eventually damage economic growth. Tackling climate change is the pro-growth strategy for the longer term, and it can be done in a way that does not cap the aspirations for growth of rich or poor countries.

Ekins explains that:

> It is clear from past experience that the relationship between the economy’s value and its physical scale is variable, and that it is possible to reduce the material intensity of GNP. This establishes the theoretical possibility of NGP growing indefinitely in a finite material world.

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5.3.3 Economic Growth and Physical Throughput Growth.

Despite this significant evidence some still believe that decoupling of economic growth and environmental pressures is not possible. Much confusion arises from a simple semantic misunderstanding. The word ‘growth’ means different things to different audiences. When businesses and governments talk about growth they generally mean economic growth: that is, (assuming the expenditure model of measuring GDP) the amount of economic value and monetary transactions as measured by the GDP. When environmentalists talk about growth they are focusing on the growth of physical throughput in the economy.

Economic growth and physical throughput growth are not the same thing. Economic growth is an acceleration in the production of economic value. The GDP of a country is defined as the total market (monetary) value of all final goods and services produced within a country in a given period of time, usually a calendar year. It is also considered the sum of economic value added at every stage of production (the intermediate stages) of all final goods and services produced within a country in a given period of time.

Physical growth of the economy means either that it spreads over more physical area, or that it has a larger material and energy throughput or that it has a larger stock of physical products, buildings or infrastructure. Environmentalists dislike physical growth because it correlates with increased environmental pressures, damage and resource depletion. As Geoff Davies writes eloquently on page 1 of his 2004 book *Economia*:

> Our economy must grow, but what exactly is it that grows? Most of us have the impression it is our collective material wealth that grows, but this is not what economists and politicians are actually talking about when they boast ‘the economy’ has grown. Rather, they are talking about the total amount of paid activity, whether that activity is useful, useless, harmful, or trying to fix the harm caused by other activity. The ‘growth’ we hear so much about is actually of the Gross Domestic Product, and the GDP is calculated basically by entering all transactions in the credit column of the ledger, regardless of whether they are income or expenses, and adding them up.

The most common approach to measuring and understanding GDP is the expenditure method:

\[ \text{GDP} = \text{consumption} + \text{investment} + (\text{government spending}) + (\text{exports} - \text{imports}), \text{ or, } \text{GDP} = C + I + G + (X-M) \]

- $C$ is private consumption in the economy. This includes most personal expenditures of households such as food, rent, medical expenses and so on but does not include new housing.

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Thus if household’s purchase energy efficient light bulbs and appliances, organic food, new bicycles or accredited green electricity from renewable energy sources, this all adds positively to GDP.

- I is defined as business investments in capital. Spending by households on new houses such as “truly sustainable homes” is also included in Investment.\textsuperscript{725} All the sorts of investments needed by business to enable a transition to a sustainable economy such as investment in eco-efficiency opportunities, distributed energy and water supply and green retrofitting of buildings all therefore count positively to a nation’s GDP.

- G is the sum of government expenditures on final goods and services. It includes salaries of public servants, purchase of weapons for the military, and any investment expenditure by a government. It includes major sustainable development infrastructure and investment projects from government such as
  
  - green retrofit of the publicly owned built environment infrastructure (defence and military, schools, housing commission flats, hospitals, government operations)
  - sustainable transport (new rail infrastructure, new fuel efficient hybrid/hydrogen bus services, new bicycle paths, and improved intelligent urban design)
  - national broadband infrastructure to enable video conferencing to dramatically reduce dependency on air transportation and trucking freight
  - structural adjustment packages and retaining of those workers and business owners currently working in unsustainable industries that cannot be made sustainable through innovation.
  - overseas development aid to assist developing countries leapfrog to sustainable futures

- X is gross exports. GDP captures the amount a country produces, including goods and services produced for overseas consumption, therefore exports are added. M is gross imports. Imports are subtracted since imported goods will be included in the terms G, I, or C, and must be deducted to avoid counting foreign supply as domestic.

A transition to an environmentally and sustainable economy can help improve balance of trade results in the following ways and thus improve GDP results.

- A transition to sustainable transport systems reduces the amount of oil and gas imports needed. Oil production has peaked already in over fifty countries. Oil imports

\textsuperscript{725} Unlike the general meaning, 'Investment' in GDP is meant very specifically as non-financial product purchases. Buying financial products is classed as 'saving', as opposed to investment. The distinction is (in theory) clear: if money is converted into goods or services, it is investment; but, if you buy a bond or a share of stock, this transfer payment is excluded from the GDP sum. Although such purchases would be called investments in normal speech, from the total-economy point of view, this is simply swapping of deeds, and not part of the real economy or the GDP formula.
over the coming decades will add significantly to import bills for most nations unless they find alternative sustainable transport approaches.

- A shift to a recycling economy which reduces waste also reduces the amount of new appliances, cars and equipment plus raw materials metals, chemicals and plastics, fertilizers, needed to be imported. A recycling economy can lead to surplus’s of materials being created enabling more exports. For instance, Australia recycles more paper and cardboard products than can be re-used in Australia. This has led to the export of paper pulp overseas. Similarly, investment in new recycling plants of PET plastic bottles has led to Australia becoming a net exporter in PET material.

- Nations which shift their subsidies and incentives to reward businesses which are innovating eco-friendly technologies will help to create the export industries of the 21st century. As I showed in Chapter 4, global markets in sustainable solutions are amongst the most rapidly growing markets for business in the world today. Thus government investment in sustainability orientated R&D to assist local firms commercialise such investment will add positively to the nations GDP.

- Another significant step, widely acknowledged to be needed to achieve sustainable development globally is for the OECD to assist the developing world through “green” technological transfer. In this case government expenditure is assisting to increase exports and thus again contributes positively to GDP.

Another way of measuring GDP is to measure the total income payable in the GDP income accounts. In this situation, one will sometimes hear of Gross Domestic Income (GDI), rather than Gross Domestic Product. This should provide the same figure as the expenditure method described above. (By definition, GDI=GDP. In practice, however, measurement errors will make the two figures slightly off when reported by national statistical agencies.)

The formula for GDP measured using the income approach, called GDP(I), is:

\[ GDP = \text{Compensation of employees} + \text{Gross operating surplus} + \text{Gross mixed income} + \text{Taxes less subsidies on production and imports} \]

- Compensation of employees (COE) measures the total remuneration to employees for work done. It includes wages and salaries, as well as employer contributions to social security and other such programs. During the transition to a fully operational ecologically sustainable economy, which would be a period of several decades at least, the economy would have a strong structural tendency to higher levels of employment. The structural tendency to favour higher employment is caused by three things: (i) the recycling of revenues from eco-taxes to reduce payroll taxes or other costs of employing labour; (ii) the greater labour intensity of new ways of doing things where the technology and the manufacturing and operational techniques are not
yet highly refined; and (iii) the pump-priming effect of investments brought forward to replace scrapped capital. Thus such a transition to sustainable development would tend to lead to overall an increase in the number of employees and their wages in each nation and globally.

- Gross operating surplus (GOS) is the surplus due to owners of incorporated businesses. Often called profits, although only a subset of total costs are subtracted from gross output to calculate GOS. Chapter 4 showed that there is now significant empirical evidence that, wisely applied, pursuing environmentally sound practices can help improve businesses bottom line both through eco-efficiency savings in the short term but also by positioning themselves for new emerging markets longer term.

- Gross mixed income (GMI) is the same measure as GOS, but for unincorporated businesses. This often includes most small businesses.

GDP is measured in economic monetary terms rather than physical throughput terms. Why have so few experts seen or understood this? A significant semantic confusion about the word “growth” goes back to the first Limits to Growth books which defined “growth” in purely physical terms. In the first two of the three Limits to Growth books, when the authors use the word ‘growth’, they (almost) entirely to refer to the growth in physical terms. These authors usually use the word ‘growth’ as growth in population, pollution and physical throughput of the economy. But many economists and business people have assumed that, at least some of the time, the word “growth” meant economic growth. This misunderstanding has led to significant confusion and has also seriously delayed resolution of important debates on ‘growth’ and ‘sustainable development’.

Semantic confusion like this has led many economists to see by the Limits to Growth books and the literature they have inspired as anti-economic growth. Limits to Growth and its sequels have succeeded like few others in uniting the economic profession against it. This may seem a harsh criticism but these authors readily acknowledge that there has been a backlash from economists about their work. In both the 20 and 30 year Limits to growth updates, the authors of these book quote Aurelio Pecci, founder of the Club of Rome, who acknowledged in 1977 the fact that:

“Some of those … accuse the [Limits to growth] report … of advocating zero growth. Clearly, such people have not understood anything, either about the Club of Rome, or about growth. The notion of zero growth is so primitive—as, for that matter, is that of infinite growth—and so imprecise, that it is conceptual nonsense to talk of it living in a dynamic society.”

The three Limits to Growth books have been published during a time where the benefits of economic growth were being seriously disputed by many academics. Such academics, inspired partly by Limits

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In that context it would have been wise for the Limits to Growth team to acknowledge this literature and clearly address it in their sequels. Given the real debate amongst academics, NGOs and environmentalists over whether economic growth is good or not, surely it is wise to differentiate between economic growth in value and growth in physical throughput and the resulting negative environmental pressure that it produces. Surely it is wise to at least include a focus on how to decouple economic growth from environmental pressure as part of one’s strategies to achieve sustainable development? If the Limits to Growth team had used the decoupling framework and clearly differentiated between different types of growth 35 years ago they would have received far less criticism and some of their readers much confusion.

To try to help advance and resolve the sustainability debates, which is the goal of this thesis, a review of the Limits to Growth books (See Appendix 5.2) with this line of argument was sent to Dennis Meadows. He commended this analysis and agreed that, ‘surely the goal is to decouple GDP growth from the growth of physical throughput growth’. (See Appendix 5.2)

AtKisson has been one of the main people in the last decade to popularise the work of the Limits to Growth team. He also has come to this conclusion writing:

“The trick is in separating out two kinds of growth: so-called 'economic growth', on the one hand, from growth in the amount of stuff we use and discard on the other [physical growth] These are two very different phenomena, and they have been falsely—and dangerously—confused for too long. Economic growth, remember, is nothing more than an increase in the flow of money. That's what we're measuring when we look at the Gross Domestic Product, which economists use as the key indicator of whether a country's economy is 'growing' or not … Because GDP growth has all too often been correlated with the destruction of nature, it's a measurement environmentalists love to hate, and with good reason. Yet

\footnote{The trick is in separating out two kinds of growth: so-called 'economic growth', on the one hand, from growth in the amount of stuff we use and discard on the other [physical growth] These are two very different phenomena, and they have been falsely—and dangerously—confused for too long. Economic growth, remember, is nothing more than an increase in the flow of money. That's what we're measuring when we look at the Gross Domestic Product, which economists use as the key indicator of whether a country's economy is 'growing' or not … Because GDP growth has all too often been correlated with the destruction of nature, it's a measurement environmentalists love to hate, and with good reason. Yet}
contrary to what many environmentalists believe, there’s nothing inherently ‘unsustainable’ about economic growth—as long as it gets decoupled from the flow of stuff. Money flow [value] can increase, even as material flow [resource use and waste] decreases. In fact, indicators suggest this decoupling is already starting to happen. Even the US economy, for example, has begun to increase GDP without a similar increase in energy consumption. The ‘materials intensity’ of many industrial economies is getting more efficient, generating more money per unit of stuff every year.”

As outlined in 5.3.2 there is sufficient evidence to show that decoupling deserves to be part of any comprehensive strategy to achieve environmental sustainability. At least one OECD country has achieved absolute decoupling of each of the OECD’s decoupling indicators. But to date, whilst there are some significant success stories, outlined in 5.3.2, in most countries, across many environmental pressures, only relative decoupling has been achieved. Thus, in most countries, decoupling rates are currently not sufficient to ensure, ad infinitum, ecological thresholds will be not be crossed and environmental sustainability achieved. Hence there are those in the survivalist tradition who, whilst recognising that in theory significant decoupling is possible, question whether in practice it can be sufficiently achieved on the scale and speed required. Also it is important to recognise that, to date, decoupling usually has required regional or global agreements and purposeful sustainability policy. Given the power of vested interests in many countries keen to maintain the status quo, it is impossible to guarantee that the required institutional and policy changes needed will be politically possible. Hence a sophisticated approach, which recognises the power of these vested interests, is needed. It is important to recognise that, if due to vested interests and other barriers to sustainability, decoupling and natural capital restoration is insufficient to prevent ecological thresholds being crossed then there will need to be stronger emergency style interventions by government and communities to prevent ecosystem collapse if environmental sustainability is to be achieved.

In Herman Daly’s steady state economy there is the understanding of the need for a capping of resource consumption if there is a risk of a sustainable threshold being reached. At this point any further growth in physical throughput is limited to improvements in resource productivity and restoration of ecosystem resilience. Daly is saying that to ensure environmental sustainability, it is vital that environmental pressures do not further pass ecological thresholds. He is providing the possibility for reducing those environmental pressures over time through resource productivity, restoration of ecosystem resilience and sustainable consumption. But he is being realistic that, if resource productivity and restoration of ecosystem resilience are not sufficient then there will need to be a cap on resource consumption until higher levels of resource productivity and restoration of natural capital is achieved.

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728 Alan AtKisson, private correspondence.
729 OECD Secretariat (2002) “Indicators to Measure Decoupling of Environmental Pressure and Economic Growth” OECD, Paris
This brings us to the next question of what is the required level of decoupling economic growth from environmental pressures and restoration of ecosystem resilience is needed to avoid crossing ecological thresholds? And what is the potential for large scale decoupling and significant restoration of the environment? The next two subsections look at what is the required level of decoupling to achieve environmental sustainability and what evidence is there that large scale decoupling could be achieved? The first part of Chapter 8 of this thesis looks at the potential and costs of protecting and conserving biodiversity and natural resources and trying to restore natural capital.

5.3.4 What is the Required Level of Decoupling to Achieve Environmental Sustainability?

In 2004, OECD nations agreed that the following conditions need to be satisfied to achieve sustainable development:

- **Regeneration:** Renewable resources shall be used efficiently and their use shall not be permitted to exceed their long-term rates of natural regeneration.

- **Substitutability:** Non-renewable resources shall be used efficiently and their use limited to levels which can be offset by substitution by renewable resources or other forms of capital.

- **Assimilation:** Releases of hazardous or polluting substances to the environment shall not exceed its assimilative capacity; concentrations shall be kept below established critical levels necessary for the protection of human health and the environment. When assimilative capacity is effectively zero (e.g. for hazardous substances that are persistent and/or bio-accumulative), a zero release of such substances is required to avoid their accumulation in the environment.

- **Avoiding Irreversibility:** Irreversible adverse effects of human activities on ecosystems and on biogeochemical and hydrological cycles shall be avoided. The natural processes capable of maintaining or restoring the integrity of ecosystems should be safeguarded from adverse impacts of human activities. The differing levels of resilience and carrying capacity of ecosystems must be considered in order to conserve their populations of threatened, endangered and critical species.

As chapter 1 outlined, in many areas current levels of pollution, greenhouse gas emissions and exploitation of non-renewable resources have already overshot ecological thresholds. There is real concern in the science community that due to uncertainties inherent in modelling complex ecosystems many have overestimated their resilience and now face the risk of unknown consequences.

Many people have assumed that humankind can pull back once humanity’s environmental pressure pushes ecosystems beyond their ecological thresholds and start to collapse, but by then it may be too late. By then the ecosystem has already passed the ecological threshold and the collapse is irreversible.

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unless the environmental pressure is reduced by at least 90 percent; a factor of ten or more to allow the ecosystem to recover. As chapter 1 and 3 explained, this phenomenon is known as “Hysteresis.”

Other factors also have to be taken into account in working out what level of decoupling is needed to achieve sustainable development. There are many factors therefore responsible for environmental impact. The most common formula, based on the original formula by Ehrlich and Commoner, used to reflect this is:

\[ \text{I} = \text{A} \times \text{P} \times \text{T} \]

where

\( \text{I} \) = Total environmental impact of humankind on the planet

\( \text{A} \) = Affluence: the number of products or services consumed per person

\( \text{T} \) = Environmental impact per unit of product/service consumed

This formula can help us to gain clarity on the magnitude of decoupling to meet society’s needs and services sustainably. It shows that it is possible to reduce environmental impact through

- stabilising population,

- reducing wasteful consumption patterns through lifestyle changes, and finally

- through reducing the environmental impact of each product/service consumed.

Even if global population stabilizes in the coming decades and wasteful western consumption patterns do not spread worldwide, \( \text{T} \), as expressed as a function of the environmental impact per unit of product or service consumed needs to be reduced by at least 10 fold, \( \text{Factor 10} \), by 2050 if economic development is to return within the ecological limits of the Earth’s ecological life support systems. This has been the finding of a leading government study, i.e. the Netherlands Government in their Inter-ministerial Sustainable Technology Development Programme. The programme is one of the first to both work out the scale and speed of change required to achieve nationwide ecological and social sustainable development over the next 50 years.

In setting a time-horizon of 50 years – two generations into the future – it was found that ten to twenty-fold eco-efficiency improvements will be needed to achieve meaningful reductions in environmental stress. It was also found that the benefits of incremental technological development could not provide such improvements.

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732 Commoner, B. (1971) ‘The Environmental Cost of Economic Growth’ in Shurr, S. (1971) Energy, Economic Growth and the Environment, John Hopkins University Press, Baltimore/London, pp 30-65. [It should be noted clearly though that the ‘T’ for technology in The Commoner Ehrlich equation uses the word technology in the broadest sense of the word. The variable \( \text{T} \) in the Commoner-Ehrlich equation refers to two forms of reductions to environmental impact namely those due to economic structure (changing the composition of output towards less damaging products, changing the production-consumption system,) and technical change (substituting less damaging factor inputs for more damaging ones such as using renewable energy, and increasing the resource productivity)]
The scale and speed of greenhouse gas reductions required to stabilise greenhouse gas levels in the atmosphere without causing dangerous climate change is a significant factor in the call for Factor 10 type reductions. As Chapter 1 and 3 showed, humanity has already exceeded the greenhouse gas levels which have existed naturally for over the last 450,000 years. The IPCC now recommends that greenhouse gas levels be reduced by 80 per cent by 2050 and higher still by 2100.

The governments of Austria, the Netherlands, and Norway have publicly committed to pursuing Factor 4, or 75 percent efficiencies. The same approach has been endorsed by the European Union as the new paradigm for sustainable development. Austria, Sweden, and OECD environment ministers have urged the adoption of Factor Ten goals, as have the World Business Council for Sustainable Development and the United Nations Environment Program (UNEP). The concept of Factor 10 (a target of reducing environmental pressures by a factor of 10) is not only common parlance for most environmental ministers in the world, but such leading corporations as Dow Europe and Mitsubishi Electric see it as a powerful strategy to gain a competitive advantage.

5.3.5 Can Humanity Achieve Decoupling of the Order of Factor 10+?

This is one of the main points of contention with the sustainability debates about “growth” and “environment”. Even if experts accept that economic growth is not the same as physical growth, and that market failure’s can be addressed with purposeful and effective policy, the scale and speed of decoupling required to achieve sustainable development seems so large as to make it impossible to achieve without at least slowing economic growth. In a World Bank debate on this topic in 2004, Herman Daly summed up the crux of this debate when he asked:

> Just how tight is this coupling between GNP [economic growth] and [physical growth] throughput? That is a debateable question. Ecological economists tend to think that the throughput GNP coupling is relatively tight. Some folks, like Amory Lovins, think that GNP could grow 10 fold or more with a constant throughput. I tend to doubt it. I believe the coupling is stronger than that, but if Amory is right that’s fine with me. Let GNP grow forever as long as throughput is constrained and held constant.734

The good news is that there is a surprising amount of evidence to suggest that Amory Lovins is right, and that this is technically possible.

An example is the Netherlands’ Government sustainable technology development project highlighted in Weaver et al. *Sustainable Technology Development*. This is one of the first national government

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programs to suggest that it is possible to decouple economic growth and environmental damage by as much as 75-95% (a factor of 4-20) over a 50-year period in many critical sectors of the economy. The results of this project\textsuperscript{735} are remarkable and are summarised in table 5.1 below.\textsuperscript{736} This has profound implications for this debate. As Weaver \textit{et al.} state:

Certainly many use growth [of global material and energy flows, population, environmental damage] to forecast disaster. But there is an alternative vision: one of a sustainable future where [economic] growth is not seen as a threat but as a driving force behind innovation.\textsuperscript{737}

\textit{Sustainable Technology Development} (STD) is one of the most important works on the environmental sustainability debate. It uses a powerful methodology for generating innovations that are driven by the need to achieve ecological sustainability. It starts with a 'no-flinching' analysis of just how big a change would be needed to achieve ecological sustainability. This was assessed for a range of issues and the result in all cases is that the changes need to range from factor 20 - factor 50 improvements. It is very rare for government-sponsored projects to begin from such a standpoint and from this recognise that nothing less than wholesale technology reinvention was required. The project went on to calculate how the necessary efficiency gains could be accomplished. As case studies, the project looked at issues of nutrition (food supply), water management, chemicals supply and alternative engine/fuel systems for cars. (Table 5.1). The STD program was a key influence leading to the development of the 4\textsuperscript{th} Dutch National Environment Plan that looks specifically at system change to achieve ecological sustainability.\textsuperscript{738} It is important to acknowledge that, to date, many aspects of the Netherlands Sustainable Technology Development Program are yet to be taken up by business in the Netherlands. Nevertheless, the study is important as it shows that Factor 10 was technically possible. This is still a major achievement and important in terms of demonstrating the technical potential for significant decoupling of economic growth from environmental pressures.

\begin{table}[h]
\centering
\begin{tabular}{|c|p{0.7\textwidth}|}
\hline
\textbf{Challenge} & \textbf{Achievements} \\
\hline
Overall & Factor 10 - 50 in 50 years from 1990 (i.e. by 2040) - depending on the issue (e.g. fossil carbon emissions factor 25 (p. 42), oil factor 40, copper factor 30, acid deposition factor 10, etc.) \\
\hline
\end{tabular}
\end{table}


\textsuperscript{736} Also see Weaver, P. Chapter 13 in Hargroves, K. Smith, M. (2005) ‘Natural Advantage of Nations: Business Opportunities, Innovation and Governance for the 21\textsuperscript{st} Century’, Earthscan Publishing.


Table of specific factor improvements needed without adjustment for population growth and poverty reduction ranging from 20-99% improvements (p. 41).

<table>
<thead>
<tr>
<th>Nutrition</th>
<th>Factor 20 (95%) over several eco-capacity criteria (p. 100).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable multifunctional land use</td>
<td>Wastage of CO2 can be cut by factor 8 (87%) and water by factor 18 (94%) (p. 116).</td>
</tr>
<tr>
<td>High technology closed-cycle horticulture</td>
<td>In general in many cases: factor 20-factor 30 (95-97%) ½ to 1/5 $ cost (p. 104).</td>
</tr>
<tr>
<td>Novel protein foods</td>
<td>Specific examples: Lupin cheese factor 9–factor 21 (89-95%) improvement on dairy cheese production (p. 112), potato-derived pasta factor 8 (87%) improvement over normal pasta (p. 112), by 2035 novel food protein could be produced more efficiently than pork today by a factor 80 (99%) or factor 60 (98%) better than meat in 2035 (p. 143).</td>
</tr>
<tr>
<td>The water handling system (doesn’t deal with water use efficiency measures)</td>
<td>Some of the most important actions need to be taken on the demand side by system users in households, businesses and industry (p. 152). Abiotic depletion can be reduced by factor 3 (67%) and aquatic eco-toxicity by factor 4 (75%), fossil energy use by ~factor 1.25 (15-20%), solid waste production by factor 1.3 (25%).</td>
</tr>
<tr>
<td>Clean domestic textiles</td>
<td>Household by 2025: factor 2.5 (60%) for energy, factor 4 (75%) for water, factor 5 (80%) for detergent (p. 194). Neighbourhood by 2025: factor 2 (50%) for energy, factor 10 (90%) for water, factor 10 (90%) for detergent (p. 195). Centralised by 2025: (no conclusions reported). More efficient technologies expected to be cheaper: less than ½ the cost possible even by 2005 (p. 197).</td>
</tr>
<tr>
<td>Chemical and industrial materials</td>
<td>Many promising technology changes identified but no quantitative results reported.</td>
</tr>
<tr>
<td><strong>Sourcing organic chemical feedstocks</strong></td>
<td>To supply sufficient biomass to source organic chemicals and materials (plastics, liquid fuels, etc), and to find effective chemical pathways from biomass to needed organics chemical materials.</td>
</tr>
<tr>
<td><strong>Biomass production on saline soils</strong></td>
<td>To find halophytic plants that produce useful biomass as feedstock for the production of chemical products so that biomass production can be expanded by utilising otherwise unavailable salinised land.</td>
</tr>
</tbody>
</table>

**Motor vehicle propulsion**

| **Hydrogen fuel / fuel cell cars** | To find alternative renewable energy ‘carrier’ fuel(s) (with high end-use conversion efficiency to offset any inefficiency of initial production (p. 249)) that can provide the basis for a significant Dutch industry to replace fossil fuel oil in the refinery sector (p. 248). | Hydrogen fuel (or hydrogen-rich liquid carriers, such as cyclohexane and methanol) was identified as possible alternatives (p. 248). A hydrogen-fuelled fuel cell car could have an increased energy efficiency of factor 1.75 (43%) compared to conventional internal combustion engine cars (p. 263). Renewable energy use with carbon removal from the fuel and carbon sequestration could enable CO2 to be removed from the atmosphere (p. 265). |


More compelling evidence that such high levels of decoupling are required is provided by the recent 2002 OECD report, *Indicators to Measure Decoupling of Environmental Pressure and Economic Growth.*

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739 OECD Secretariat (2002) ‘*Indicators to Measure Decoupling of Environmental Pressure and Economic Growth*’. OECD. Paris
country has already achieved absolute decoupling.\textsuperscript{740} This suggests that absolute decoupling is possible in all OECD countries with the necessary political will, policy reforms and technical knowledge.

But what about developing or rapidly emerging countries where there will be significant growth in energy usage and production and consumption this century? Their total energy consumption today is only half that of the rich countries—and their per capita energy consumption a mere one-tenth of what it is in the rich countries—but it is doubling every 15 years and is expected to increase fivefold over the next three decades or so in the course of economic growth. This projection assumes significant improvements in energy efficiency, without which the increase could be higher yet. Will developing countries be able to increase energy use while reducing pollution? From a technical and an economic perspective, the World Bank as early as 1992 argued yes. Anderson wrote for the World Bank that, ‘Yes, if the environmental policies required are put in place, it is possible to reduce pollution by factors of 10 or more in the most serious cases, even if energy consumption levels rise fivefold. Furthermore, developing countries would find themselves better off both economically and environmentally’.\textsuperscript{741} In the background paper for the World Bank’s \textit{World Development Report 1992}, Anderson brought together evidence to show that it is possible to reduce environmental pressures in each of the major fields of concern on the scale required of a factor of 10. This is summarised in table 5.2

\textsuperscript{740} OECD Secretariat (2002) ‘\textit{Indicators to Measure Decoupling of Environmental Pressure and Economic Growth}’. OECD. Paris.

Table 5.3 Relative Pollution (or damage) Intensities of Polluting or Low-Polluting Practices.

Low-polluting technologies are available

Relative pollution intensities of polluting and low-polluting practices for selected activities and pollutants

(polluting practice = 100)

Index per unit of output

<table>
<thead>
<tr>
<th>Source and type of emissions</th>
<th>Low-polluting technologies available</th>
<th>Polluting practice</th>
<th>Low-polluting practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Household fuels</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoke from firewood, dung</td>
<td>100</td>
<td>0.0</td>
<td>Gas, kerosene</td>
</tr>
<tr>
<td></td>
<td></td>
<td>&lt;1 to 5</td>
<td>Stoves with flues</td>
</tr>
<tr>
<td>Soil erosion (sediment yield)</td>
<td>100</td>
<td>&lt;1 to 5</td>
<td>Agroforestry; erosion-prevention practices such as contouring, mulching, use of vetiver grass, &quot;no till&quot; agriculture</td>
</tr>
<tr>
<td><strong>Electricity production</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Particulate matter</td>
<td>100</td>
<td>&lt;0.1</td>
<td>Natural gas; clean coal technologies;</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>100</td>
<td>&lt;0.1</td>
<td>scrubbers; low-sulphur fuels;</td>
</tr>
<tr>
<td>Sulphur dioxide (SO2)</td>
<td>100</td>
<td>0 to &lt;5</td>
<td>low NOx combustion methods;</td>
</tr>
<tr>
<td>Nitrogen oxides (NOx)</td>
<td>100</td>
<td>5 to 10</td>
<td>emission control catalysts</td>
</tr>
</tbody>
</table>

**Motor vehicles: diesel engines**

ibid
<table>
<thead>
<tr>
<th>Particulate matter</th>
<th>100</th>
<th>&lt;10</th>
<th>Clean fuels and particulate traps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sulphur dioxide (SO2)</td>
<td>100</td>
<td>5</td>
<td>Low-sulphur fuels</td>
</tr>
<tr>
<td><strong>Motor vehicles: gasoline engines</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td>100</td>
<td>0</td>
<td>Unleaded and reformulated fuels; catalytic converters</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>100</td>
<td>5</td>
<td>Unleaded and reformulated fuels; catalytic converters</td>
</tr>
<tr>
<td>Nitrogen oxides (NOx)</td>
<td>100</td>
<td>20</td>
<td>Unleaded and reformulated fuels; catalytic converters</td>
</tr>
<tr>
<td>Volatile organic compounds</td>
<td>100</td>
<td>5</td>
<td>Unleaded and reformulated fuels; catalytic converters</td>
</tr>
<tr>
<td><strong>All Fossil Fuels for electricity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbon dioxide (CO2)</td>
<td>100</td>
<td>&lt;01</td>
<td>Renewable energy sources</td>
</tr>
<tr>
<td><strong>Other Areas of Concern</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Marine Pollution</td>
<td>100</td>
<td>&lt;10</td>
<td></td>
</tr>
<tr>
<td>Surface Water Pollution</td>
<td>100</td>
<td>negligible</td>
<td>Sewerage Works, Effluent Control Technologies</td>
</tr>
<tr>
<td>Soil Erosion</td>
<td>100</td>
<td>negligible</td>
<td>Agro-Forestry, soil erosion prevention practices.</td>
</tr>
<tr>
<td>Forestry</td>
<td>100</td>
<td>negligible</td>
<td>Sustainable Practises</td>
</tr>
<tr>
<td>Industrial Effluents and Wastes</td>
<td>100</td>
<td>small</td>
<td>Effluent control technologies: waste reduction or prevention.</td>
</tr>
</tbody>
</table>

Sources: Anderson (1992)\(^{743}\)

There are numerous other studies that suggest a transition that achieves this level of decoupling is possible while allowing economic growth to continue.

In 1973, Lecomber argued that the limits to eternal (economic) growth can be significantly delayed if it is possible to shift away from the limiting resource or pollutant at an equal or greater rate than the rate of (economic) growth.\(^{744}\) Lecomber identified the three key variables that can reduce depletion or pollution: changes in composition or output; substitution between factor inputs; and technical progress (more efficient use of the same input). Limits to the infinite (economic) growth need not in principle

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\(^{743}\) Ibid.

come from non-renewable resources running out, as human inventiveness has already developed renewable replacements and substitutes that dramatically reduce pollution as well.

Lecomber was one of a series of eminent academics, that included Cole et al.\textsuperscript{745} and Nordhaus\textsuperscript{746}, who critiqued the \textit{Limits to Growth} modelling in the 1970s arguing that the assumptions made about technological innovation and efficiency improvements were too pessimistic. They argued that the modelling done at the time by the \textit{Limits to Growth} team did not consider a wide enough range of assumptions about the rate with which economies could become more resource efficient. Specifically, they felt further investigation was needed using the \textit{Limits to growth} team’s model to more fully explore the potential for innovation, recycling, pollution controls, substitution of scarce resources with less scarce resources etc., to assist humankind to stay within the limits of sustainability.

The \textit{Limits to Growth} team generously gave these academics their model and when run with these new assumptions this modelling showed that it was possible for humanity to stay within the ecological limits of the planet. These new modelling efforts were done without the tight restrictions on population or capital growth that the \textit{Limits to Growth} team had used.

While these academics have a point, it is minor and is not significantly different from the message or the modelling described in chapter 5 of the original \textit{Limits to Growth}, entitled ‘The state of global equilibrium’. In that chapter the original team also modelled scenarios where a sustainable society could be achieved. This final chapter of \textit{Limits to Growth} in 1972 describes how humanity could create a truly sustainable society and live within the ecological and finite resource limits. It is important to emphasise this fact: namely, the authors do describe a scenario where humanity achieves ecological and social sustainability. As the title of both chapter 7, ‘Transition to a sustainable system’ of the 1992 update, \textit{Beyond the Limits} and the 2005 \textit{Limits to Growth – the Thirty Year Update} suggests, the \textit{Limits to Growth} authors were more optimistic than assumed.

Similarly, in the 1992 and 2005 updates the authors highlight the ozone case study as a prime example of humanity’s capacity to innovate new technologies to avoid catastrophic overshoot. They do believe that humanity can achieve a truly sustainable society and outline how. They emphasise the fact that trend is not destiny. In all these chapters and scenario’s the \textit{Limits to growth} team show an appreciation of the role technological innovation, recycling, renewable energy and efficient use of resources will play in assisting humankind to stay within the ecological limits of the planet. As the Meadows wrote in the 1992 update to \textit{Limits to Growth}, ‘The decline [of ecosystem services] is not inevitable. To avoid it, two changes are necessary. The first is a comprehensive revision of policies and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used’.


Once the evidence for both the technical, social and political ability and will to achieve significant decoupling is understood, we should not then assume that economic growth, development and progress are in themselves automatically bad. If damaging production processes are used and damaging products are produced then growth in the economy driven by those production processes and products will be bad. But if businesses, governments and citizens through their choices amplify positive steps forward it is possible over time to bring about significant changes to how society meets its needs.

It is possible that if the economy radically changes its production processes and products so that they are benign or even restorative, then growth in the economy caused by an expansion of the beneficial production process and products would be a blessing.

It is possible to design buildings\(^747\), developments, industrial processes\(^748\), agriculture\(^749\) and waste management processes to be restorative as shown in books like *Factor 4*\(^750\), *Natural Capitalism: The Next Industrial Revolution*\(^751\) and *Design for sustainability*\(^752\) so significant Factor10 plus decoupling can be achieved. This is important because overtime, greater than Factor 10 will need to be achieved if current levels of economic growth are to continue. Overtime, if the physical size of the economy and its associated current levels of pollution and environmental pressure continues to grow, then the required scale and speed of decoupling economic growth from environmental pressures will increase beyond Factor 10 to avoid crossing ecological thresholds. It is important then that we work to understand how to design systems to be benign by design and reduce their negative impact on the environment by more than even Factor 10. We consider how next.

### 5.3.6 Advanced Strategies for Decoupling – Whole System Approaches to Sustainable Design

One of the best ways to radically reduce the amount of resources needed and waste produced is to re-optimise designs to be as resource efficient as possible. Studies show that spending a little more time and money in the front end design phase of any project and development (product development, built environment, chemical or pharmaceutical development) to reduce negative environmental and social impacts saves significant time and money over the whole project. As Hawken *et al* wrote in Natural Capitalism, “by the time the design for most human artifacts is completed but before they have

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actually been built, about 80–90 percent of their life-cycle economic and ecological costs have already been made inevitable.\textsuperscript{753} Figure 5.12 shows that approximately 60 percent of lifecycle costs are determined in the concept phase of a project, and a further 20 percent are determined in the design phase of the project.

![Figure 5.11 Comparison of the Incurred Costs and Committed Costs for Each Phase of System Development.](image)

\textit{(Source: Adapted from Andersen, D.M. (2006))}\textsuperscript{754}

In addition to the direct costs associated with the project, the cost of making design changes escalates as system development progresses. Figure 5.13 shows that the cost of making design changes is lowest during the initial design phase, is 10-fold higher during the pre-production phase, and more than 80-fold higher during the production phase.


\textsuperscript{754} Ibid.
Designs such as water sanitation and sewerage infrastructure, chemical plants, buildings, cars and appliances have long design lives. The size and duration of infrastructure and building developments for instance demand that they should now be much more critically thought through for efficiency, function and environmental impact.

These facts have lead many in the design professions to call for greater effort to be made at the concept and early design phases – known as front end design. There is tremendous leverage in investing adequate human and financial resources into the earliest phases of the development process. A front ended design can lead to better-considered decisions, lower life cycle costs, and fewer late changes, through a concentration of design activity and decisions in the earliest phases, where changes cost the least. This emphasis on more front end design makes intuitive sense as shown in Figure 5.13.

In traditional design without consideration of whole system approaches and the lifecycle of a product or development, the creation of a system is focused on production, integration and testing. In a Whole System Approach to Designing systems to be sustainable, greater emphasis on the front end design creates easier, more rapid integration and testing by avoiding many of the problems normally encountered in these phases. By reducing risk early in the design process, the overall result is a saving in both time and cost, with a higher quality system design. There are now a range of empirical studies

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that support the idea that increasing the level of front end design has a positive effect on cost compliance and quality of the project."\footnote{Honour, E.C (2002) The Value of Systems Engineering, Honourcode, Inc. Available at http://www.incose.org/secoc0103/ValueSE-INCSE04.pdf. Accessed 16 July 2007.}

Whole system designers like Amory Lovins, Hunter Lovins, Ernst von Weizsäcker, Bill McDonough, John Todd, Janis Birkeland, Alan Pears, Green Chemistry have recognised the desperate need for the designers to be able to step back and analyse the whole system to ensure that the solution is as effective as possible. (See Appendix 5.1)

Through re-examining traditional processes from scratch and taking a pollution prevention approach often new more environmentally benign ways can be found to meet society’s needs with multiple benefits.

An excellent example of green chemistry is the technology developed by Argonne National Lab, a winner of the 1999 USA President’s Awards for Green Chemistry. As the USA EPA explains

>“Argonne National Laboratory (ANL) has developed a process based on selective membranes that permits low-cost synthesis of high-purity ethyl lactate and other lactate esters from carbohydrate feedstock. The process requires little energy input, is highly efficient and selective, and eliminates the large volumes of salt waste produced by conventional processes. The innovation overcomes major technical hurdles that had made current production processes for lactate esters technically and economically noncompetitive. The innovation will enable the replacement of toxic solvents widely used by industry and consumers, expand the use of renewable carbohydrate feedstocks, and reduce pollution and emissions. More than 80 percent of the applications requiring the use of more than 7.6 billion

\footnote{Ibid.}
Green chemistry is one example of a whole system approach to sustainable design.

Whole System Approaches to Sustainable Design are the most cost effective way to reduce environmental impacts significantly in new industrial plants, infrastructure, appliances, new buildings. Over the next five to thirty years most chemical industry plants, infrastructure, appliances, catering and industry equipment, and transportation vehicles will be replaced and new ones will be built and paid for globally. In addition over the next 30 years many new industry plants, infrastructure and new buildings and products will be designed, built and produced. With population likely to growth until mid century and western consumer patterns spreading to Asia many sustainability experts are calling for new designs for new buildings and products to be factor 4-10. Whole system approaches to sustainable design are the only way to achieve such large resource productivity savings. Using whole system approaches to sustainable design as the OECD states:

“It is relatively easy to identify technical and organisational changes that can achieve 75% reductions in resource use or environmental impact. So those businesses and nations that miss out on knowing how to do this will be left behind.”

In the past some engineers have failed to see these large potential energy and resource savings because they have been encouraged to only optimise parts of the system - be it a pumping system, a car or a building. Engineers have been encouraged to find eco-efficiency improvements in part of a plant, or a building but rarely encouraged to seek to re-optimise the whole system. A culture of incrementalism is rampant in the engineering culture globally. ‘Incremental product refinement’ has been traditionally undertaken by isolating one component of the technology and optimising the performance or efficiency of that component. Though this method has its merits with the traditional form of manufacturing and management of engineering solutions, it prevents engineers from achieving more significant energy and resource efficiency savings often at less cost. Over the last twenty years engineers using whole system design techniques have found that they can achieve Factor 4 – 100 (75-99 percent) efficiency improvements which profitably reduce our load on the environment. This is because in the past many engineered systems did not take into account the multiple benefits that can be achieved by considering the whole system.

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5.3.6.1 What is Whole System Design?

Whole system design is a process through which the inter-connections between sub-systems and systems are actively considered, and solutions are sought that addresses multiple problems via one and the same solution. As Amory Lovins, chief scientist of the Rocky Mountain Institute explains, most energy-using technologies are designed sub-optimally in three ways, which are so pervasive both often go unnoticed:

1. Components are optimised in isolation (thus ‘pessimising’ the systems of which they are a part)
2. Optimisation typically considers single rather than multiple benefits, and
3. The right steps should be taken at the right time and in the right sequence.\(^{759}\)

(See Appendix 5.1 for more details). A case study illustrates this approach well. Consider the case of Jan Schilham’s work on pipes and pumps for Interface Ltd made famous by its coverage in the bestselling publication Natural Capitalism.\(^{760}\) In 1997, while Interface was building a factory in Shanghai: ‘One of its industrial processes required 14 pumps. In optimising the design, the top Western specialist firm sized the pump motors to total 95 horsepower. But by applying methods learned from Singaporean efficiency expert Eng Lock Lee (and focusing on reducing waste in the form of friction), it cut the design's pumping power to only 7 horsepower - a 92 percent or 12-fold energy saving - while reducing its capital cost and improving its performance in every respect.’ He did this in two simple ways. He asked how thick should the pipes be? The friction in pipes decreases rapidly as the diameter increases. Hence he found the pipes that most engineers typically use are too thin. He then designed the plants to minimize bends in the pipes. He found that by doing this there was a 12 fold reduction in the energy required to pump the fluids through these pipes and thus reduced the size of the motor required significantly. Why does is this significant? As Amory Lovins writes,

“Pumping is the biggest use of motors, motors use 3/5 of all electricity. Saving one unit of friction in the pipe save 10 units of fuel. And, because of all the large amount of losses of electricity in its transmission from the power plant to the end use, saving one unit of energy and the end of end user for the pump/pipe system saves upwards of ten units of fuel at the power plant.”\(^{761}\)

Whole system redesigns delivering multiple benefits have been achieved in the design of air-handling, clean-room, lighting, drivepower, chiller, insulating, heat-exchanging, and other technical systems, and in buildings in a wide range of sizes, programs, and climates. Such redesigns commonly yield

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\(^{761}\) Ibid. p 121.
energy savings between 50-90 percent. Usually with reduced capital cost. Fully applying such redesign to national capital stock would reduce energy costs by anywhere from Factor 4 to 20. However, only a tiny fraction of design professionals routinely apply a whole-system approach to design. Most energy efficiency projects deal with only some elements of an energy-consuming system and do not take into account the whole system. This is the main reason why they fail to capture the full savings potential. Whole System Design is increasingly being seen as the key to achieving the most cost effective ways to reduce negative environmental impacts.

This was one of the main conclusions of the five year Australian Federal Government’s Energy Efficiency Best Practice (EEBP) program run by the Department of Industry, Tourism and Resources. This program has now become the DITR Energy Efficiency opportunities program. The team involved here has found that through a whole of systems approach they can achieve 30-60 percent energy efficiency gains across a wide range of industries such as bakeries, supermarkets, mining, breweries, wineries and dairies. The DITR Big Energy Program explicitly recommends as one of the key steps with companies, “The need for complex problems to be understood and explored from a ‘whole of system’ perspective.” The program considered a number of industry applications including motor systems that are used in almost every industry. The program found that electric motors are used to provide motive power for a vast range of end-uses, with crushing, grinding, mixing, fans, pumps, material conveying, air compressors, and refrigeration compressors, together accounting for 81 percent of industrial motive power. The program pointed out that through a whole-of-system approach to optimising industrial motor driven applications, when coupled with best practice motor management, can deliver electricity savings of between 30-60 percent.

5.3.6.2 Whole System Design for Sustainability

Improving efficiency and the whole system design is a good start. But in the 21st century whole system design needs to go further. Whole system design needs to design for sustainability. Whole system

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762 This program has now become the Department of Resources, Energy and Tourism’s Energy Efficiency Opportunities Program


design in the 21st century needs to seek to be restorative of the planet rather than destructive. In the context of the loss of natural capital and loss of resilience of many of the world’s ecosystems development must be redesigned to not simply harm the environment less but rather truly be restorative of natural and social capital. This involves the complete reversal of the negative impacts of existing patterns of land use and development, improving human and environmental health, and increasing natural capital (i.e. increase renewable resources, biodiversity, ecosystem services and natural habitat). To achieve sustainability we must transform our design and construction processes well beyond what many today see as ‘best practice’, which merely aims to reduce adverse impacts relative to conventional development. What are currently regarded as ‘ecological’ design goals, concepts, methods and tools are not adequately geared toward the systems design thinking and creativity required to achieve this challenge. An entirely new form of design for development is required of which whole system design provides many of the keys to achieving

"To use an analogy, in the health care fields we have moved (conceptually) from (a) alleviating symptoms, to (b) curing illness, to (c) preventing disease, to (d) improving health. Development control is still largely at the first stage - mitigating impacts (i.e. alleviating symptoms). Restorative whole system design for sustainability approaches instead seek to reverses impacts, eliminate externalities and increase natural capital by supporting the biophysical functions provided for by nature to restore the health of the soil, air, water, biota and ecosystems."  

Whole system design for sustainability is not simply about reducing harm but about restoring the environment. It is also about not just ensuring that future generations can meet their needs but they have even more choices than the current generation in how they meet those needs. One of the leading proponents of whole system design for sustainability, Bill McDonough tells the following story to illustrate the benefits of a restorative perspective to whole system design. This case study is set out in full to give a sense of the potential of whole system design. McDonough tells the following story as an example

“In 1993, we helped to conceive and create a compostable upholstery fabric, a biological nutrient. We were initially asked by Design Tex to create an aesthetically unique fabric that was also ecologically intelligent, although the client did not quite know at that point what this would (tangibly) mean. The challenge helped to clarify, both for us and for the company we were working with, the difference between superficial responses such as recycling and reduction and the more significant changes required by the Next Industrial Revolution (and whole system design). For example, when the company first sought to meet our desire for an environmentally safe fabric, it presented what it thought was a wholesome option: cotton, which is natural, combined with PET (Polyethylene Terephthalate) fibres from

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recycled beverage bottles. Since the proposed hybrid could be described with two important eco-buzzwords, ‘natural’ and ‘recycled,’ it appeared to be environmentally ideal. The materials were readily available, market-tested, durable, and cheap. But when the project team looked carefully at what the manifestations of such a hybrid might be in the long run, we discovered some disturbing facts. When a person sits in an office chair and shifts around, the fabric beneath him or her abrades; tiny particles of it are inhaled or swallowed by the user and other people nearby. PET was not designed to be inhaled. Furthermore, PET would prevent the proposed hybrid from going back into the soil safely, and the cotton would prevent it from re-entering an industrial cycle. The hybrid would still add junk to landfills, and it might also be dangerous.

The team decided to design a fabric so safe that one could literally eat it. The European textile mill chosen to produce the fabric was quite ‘clean’ environmentally, and yet it had an interesting problem: although the mill's director had been diligent about reducing levels of dangerous emissions, government regulators had recently defined the trimmings of his fabric as hazardous waste. We sought a different end for our trimmings: mulch for the local garden club. When removed from the frame after the chair’s useful life and tossed onto the ground to mingle with sun, water, and hungry micro-organisms, both the fabric and its trimmings would decompose naturally. The team decided on a mixture of safe, pesticide-free plant and animal fibres for the fabric (ramie and wool) and began working on perhaps the most difficult aspect: the finishes, dyes, and other processing chemicals. If the fabric was to go back into the soil safely, it had to be free of mutagens, carcinogens, heavy metals, endocrine disrupters, persistent toxic substances, and bio-accumulative substances. Sixty chemical companies were approached about joining the project, and all declined, uncomfortable with the idea of exposing their chemistry to the kind of scrutiny necessary. Finally one European company, Ciba-Geigy, agreed to join. With that company’s help the project team considered more than 8,000 chemicals used in the textile industry and eliminated 7,962. The fabric - in fact, an entire line of fabrics - was created using only thirty-eight chemicals. The resulting fabric has garnered gold medals and design awards and has proved to be tremendously successful in the marketplace. The non-toxic fabric, Climatex®Lifecycle™ is so safe that the fabric's trimmings can indeed be used as mulch by local garden clubs. The director of the mill told a surprising story after the fabrics were in production. When regulators came by to test the effluent, they thought their instruments were broken. After testing the influent as well, they realised that the equipment was fine – the water coming out of the factory was as clean as the water going in. The manufacturing process itself was filtering the water. The new design not only bypassed the traditional three-R responses to environmental problems but also eliminated the need for regulation."

There is now a rapidly emerging field of design for sustainability which is bringing together important eco-innovations and innovations in design to help achieve Factor 10 plus to achieve the transition to sustainable development. (See more detail in Appendix 5.1) This body of work is important because it
points the way to truly achieve environmental sustainability through going beyond factor 10 and becoming net climate neutral and designing truly restorative systems.

5.3.7 How Large is The Rebound Effect and Can it Be Addressed Through Policy Effectively?

There are some who recognise that significant eco-efficiencies or design for sustainability opportunities exist but still argue that economic growth cannot be reconciled with environmental sustainability. The reason they argue this is the problem of the rebound effect. As Chapter 2 outlined, in 1865 Jevons in his book *The Coal Question* asserted that the more efficient use of coal in engines doing mechanical work actually increased the use of coal, iron and other resources, rather than “saving” them. Jevons, in *The Coal Question*, showed that cutting the amount of coal used to produce a ton of iron by over two thirds, was followed, in Scotland, by a tenfold increase in total consumption, between the years 1830 and 1863. Fouquet and Pearson’s study of lighting came to similar conclusions. It showed that over two centuries, since 1800, lighting efficiency improvements have led to a reduction in the real cost of lighting by three thousand times and per capita use has increased by 6,500 times while GDP rise only by fifteen times.

This has become known as the rebound effect. The rebound effect is generally acknowledged as containing a number of economic responses to efficiency gains. These are as follows

1. “Direct effects. Where the consumption of a good increases due to a price reduction caused by the more efficient production methods.

2. Indirect effects.
   i. The re-spending or income effect. Where the money saved on the particular good or service due to a reduction in price is spent on other goods and services.

3. Economy wide general equilibrium effects. Where the changing prices affect the nature and balance of the production and consumption processes, and new markets for the goods are created. It includes the following specific effects:
   i. Producers may use cost savings from improvements in efficiency to increase output which result in increasing consumption of capital, labour and materials.

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770 Murray, C (2007) The Fallacy of Win-Win Outcomes in the Economy-Environment debate: Why environmental protection and restoration must come at cost –the higher the cost, the better. (In Press)

ii. Efficiency improvements will also increase the labour, capital and materials productivity which may stimulate further economic growth and subsequently increase resource use.

iii. Efficiency improvements in the use of a particular resource will decrease the price of goods which contain that resource relative to other goods, thus causing a substitution towards those goods.\textsuperscript{772}

As outlined in Chapter 4 the fact that the potential for significant eco-efficiency gains exist in the economy is an important part of the argument of why economic growth can be reconciled with sustainable development. This thesis argues that efficiency gains provide the low cost hanging fruit through which to reduce environmental pressures and thus help the economy to afford to invest in a transition to a truly sustainable economy. The literature on the rebound effect shows that such a transition will not be so simple. Rather special attention has to be given the thorough design of policy and of technologies, urban planning and NRM to minimise the rebound effect and instead maximise its opposite – positive amplification effects. We now consider how best to do this, as this is a critical part of ensuring that a transition to sustainable development is achieved and in a way that is compatible with ongoing economic growth. First we need to understand how large the different types of rebound effect tend to be.

5.3.7.1 How Big Are Direct and Indirect Rebound Effects?

‘Direct’ rebound occurs when a more efficient technology lowers the cost of the energy service (transport miles, a warm house) and thus allows it to be used for longer periods than was previously affordable. Direct rebound occurs in numerous situations. Say an individual changes all the light bulbs in the house to compact fluorescents in order to reduce their energy consumption. Because the lights are now cheaper to run\textsuperscript{773}, people will tend to use them for longer. It could be that we become less concerned about leaving lights on while we are not at home or in a room. Evidence suggests that people who adopt efficient lighting lose between 5-12\% of the potential energy saving due to increased use\textsuperscript{774}. The direct rebound effect has been studied extensively in the past two decades. Some empirical research of the direct rebound effect is summarised in Table 5.3 below, and shows variations in the scale of the effect due to variations in the elasticity of demand for each service in each study area.

\textsuperscript{772}Murray, C (2007) The Fallacy of Win-Win Outcomes in the Economy-Environment debate: Why environmental protection and restoration must come at cost–the higher the cost, the better. (In Press)

\textsuperscript{773} About 60\% over the bulbs lifetime, with discounting of future savings.

Table 5.3: Summary of Empirical Evidence for Direct Rebound Effects in the US Residential Sector (Source: Greening et al\textsuperscript{775})

<table>
<thead>
<tr>
<th>Device</th>
<th>Potential Size of Rebound</th>
<th>Number of studies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>10-30%</td>
<td>26</td>
</tr>
<tr>
<td>Space Cooling</td>
<td>0-50%</td>
<td>9</td>
</tr>
<tr>
<td>Water Heating</td>
<td>&lt;10-40%</td>
<td>5</td>
</tr>
<tr>
<td>Residential Lighting</td>
<td>5-12%</td>
<td>4</td>
</tr>
<tr>
<td>Appliances</td>
<td>0%</td>
<td>2</td>
</tr>
<tr>
<td>Automotive Transport</td>
<td>10-30%</td>
<td>22</td>
</tr>
</tbody>
</table>

‘Indirect’ rebound is an economic rebound. In this case what happens is that the money saved for instance from saving energy (after the cost of the measure has been repaid), flows through the economy, which may lead to additional energy use. Monetary savings from the ‘direct’ effect allows a greater range of consumption activities for example a second car, a plasma TV, more energy using appliances at home, or a domestic or overseas airline trip. There is evidence showing that many households to not use monetary savings from energy efficiency initiatives to then significantly reduce their carbon and ecological footprints. Surveys have shown that in the past a radical disconnection between the level of environmental concern, and the consumption patterns of households\textsuperscript{776}. This can be due to a range of factors. Firstly, it is suggested that this is due to competing social norms, where the social pressure to conform to the norm of a pattern of work and consumption outweighs the individual desire to reduce environmental impact. Secondly, it may also reflect issues of time and convenience. Working couples with children often operate in “time poor” environments. When people have little spare personal time to research upcoming purchases, it is often easier simply to purchase something that is “conveniently available” even though it may not be the best environmentally available product in that market. Thirdly, it may reflect the lack of information available to the public to inform them of the sustainability performance of products in the marketplace. Fourth, it also reflects that much of the current global economy and goods and services, that we purchase, are intrinsically unsustainable. Hence anything that saves people and business money and enables them to purchase more will lead to purchasing new products and services that are intrinsically unsustainable. Studies have shown that most energy consumed by a household is embodied in the goods and services we consume, sometimes accounting for up to 75% of total energy use\textsuperscript{777}. This is further evidence to

\textsuperscript{775} Ibid.
support one of the main themes of this thesis, namely that a broad integrated approach to sustainable development is needed to transform the whole economy and not just parts of the economy.

5.3.7.2 The Khazzoom-Brookes Postulate and Jevon’s Paradox – the economy wide negative rebound effect

Combinations of direct and indirect rebound effects can occur multiple times throughout the economy leading to an overall economy wide rebound effect. George Monbiot explains this economy wide rebound effect in *Heat: How to Stop the Planet Burning* as follows,

“(Greater efficiency of processes, products and services has) two effects. The first is that money you would otherwise have spent on energy is released to spend on something else. The second is that as processes, which use a lot of energy, become more efficient, they look more financially attractive than they were before. So when you are deciding what to spend your extra money on, you will invest in more energy-intensive processes than you would otherwise have done. The extraordinary result is that, in a free market, energy efficiency could increase energy use.”

This is called the Khazzoom-Brookes Postulate named after two economists – Daniel Khazzoom and Len Brookes who formed their theory in 1979 and 1980. But this economy wide effect was first noticed in 1865 by 19th Century English economist William Stanley Jevons in his book *The Coal Question*. Jevons asserted that the more efficient use of coal in engines doing mechanical work actually increased the use of coal, iron and other resources, rather than “saving” them. Jevons, in *The Coal Question*, showed that cutting the amount of coal used to produce a ton of iron by over two thirds, was followed, in Scotland, by a tenfold increase in total consumption, between the years 1830 and 1863. This has become known as the Jevon’s Paradox. The Khazzoom-Brookes Postulate/Jevon’s Paradox is also known as the ‘Equilibrium rebound effect’ which occurs when a wide range of more efficient energy services cascade throughout the economy, stimulating what economists like to call a ‘larger cake’ where everyone possibly gets a larger slice. The ‘equilibrium’ or economy-wide rebound is also termed ‘the inter-sectoral rebound effect’ to signify its macro-economic scale. This assertion has often been the subject of scholarly review such as by Alcott in a 2005 paper in Ecological Economics and in a series of papers in the journal Energy Policy in 2000.

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782 Ibid.
It should be noted that the Khazzoom-Brookes Postulate is just that: a postulate and a contested one. Rebound ‘sceptics’ such as Schipper\textsuperscript{784} found no evidence for economy-wide rebound effects. In the year 2000 Energy Policy series of papers, a review of rebound by Greening et al\textsuperscript{785} noted the difficulty at the economy-wide scale (i.e., equilibrium rebound) due to lack of robust data and appropriate analytical tools. They noted that many economic models could not analyse the effect due to lack of appropriate theory and the ways in which the model equations are formulated. Several studies reiterate that “rebound are effects outside economic equilibrium modelling”\textsuperscript{786} and thus difficult to address within the confines of economically-based national decision making.

However, methods such as decomposition analysis\textsuperscript{787} and appropriately formulated models\textsuperscript{788} allow whole-economy rebound to be separated from positive trends due to GDP growth per se, and restraining influences such as energy efficiency. A study of the US manufacturing sector\textsuperscript{789} found that rebound was 24% “which is quite high compared to most other empirical studies of this issue related to firms”. Long run analyses of the US economy from an industrial ecology perspective by Robert Ayers\textsuperscript{790} and colleagues concluded that ‘physical rebound’ (efficiency improvements in energy and materials) was the main motor of GDP growth (and thus use of energy and materials) over the last one hundred years timespan. Another study of clean development mechanisms in India\textsuperscript{791} found that implementing aggressive end use efficiencies caused a rebound of 25%, largely negating the greenhouse rationale for the clean development approach.

Studies show that the economic multiplier\textsuperscript{792} from eco-efficiency investments can be significant. Firstly, investments in eco-efficiency – energy efficiency, water efficiency and resource efficiency, have a higher economic multiplier than general expenditure as eco-efficiency investments provide a return on investment. Secondly, eco-efficiency and recycling investments have a higher economic multiplier than general expenditure on many goods and services because they reduce demand for energy, water and virgin resources and thus delay (and even in some cases prevent) the need to spend

\begin{itemize}
\item \textsuperscript{786} Hertwich EG (2005). \textit{Consumption and the rebound effect: An industrial ecology perspective.} Journal of Industrial Ecology 9,1-2,85-98
\item \textsuperscript{787} Sun J.W,. (2001). \textit{Energy demand in the fifteen European Union countries by 2010–A forecasting model based on the decomposition approach.} Energy 26,549-560
\item \textsuperscript{788} Rood, G., et al (2003). \textit{A structure of models for future projections of environmental pressure due to consumption.} Journal of Cleaner Production 11,491-498
\item \textsuperscript{790} Ayers RU Ayers LW and Warr B (2003). \textit{Energy, power and work in the US Economy.} Energy 28,219-273
\item \textsuperscript{791} Shrestha RM and Shrestha R (2004). \textit{Economics of clean development power projects under alternative approaches for setting baseline emissions.} Energy Policy 32,1363-1374
\item \textsuperscript{792} Economic multipliers measure the increase in GDP for each dollar of government or business expenditure on different activities in the economy. The economic multiplier, also known as the multiplier effect, is a measure of how much economic activity can be generated in a community by different combinations of purchasing and investment.
\end{itemize}
billions on new energy, water supply infrastructure and new extractive industries. Businesses and governments can save 10s of billions of dollars from not needing to make these investments freeing up capital to instead be invested in more eco-efficiency initiatives, recycling plants and local renewable distributed supply options for energy and water. Thirdly, jobs are created to help business and households implement eco-efficiency savings which over time save both business and households money meaning that they have more to spend in the local economy or give to local charities. Hence more of a city’s or town’s energy, water and material dollars are being spent in a way that helps the local economy grow. Also these new local “green” jobs have a direct effect attracting more people to the city or town who contribute to that local economy.

Several local and state governments have analyzed actual and projected economic development effects of energy efficiency or alternative energy projects. Osage Municipal Utilities chose to help its customers use less energy by helping them invest in energy efficiency. In doing so, the OMU’s Demand-Side Management Program,\textsuperscript{793} saved its customers in this small rural town US$1.2 million annually, which is almost US$200 a year in energy bills per household. A study of economic multipliers in Osage, Ohio, found that a US$1.00 purchase of ordinary consumer goods in a local store generated US$1.90 of economic activity in the local economy. In comparison investments in energy efficiency generated US$2.23.\textsuperscript{794} History shows that there is no guarantee that that US$2.23 will be wisely spent to facilitate further steps towards sustainability. It could be equality spent on purchases which lead to greater pollution.

Having acknowledged that there are negative economy wide effects from energy efficiency improvements which need to be managed with effective policy, education and better information, this thesis will also seek to bring some balance to the debate on rebound effects that tends to be quite polarised. In the rebound effect debates there are a number of camps but at the extreme ends that take totally opposing positions

\begin{itemize}
\item[i)] one camp that sees rebound effects as to be so large as to make investment in any energy efficiency pointless and
\item[ii)] another camp that do not see rebound effects as having any significance at all.
\end{itemize}

This thesis argues that negative rebound effects are partly the result of market, informational and institutional and design failures which can be significantly minimised by government policies and better design and instead the savings from eco-efficiencies recycled into further sustainability investments.

\textsuperscript{793} Ibid.

Thus this thesis argues that the negative rebound effect can be significantly reduced. In the subsequent discussion, modelling by Foran\textsuperscript{795} et al shows how one particular policy mechanism can significantly reduce negative rebound effects. After the following discussion of positive amplification effects, policies are considered which will assist to reduce negative rebound effects whilst increasing positive amplification effects through recycling the savings from eco-efficiencies into investment in sustainable development.

5.3.7.3 Opportunities for Positive Amplification Effects

Whilst most of the rebound effect literature debate whether or not there are negative rebound effects and if so what can be done to reduce them, Adjunct Professor Alan Pears makes the key point that there is in principle just as much potential for money saved from energy efficient initiatives to be invested in new positive sustainable initiatives.\textsuperscript{796} Pears argues that it is just as likely that positive environmental change from investments in eco-efficiency initiatives, like energy efficiency, will lead to people in their homes and workplaces undertaking more ecologically sustainable initiatives, not less. Pears asks is it not possible that the money saved from energy efficiency could then be spent on making further investments to reduce greenhouse gas emissions through investing in solar hot water systems,

- solar PV systems,
- purchasing accredited green power,
- insulation, double glazed windows and pelmets
- reducing travel and, if necessary, use low emission transportation options
- purchasing locally grown organic goods
- investing in 3\textsuperscript{rd} party certified carbon offsetting schemes
- dual flush toilets,
- AAA shower heads
- rainwater tanks
- purchasing recycled paper and other products with reduced embodied energy.
- reducing and reusing so as to reduce items purchased in the first place.

leading to a positive amplification effect rather than a negative rebound effect. All these items listed above have require sometimes significant up front investment costs to the average citizen. Hence energy efficiency savings can help the average citizen, who may have many other important costs,

(mortgage repayments or rent, expenses on children, childcare) to be able to save money to afford the up front costs of these sustainability initiatives.

In 2006-8, since the launch of Al Gore’s *An Inconvenient Truth*, a significant shift has started with many more businesses, governments, households and individuals committing to becoming climate neutral rapidly through investing in energy efficiency, and then recycling the money, saved from that, into purchasing renewable energy and carbon offsets. UNEP has launched a global Climate Neutral network which includes four nations Norway, Iceland, New Zealand and Costa Rica and leading companies and cities which have all committed to becoming net climate neutral. The emergence of the movement to achieve climate neutrality shows how more people are realising that negative rebound effects from energy, water and materials efficiency can be turned into positive amplification effects by investing the savings from eco-efficiency gains into renewable energy and carbon offsets. To date there has been no studies of the extent to which rebound effects are being reduced within organisations and corporations that have strong commitments to becoming climate neutral.

5.3.7.4 Opportunities for Positive Economy Wide “Equilibrium” Amplification Effects from Eco-Efficiencies.

Whilst these voluntary efforts are an encouraging step still the majority of businesses and households and governments have not committed yet to become climate neutral. Hence there is still significant risks for economy wide negative rebound effects to occur from eco-efficiencies. Hence more systematic government policy changes are needed to reduce economy wide rebound effects by recycling eco-efficiency savings into sustainability investments to enable a transition to sustainable development. This is because one of the key barriers to achieving sustainable development is that significant up front investment is needed to implement the necessary changes to infrastructure, the built environment and rural economies for them to become sustainable. Just some of the significant up front investments needed to become sustainable include investments in

- de-centralised low carbon renewable energy supply
- distributed water supply and treatment infrastructure
- cleaner production approaches for industry
- recycling infrastructure
- green retrofit of the built environment

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- green retrofit of the publicly owned built environment infrastructure (defence and military, schools, housing commission flats, hospitals, government operations)
- green retrofit of all street and public lighting nationally.
- sustainable transport (new rail infrastructure, new fuel efficient hybrid/hydrogen bus services, new bicycle paths, and improved intelligent urban design)
- very fast and reliable trains between capital cities and national broadband infrastructure to enable video conferencing to dramatically reduce dependency on air transportation and trucking freight
- investment in climate change adaptation of infrastructure
- sustainable agriculture and water management
- investment in natural capital and biodiversity restoration
- structural adjustment packages and retaining of those workers and business owners currently working in unsustainable industries that cannot be made sustainable through innovation.
- overseas development aid to assist developing countries leapfrog to sustainable futures
- overseas development aid to assist climate change mitigation and adaptation.
- oversees development aid to assist in the protection of biodiversity hotspots and tropical rainforests that act as carbon banks.

to name just a few areas.

One of the significant government failures in Australia and many nations is that governments have never calculated how much this will cost but we will assume for this thesis that the up front investment cost even for a relatively small economy like Australia is likely to be significant. It is vital then that we find the best ways to reduce these up front sustainability investment costs for much needed sustainable infrastructure to enable a transition to sustainable development as fast as possible to reduce the risk of more irreversible ecosystem collapse. We also need to ensure that we minimise the long term running costs of more environmentally sustainable ways of meeting society’s needs. Greater end use energy, water and materials efficiency can reduce dramatically the size of new sustainable energy infrastructure, distributed water supply/treatment systems and recycling infrastructure. Greater end use energy, water and materials efficiency thus can help to make economically viable a transition to sustainable energy, water supply and recycling systems which have significant up front costs.

Investing in end use energy and water efficiency can have further positive rebound effects such as delaying the need to build new unsustainable energy (coal and gas fired power stations) and water supply infrastructure (more dams, desalination plants run from carbon intensive electricity) if governments institute effective policies. The Stern Review, for instance, points out that
as of 2004, California’s Building and Appliance Energy Efficiency Standards and Energy Efficiency Incentives and Education Programs had cumulatively saved more than 40,000 GWh and 12,000 MW of peak electricity, equivalent to 24 500 MW power plants.\(^\text{800}\)

Energy and water efficiency thus by delaying investment in further unsustainable infrastructure can help ensure scarce investment dollars are saved to be more wisely invested in the future into a transition to a sustainable energy, water, recycling and built environment infrastructure. This understanding should provide a clear rationale for why good government policies are needed to reduce negative rebound effects from eco-efficiency to maximise the overall positive economic, social and environmental benefits of eco-efficiencies.

5.3.7.5 Government Policies to Reduce Negative Rebound Effects and Instead Encourage Positive Rebound Effects.

Adjunct Professor Alan Pears\(^\text{801}\) argues that government policies, education and access to information can influence rebound effects and amplification effects significantly. The recently launched UK Stern Review offers a comprehensive policy package that, if implemented, would do much to reduce negative rebound effects. For example, Pears argues that governments driving aggressive mandatory energy efficiency standards of new appliances and industrial equipment with quite long payback periods diverts money towards re-investment in energy efficiency and away from other economic activity, reducing the negative rebound effect. New Zealand is exploring this way to reduce rebound and add amplification by encouraging people to invest in "cost-effective energy efficiency improvements that have very long payback periods."\(^\text{802}\) There is significant potential in Australia and most countries to implement such regulation. In Australia, the National Framework for Energy Efficiency has identified that within the Australian economy most sectors have 30 per cent energy efficiency opportunities with a 4 year pay back period and up to 70 per cent with an 8 year pay back period.


Making it mandatory for companies above a certain size to invest in energy efficiency opportunities with an 8 year or less payback period will ensure that savings from short term energy efficiency gains are pumped back into investing in 8 year or less energy efficiency opportunities. To ensure that this does not just delay and make the negative rebound even larger a portfolio policy approach is needed.

Government regulation and incentives are needed to require companies to go further than simply eco-efficiency and also invest in for instance onsite co-generation, renewable energy and other sustainability initiatives like onsite rainwater harvesting that tend to have relatively high up front costs and longer return on investment than eco-efficiency investments. Such regulation should require companies to use the money saved from investing in eco-efficiency investments then into investing in onsite co-generation, renewable energy and rainwater harvesting technologies to further reduce their environmental pressures on the planet.

However a portfolio of policy is designed, it is likely that energy and carbon taxation will be part of the solution recipes. Economists are generally agreed that an effective way of improving social welfare in the light of negative environmental externalities is to impose either a tax on damaging goods, on the material whose production process causes the externality, or the pollutant itself. The introduction of such Pigouvian taxes enable a ‘recycling’ of revenues that can be returned to the public through reductions in labour or other taxes, leaving the state fiscally neutral after implementing environmental tax reform (ETR). The primary dividend from such a reform is the reduction of environmental externalities to their internalisation via taxation. It has also been proposed that other dividends result from ‘revenue recycling’ resulting in a double dividend. The economics discipline has

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a wide coverage how to ‘recycle’ these taxes so to avoid ‘perverse’ outcomes and then provide a ‘double dividend’ which achieves environmental social and economic objectives. Governments (through a carbon tax or the money gained from selling permits in an emissions trading or carbon rationing schemes) and organisations (through their own internal operations) could reduce significantly the negative rebound effects by recycling any savings from eco-efficiencies into helping address areas where high up front costs are preventing investment in necessary sustainability infrastructure investment. As Herring argues whilst a simplistic focus on “efficiency alone” will continue to cause whole-economy rebound, policy changes such as

- “the direct subsidization for renewable energies from fossil energies (‘black’ to ‘green’ electrons),
- a focus on limiting carbon use (by physical caps, rationing and high prices/carbon taxes) and
- the removal of efficiency gains away from further economic circulation and into re-investment in natural capital improvement” can significantly reduce negative rebound effects.

(see comments list)

Schemes that cap emissions such as emissions trading schemes and rationing also offer policy mechanisms to significantly reduce negative rebound effects from eco-efficiency. Carbon trading has got off to a bad start in Europe where the EU set the emissions caps too high. This has resulted in generating vast profits for some whilst having little measurable effect on reducing greenhouse gas emissions. The Garnaut Review is currently working on the question of how an effective national emissions trading scheme can be created for Australia that is not rorted by the vested interests. Much current thinking favours well focused carbon taxes and correct institutional settings to control rebound. To date however, carbon taxes have been selectively applied mostly to industrial producers and avoid household consumption apart from petrol excise. In the Norwegian economy, a carbon tax of US$21 per tonne of carbon dioxide applied since 1991, has reduced emissions by only 1.5% compared to the base case. Other critics of the carbon tax include Monbiot who argues that the weakness of a carbon tax is that it is simply not socially equitable. Monbiot states that

“The poor would be hit much harder than the rich, as the costs took up a higher proportion of their income. And the rich would be able to carry on burning as much fuel as they could afford.”

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Two policy alternatives have been proposed to help control rebound effects – carbon rationing and creating a future fund. We consider these both next.

5.3.7.6 Carbon Rationing to Reduce Negative Rebound Effects and Encourage Positive Amplification Effects

The concept of carbon rationing was developed by Aubrey Meyer. This approach has been featured in George Monbiot’s book Heat: How to Stop the Planet Burning. Monbiot argues that it is the best way to reduce negative rebound effects and the concept has been heavily promoted by journalists like Kenneth Davidson and NGO’s like Carbon Equity in Australia. They claim that the idea is being seriously considered by the UK and Californian governments. Monbiot explains it as follows,

“Rationing begins with a decision about the amount of carbon the world can emit every year. If, for example, it is correct to say that out 7 billion tonnes of current carbon emissions must be reduced to 2.7 by 2030, and if we want to make the biggest cuts sooner rather than later, we might decide that in 2012 the world should be producing no more than 5.5 billion tonnes. We divide the figure by the number of people we will expect to find on earth in 2012, and discover how much carbon everyone would be entitled to emit: it would be around 0.8 tonnes. Every nation would then multiply that figure by the number of people it contained, and this would become its national allocation."

“This means that some countries, generally the poorest ones, would be allowed to raise their emissions: even in 2030, Ethiopia, if its population remains stable, could emit five and a half times as much carbon as it does today. But the overall effect would be an annual contraction of the global carbon emissions. as the different countries converged towards the same amount per person.”

“Once a country has its allocation, it can then decide how its emissions should be parcelled out. In theory, you would simply hand everyone his or her global share: 0.8 tonnes of carbon. But this would lead to a very complex system. Everything you bought would need both a cash price and a carbon price. So a much simpler system has been developed by Mayer Hillman and David Fleming. In their system, both companies and people would need to use their carbon accounts when buying: fuel and electricity, aeroplane, bus and rail tickets. If, for example, emissions in these sectors that people consumed directly added up to 40 per cent of a country’s emissions, then the citizens of that country would be given 40 per cent of that nations carbon budget in allocations. The remaining 60 per cent of the nations carbon budget would remain with the government to keep some for itself an auction the rest directly to companies, who purchase fuel, electricity, and transportation. The price, like any other commodity,

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would depend on the competition for the resource, which in turn would depend on its scarcity. Since the scheme includes business it means that the costs of carbon will be passed on into everyday goods. The incentives this scheme would create would mean that low carbon goods and services would be cheaper than higher carbon goods and services.

According to David Spratt of Carbon Equity,

“the effect would be rapid and effective: suddenly renewable energy would be cheaper than coal-fired power, everyone would want solar hot water and better insulated houses, the madness of excessive use of private cars would be rationalised, stores and offices would be lit by natural lighting and efficient technologies. If a new appliance or service is low carbon then it will take up less of your carbon ration and hence demand for such products and services will increase rapidly.”

5.3.7.7 Future Fund to Reduce Negative Inter-Sectoral Rebound Effects and Encourage Positive Amplification Effects.

Foran et al\(^{812}\) have suggested a future fund mechanism as another mechanism that would reduce significantly negative rebound effects. Foran et al have modelled the effects of such a policy change and its effectiveness at reducing negative rebound effects. Foran et al have created an OzEcco model to model the effect of rebounds when large and sudden innovations creating large improvements in energy efficiency are introduced into its technical control parameter. To control these rebound effects a ‘future fund’ module has been implemented into the model which serves as a ‘terminal sink’ for funds (or potential energy services) extracted from a rebounding economy. A future-fund concept has been implemented in the model and is used to control intersectoral rebound stimulated by energy efficiency ‘shocks’. This function effectively constrains energy supply and so limits fast expansion of personal consumption and economic growth. It is similar to Australia’s Reserve Bank controlling money supply, growth and inflation by periodically adjusting interest rates. ‘Future funds’ for this purpose have been operating with petrodollars in Norway for 16 years, and Australia has recently begun one to receive budget surpluses, and capital funds from the sale of Telstra.

5.3.7.8 Modeling the Rebound Effect for the Australian Economy - Simulating the Rebound Effect

Foran et al\(^{813}\) illustrate rebound creation within the physical economy through a technological shock – improving energy efficiency in the Australian services sector by 50 per cent within 10 years from 2011-2021. They found that. this energy ‘shock’ stimulates increases in GDP growth rate and the volume of carbon dioxide emissions (‘induced rebound’ in Figure 5.15 and Table 5.4), driven by economy-wide expansion and increases in per capita consumption which catalyse each other.


\(^{813}\) Ibid.
The effect on GDP measures of the energy-saving shock is substantial when the rebound is unconstrained. As the energy savings are phased in, there is an elevation of GDP growth rate by three percentage points above the base case, and this reduces to about one and one half percentage points by 2030. By 2051, the annual GDP in 2005 dollar terms has grown to 6,000 billion dollars compared to just over 2,000 billion in the base case. Across the 45 year scenario period average GDP growth rate is 4.2% compared to 2.3% in the base case while the accumulated stock of GDP is $128,000 billion compared to $75,000 billion in the base case, an increase of 70%.

**Figure 5.15.** A comparison of the base case scenario with an ‘inter-sectoral rebound’ scenario for GDP growth rates (left hand graph) and absolute GDP in 2005 dollars (right hand graph). (Source: Foran et al, (2007)\textsuperscript{814})

**Table 5.4.** A comparison of key indicators over the 45 year scenario period (2006-2051) for the ‘base case’ and ‘induced rebound’ scenarios. (Source: Foran et al, (2007)\textsuperscript{815})

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Base Case</th>
<th>Induced Rebound</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average GDP growth rate--%</td>
<td>2.2</td>
<td>4.1</td>
<td>Nearly a doubling of GDP growth rate</td>
</tr>
<tr>
<td>Accumulated stock of GDP--billion 2005 dollars</td>
<td>73,288</td>
<td>124,753</td>
<td>Accumulated stock of GDP is 70% greater than the base case</td>
</tr>
<tr>
<td>Accumulated stock of net CO2 emissions--billion tonnes</td>
<td>29.07</td>
<td>37.71</td>
<td>The increase in greenhouse emissions is 30%, about half the increase in accumulated GDP, reflecting the lower</td>
</tr>
</tbody>
</table>

\textsuperscript{814} Ibid.
\textsuperscript{815} Ibid.
Foran and colleagues then applied a test by constraining this inter-sectoral rebound effect by extracting either energy capacity or money out of the growth loop of the model. They then redirect the funds to a future-fund held outside the domestic economy where investment earnings do not feed back. This moderates immediate consumption by today’s generation so providing a ‘wealth stock’ for transfer to future generations. Foran et al writes

“The future-fund mechanism is used to approximately match the GDP growth rate of the base case. It results in a slightly lower trajectory for carbon dioxide emissions than the base case. Since the energy intensity of economic growth in the services sector is reduced, the accumulated stock of GDP grows 16% higher by 2051, while the stock of carbon dioxide emissions is 6% lower. The per capita consumption indicator is also 6% lower than the base case but the future-fund has accumulated to over $7,500 billion, or over seven times the 2006 stock of private pension or superannuation funds in Australia.”

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<th></th>
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</thead>
<tbody>
<tr>
<td>Accumulated stock of per capita consumption—GJ</td>
<td>7196</td>
<td>8962</td>
</tr>
<tr>
<td>Accumulated oil use -- PJ</td>
<td>169,754</td>
<td>250,816</td>
</tr>
<tr>
<td>Accumulated gas use -- PJ</td>
<td>128,157</td>
<td>164,724</td>
</tr>
<tr>
<td>Accumulated coal use-- PJ</td>
<td>145,000</td>
<td>166,000</td>
</tr>
<tr>
<td>Accumulated managed water use—GL and she</td>
<td>1,606,000</td>
<td>1,785,000</td>
</tr>
</tbody>
</table>

she=Sydney Harbour equivalents
Once both the energy efficiency shock and its future-fund control are implemented, approximately $200 billion 2005 dollars are invested each year. This is a quarter of GDP in the early 2000s and about 8% of base case GDP at 2051. This represents a large and continuing capital extraction from the economy and limits the GDP growth rate and the overall amount of GDP (Figure 28). Over the full scenario period to 2051, the average GDP growth rate for the constrained rebound case is 2.7% compared to 2.2% for the base case and the accumulated stock of GDP is $86,152 billion versus $73,288 billion in the base case, or 17% greater (Table 14). By 2051, the accumulated capital in the futurefund is $7,584 billion which is 15 times the current stock of superannuation funds in Australia or seven times the stock of all funds under management.

“The combined effects of the energy shock and rebound constraint reduces the energy intensity of GDP to a similar degree to the energy shock alone (ie from 6MJ/$ to 4MJ/$ by 2051 (Figure 29). There is a much larger effect on the personal consumption indicator which is reduced by about 11% at 2051, or 22% less in an aggregate sense over the full scenario timescale (Table 14). Most of the constraining effect occurs in the first decade of applying the energy shock and the rebound constraint. When it is fully implemented, personal consumption then grows at a similar rate to the base case. The added nuance of interpretation here is that the consumption indicator is a physical one ie the energy embodied in the total basket of consumption goods. Because the energy shock is causing the energy content of each constant dollar to decline, the dollar outcome can keep increasing giving a signal of increasing affluence. Implementing a less severe rebound control could give a more or less equal outcome to the base case if required. However bringing personal consumption under control, whether by reducing energy and greenhouse content per unit, reducing the total amount or both, is a central part of reducing greenhouse emissions.”

Foran et al⁸¹⁶ conclude that without rebound control, there would be little or no greenhouse advantage in altering the energy metabolism of the Australian economy.

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Figure 5.16. A comparison of gross domestic product (left hand graph) and carbon dioxide emissions (right hand graph) for the base case scenario and two rebound scenarios: ‘induced rebound’ caused by large increases in energy efficiency, and ‘constrained rebound’ where the future fund mechanism is used to control the rebound effect.

(Source, Foran et al, (2007)\textsuperscript{817})

Table 5.5 A comparison of five whole-economy indicators for the period 2006 to 2051 for an economy where the rebound effect is stimulated by efficiency improvements (induced rebound) and where that rebound is controlled by future fund mechanisms (constrained rebound). (Source, Foran et al, (2007)\textsuperscript{818})

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Base Case</th>
<th>Induced Rebound</th>
<th>Constrained Rebound</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average GDP growth rate--%</td>
<td>2.2</td>
<td>4.1</td>
<td>2.7</td>
</tr>
<tr>
<td>Accumulated stock of GDP--billion 2005 dollars</td>
<td>73,894</td>
<td>124,753</td>
<td>86,152</td>
</tr>
<tr>
<td>Accumulated stock of net CO2 emissions--billion tonnes</td>
<td>28.74</td>
<td>37.71</td>
<td>26.86</td>
</tr>
<tr>
<td>Accumulated stock energy embodied in per capita consumption--GJ</td>
<td>7,251</td>
<td>8,962</td>
<td>5,606</td>
</tr>
<tr>
<td>Future fund—accumulated stock of constant 2005 dollars-- billions</td>
<td>0</td>
<td>0</td>
<td>7,584</td>
</tr>
</tbody>
</table>

\textsuperscript{817} Ibid.  
\textsuperscript{818} Ibid.
5.3.7.9 Using the Future Fund to Constrain Rebound

The Future Fund model proposed by Foran et al is not a new concept. In 2006 Australia’s federal government launched its own future-fund\(^{819}\), to help invest the proceeds from the sale of Telstra to fund the superannuation liabilities of federal government public servants in the long term. The total initial investment was $18 billion, The goal of the Australian Government’s Future Fund is to reinvest all earnings without cash withdrawals before 2020, or until the superannuation liabilities are exceeded. The future fund concept proposed by Foran et al to constrain rebound is the same as this existing Future Fund except that Foran et al’s fund does not re-invest the sequestered funds. The chief goal of Foran et al’s Future Fund he paraphrases as “**putting off today’s consumption to achieve broader national goals, while ensuring long term resilience in the face of future uncertainties**”.

5.4 What are the Estimates of the Relative Costs of Action versus Inaction on Sustainable Development?

Finally, it is important to re-introduce the major argument of the vested interests which oppose action on sustainable development, namely that the costs of action outweigh the costs of inaction. In Chapter 3, I outlined how one of the main arguments of the vested interests working against efforts to achieve sustainable development has been that it would cost too much and harm the economy. Those arguing against serious action to achieve sustainable development have consistently argued that the costs of action outweigh the costs of relative inaction. This has been an effective argument because valuing the costs of action and inaction on sustainable development is not easy. The OECD Environmental Outlook to 2030\(^{820}\) outlines in detail a range of issues regarding the vexed topic of estimating the costs of inaction on environment protection.

Valuing the costs of inaction versus action on sustainable development for Australia and the global economy is not easy. This is why so few studies have been done anywhere in the world to calculate the costs of inaction. The *Stern Review* is one of the few studies to do so for the issue of climate change.\(^{821}\) A detailed discussion of how costs of inaction on climate change can and should be valued is beyond the scope of this thesis, and Part 2 of the *Stern Review* already provides an overview of this topic.

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\(^{820}\) OECD (2008) *OECD Environmental Outlook to 2030*. OECD. Available At [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008

The *Stern Review*, having analysed the costs of action and inaction, estimated that ‘the costs of action to the global economy would be roughly 1 percent of GDP, while the costs of inaction could be from 5-20 percent of GDP’.

The *Stern Review* describes how the cost of inaction ranges significantly from 5-20 per cent of global GDP. The 20 per cent figures is the result of the modelling taking into account additional impacts on the environmental and human health, the effects of positive greenhouse gas feedbacks and the disproportionate burden of climate change on the poor and vulnerable globally. Stern predicts that if fast and dramatic action is not taken on climate change, then the impacts of climate change could lead to an economic recession to rival the great economic recession of the 1930s, concluding:

> If we don’t act the overall costs and risks of climate change will be equivalent to losing at least 5 percent of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20 percent of GDP or more. In contrast, the costs of action – reducing greenhouse gas emissions is to avoid the worst impacts of climate change – can be limited to around 1 percent of global GDP each year. The investment that takes place in the next 10-20 years will have a profound effect on the climate in the second half of this century and the next. (Inaction now) and over the coming decades could create risks of major disruption to economic and social activity, on a scale similar to those associated with the great wars and the economic depression of the first half of the 20th century. And it will be difficult or impossible to reverse these changes.

Chapter 7 will show that action on climate change yields significant co-benefits which helps to make the economic case for action on climate change even stronger. For instance, globally 80 per cent of air pollution is produced from transportation. Thus there are significant co-benefits for nations seeking to reduce transport fuel emissions and efficiency and reduce air pollution simultaneously. Van Vuuren et al\(^\text{824}\) found that for the Kyoto Protocol, about half the costs of climate policy might be recovered from reduced air pollution control costs. Similarly, Van Harmelen et al\(^\text{825}\) found that to comply with agreed or future policies to reduce regional air pollution in Europe, mitigation costs are reduced by 50-70% for SO\(_2\) and around 50% for NOx when combined with greenhouse gas policies.

Another co-benefit from taking action to reducing greenhouse gas emissions from transport is that it will insulate economies from the likely sustained high oil prices into the future. As Chapter 1 outlined, many experts argue that, as long as there is rapid economic growth in China and India, it is likely that

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823 Ibid


the current oil prices will remain high. Since 1965 there have been five peaks of world oil price, all of which were followed by economic recessions of varying degree. The last three years of high oil prices has not led to a global recession but “The rapidly growing appetite for fossil fuels in China and India is likely to help keep oil prices high for the foreseeable future - threatening a global economic slowdown,” according to Fatih Birol, chief economist of the International Energy Agency.826

Another way that inaction on climate change will add significant costs to the global economy is through rising risks of greater intensity from natural disasters. A report827 published by the Chartered Insurance Institute (CII) in 2001 in the UK estimated that, if nothing is done to stop global warming, economic losses from extreme weather, if current trends continue, will be larger than global GDP by 2065. The World Bank828 has estimated that, for the poorest countries, the cost of natural disasters represents already more than 13% of national GDP on average. Costs of action to reduce the economic losses from natural disasters are worthwhile investments. The World Bank and the US Geological Survey have estimated that the worldwide economic losses from natural disasters in the 1990s could have been reduced by US$280 billion, if US$40 billion had been invested in disaster preparedness, mitigation and prevention strategies.829

Costs of inaction on protecting biodiversity, conserving natural resources and their ecosystem services, upon which the world economy depends, are difficult to value. This is because many of these values are externalized from the market. However, respected ecologists and economists have at least tried to calculate in economic terms what nature’s ecosystem services contribute to the global economy. The approximate value, calculated in 1997, was US$43 trillion830. The current global economy is valued at US$46.66 trillion dollars. Hence the value of the ecosystem services provided is roughly the equivalent of the world’s GDP. Most of these ecosystem services cannot be substituted with technology:

- Production of atmospheric gases
- Supporting evolutionary processes, and biodiversity
- Purification of soil, water and air
- Storage and cycling of freshwater and nutrients
- Regulation of the chemistry of the atmosphere and oceans

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• Maintenance of habitats for wildlife
• Disposal of organic wastes
• Sequestration and treatment of waste
• Pest and disease control by insects, birds, and other organisms
• Production of the variety of species required for food, fibres, pharmaceuticals and materials
• Conversion of solar energy into natural materials
• Prevention of soil erosion and sediment loss
• Alleviation of floods and managing runoff
• Protection against UV radiation
• Regulation of the local and global climate
• Development of topsoil and maintenance of soil fertility
• Production of grasslands, fertilisers and food.

The longer nations leave action on biodiversity and natural resource conservation the higher the costs of action will be. Delaying action on biodiversity and the conservation of natural resources are likely to be very high because of non-linear effects as discussed in Chapter 3. Scientists explain that ecosystems have inherent resilience and balance, but due to cumulative environmental pressures, loss of habitat, and extinction of species this resilience and balance can be lost rapidly in a non-linear fashion. Scientists explain that ecosystems have thresholds, which if passed, can lead to a rapid loss of species and resilience. Once such ecological thresholds are crossed often habitats and ecosystems cannot be restored easily or cheaply. As the OECD 2008 Environmental Outlook 2030 report states “Non-linear impacts, including the existence of ecological thresholds and irreversible changes, can have significant effects on the total costs of inaction.”

The United Nation’s 2005 Millennium Ecosystem Assessment documented several accelerating, abrupt, and potentially irreversible changes already occurring today. These include algal blooms from overuse of nitrogen fertilisers, fishery collapses, bleaching of coral reefs, desertification, increased vulnerability to natural disasters, and crop failures. In the OECD Environmental Outlook to 2030 shares these concerns stating that

While some environmental impacts are potentially “reversible” (allowing for the restoration of environmental conditions to their prior state), there are many areas in which this is not the case (once

831 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
degraded, environmental values are lost permanently). In the presence of such non-linear effects, the costs of preventing environmental degradation in the first place (mitigation) will be less than the costs of addressing the impacts of the environmental problem once it has occurred (restoration). For many types of impacts – and particularly for those involving irreversible changes – it is not possible to restore the environment to its previous state.”

Different studies have reported economic losses of 2-4% of GDP of cities and countries because of air pollution. Most of the economic costs are due to health costs. For instance the World Bank in 2007 estimated Chinese air pollution health costs at about 3.8% of GDP. Where air pollution has been reduced, the economic benefits associated with reduced impacts have far outweighed the costs of action. The USA EPA, for instance, conducted an extensive study which found that the total benefits of Clean Air Act programs saved the US economy US$22 trillion from 1970-1990. In other words, if US air pollution trends in 1970 had continued to 1990, then the measurable economic, social, health and environmental costs to the US economy would have been an extra US$22 trillion. By comparison, the actual costs of achieving the pollution reductions observed over the 20 year period was US$523 billion, a small fraction of the estimated economic costs from inaction. In 1995, the UK government calculated that total costs of damage from sulphur to be over £18 billion whilst the costs of action to be no more than £1-3 billion. When the United States converted to unleaded gasoline, it saved more than $10 for every $1 it invested thanks to reduced health costs, savings on engine maintenance, and improved fuel efficiency.

In non-OECD countries, the costs of inaction with respect to unsafe water supply and sanitation are particularly acute. At the global level, water stress is a major issue, with 1.1 billion people without access to a safe water supply and 2.6 billion people do not have access to adequate sanitation facilities. The associated health impacts are alarming: 1.7 million deaths per year, of which 90% are children under 5 years of age. Achieving the Millennium Development Goals of halving the population without access to water and sanitation by 2015 is expected to cost about US$10 billion per year. But this figure could be far outweighed by the costs of inaction if the MDG is not achieved, in terms of

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833 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
839 Ibid.
impacts on human health and economic productivity. The cost of not meeting this MDG (cost of inaction) has been estimated at some US$ 130 billion a year.\textsuperscript{841} Hence investments in water supply and sanitation have a return of as much as 13:1. This may seem large but many other studies have also found the rate of return is roughly an order of magnitude. Globally, the Whole Health Organisation (WHO) has estimated that the economic benefits of investments in meeting this target would outweigh costs by a ratio of about 8:1.\textsuperscript{842} Investment to improve water quality by effectively removing water pollutants is also economically efficient. The studies reviewed by the OECD\textsuperscript{843} show that national measures to reduce agricultural runoff and storm water management (including introducing targeted measures to reduce a variety of different pollutants such as arsenic and nitrates) result in health benefits costed to be in excess of US$100 million for large OECD economies. Recreational water quality improvements through sewage treatment in France, Portugal, the US and the UK and drinking water quality improvements in the US and show that health benefits of drinking water quality and sewage treatment often outweigh the costs of policy implementation.\textsuperscript{844}

Given the evidence presented on the costs of inaction from air and water pollution it is clear that part of the costs of inaction on sustainable development are health related costs. A recent extensive World Health Organization (WHO) study\textsuperscript{845}, involving more than 100 experts found that 24% of the global burden of disease and 23% of all deaths are attributable to environmental factors. Children are more susceptible to the impacts of environmental pollution than adults. This World Health Organisation study\textsuperscript{846} estimate that 33% of diseases among 0 to 14-year-old children can be attributable to environmental factors; this figure increases to 37% for the 0-4 age group. The study also found that the costs of - environmental health interventions - are economically competitive with more conventional curative health-sector interventions. The costs of inaction will mount up if we do not act. The OECD Environmental Outlook 2030 warns that

Without more ambitious policies, increasing pressures on the environment could cause irreversible damage within the next few decades.\textsuperscript{847}

The Chair of UNEP’s 4\textsuperscript{th} Global Environment Outlook has stated in late 2007 that


\textsuperscript{844} ibid


\textsuperscript{846} Ibid.

\textsuperscript{847} OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008.
The systematic destruction of the Earth’s natural and nature-based resources has reached a point where the economic viability of economies is being challenged—and where the bill we hand on to our children may prove impossible to pay. Conversely, the costs of action are usually an order of magnitude less than the costs of inaction. The OECD in 2008 published results of economic modeling the economics costs of action on the following policy package:

- mitigating climate change to CO\(_2\) 450 ppm equivalent by 2030, through implementing a carbon price of US$25/tonne of carbon.

- policies to bring forward the introduction and uptake of second generation biofuels, i.e. those using agricultural waste material or woody inputs developed on abandoned or marginal soils, rather than competing with agricultural land use.

- ensure clean water and sanitation to 50 per cent of people who currently do not have it. Connecting all urban dwellers with improved sanitation by 2030. For existing sewage treatment, treatment is upgraded to the next best level in terms of removal of nitrogen compounds

- achieving “maximum feasible reductions” in air pollutant emissions. For instance, reduce SO\(_x\) and NO\(_x\) air pollution levels to 31 and 37 per cent less in 2030 to a business as usual baseline (and about one-third less than 2005 levels).

The OECD modelling showed that these key environmental challenges can be addressed at a cost of just 0.5 and 2.5 per cent GDP by 2030 and 2050 respectively, equivalent to a reduction in annual GDP growth of just 0.1% of world GDP in 2030. [Italic for emphasis]

The Secretary General of the OECD in 2008 Angel Gurría stated that “If we want to avoid irreversible damage to our environment and the very high costs of policy inaction, we’d better start working right away.”

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850 Application of a price on carbon across all sectors, via a carbon tax starting at USD 25 per tonne of CO\(_2\)eq, which increases in real terms by 2.4% per year. The carbon price was phased-in by region, starting in OECD countries in 2012, Brazil, India, Russia and China in 2020 and the rest of the world in 2030.

5.4.1 Towards A Deeper Understanding of the Costs of Action on Climate Change and Sustainable Development.

In 2002, Professor Stephen Schneider, a United States representative on the Intergovernmental Panel on Climate Change, and Swedish climate expert Professor Christian Azar, a specialist in Sustainable Industrial Metabolism at Chalmers University of Technology, published a seminal paper which provided a new perspective about the relative costs and benefits of stabilising greenhouse gas emissions. This paper has underpinned the Australian Business Roundtable and CSIRO’s modelling results outlined in this submission. Thus, the Schneider and Azar paper is a critical one for all business leaders, politicians, economists and policy makers to understand to better inform debates on costs of action versus inaction not just on climate change but for sustainable development in general.

In this paper Schneider and Azar pointed out that the estimates by many economists of significant costs of purposeful action incorrectly assume that the cost will be born in the short term. Rather, if countries, business and citizens focus on investing over time, firstly in the most cost effective methods of mitigation, such as energy efficiency, and then more systemic options, the costs can be spread out over at least a number of decades, and economic growth will continue to be strong. Schneider and Azar showed that even those economic modellers who predict at worst 3.5 percent costs to GDP by, for instance, 2050 and also argue that action on climate change will cost tens of trillions of dollars (US), have not accounted for the predicted growth of the global economy of 2-3 percent a year throughout the 21st Century. This means that the global economy will have grown an order of 8-10 times in size by 2100 than it was in the year 2000, as shown in Figure 5.17 below. As Schneider and Azar explain,

Top–down models typically suggest that the cost of a 50% reduction of global CO₂ emissions from baseline by 2050 would cost some 1–4% of global GDP, and a 75–90% reduction by 2100 would cost some 3–6%. But since these studies also assume that global income grows by 2–3% per year, this abatement cost would be overtaken after a few years of income growth. Thus, the cost of ‘climate insurance’ amounts to ‘only’ a couple of years delay in achieving very impressive growth in per capita income levels. To be ten times richer (than in 2000) in 2100 AD versus 2102 AD would hardly be noticed and would likely be politically acceptable as an insurance policy against the spectre of potential ‘dangerous’ climatic changes by most risk averse people.

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853 Ibid
854 Ibid
This clarity of perspective from Schneider and Azar has been sorely needed to help progress the economics of climate change and sustainable development debates. In Australia, the previous Federal Government did not understand such realities and instead, encouraged by lobby groups, assumed that the costs of concerted action on climate change would be large and significantly damaging to the economy. The previous Australian Federal Government used the Australian Bureau of Agriculture and Resource Economics (ABARE) modelling from 1997 which concluded that Australia’s real gross national expenditure would fall by 0.49 percent by 2020 if Australia committed to a 15 percent cut in emissions below 1990 levels by 2020. This was the target being recommended by the EU at the time. Most government ministers at the time in Australia assumed that ABARE’s modelling was predicting a fall in 0.49 percent of the economic growth rate per year. Thus Australian government ministers made speeches at the time that action on climate change would severely damage the economy and lead to significant job loses. However, what ABARE was referring to was that absolute levels of real gross national expenditure would be lower by less than half a percentage point by 2025. This is an extremely small reduction by any standard. As Clive Hamilton explains in his 2008 book, *Scorcher: The Dirty Politics of Climate Change*,

A projected fall in gross national expenditure by half a per cent over a 25 year period would be swamped by many other changes in the economy. It was pointed out by economist Professor John Quiggan, then at the ANU, that if the Australian economy were to grow by an annual average of 3.5 per cent, then per

855 Ibid

capita incomes would reach double their prevailing levels around 1 January 2025. If Australia reduced its emissions, according to the estimates, the doubling of per capita incomes would have to wait until around March 2025, a delay of a mere 2 months.

Thus Schneider and Azar’s work shows there is no foundation to fears of purposeful action significantly harming economic growth and wages. While some academics may argue that it is still early days for economic modelling of these issues, already there are many studies which support such findings (See Appendix 7.1 and 7.2). As Dr Steve Hatfield Dodds, from the CSIRO, writes,\textsuperscript{857}

> There is an emerging consensus that avoiding dangerous levels of climate change will require high-income nations to reduce their greenhouse emissions footprint by 80–90% from current levels by 2050. While this is an enormous task, contrary to some views now there is a growing consensus from a range of economic modelling suggests that sensible policy options utilising the latest advances in energy efficiency and low carbon technologies can achieve reductions of this magnitude with at worst only modest negative social and economic impacts.

The same argument applies to the costs of action versus inaction on most other aspects of sustainable development where there is a significant upfront cost such as ending extreme poverty. The common perception persists that it would be economically prohibitive to end extreme poverty. Yet, as Chapter 6 will show, some economists disagree with this perception. Jeffrey Sachs for instance, in \textit{The End of Poverty}, brings together the case that it is possible and extremely affordable to end extreme world poverty by 2025 and thus help numerous countries which currently experience negative economic growth to achieve a transition to positive economic growth. He writes:

> The truth is that the cost now [of ending extreme poverty] is.. small. Most importantly, the task can be achieved within the limits that the rich world has already committed: 0.7% of the gross national product of the high-income world, a mere 7 cents out of every $10 in income. All the incessant debate about development assistance, and whether the rich are doing enough to help the poor, actually concerns less than 1% of rich-world income.

Econometric studies show that the US economy, growing at 1.9% per annum, would reach the same level of increased prosperity in May 1 of 2010 paying 0.7% of GDP rather than January 1, 2010 if it continues paying 0.15%.

Chapters 6, 7 and 8 look at the costs of action on a wide range of sustainable development goals to investigate further whether these costs are prohibitive. Chapters 6, 7 and 8 also look at ways to reduce the costs of action through learning from a sample of leading examples from around the world. There will be costs of action hence it is vital that lessons are learnt and innovations identified which help to

bring down these costs. Chapters 6, 7 and 8 should not be seen as an exhaustive review of such developments but rather as an overview of encouraging developments which suggests that further work is needed in this area. Chapter 7 and 8 also compares these costs of action where possible to estimates of the costs of inaction.

Taking the Earth Charter as a framework, Chapter 6 looks at how goals from the Earth Charter, if pursued, are likely to correlate with economic growth based on empirical and theoretical results were available. Chapter 7 and 8 look at how decoupling economic growth from environmental pressures is likely to correlate with economic growth based on available data and estimates of costs of action versus inaction. If the evidence to date suggests, like with climate change and ending extreme poverty, other sustainable development goals can be achieved with negligible negative effect on economic growth, then this will be an important result. Governments and politicians see economic growth so closely associated with ‘social goods’ such as less unemployment and business and political success. Also, as outlined in Chapter 3 and again here in Chapter 5, one of the main arguments of the vested interests has been that pursuing sustainable development would significant harm and even crash the economy. If the evidence in Chapters 6, 7 and 8 shows that it is possible to achieve environmental and social sustainability with negligible negative effect on economic growth then this is an important result to help move forward the sustainability debates and help to more effectively counter powerful vested interests.

Before proceeding with this discussion, it is important to ask whether or not achieving the highest level of economic growth possible is critical to achieving sustainable development and whether or not the GDP is the best measure of progress to a sustainable society?

5.5 Criticism of Economic Growth as a Measure of Progress and Well Being.

Economic growth is currently the primary goal of many political leaders. For instance, Tony Blair said that GDP growth would be the ‘judge and jury’ of British Labour's success. But this was never the intention of those that invented the GDP indicator by which economic growth is measured. John Maynard Keynes, John Hicks and Simon Kuznets who first developed the system of national accounting to assist nations manage their economies out of the great depression, warned against using the GDP as a measure of well-being and prosperity. Kuznets, the originator of the system of uniform accounts in the US, warned Congress in 1934, that ‘The welfare of a nation can scarcely be inferred from a measurement of national income’.

An example of why these great economists made this warning is illustrated by the Economic Report on Africa 2003. This report and other articles show that Mozambique, Rwanda and Uganda, whose

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858 ([//betterworld.earthwise.com/BWZ/9610/learn.htm](//betterworld.earthwise.com/BWZ/9610/learn.htm)).
economies grew by 12%, 9.9% and 6.2% respectively, had the highest economic growth rates in Africa at that time.

But all three economies had been ravaged by wars and, despite over a decade of peace, none had regained its pre-war level of prosperity. Growth rates must be related to baselines. All three countries depend on charity. Aid accounts for 50% of Uganda’s national government budget; in Rwanda it’s 60% and Mozambique 70%. The highly aggregated GDP measures also obscure large areas of stagnation, with growth of incomes occurring largely in their capital cities with huge regional disparities in poverty-ridden rural areas. 860

Hence, good economists understand that economic growth as measured by the GDP is an outcome and not the primary goal of development.

Most economists today have adhered to the warning made by the creators of the GDP not to mistake the GDP for a measure of national well-being or progress. 861 They use a raft of additional data to supplement the GDP to better inform judgements and predictions; data such as unemployment figures, terms of trade and so on. First year economics textbooks 862 now discuss the limitations of the GDP measure by, for instance, quoting Robert Kennedy when he said in 1968:

“The Gross National Product includes air pollution and advertising for cigarettes, and ambulances to clear our highways of carnage. It counts special locks for our doors, and jails for the people who break them. GNP includes the destruction of the redwoods and the death of Lake Superior. It grows with the production of napalm and missiles and nuclear warheads. And if GNP includes all this, there is much that it does not comprehend. It does not allow for the health of our families, the quality of their education, or the joy of their play. It is indifferent to the decency of our factories and the safety of our streets alike. It does not include the beauty of our poetry or the strength of our marriages, or the intelligence of our public debate or the integrity of our public officials ... GNP measures neither our wit nor our courage, neither our wisdom nor our learning, neither our compassion nor our devotion to our country. It measures everything, in short, except that which makes life worthwhile; and it can tell us everything about America—except whether we are proud to be Americans”. 863

It is widely recognised by most professional economists that the way societies currently measure economic growth through GDP per capita is not a good indicator of national welfare or well-being for five main reasons:

- GDP measures production of both defensive expenditures that are needed to correct or compensate for avoidable problems as well as expenditures that cause a boost in welfare. The current system counts oil spills and wars as contributors to economic growth, while child-rearing and housekeeping are deemed valueless. Many additions (e.g. volunteer activities) to or subtractions (declines in the state of the environment or the vitality of communities) from welfare are not part of the monetised economy and so do not register in the GDP figures at all.

- The same level of economic output can produce wildly different levels of well-being depending on what types of products and services are offered, how well these products match human and environmental need and how these goods and services are distributed throughout the community. For instance, whilst GDP growth has increased worldwide at an unprecedented rate since the 1940s, global inequality has also been increasing at an unprecedented rate. Studies like Wilkinson’s *The Impact of Inequality* now show empirically that regions and nations with higher inequality also have poorer health and increased violent crime and homicide.

- The weak link between life expectancy and quality of life and GDP. For example, those living in South Africa, Gambon, Brazil or Namibia may well have higher GDP per capita than the citizens of Sri Lanka, China, and Kerala in India but those living in the latter have significantly higher life expectancy.

- The sustainability of growth is not measured by GDP. Countries may achieve high GDP figures in the short term by over-exploiting natural resources. For example, while they exploited their large deposits of phosphates, the people of Nauru enjoyed one of the highest per capita incomes on earth, but since 1989, as the phosphate deposits have run out, their standard of living has declined sharply. An oil-rich state can sustain high GDPs without industrializing, but this high level will not be sustainable if the oil runs out and other industries have not been developed. High GDP figures can also be achieved over the short term by misallocating investment. Economies can appear to be growing faster during an economic bubble, such as a housing bubble or stock bubble, or where there is a low private-saving rate and higher consumption is generated. But the economies are mortgaging their

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futures for present growth. Economic growth can also be achieved at the expense of environmental degradation but will not be sustainable and can end up imposing a heavy clean-up cost. GDP does not attempt to measure or account for any of these matters.

- GDP does not tell us anything about the disparities in incomes between the rich and poor.
- Finally, GDP tells us little about the welfare of the members of a community. The connection between human well-being, happiness and economic growth as measured by GDP per capita is weak at best, especially above a certain level of affluence. Quality of life and happiness are determined by many things other than the level of physical goods and services. Clearly, well being is dependant on more than the quarterly GDP result. Studies of happiness show that the following things all enhance our well being: a good marriage; the company of friends; rewarding work; sufficient money; a good diet; physical activity; sound sleep; engaging leisure; religious or spiritual belief and practice, optimism, trust, self-respect and autonomy.

![Figure 5.18: Does money buy happiness? While buying power has more than doubled since the 1950s, the average American’s reported happiness has remained almost unchanged (Source: D. G. Myers, Happiness, 2004)](image)

The “well being” literature shows that

“Gratitude and kindness lift our spirits. Having clear goals to work towards, a sense of place and belonging, a coherent and positive view of the world, and a belief that we are part of something bigger than ourselves also fosters well-being.”

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In his seminal publication *Development as Freedom* Amartya Sen eloquently demonstrates that essential freedoms are vital to our sense of well being. Sen demonstrates that an expanding sense of personal freedoms, capabilities, responsibilities and opportunities are vital for us to feel that our lives are worthwhile and have value. Sen states that

"The idea of development is a complex one: it is not surprising that people think that the way development is defined could be improved. When the subject began in the 1940s it was primarily driven by the progress in economic growth theory that had occurred through the preceding period in the 1930s as well the 1940s. It was dominated by the basic vision that poor countries are just low-income countries, and the focus was simply on transcending the problems of underdevelopment through economic growth, increasing GNP and so on. That proved to be a not very good way of thinking about development, which has to be concerned with advancing human well-being and human freedom. Income is one of the factors that contribute to welfare and freedom, but not the only factor. The process of economic growth is a rather poor basis for judging the progress of a country; it is not, of course, irrelevant but it is only one factor among many."\(^{870}\)

An important qualifying point is that average income is better correlated with well-being in less developed countries, particularly those with average per capita GDP below US$4,000 -10,000 per annum or less\(^{871}\), a fact noted by Clive Hamilton in *Growth Fetish* where he stated that: ‘Obviously income matters a great deal for people living in poverty. There are powerful arguments for more economic growth in countries where a large proportion of the populace lives in poverty’.\(^{872}\)

So increasingly, around the world the well-being of people and society and ensuring non-declining well being to future generations is being seen by economists as their central goal. For instance, the Australian Treasury Department’s mission statement is ‘To improve the well-being of the Australian people …’ It has developed an extensive well-being framework to assist them in their stated mission. Nevertheless, across the world the great majority of governments and businesses and a great many people have such strong commitments to maximising economic growth that few governments have been able to make a genuine commitment to sustainable development.

Whilst economic growth has often increased job opportunities and per capita GDP, those same politicians are now becoming more aware that the current methods of production that have


\(^{872}\) Hamilton, C. (2004) ‘Growth Fetish’, p27. Herman Daly who has spoken at length on the negatives of economic growth nevertheless acknowledges that it is needed for developing nations. In an interview Daly was asked “What about the underdeveloped countries? Isn't it hypocritical for America to tell such nations, "Don't grow. Don't try to be like us"?” Herman Daly responded: Of course. It doesn't make sense for us to urge a steady-state economy—at least at current economic levels—on countries like Honduras or Guatemala . . . because such lands are still impoverished: [www.motherearthnews.com/library/1980_January_February/Plowboy_Interview__Herman_E__Daly__Steady_State_Economics](http://www.motherearthnews.com/library/1980_January_February/Plowboy_Interview__Herman_E__Daly__Steady_State_Economics).
underpinned industrialisation have been associated with negative externalities such as environmental
damage and resource wastage. There is also rising concern amongst politicians that GDP currently
ignores the state of any nation’s natural wealth. As Australian Senator Robert Hill stated at the
Australian, New Zealand Society of Ecological Economics:

“...but what about our nation's natural asset base? If we accept the estimate that degradation of our
natural environment costs us $2 billion a year, why does that not seem to be factored into the financial
market’s assessment of our economic performance? In fact most of the economic measures—such as
Gross Domestic Product and Balance of Payments—that governments, industry and the financial
markets use to assess our national performance, pay no attention to the state of our natural capital
base.”

Is there a better way to measure well being and genuine progress to sustainable development?

5.6 Ways of Measuring Sustainable Development and Genuine Progress.

Measurement matters, because, unless we can develop reliable methods and good indicators to
measure the sustainability process, it will be impossible for governments, businesses and communities
to know if their efforts are heading in the right direction. Measurement is also vitally important to
ensure that government and business can be held accountable for their actions and policies. The point
is not to be working endlessly towards sustainability but to achieve it. It is important, therefore, that
we have adequate measurement frameworks for nations to assess if they are achieving progress that is
truly genuine and sustainable.

Many economists supplement macroeconomic measures such as GDP by various indicators, data
sources and reports on environmental issues in assessing progress, and making predictions and
planning. The OECD report published in 2002 “Indicators to Measure Decoupling of Environmental
Pressure and Economic Growth” provides all OECD nations with a clear set of indicators to enable
any nation now to start measuring its progress to achieve decoupling of economic growth from
environmental pressures. The UN’s Human Development Index (HDI) provides at least a good start to
measure a wide variety of social indicators of progress.

The United Nations and World Bank have developed alternative macro-indicators for environmentally
adjusted and sustainable national income and products. The UN Statistical Division published a
System of National Accounts handbook in 1993 to provide a conceptual basis for the implementation
of a System for Integrated Environmental and Economic Accounting (SEEA) and environmentally
adjusted domestic product (Green GDP) that illustrate the interrelationships between the natural
environment and the economy. In addition over the last decade new measures of well being such as the

genuine progress indicator (GPI)\textsuperscript{874} and inclusive wealth framework\textsuperscript{875} which measures sustainable development have also been developed.

These new measures show that, once these negative externalities are internalised in these new measures, nations are not achieving much genuine progress. This trend has been shown now in many countries, especially since the 1970s. For instance, GPI studies have shown that this is the case for UK (Figure A6.1) for instance.

![Figure 5.19: UK GDP vs GPI from 1950-1996 (Source: The Australia Institute, 2001)](image)

This is one reason why academics\textsuperscript{876} and much of the environment movement have formed a view that economic growth (e.g. expansion in the size of the monetized economy) is a generally bad thing. This is also one reason why politicians have been traditionally reluctant to use Green GDP. Politicians are reluctant to adopt a new indicator that will show the national well being has improved less than what currently the GDP shows. In addition, if politicians believe that there are inevitably significant trade offs between seeking better economic, social and environmental outcomes then they will be reluctant

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to adopt new Green GDP type measures. If politicians assume that major trade-offs are inevitable, and thus then they will be reluctant to ever use the GPI or Inclusive Wealth Frameworks.

The good news is that this is starting to change. In response to the UN recommendations for nations to adopt a Green GDP in 1993, the Japanese Economic Planning Agency in 1995 released its first estimates of the Japanese SEEA and Green GDP covering the period 1985 to 1990. Three years later, the Agency revised its estimates and extended the period to 1970-1995. Taking these developments into consideration, UNU/IAS launched a project on Trade, Industrialisation and the Environment in 1997. The project sought to measure the environmental impacts resulting from industrialization and trade in Asia, especially China, Indonesia and Japan, within a framework that explores the interactions between the economy and the environment.

As part of its research activities, the project compiled preliminary estimates of SEEA and Green GDP for China and Indonesia, based on method employed in Japan. The results of this have been published in “Green GDP Estimates in China, Indonesia, and Japan: An Application of the UN Environmental and Economic Accounting System” edited by Takahiro Akita and Yoichi Nakamura. Whilst this may seem encouraging it is worth remembering that for instance a country like Norway has been calculating the costs of resources and environment since 1978. Resources and environmental pollution included in its calculations are mainly mineral, biological, fluid (water power), land, environmental resources and air pollution, and two water pollutants (nitrogen and phosphorous). A comprehensive statistical system has been established that includes energy, existing fishes and forests, air emissions, wastewater (mainly domestic sewage and polluted water from farming), recycling and environmental expenditure. This lays a solid foundation for a Green GDP statistical system. Also in North America, Canada has adopted a new range of indicators. This is indicative of an emerging trend around the world as more and more societies and politicians are increasingly aware of the limitations of the GDP measure and are seeking to supplement it with additional measurements.

Whist there is this emerging trend, case studies like Canada are the exception rather than the rule. In most countries still politicians are reluctant to trial, let alone take these new measures as their central measures of well being. Fundamentally the mental barrier for politicians is that they believe that there is a there are inevitably significant trade offs between seeking better economic, social and environmental outcomes? If politicians assume that major trade-offs are inevitable then they will be reluctant to ever use the GPI or Inclusive Wealth Frameworks. Hence this thesis’s focus on investigating whether or not major trade offs are inevitable? There are now a wide array of indicators which nations can use to compliment the traditional GDP measure to help monitor and measure progress to achieve decoupling and sustainable development. Given the weaknesses of the GDP

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measure, it is strongly advisable that nations do green their national accounts to provide important feedback on the effectiveness of sustainability policy and practice.

To conclude, in this previous section I have overviewed some of the literature which shows that the GDP measure is an inadequate measure of national well being and economic prosperity. Despite this, the rest of the thesis next investigates how many of the different aspects of the social and environmental sustainability agenda, as defined by the Earth Charter and other sustainability declarations, correlate with GDP because it is the established government measure of economic progress and the mostly widely accessible. The GDP measure is the main measure currently used by most governments around the world to measure economic growth. Thus it is important to investigate how different aspects of social and environmental sustainability correlate with economic growth. If it turns out that, by researching this topic, even some of the aspects of social and environmental sustainability correlate positively with economic growth, this will help provide governments with greater confidence and political will to pursue such measures given the current focus on GDP performance. It will also help to address the common argument from vested interests that social and environmental sustainability initiatives will reduce GDP and harm the economy.
Chapter 6: How Will Striving to Achieve Social Sustainability Goals Affect or Correlate with Economic Growth?

Introduction

In Chapter 5, I have discussed the importance of needing to achieve a new form of economic growth that is based on improving national and global well being whilst ensuring non-declining well being for future generations. To be sustainable, this new form of economic growth would

- decouple economic growth from negative environmental and social pressures significantly to ensure reducing environmental pressures whilst for instance poverty is reduced globally
- drive forward, rather than slow down, a transition to an ecologically and socially sustainable society
- result in a society that is safe, secure, just and has a low carbon, low waste economy with fulfilling jobs and strong communities.

I have called this new form of economic growth in Chapter 5 “sustainable economic growth” to differentiate it from the current form of economic growth. We have shown that a new form of economic growth will need new measures such as decoupling indicators to provide feedback to decision makers to assess progress to achieving ecological sustainability. But just as it will be impossible to ensure future generation’s economic prosperity if ecosystems irreversibly collapse, it will be impossible to prevent ecosystems from collapsing if little is done to end extreme poverty and population growth. Extreme poverty and inequality and high infant mortality rates are the main drivers for high population growth rates, which are a major factor in increasing environmental pressures. In 2001, humanity’s ecological footprint exceeded the global bio-capacity by 21%. Just as poverty drives population growth, rapid population growth is a factor in entrenching poor countries in the poverty trap. No country has ever raised itself out of poverty without reducing population growth rates.

“The factors believed to be the most directly important in lowering birth rates are not so much the size or wealth of the economy, but the extent to which economic improvement actually touches the lives of all families and especially the lives of women. More important predictors than GDP per capita are factors such as education and employment (especially for women), family planning, low infant mortality, and relatively egalitarian distribution of income and opportunity.”

Sri Lanka, Costa Rica, Singapore, Thailand and Malaysia have shown that when literacy, basic health care and family planning are made

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available to most families, birth rates can drop even at modest income levels. Hence integrated social sustainability investments in education, health services and family planning are needed in countries to turn around the current unsustainable trends in population growth."

One of the biggest impediments to reduce global inequality and ensure the necessary investments in health, education and family planning is corruption. Corruption is one of the biggest impediments to economic growth and social and environmental sustainability. This is shown simply by comparing Transparency International’s (TI) 2000 Corruption Perceptions Index (CPI), which ranks 90 countries, with the performance of these same countries in the Environmental Sustainability Index (ESI). The 2000 TI CPI revealed a 0.75 correlation with ranking of environmental performance.880 ‘Corruption and environmental destruction go hand in hand’, TI Chairman Prof. Dr. Peter Eigen stated. ‘The ESI underscores that the battle to preserve the world’s natural heritage can only be won if there is transparent and accountable government’, Eigen said at the World Economic Forum in Davos in 2001. A myriad of other studies and reports have found similar results.881

Also history shows that if we do not address extreme poverty and global inequity there will be no end to terrorism, conflict and war. In addition, in recent years, a quarter of the world’s armed conflicts have involved a struggle for natural resources. More than 5 million people died as a result of these conflicts in the 1990s.882 Hence many experts now acknowledge that the myriad of problems and challenges we face are intertwined and cannot be addressed in isolation. Hence investments are needed in social and institutional capital, systems of governance and democratic institutions simultaneously with efforts to achieve a decoupling of economic growth from environmental pressure.

This is one of the messages of the Earth Charter. As Professor Rockefeller has stated:

“We cannot care for people in a world with collapsing ecosystems, and we cannot care for the Earth in a world with widespread poverty, injustice, economic inequity, and violent conflict exists.”883

And elsewhere

“The Earth Charter recognizes that there will be no peace without social and economic justice. This includes the urgent need to eradicate the poverty in which 1.3 billion people live hopeless and desperate lives. A war on terrorism must include a war on global poverty if it is to have any chance of lasting success. We must also recognize that 85% of the world’s resources are in the hands of 20% of the world’s people, and the gap between the rich and the poor continues to widen. Such conditions

generate resentment and anger that make young people easy targets for religious fanatics, revolutionaries, and terrorists." 884

And finally,

“Another condition of enduring peace is democracy. Democracy gives a voice to the people and opens the door to participatory decision making. It provides a social and political environment in which women and men can secure their human rights and fundamental freedoms. Building a global culture of peace means renewing our own democratic institutions at home and supporting other peoples in their efforts to create democratic institutions... It means making more democratic the international institutions that govern world trade and international relations.” 885

The Earth Charter specifically lists a number of such social sustainability goals (See Appendix 1) These goals include

9. Eradicate poverty as an ethical, social, and environmental imperative
9c. Recognize the ignored, protect the vulnerable, serve those who suffer, and enable them to develop their capacities and to pursue their aspirations
11. Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity
14. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life
13. Strengthen democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision making, and access to justice
13e. Eliminate corruption in all public and private institutions
16. Promote a culture of tolerance, non-violence, and peace.

Achieving these goals will require significant financial investment especially from the OECD countries in overseas development aid. To date, many have assumed that the costs of such an investment, to truly address these challenges, would be too great. This has been a significant barrier to building the necessary political will for such investments to occur. So here in Chapter 6 we ask what might happen economically if the governments of the world invested in the achievement of strong social-sustainability goals such as ending extreme poverty, reducing global and national economic inequality, ensuring basic human rights (such as access to health and education), reducing corruption and enhancing democratic institutions.

885 Ibid.
In this chapter we explore the question of how does investing in a selection of the Earth Charter’s social sustainability goals correlate with traditional economic growth. Specifically Chapter 6 focuses on the correlations of investments in the following variables with traditional economic growth—eradicating poverty and addressing global inequality, access to health and education, gender equity, tolerance and diversity, social trust, employment and issues of democracy, peace and reducing corruption. It is beyond the scope of this one thesis to investigate all of the social sustainability goals within the Earth Charter in detail.

If the empirical evidence outlined in this chapter shows that investing globally to achieve social sustainability goals correlates with higher economic growth, this will also have significant political implications. If investment to achieve ambitious social sustainability goals correlates with higher economic growth rather then less, then this demonstrates that there may be causal factors. By examining these questions this chapter will, at the very least, better inform these discussions on the best way to achieve win-win economic and social results. Fundamentally this is what sustainable development is all about; namely taking the time to understand in detail the economic, social and environmental dimensions of every problem and challenge to find optimal paths forward with minimal trade offs. Finding such optimal paths that, where possible, will enhance economic growth is important, as there are aspects of social sustainability that will negatively affect economic growth such as sustainable consumption.

To conclude, since humanity’s ecological footprint has already overshot the size of planet earth, if we are to truly end extreme poverty and increase the income of billions of people significantly, then development will need to be done in an environmentally sustainable fashion to avoid ecosystems collapsing irreversibly. Chapter 5 discussed this and how it will be necessary to achieve Factor 10-20 reductions in environmental pressure per capita to enable such significant global poverty reduction to be done sustainably. After this chapter, in Chapters 7 and 8 these issues will be discussed in more detail.

Before discussing these issues in detail, it is important to note that the ordering and structure of the chapter aligns with the ladder of development as described by Professor Jeffrey Sachs in his book *The End of Poverty*. So Chapter 6 starts with extremely poor countries and overviews a range of strategies to assist them to rise up the ladder of development in an environmentally benign fashion whilst also addressing the rights of women and other important social issues in an integrated fashion. Once countries have risen out of extreme poverty and further up the ladder of development then other social issues become more important like labour standards and rights. Thus the second half of Chapter 6 then talks of social issues for countries which are further up the ladder of development and are also relevant for OECD countries.

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6.1 How Does Pursuing Social Sustainability Goals Correlate with Economic Growth?

6.1.1 Eradicate poverty as an ethical, social, and environmental imperative.

The Earth Charter states as one of its main goals “Eradicate poverty as an ethical, social, and environmental imperative.” Poverty is a major cause and effect of global environmental problems. Therefore it is pointless to try to reduce environmental harms, without a broader strategy that addresses the factors that cause world poverty. The call for sustainable development came from the realisation that economic development and issues of poverty reduction and human well-being could not be separate from environmental protection. Environmental damage in the long run harms human well-being and contributes to poverty; in turn people living in poverty contribute to pressures on remaining biomass, forests, water resources, fish stocks, farmland, and wildlife. To reduce poverty it is vital first to understand what factors cause it? We consider this next.

6.1.2 Towards a Deeper Understanding: What Factors can lead to Nations Falling into a Poverty Trap?

Five main inter-relationships are identified as domestic aspects of the poverty trap. First, domestic resources available to finance physical and human capital investment and productivity growth are low owing to generalized poverty. Second, state capacities are weak as all activities, including administration and law and order, are under-funded. Third, corporate capacities, in business, finance and support services, are weak, even though there may be a thriving informal sector. Fourth, generalized poverty engenders rapid population growth and environmental degradation. Fifth, in a situation of generalized poverty, the probability of political instability and conflict is greater. Low productivity, rapid population growth, environmental degradation, political instability and conflict, weak state capacities all serve to reinforce generalized poverty directly and indirectly. Generalized poverty in turn results in low savings and investment, and low productivity.

In addition external trade and finance relationships interact with these domestic cycles of stagnation and together cause generalized poverty to persist. Four principal inter-relating aspects of the poverty trap have been identified namely: the type of primary commodity dependence; the development of external debt to unsustainable levels the development of an aid/debt service system, and the extent of access to international markets. While inter-related, each has a cause-and-effect nexus with general poverty and low productivity, investment and savings. These factors combine to make it very hard for these countries to escape the poverty trap without foreign assistance.

Professor Jeffrey Sachs outlines a recent exposition of the poverty trap, and how to break it, in *The End of Poverty*\textsuperscript{888}. In this book he shows that the extreme poor find themselves trapped in poverty because the ratio of capital per person (GDP per capita) actually falls from generation to generation because of depreciation of what little capital they have and loss of natural capital. Whether capital is accumulated and the poverty trap is broken fundamentally depends on whether households and business are able to save some of their current income or contribute some taxes to government at a higher rate than that which capital depreciates. Capital is diminished or depreciated as a result of the passage of time, wear and tear of equipment for instance, or other diseases, or the death of skilled workers through AIDS. Also the amount of capital per person declines when the population is growing faster than capital is being accumulated. So even if there is net positive capital accumulation whether this translates into rising income/economic growth per capita depends on whether the net capital accumulation is large enough to keep up with population growth. Much faster population growth in most developing countries is offsetting comparatively faster GNP growth, causing GNP per capita growth rates in these countries to be low or even negative.

A simple economic model illustrates the point\textsuperscript{889}. Suppose that an economy requires $4 of capital for every $1 of annual production. Suppose also that the capital stock depreciates at a rate of 2 per cent per annum. For each $1 million of capital this year, about $835,000 will remain at the end of a decade. Suppose that the economy has one million poor people, each with capital of $1200. This results in an annual income of $300 per person ($1200 divided by four). The total GNP is therefore $300 million ($300 per person multiplied by one million people). The population is growing at two percent per year, so at the end of the decade there will be about 1.2 million poor people.

Assume now that this society is too poor to save any of their income since it does not even ensure that they can meet their basic needs for food, shelter and water, let alone medical or educational needs. At the end of the decade, the capital stock that they do own or lease will have depreciated. So instead of $1200 million in capital, there will only be $1000 million in capital. But also the population has grown from one million to 1.2 million so instead of $1000 in capital per person each person now only owns ~$833 per capita. Hence over a decade per capita wealth has dropped from $1200 per person to $833 per capita amongst the poor in this country. This leads to households sinking into extreme poverty.

Now suppose that due to overseas development assistance the economy begins with the same population but with capital stock that is twice as much equal to $2.4 billion. Assume that per capita income is twice as large at $600 per capita. Assume that as before households do not save anything out of incomes up to $300 and of income above $300 they now can save 20 per cent of $300 or $60 per annum.


\textsuperscript{889} Ibid, p246-250. This is a summary and adapted version of the economic model presented by Sachs in *The End of Poverty*. 
The capital stock is $2.4 billion so over a decade it will depreciate to $2.2 billion. In other words $200 million will be lost. Also population growth will mean over that decade that in fact per capita wealth (not including saved income) is reduced to $1833 per capita from $2400 per capita. But over that same decade per capita saved income is $600 or $600 million. Thus savings are just ahead overall from depreciation costs and this country no longer is experiencing negative economic growth but economic growth (albeit at a slow rate).

At this point the poverty trap is broken, a nation now achieving positive economic growth has the potential to break this trap once and for all. Economic growth can become self-sustaining through household savings and public investments supported by taxation of households and business. Hence overseas foreign aid should not be ever seen as a hand out but rather an investment that breaks the poverty trap once and for all.

When countries get their foot on the ladder of development they are then able to continue an upward climb. The problem is that currently most poverty occurs globally because nations are not even on the first rung of development. Once countries and the extremely poor can be assisted onto the first rung then virtuous cycles can be created. If people and nations are trapped below the first rung on the ladder of development as the simple economic model above shows they will simply slide into deeper and more extreme poverty due to depreciation, population growth, greater vulnerability to disease, outside shocks (such as climate change) and the pressures this puts on increasingly scarce natural resources and ecosystems. Sachs states

“Even if well-governed countries stuck in a poverty trap mobilize domestic resources to pay for the interventions, they will not be able to afford the entire cost, and the difference must be borne by the developed world.”

The results of the failure of the developed world to more effectively help poorer countries break the poverty trap is evident in the number of failed states in the world. The US Central Intelligence Agency estimates that there are at least 20 failed states currently and the World Bank estimates that there are an additional 35 fragile low-income countries under stress. A failed state is a state whose government is so ineffective that it can no longer guarantee law and order or control over the country. The most systematic ongoing effort to analyse failed states is done by the ‘Fund for Peace’ and the Carnegie Endowment for International Peace. These reviews are published annually in each July/August issue of Foreign Policy.

Table 6.1: Top Ten Failed States 2006

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FAILED STATES 2006 - TOP 10 (*designates ranking in 2005)

<table>
<thead>
<tr>
<th></th>
<th>Country</th>
<th>Rank in 2005</th>
</tr>
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<tbody>
<tr>
<td>1.</td>
<td>Sudan</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>DR Congo</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>Ivory Coast</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>Iraq</td>
<td>4</td>
</tr>
<tr>
<td>5.</td>
<td>Zimbabwe</td>
<td>15</td>
</tr>
<tr>
<td>6.</td>
<td>Chad</td>
<td>7</td>
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<tr>
<td>7.</td>
<td>Somalia</td>
<td>5</td>
</tr>
<tr>
<td>8.</td>
<td>Haiti</td>
<td>10</td>
</tr>
<tr>
<td>9.</td>
<td>Pakistan</td>
<td>34</td>
</tr>
<tr>
<td>10.</td>
<td>Afghanistan</td>
<td>11</td>
</tr>
</tbody>
</table>

Source: BBC

In reviewing the data for 2006, Fund for Peace’ and the Carnegie Endowment for International Peace noted that

“few encouraging signs emerged to suggest the world is on a path to greater peace and stability.”

In his book, Plan B, Lester Brown points out that

“Ranking on the Failed States Index is closely linked with key demographic and environmental indicators. Of the top 20 failing states, 17 have rapid rates of population growth, many of them expanding at close to three percent a year or 20-fold per century. In 5 of these 17 countries, women have an average of nearly seven children each... In all but 6 of the top 20 failing states, at least 40 percent of the population is under 15. Such a large share of young people often signals future political instability. Young men, lacking employment opportunities, often become disaffected, making them ready recruits for insurgency movements. Not surprisingly, there is also often a link between the degree of state failure and the destruction of environmental support systems. In a number of countries on the list - including Sudan, Somalia, and Haiti - deforestation, grassland deterioration, and soil erosion are widespread. The countries with fast-growing populations are also facing a steady shrinkage of both cropland and water per person. After a point, as rapid population growth, deteriorating environmental support systems, and poverty reinforce each other.”

Thus to help fragile states break out of the poverty trap and ensure they do not become failed states, an integrated and multi-faceted approach is going to be needed to address endemic poverty, rapid population growth, environmental degradation and lack of good governance and institutional capability.

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We now consider in more detail the types of investment needed and the benefits of such investment to the developing world.

6.1.3 Breaking the Poverty Trap – Stabilising Population.

Given the correlation between terrorism, conflict and war with extreme poverty and failed states eradicating poverty and stabilising population is a national security issue of great importance to the global community. If current trends continue the global population will exceed 10 billion by 2050. If current trends continue then, of this growth, 99% will take place in the developing countries, and more than 90% of the growth will be concentrated in the poorest of these developing countries.\textsuperscript{894}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{world_population_growth.png}
\end{figure}

As the Earth Charter states in its preamble, “An unprecedented rise in human population has overburdened ecological and social systems.” So, if we are serious about reducing environmental pressures to sustainable levels and eradicating extreme poverty, it will be necessary to address the factors which drive high population growth.\textsuperscript{896} Slowing population growth helps reduce poverty, and, conversely, eradicating poverty helps slow population growth.

Over 40 countries no longer have population growth. Japan, Russia, Germany, and Italy, have the lowest fertility rates and are likely to see a decline in population growth over the coming decades.


unless immigration levels are increased.\textsuperscript{897} The majority of countries have relatively stable population numbers due to the fact that their fertility rates are at replacement level or just below. This group includes China and the United States. A third group of countries, with poor levels of GDP per capita, is projected to more than double their populations by 2050.\textsuperscript{898} Even if these nations quickly move below replacement level fertility levels to 1.6 children per couple, the UN forecasts that global population will not stabilise until 2041 at 8 billion people.

A first step to slowing world population growth is investing to ensure that all women who want to plan their families should have access to the family planning and basic health services they need. Unfortunately, at present 201 million couples cannot obtain these services that they need.\textsuperscript{899} Former U.S. Agency for International Development official Joseph Speidel notes that

“if you ask anthropologists who live and work with poor people at the village level...they often say that women live in fear of their next pregnancy. They just do not want to get pregnant.\textsuperscript{900}"

The benefits of addressing this issue are enormous and the costs are minimal.\textsuperscript{901} Also, countries that want to help couples reduce family size can do so quickly. Janet Larsen from the Earth Policy Institute has shown\textsuperscript{902} that in just one decade Iran dropped its near-record population growth rate to one of the lowest in the developing world. Back in 1979, when Ayatollah Khomeini assumed leadership in Iran, he dismantled all family planning programs and instead advocated large families. Khomeini wanted large families to increase the ranks of soldiers for Iran's war against secular Iraq during the 1980s. In response to his pleas, fertility levels climbed, to a peak population growth rate of 4.2 percent in the early 1980s. As this rapid population growth continued it began to burden the economy and the environment. Iran’s leaders realized that such rapid population growth was burdening social services, infrastructure, whilst also contributing to unemployment and environmental


degradation, and unemployment.903 As a result, in 1989, the government restored the family planning program. In May 1993, it passed a national family planning law. Several government ministries, including education, culture, and

health, were given the task of encouraging smaller families and Iran Broadcasting was given the task of raising awareness. Specific measures taken included the establishment of 15,000 clinics known as “health houses”, the provision of all forms of birth control free of charge, and all couples, before receiving their marriage license, were required to attend a class on modern contraception.904


Janet Larsen wrote that

“In addition to the direct health care interventions, a broad based effort was launched to raise literacy. The literacy rate for adult males increased from 48 percent in 1970 to 84 percent in 2000, nearly doubling in 30 years. Female literacy climbed even faster, rising from less than 25 percent in 1970 to more than 70 percent. Meanwhile, school enrolment grew from 60 to 90 percent. And by 1996, 70 percent of rural and 93 percent of urban households had televisions, allowing family planning information to be spread widely through the media. As a result of these initiatives, family size in Iran dropped from seven children to fewer than three. From 1987 to 1994, Iran cut its population growth rate by half. Its overall population growth rate of 1.3 percent in 2006 is only slightly higher than the U.S. growth rate.\textsuperscript{905}

The costs of providing reproductive health and family planning services are small compared with their benefits. Joseph Speidel estimates that expanding these services to reach all women in the developing countries would take close to $17 billion in additional funding from both industrial and developing countries.\textsuperscript{906}”

\textsuperscript{905} Ibid.

\textsuperscript{906} Additional spending from J. Joseph Speidel et al., Family Planning and Reproductive Health: The Link to Environmental Preservation (San Francisco: Bixby Center for Reproductive Health and Research Policy, University of California, 2007), p. 10, and from J. Joseph Speidel, discussion with J. Matthew Roney, Earth Policy Institute, 16 October 2007.
The United Nations has estimated that giving access to effective contraception to the 201 million women who do not have it, could prevent, in each year, 52 million unwanted pregnancies, 22 million induced abortions, and 1.4 million deaths of infants. The situation is one in which the costs to society of not adequately addressing the family planning issues is greater than we can afford.\footnote{Program for Appropriate Technology in Health (PATH) and U.N. Population Fund (UNFPA) (2006) \textit{Meeting the Need: Strengthening Family Planning Programs}. Seattle, pp. 5–11; quote from All Party Parliamentary Group, op. cit. footnote 17, p. 22.}

Moving to smaller families brings with it significant economic benefits. For example, analysts have concluded that in Bangladesh, $62 spent by government to prevent an unwanted birth would save $615 in spending on other social services. Spending fiscal resources on reproductive health and family planning services will result in more fiscal resources per child for health care and education, and so speed up the escape from poverty. From the perspective of donor countries, filling the entire gap of $7.9 billion to ensure that couples everywhere have access to the reproductive health and family planning services that they need would have significant social returns in the form of improved education and health care, greater economic prosperity and would, at the same time, reduce environmental pressures.\footnote{See Family Planning Programs: (1994) \textit{Bangladesh: National Family Planning Program, Family Planning Programs: Diverse Solutions for a Global Challenge}. Washington, DC.} This is widely acknowledged.

Economists talk of the per capita economic benefits of lower fertility rates which raise the capital stock per person. This is intuitively obvious. At the household level, higher fertility rates mean less investment in each child’s development (nutrition, schooling, and health care). At the national level higher population growth means more capital investment must be provided simply to expanding the number of services and infrastructure just to keep up with population growth rather than improving the quality of services and infrastructure. This can be empirically tested with cross-country studies of economic growth and fertility rates. Barro and Martin have found a statistically significant negative correlation of high fertility rates with economic growth. As Jeffrey Sachs explains,

\begin{quote}
"Consider two countries that are identical in all respects except that one has a fertility rate of 6 and the other a fertility rate of 2. According to the statistical result of the Barro and Sala-i-Martin study, the high fertility country will have per capita income growth that is 1.3 percentage points per year lower than the economic growth of the low-fertility country. That's a whopping negative effect of high fertility."\footnote{Barro, R.J., Sala-i-Martin. (2004) \textit{Economic Growth}. 2nd Edition. Cambridge, Mass.; MIT. Press.}
\end{quote}

6.1.4 Breaking the Poverty Trap - Ensure Universal Access to Education.

The overwhelming majority of those living in poverty today are the children of people who lived in poverty. The key to breaking out of the vicious cycle of poverty is education—especially the education of girls. As female educational levels rise, fertility falls. And mothers, with at least five
years of school, lose fewer infants during childbirth, or to early illnesses, than their less educated peers do. Economist Gene Sperling concluded in a 2001 study of 72 countries that

“the expansion of female secondary education may be the single best lever for achieving substantial reductions in fertility.”

At a time when the HIV epidemic is spreading, schools provided the institutional means to educate young people about the risks of infection. Education systems provide the means to reach children at the right age with this information before they have had the chance to get infected. Another way that investment in education can reap significant benefits is by OECD countries investing in teacher training. One great need in developing countries, particularly those where the ranks of teachers are being decimated by AIDS, is more teacher training. Scholarships could be provided to motivated students from poor families to attend training institutes in exchange for a commitment to teach for at least three-five years. Such an initiative would help create the teaching capacity to address the massive problem of lack of primary education and child and adult illiteracy. There are currently nearly 800 million illiterate adults. Bangladesh and Iran provide models of what can be done through successful adult literacy programs. It has been estimated that to achieve universal primary education across the world, an additional $10 billion in external funding and spending is needed. In an age when education can give children access to the computer and the Internet as well as books, a situation where there are children who never go to school is not acceptable. But there are also obstacles; for in very poor countries often children will have little food unless they help with the farming. Thus, as Lester Brown explains

“Few incentives to get children in school are as effective as a school lunch program, especially in the poorest countries. Since 1946, every American child in public school has had access to a school lunch program, ensuring at least one good meal each day. There is no denying the benefits of this national program. Children who are ill or hungry miss many days of school. And even when they can attend, they do not learn as well.”

Jeffrey Sachs of the Earth Institute at Columbia University notes

“Sick children often face a lifetime of diminished productivity because of interruptions in schooling together with cognitive and physical impairment.”

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It has been found that enrolments of children jump when school lunch programs are introduced in low-income countries. In addition, their academic performance improves and they spend more years in school.\textsuperscript{914} Girls particularly benefit. Drawn to school by the lunch program, they also stay in school longer. As a result they marry later, and have fewer children. It has been estimated that a school lunch programs in the 44 lowest-income countries would cost $6 billion per year beyond what is now spent by the United Nations to reduce hunger.\textsuperscript{915}

It would also be very important to increase efforts to improve the nutrition of pre-school age children so they can benefit from the school lunches when they attend school. Former US Senator George McGovern notes that

> “a women, infants and children (WIC) program, which offers nutritious food supplements to needy pregnant and nursing mothers”

should also be available in the poor countries. After running for 33 years, it is clear that the U.S. WIC program has been enormously successful in improving nutrition, health, and the development of preschool children from low-income families in the USA. This 33 years of experience could be expanded to create new AID programs to reach pregnant women, nursing mothers, and small children in the 44 poorest countries. Such a program would help eradicate hunger among millions of small children at a time when it could make a huge difference to their early childhood development and progress.\textsuperscript{916} It is estimated that such an expansion would cost annually US$4 Billion.

6.1.5 Breaking the Poverty Trap - Ensure Universal Access to Health Care

In developed countries, smoking, obesity, cancer and heart disease are the dominant health concerns. In developing countries the dominant health concern is infectious diseases; AIDS, malaria, tuberculosis, measles diarrhoea, respiratory illnesses. Child mortality rates are high. These infectious diseases not only take a devastating human toll but they also have a significant negative effect on economic growth. The poorest countries in GDP per capita also correlate with those countries with the worst malaria outbreaks globally. Mosquito bed nets, indoor spraying and the best malaria medicines are all very cost effective in preventing the spread of malaria to humans and vital investments to help most of the countries with negative economic growth break the poverty trap. Mosquito bed nets cost less than 50 cents each. Yet currently the world only spends tens of millions in aid per annum on fighting malaria when US$2 to US$3 billion is needed. Currently most people in Africa, where malaria is the most virulent, have no access even to mosquito bed nets.\textsuperscript{917} In a devastating analysis of current aid


\textsuperscript{915} Ibid.

\textsuperscript{916} Ibid.

\textsuperscript{917} Ibid, p 200.
expenditure on AIDS, Sachs and Attaran found that until early 21\textsuperscript{st} century the world was only giving Africa $70 million per annum to fight AIDS. In recognition of this serious failure, the World Health Organisation (WHO) formed the Commission of Macroeconomics and Health to study and outline the cost benefits to the world of investing to improve health outcomes globally. In 2001 the WHO Commission published *Investing in Health for Economic Development*.\textsuperscript{918} This report found that

“The role of health in economic growth has been greatly undervalued. Evidence presented by the Commission suggests that each 10 percent improvement in life expectancy is associated with an increase in economic growth of about 0.3 percent to 0.4 percent per year, other growth factors being equal. Economic losses from ill health have been underestimated. Countries with the weakest conditions of health and education have more difficulty in achieving sustained growth. In sub-Saharan Africa losses due to HIV/AIDS are estimated to be at least 12 percent of annual GNP. Economic development in malaria-free zones is at least one percent per year higher than in areas where malaria is endemic.

A few health conditions account for a high proportion of avoidable deaths. In 1998, 16 million deaths were caused by communicable diseases, maternal and perinatal conditions, childhood infections, tobacco-related illness and nutritional deficiencies. Of the 30 million children not receiving basic immunisations, 27 million live in countries with GNP per capita lower than US$1200. Of the half million women who die annually in pregnancy and childbirth, 99 percent live in developing countries. The level of spending on health in low-income countries is insufficient to address the health challenges they face.

The recommended increase in spending is large, but so is the potential return. The aggregate additional cost of scaling up interventions in low-income countries is in the order of US$66 thousand million per year, with around half of this amount coming from donors. The predicted result is to save around eight million lives a year and generate economic benefits of US$360 thousand million: a sixfold return on investment.”\textsuperscript{919}

The Earth Charter emphasises the importance of ensuring universal access to health care for the poor. The WHO report shows that investing more into health in developing countries could significantly help improve economic growth and social outcomes in these countries. Another significant report that shows the economic benefits of investments in public health is *Millions Saved: Proven Successes in Global Health*\textsuperscript{920}. This report showed that


\textsuperscript{919} Ibid.

“The costs of successful public health initiatives are dwarfed by the social and economic benefits of eliminating, treating, or controlling the disease. For example, a tuberculosis program in China treated more than 1.5 million patients over 10 years at a total cost of $130 million, preventing 30,000 TB-related deaths annually and averaging just $15-20 for each healthy life-year saved. The economic returns were enormous: Each dollar invested in the program generated $60 in the form of savings on treatment costs and the increased earning power of healthy people. Similarly, efforts to control river blindness in sub-Saharan Africa between 1974 and 2002 cost less than $1 per protected person and prevented 60,000 cases of blindness. As a result of the program’s positive impact on health, an estimated $3.7 billion will accrue from improved worker and agricultural productivity.”

We consider next some of the major infectious diseases to highlight how cost effectively they can now be addressed to further re-enforce the main message of the WHO Macroeconomics of Health report.

6.1.6 Curbing the HIV Epidemic

The most cost effective approach to curbing the AIDS epidemic is prevention through education. In Africa governments are beginning to design effective prevention education programs. To rapidly reduce the spread of the infection it is vital to target the groups in society which are most likely to spread the disease. Studies show that targeting truck drivers and sex workers in particular for education programs and free condoms is particularly effective. Studies also show that, infected truck drivers spread HIV from country to country engaging in commercial sex during their extended travels. As to education programs, studies in India have shown that it has been very beneficial to educate its 2 million female sex workers about the risks of HIV and the value of using condoms. Lester Brown argues that

“At the most fundamental level, dealing with the HIV threat requires roughly 13.1 billion condoms a year in the developing world and Eastern Europe. Including those needed for contraception adds another 4.4 billion. But of the 17.5 billion condoms needed, only 1.8 billion are being distributed, leaving a shortfall of 15.7 billion. At only 3.5¢ each, or $550 million, the cost of saved lives by supplying condoms is minuscule. The condom gap is huge, but the costs of filling it are small.”
In the excellent study *Condoms Count: Meeting the Need in the Era of HIV/AIDS*, Population Action International notes that

“the costs of getting condoms into the hands of users—which involves improving access, logistics and distribution capacity, raising awareness, and promoting use—is many times that of the supplies themselves.”

So assuming that these costs are six times the price of the condoms themselves, the total cost of filling the gap would cost $3 billion.

Also significant breakthroughs have occurred to reduce the costs of AIDS medicine. For instance, the cost of anti-retroviral medicine for AIDS now costs under US$300 per annum per capita down from US$12,000 per annum. The US administration promised US$15 billion over five years for the ‘Emergency Plan for AIDS Relief’ in 2003. The plan sought to prevent 7 million new AIDS...
infections and treat at least two million with life extending anti-viral medicine. If other OECD nations made a similar commitment it would then be possible to afford for all those currently suffering from AIDS to have access to anti-retroviral and allow them to assist the work of their communities. President George Bush stated in his 2003 State of the Union Address

“As our nation moves troops and builds alliances to make our world safer, we must also remember our calling, as a blessed country, is to make the world better. Today on the continent of Africa nearly 30 million people have the AIDS virus, including three million children under the age of 15. There are whole countries in Africa where more than one-third of the adult population carries the infection. More than 4 million require immediate drug treatment. Yet across that continent, only 50,000 AIDS victims- only 50,000- are receiving the medicine they need.

Because the AIDS diagnosis is considered a death sentence, many do not seek treatment. Almost all who do are turned away. A Doctor in rural South Africa describes his frustration. He says, ‘We have no medicines, many hospitals tell people - You’ve got AIDS. We can’t help you. Go home and die.’ In an age of miraculous medicines, no person should have to hear those words.

AIDS can be prevented. Anti-retroviral drugs can extend life for many years. And the cost of those drugs has dropped from $12,000 a year to under $300 a year, which places a tremendous possibility without our grasp. Ladies and gentlemen, seldom has history offered a greater opportunity to do so much for so many… This nation can lead the world in sparing innocent people from a plague of nature.”

6.1.7 The Value of Immunisation Programs

Infectious diseases that cause relatively few problems in developed countries continue to spread sickness and death in poorer regions of the world. One of the reasons for this is that poorer countries cannot afford the immunisations that those in the OECD countries take for granted. The largest private-public partnership to address this is the GAVI Alliance whose goal is to make a

“major contribution to the two-thirds reduction in under-five mortality targeted by the international community in the Millennium Development Goals. It will do this by making advanced vaccine products available in the world’s poorest countries and strengthening delivery systems to ensure that their children derive full benefit.”

Governments, philanthropists and benefactors can donate to the GAVI initiative. The Bill and Melinda Gates Foundation already invested more than $1.5 billion through 2006 to protect children from infectious diseases like measles. The Bill and Melinda Gates Foundation are partners with the

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GAVI Alliance. Vaccinations are one of the most cost effective investments anyone can make. There are few situations where spending a few cents per child can make such a difference. Immunisation programs, led by the UN the World Health Organization (WHO) have successfully eradicated a number of diseases through global immunisation programs including smallpox saving billions of dollars in health care expenditures. Lester Brown writes that

“Similarly, a WHO-led international coalition, including Rotary International, UNICEF, the U.S. Centers for Disease Control and Prevention (CDC), and Ted Turner’s UN Foundation, has waged a worldwide campaign to wipe out polio, a disease that has crippled millions of children. Since 1988, Rotary International has contributed $600 million to this effort. Under this coalition-sponsored Global Polio Eradication Initiative, the number of polio cases worldwide dropped from some 350,000 per year in 1988 to fewer than 700 in 2003.”

A different and very successful campaign was begun in Bangladesh by BRAC, a non-governmental group. Its aim was to teach every mother in Bangladesh how to treat diarrhoea at home and thereby significantly reduced the number of infants and children dying. The BRAC model has since been used by UNICEF for its worldwide program for the treatment of diarrhoea. It too has been very effective. It has reduced the number of children dying from diarrhoea from 4.6 million in 1980 to 1.6 million in 2006. Between 1982 and 1989, Egypt used this model to reduce infant deaths from diarrhoea by 82 percent. Few investments in programs have saved the lives of so many children at such a minimal cost.


Another very important social sustainability goal of the Earth Charter is to

“Guarantee the right to potable water, clean air, food security, uncontaminated soil and safe sanitation, allocating the national and international resources required.”

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It is physically impossible for all developing nations to achieve Western material living standards with previous modes of development, as the global ‘ecological footprint’ (the equivalent land and water area required to produce a given population’s material standard, including resources appropriated from other places) is already greater than the carrying capacity of our planet.

If the goal is to end poverty, then the world simply must find new innovative ways to achieve sustainable development. Only through dramatically improving resource productivity globally can we truly end poverty. Yet to date there has been little effort made to ensure that poverty alleviation efforts also focus on ensuring the environmental sustainability of the programs.

This is not because aid workers do not understand the linkages. The UN Millennium Goals reports all recognise that achieving environmental sustainability goals are key to achieving the Millennium Goals (see Table 6.2).

It is because the investment needs of the extreme poor are diverse, and decision-makers must weigh the need for investments in environmental assets against investment needs in other sectors, including education, health, vaccinations, family planning and infrastructure. In the past, therefore, scarce development finance has often not been allocated towards environmental investments because the belief has been that they secure a lower rate of return than investments in other forms of capital. However, economists can now measure rates of return on environmental investments and are therefore able to test these assumptions.

This new capability has resulted in a new report, *Investing in environmental wealth for poverty reduction,* by the late UK environmental economist David Pearce. This report finds that rates of return on investments in environmental assets, in increasing access to water supply and sanitation for example, can yield very high rates of return, with benefit-to-cost ratios in the range of 4:1 to 14:1, making them extremely attractive from a social investment standpoint.

**Table 6.2 Why reaching the Environmental Goals is so important for achieving the Millennium Goals in the developing world.**

| 1. **Eradicate extreme poverty and hunger** | Poor people’s livelihoods and food security often depend on ecosystem goods and services. The poor often have insecure rights to environmental resources, inadequate access to markets, decision-making and environmental information which limits their ability to protect the environment and improve their |

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Pearce, D. (2005) *Investing in environmental wealth for poverty reduction,* prepared on behalf of the Poverty-Environment Partnership: UNDP, UNEP, IUCN, IIES, World Resources Institute. These are among some of the findings from *Investing in Environmental Wealth for Poverty Reduction,* prepared on behalf of the Poverty-Environment Partnership (PEP) for the 2005 World Summit that was held at the headquarters of the United Nations in New York. One of the Summit’s aims was to review the status of the Millennium Development Goals (MDGs) covering poverty eradication and the provision of safe and sufficient supplies of drinking water up to the reversal of the spread of diseases and the empowerment of women. Launched in 2000, these internationally agreed goals are set to be met by 2015. The partnership, which includes the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), organisations such as IUCN - the World Conservation Union - and government agencies, are planning how the environment can be mainstreamed in national poverty reduction strategies in order to better achieve the Goals.
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<td><strong>2. Achieve universal primary education</strong></td>
<td>Time spent by children collecting water and fuel wood reduces the time available for schooling. In addition, the lack of energy, water and sanitation services in rural areas discourages qualified teachers from working in poor villages.</td>
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<td><strong>3. Promote gender equality</strong></td>
<td>Women and girls are especially burdened by water and fuel collection, reducing their time and opportunities for education, literacy and income-generating activities.</td>
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<td><strong>4. Reduce child mortality</strong></td>
<td>Diseases (such as diarrhoea) tied to unclean water and inadequate sanitation, and respiratory infections related to pollution are among the leading killers of children under five. Lack of fuel for boiling water also contributes to preventable waterborne diseases.</td>
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<td><strong>5. Improve maternal health</strong></td>
<td>Inhaling polluted indoor air and carrying heavy loads of water and fuel wood impacts significantly on women’s health. This can make them less fit to bear children and place them at greater risk of complications during pregnancy.</td>
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<td><strong>6. Combat major diseases</strong></td>
<td>Up to 20 percent of the disease burden in developing countries may be due to environmental risk factors (as with malaria and parasitic infections).</td>
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<td><strong>7. Develop a global partnership</strong></td>
<td>Many global environmental problems, such as climate change, loss of species diversity and depletion of global fisheries can be solved only through partnerships between rich and poor countries.</td>
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(Source: Selection of the United Nations Millennium Development Goals, 2005)

David Pearce’s report *Investing in environmental wealth for poverty reduction,* finds that rates of return on investments in environmental assets have been significantly underestimated, for example in the area of valuing the worth of forestry assets globally. Pearce has argued that, properly valued, the true value of a forest’s ability to store carbon is between US$360 and US$2,200 per hectare. This makes them far more valuable for storing carbon than if the forest is converted to cropland or grazing. Pearce’s study claims that should the price of carbon exceed US$30 a ton, it would be far more cost effective not to clear forests but to conserve them.

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939 Pearce, D. (2005) *Investing in environmental wealth for poverty reduction,* prepared on behalf of the Poverty-Environment Partnership: UNDP, UNEP, IUCN, IIES, World Resources Institute. These are among some of the findings from *Investing in Environmental Wealth for Poverty Reduction,* prepared on behalf of the Poverty-Environment Partnership (PEP) for the 2005 World Summit that was held at the headquarters of the United Nations in New York. One of the Summit’s aims was to review the status of the Millennium Development Goals (MDGs) covering poverty eradication and the provision of safe and sufficient supplies of drinking water up to the reversal of the spread of diseases and the empowerment of women. Launched in 2000, these internationally agreed goals are set to be met by 2015. The partnership, which includes the United Nations Development Programme (UNDP), the United Nations Environment Programme (UNEP), organisations such as IUCN - the World Conservation Union - and government agencies, are planning how the environment can be mainstreamed in national poverty reduction strategies in order to better achieve the Goals.
6.2.1 Investing in Stopping Deforestation

Globally there is significant interest in finding ways to better value the world’s remaining forests due to their ability to store carbon, protect biodiversity and deliver a range of ecosystem services, such as reducing soil erosion and purifying water.

The *Stern Review* and the work by McKinsey Consulting, is even more optimistic than David Pearce, and estimate that the marginal cost per GHG abated from avoiding deforestation is the cheapest form of greenhouse abatement after energy efficiency and energy demand management, and followed by a range of renewable energy technologies.

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**Figure 6.4 Relative Marginal Costs of Climate Change Abatement per unit GHG**

*Source: Stern Review (2006)*

The *Stern Review* states,\(^{941}\)

“Almost 20 per cent (8GtCO\textsubscript{2}/year) of total greenhouse gas emissions are currently from deforestation. A study commissioned for the Review looking at 8 countries responsible for 70 per cent of emissions from deforestation found that, based on the opportunity costs of the use of the land which would no longer be available for agriculture if deforestation were avoided, emission savings from avoided deforestation could yield reductions in CO\textsubscript{2} emissions for under $5/tCO\textsubscript{2} possibly for as little as $1/tCO\textsubscript{2}.”

Hence when considering the global benefit of preserving and expanding the remaining forest areas, coupled with the opportunity presented by the Clean Development Mechanism, many companies and governments are realising the benefits of investing in avoided deforestation projects in developing countries. Deforestation is currently responsible for roughly 18 per cent of global greenhouse emissions. Compensating developing countries for stopping deforestation and funding reafforestation

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\(^{941}\) Ibid.
schemes is one of the most cost effective and quickest ways the world could make progress on reducing greenhouse gas emissions in the short term.

Conversely, further loss of forests and other natural ecosystems makes developing countries more vulnerable to storms, landslides, flooding, droughts and natural disasters. The International Union for the Conservation of Nature (IUCN)\(^\text{942}\) has found that often the impacts of natural disasters are increased when nature’s natural resilience has been affected. The World Bank\(^\text{943}\) has estimated that, for the poorest countries, the cost of natural disasters represents more than 13 per cent of GDP. While only some of this cost can be attributed to environmental factors, which can in turn be influenced directly by public policy (e.g. flood control, GHG mitigation, preventing deforestation, soil erosion and mudslides etc.), ‘inaction’ concerning natural disasters is clearly resulting in significant costs. The World Bank and the US Geological Survey have estimated that the worldwide economic losses from natural disasters in the 1990s could have been reduced by US$280 billion, if US$40 billion had been invested in disaster preparedness, mitigation and prevention strategies.\(^\text{944}\)

Countries are beginning to recognise the economic, social and environmental costs associated with deforestation, partly because of the evidence that deforestation reduces the environment’s resilience to shocks, enabling storms, flooding and natural disasters to have a greater impact. Deforestation leads to greater rainfall run-off and the associated flooding and soil erosion. China, the Philippines, Sri Lanka, Thailand, and Viet Nam all have total or partial bans on deforestation.\(^\text{945}\)

6.2.2 Investing and Empowering Reafforestation

The story of the last 40 years in Niger demonstrates probably better than any other the significant benefits of investing in reafforestation.\(^\text{946}\) Forty years ago Niger was on track to become a failed state propelled by drought, desertification, unsustainable farming practices and rapid population growth. It was becoming harder and taking longer for firewood and timber to be found and the farming soils’ fertility was declining. The national average birth rate was seven children per family.

From the mid-1980s this began to change. At that time, farmers in several villages were taught to plough carefully around tree saplings when sowing crops of millet, sorghum, peanuts and beans. Careful nurturing, along with other simple soil and water conservation practices, saplings became trees, putting down roots and a buffer against top soil erosion and crop loss. The quick growing trees


became assets that families used to supplement incomes, provide insurance against crop failure and meet their own needs. The trees provided wood for charcoal, foliage for animal fodder and fruit for food.

Word of mouth and marketplaces spread the good news until an area of 7 million hectares was being replanted with trees. Whilst this transformation occurred largely due to energy of Niger’s farming families it was also assisted by the government. The government gave the farmers secure property rights over the trees in recognition farmers investment in time and labour to plant all the trees. The result of their efforts is today a more sophisticated mix of agro-forestry and a more diverse economy. The effects of this change have been profound. The average distance a woman must walk for firewood in the Zinder region of Niger has declined from 2.5 hrs to half an hour. Poverty is lower, nutrition improved and communities are less vulnerable to natural disasters. When a regional drought and locusts hit in 2005, many of the villages in the green belt of Niger reported no child deaths from malnutrition because they were able to sell wood in local markets to purchase expansive cereals that normally would have been beyond reach. This success story from Niger demonstrates that the value at overcoming barriers to empowering people. It shows that the greatest untapped resource in solving the problem of global poverty and environmental decline are those who are currently trapped in poverty and enduring hardship because of environmental degradation. They have more motivation than anyone to change their conditions if just supported to have a chance to do so.

In addition to re-afforestation, investing in other forms of natural capital provides protection and resilience from natural disasters. In Viet Nam, tropical cyclones have caused a considerable loss of livelihood resources, particularly in coastal communities. Mangrove ecosystem rehabilitation along much of Viet Nam’s coastline is an example of a cost-effective approach to improving coastal defences while restoring biodiversity, and ecosystems while generating local livelihoods. Since 1994, the Vietnam National Chapter of the Red Cross has worked with local communities to plant and protect mangrove forests in northern Vietnam. Nearly 120 km$^2$ of mangroves have been planted, with substantial resulting benefits. Although planting and protecting the mangroves cost approximately US$1.1 million, it saved US$7.3 million/year in dyke maintenance. During the devastating typhoon Wukong in 2000, project areas remained unharmed, while neighbouring provinces suffered huge losses in lives, property and livelihoods. The Vietnam Red Cross has estimated that some 7,750 families have benefited from mangrove rehabilitation. Family members can now earn additional income from selling crabs, shrimp and molluscs, while also increasing the protein in their diets.947

6.2.3 Investing in Water Quality and Sanitation

Another area where investment in natural capital has significant environmental, social, health and poverty reduction benefits is in investments in reducing water pollution and improving the quality of drinking water and levels of sanitation. Increasing access to supply of clean water and sanitation for example, can yield very high rates of return, with benefit-to-cost ratios in the range of 4:1 to 14:1, making such investments extremely attractive from a social investment standpoint. Improved water supplies and sanitation create time savings (that is, time not spent travelling long distances to fetch water) that translate into higher economic output and productivity as well as greater school attendance.

Preserving or rebuilding ecosystem services can not only increase the systems resilience to natural disasters, it can also assist to improve water quality. The services provided by biodiversity through watersheds globally are worth tens of billions of dollars. Currently 40 per cent of humanity or 2.6 billion people now do not have regular access to clean water, due in part to the removal or degradation of water catchment areas. About 90 per cent of the sewage and 70 per cent of the industrial waste in developing countries are being discharged untreated into water courses, and without the natural wetlands and natural aquatic systems this waste is not even treated to primary levels. The UN set a millennium goal of halving the proportion of people with no access to sanitation - even simple latrines rather than sewers - by 2015.

Rebuilding wetland ecosystems is a cost effective way often to provide interim water treatment. Understanding the ability of marshes and wetlands, to play an integral part in filtering waste water is often overlooked. Novel schemes currently looking to utilise ecosystem services to purify water include a plan to build an artificial wetland at a jail in Mombasa in Kenya, to process sewage from 4,000 inmates that now flows untreated into a creek, or ponds in South Africa where algae purify waste and are then used as fertiliser. This is but one way healthy ecosystems positively impact on human health.

Many poorer nations and communities depend on fish and other seafood as a key part of their diet, however, fisheries are collapsing throughout the world. A 2003 landmark study by a Canadian-German research team published in Nature concluded that 90 percent of the large fish in the oceans had disappeared over the last 50 years. The fisheries sector employs about 40 million fishers and fish farmers, most living in developing countries, who depend on fisheries worldwide. In many

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948 Pearce, D. (2005) Investing in environmental wealth for poverty reduction, prepared on behalf of the Poverty-Environment Partnership: UNDP, UNEP, IUCN, IIES, World Resources Institute


of these countries, fish is an essential part of the diet, providing 22 per cent and 19 per cent of animal proteins consumed in Asia and Africa. Fishery resources also contribute to the livelihoods of coastal or island communities. When fishery stocks collapse around the world it is the poor in those regions who immediately feel the impact.

In this brief summary I have shown several examples of why investing in natural capital needs to be part of any serious strategy to help countries break the poverty trap permanently. But there are additional reasons to invest in natural capital which are well covered by the World Health Organisation in their 2005 Millennium Ecosystem Assessment report. This report shows that there are many harmful health effects of loss of biodiversity and ecosystem services and conversely numerous benefits of maintaining biodiversity and ecosystem health to quality of life in developing countries.

**Figure 6.5 Harmful Effects of Ecosystem Changes on Human Health.** *(Source: WHO, 2005)*

As Klaus Toepfer, UNEP executive director, stated,

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953 Ibid.


955 Ibid.

956 Ibid.
“It is clear... that the environment is something like the red ribbon running through the Millennium Development Goals. It is not a luxury good, only affordable when all other problems have been solved. It is the oxygen that breathes life into all our aspirations for a healthier, fairer and more stable world. We also need to pursue more imaginative and clever methods for paying the poor for the regional and global assets they hold. It has been calculated that the carbon absorption value of tropical forests alone is worth tens of billions of dollars a year. But these ecosystem services, which largely remove the pollution of the rich countries from the atmosphere, are provided gratis and the people paid nothing for these assets.”  

Since overseas development aid funding is scarce, it is necessary for us to explore the question of what are some of the most cost effective ways to invest in developing countries to both improve natural and social capital. Given that there is now significant political will in OECD countries to invest in developing countries for projects that reduce greenhouse gas emissions, aid agencies and governments in developing countries are rethinking ways they can meet their people’s urgent needs in ways that also reduce greenhouse gas emissions. It is very likely that the Clean Development Mechanism (CDM) of the Kyoto Protocol will be a key part of any post Kyoto Framework currently being negotiated. The following examples give a taste of how in the 21st century it is possible to combine poverty reduction and climate change mitigation goals simultaneously to create new avenues to overseas development aid.

6.2.4 Low Carbon Approaches to Heating and Cooking for Developing Nations

There is significant interest in OECD countries currently in working out the best ways to work with poor and developing countries to help them reduce their rates of deforestation and help mitigate climate change. The forests of the world are under significant environmental pressures for many reasons but one factor is global poverty. Roughly 1.6 billion people are currently without electricity to enable them to cook food, stay warm or see at night.  

Hence any OECD funded scheme to reduce deforestation in a developing country will need to address the needs of the people for alternative energy sources to meet their basic needs. Fortunately, as I will now explain, there are ready made low carbon ways to do this which are already working in developing countries around the world. As Lester Brown explains

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“The largest single demand on trees - the need for fuel - accounts for just over half of all wood removed from forests. Some international aid agencies, including the U.S. Agency for International Development (AID), are sponsoring fuelwood efficiency projects. One of AID’s more promising projects is the distribution of 780,000 highly efficient wood cook stoves in Kenya that not only use far less wood than a traditional stove but also pollute less. Kenya is also the site of a solar cooker project sponsored by Solar Cookers International. These inexpensive cookers, made from cardboard and aluminium foil and costing $10 each, cook slowly, much like a crockpot. Requiring less than two hours of sunshine to cook a complete meal, they can greatly reduce firewood use at little cost. They can also be used to pasteurize water, thus saving lives. Over the longer term, developing alternative energy sources is the key to reducing forest pressure in developing countries. Replacing firewood with solar thermal cookers, or even with electric hotplates fed by wind-generated electricity or with some other renewable energy source, will lighten the load on forests.”

The health benefits from investing in more efficient wood and solar heaters are significant. As stated above, at least two billion people worldwide burn wood, dung and crop residues indoors for home cooking and heating. According to the World Health Organization, this widespread use results in the premature deaths of an estimated 1.6 million people each year from breathing elevated levels of indoor smoke, resulting in ‘indoor air pollution’ as the fourth leading cause of death in developing countries. The Partnership for Clean Indoor Air (PCIA), which involves over 160 partners worldwide, is working towards addressing the problem by funding projects in Asia, Africa, and Latin America to identify and demonstrate effective approaches for increasing the use of clean, reliable, affordable, efficient, and safe home cooking and heating practices that reduce people’s exposure to indoor air pollution. In addition to cooking and staying warm the other reason the poor burn wood is to be able to see at night to continue to carry out tasks and teach children to read who often have to work in the fields during the day.

6.2.5 Benefits from Investing in Low Carbon Approaches to Lighting and Renewable Energy

The use of efficient lighting powered by onsite renewable forms of energy has the potential to make a significant difference to the lives of millions of people in the developing world. The Barefoot Solar Engineering Program in north-west India clearly demonstrates the revolutionary power of efficient lighting powered by renewable energy. At the Barefoot Engineering College illiterate woman have been trained to make circuits for solar lighting and also how to install and maintain hand pumps, water tanks, solar cooking heaters and pipelines.

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Just one of the Barefoot engineering products, solar lanterns, has transformed community life. Traditionally, only the boys have been able to get an education with the young girls needing to work in the fields during the day for the families to survive. Now thanks to solar lanterns they are able to run a school in the evening, after dark, so the young girls can learn to read and write after their work during the day. All around the developing world this problem of young woman not getting a chance for an education exists; hence this simple practical solution has great significance. Finally, still more profound changes in the community have evolved. The female Barefoot solar engineers, who previously would have been seen as illiterate poverty stricken women, are now so respected by the communities in north-east India that they are being asked to represent the region in government. Maurice Dewulf, deputy senior resident representative, United Nations Development Programme (UNDP), comments:

“The project has demonstrated how solar energy provides a solution not just for cooking and lighting, but also for education, agriculture, health, and income generation.”

Programs like this have the potential to make a significant difference. Currently, the electrical power sector consumes a fourth of the world’s development capital. It could be turned into a net exporter of capital to fund other development needs. The Indian government and overseas aid has now enabled over half a million such solar lanterns to now be in use throughout India.

6.2.6 Benefits of Investing in Low Carbon Sustainable Transport Solutions

In many parts of the world the problem of air pollution is largely due to transportation. More than two million people globally are estimated to die prematurely each year due to indoor and outdoor air pollution. Although air quality has improved dramatically in some cities, many areas still suffer from excessive air pollution. Unlike American and European cities, Asian and developing country metropolitan areas owe a substantial portion of their air pollution to two- and three-wheel motorised vehicles. Motorcycles and mini taxis constitute the majority of vehicles in many Asian and

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961 Maurice Dewulf, deputy senior resident representative, United Nations Development Programme (UNDP), comments, “The project has demonstrated how solar energy provides a solution not just for cooking and lighting, but also for education, agriculture, health, and income generation. The Ministry of Non-conventional Energy Sources, the European Commission and the UNDP support the Barefoot Solar Engineering programme. Barefoot's project partners are encouraged by the response to the programme, which has received the Stockholm Challenge Award for Environment in 2002.”

962 India Ministry of Non Conventional Energy Sources in the past few years has distributed ½ million units of solar lanterns (http://mnes.nic.in/ach1.htm)


developing countries. Many of these small vehicles employ two-stroke engines which emit 50 times the amount of air pollution compared to modern automobiles.

Envirofit, an independent, non-profit company established at Colorado State University in 2003, is now distributing affordable retrofit kits that will both reduce air pollutant emissions by 90 percent while also improving the fuel efficiency of two-stroke engines by 30-50 percent and thus reducing greenhouse gas emissions. Since retrofitting two stroke engines results in a 30-50 percent improvement in fuel efficiency, projects to roll this out on a large scale will qualify as projects under the Clean Development Mechanism. This should attract further funding from governments looking for effective CDM projects to invest in.

Two Australian Professors, Peter Newman and Jeff Kenworthy, have published work which suggests that, overall, a new approach is needed to transportation in developing and developed countries. Their ground-breaking research, published in 1999, in a major report for the World Bank demonstrated that cities which pursue sustainable transport options have better quality of life and higher economic growth than cities dependant largely on freeways.

Previously the World Bank had assumed that investing in freeways and cars was the road to economic growth.

With oil prices reaching record highs, there is great interest currently from developing countries for ideas on how to meet local transportation needs without oil. Model sustainable cities like Curitiba in Brazil, and Bogota in Columbia, are showing the way by demonstrating how sustainable transport – cycling, walking and buses – can comfortably manage over 50 per cent of all commutes, with better health and economic outcomes.

6.2.7 Bringing It Together – The UN Millennium Villages Project

One of the best examples currently in the world of bringing these elements together is the UN Millennium Village Project. Millennium Villages is a sustainable, economic development project led by Africans and for Africans. Millennium Villages’ aim is to achieve the Millennium Development Goals at a local level throughout rural Africa. As the Millennium Villages web site states:

[References]

“The Millennium Villages seek to end extreme poverty by working with the poorest of the poor, village by village throughout Africa, in partnership with governments and other committed stakeholders, providing affordable and science-based solutions to help people lift themselves out of extreme poverty.”

The UN Millennium Villages project works with village communities to identify and implement practical measures which will make a real difference to their lives quickly. In each part of the village the project identifies opportunities to make a difference through investing in clean water, vaccines, malaria nets and appropriate technologies, food, food supplements, and health and education services. As Sachs says:

“It is a kind of aid that can work fast, providing a reliable investment, that is easy to monitor and protect against corruption.”

The first Millennium Village began in Sauri, Kenya in August 2004 and achieved remarkable results rapidly.

For example, maize yield has tripled and malaria rates have more than halved. Agriculturalists are teaching villagers new farming methods, free health care is also now available, and a school food program has been established. Since the introduction of school meals, the pupils’ school test results have improved dramatically. Improved nutrition has also led to better health, and the mosquito nets treated with insecticide have reduced the malaria rates.

In 2005, the second Millennium Village was launched in Koraro, Ethiopia. It made very good progress initially. With financial support from the Government of Japan, a further ten villages were launched in partnership with UNDP and the Earth Institute at Columbia University. As a result, there were a total of 12 Millennium Villages located in Ethiopia, Ghana, Kenya, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania and Uganda. The locations were selected as representing each of the agricultural and ecological zones of Sub-Saharan Africa. 90 percent of the agriculture population lives in these zones and the zones are representative of 93 percent of the agricultural land area of sub-Saharan Africa. The Millennium Villages are located in areas identified by the UN Millennium Project as having the highest rates of rural poverty and hunger/ and in reasonably well-governed and stable countries.

The financing model for these villages is based on the assumption that with a basic level of support, Millennium Village economies can escape the poverty trap and transition from subsistence farming to

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self-sustaining commercial activity. Over time the goal is for household incomes to grow with diversification into higher value crops and expanded off-farm jobs. As we showed in the discussion of the poverty trap, earlier in the chapter, higher incomes raise household savings, accelerating economic progress and investment. As the villages escape the poverty trap, they will be able to do more while also being less dependant long term on aid.

A multi-stakeholder approach is taken to the process of funding and implementing a Millennium Village. It involves a partnership of donors and NGOs, local and national governments, and the village community itself. The diagram that follows shows the typical anticipated financial contributions of each partner.

![Figure 6.6 Village Costs per Person per Year. (Source: Millennium Project, undated)](image-url)

The total funding of $110 per person per year will be sourced as to $50 from donors. The remaining $60 required per villager per year will be sourced from village members, local and national governments and partner organisations.

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Costings for the UN Millennium Villages project have been carried out on the basis of roughly 500 million Africans living in rural villages and each villager to receive $50 per annum resulting in a total annual cost of $25 billion per annum.\(^7\) This is very affordable for the OECD nations. This figure is also between the aid levels promised, but not yet delivered by the G8 group of countries. At the 2005 G8 Summit in Gleneagles, Scotland the G8 countries promised to reach $90 billion per annum in aid for Africa, doubling the current expenditure and charity giving. The evidence to date suggests that the UN Millennium Villages model thus offers a cost effective approach to significantly reduce poverty in Africa and other parts of the world. Much has been written already about the UN Millenium Villages project hence we will not explore it in detail here.

So far in this chapter, I have shown what a difference can be made to the lives of hundreds of millions of people currently living in poverty and suggested that the costs are manageable. We now explore this further and look at how much these costs will effect OECD economic growth rates?

6.1.8 What is the Economic Cost of Ending Extreme Poverty?

It is clear what is required to end poverty and to increase the change to smaller families. The steps required include remedying several funding gaps. They include funding for the following purposes: to achieve universal primary education; to fight HIV, tuberculosis, and malaria; and to provide reproductive health care.

\(^{976}\) Ibid.

According to the studies assembled in this chapter, the approximate annual cost of effectively undertaking the key recommendations of this chapter on a global scale are as follows:

- Water Sanitation - US$ 9-30 billion (World Bank)\textsuperscript{978}
- Universal basic health care – US$33 billion (Sachs, J \textit{et al})\textsuperscript{979}
- Reproductive health and family planning – US$17 billion (University of California)\textsuperscript{980}
- Closing the condom gap – US$3 billion (UNFPA)\textsuperscript{981}
- Universal primary education – US$10 billion (U.K Treasury)\textsuperscript{982}
- Eradication of adult illiteracy – US$4 billion (Brown, L)\textsuperscript{983}
- Assistance to preschool children and pregnant women in 44 poorest countries – US$4 billion (Brown, L)\textsuperscript{984}
- School lunch programs for 44 poorest countries – US$6 billion (McGovern, G),\textsuperscript{985} and
- Natural Disaster Prevention - US$4-6 billion (World Bank)\textsuperscript{986}
- Emergency Food Aid- US$3.8 billion.(UN World Food Program)\textsuperscript{987}

In total this amounts to between US$77-$100 billion per annum. This estimate is very close to estimates of the cost to achieve the UN Millennium Development Goals. Using two different approaches, the World Bank estimates that if countries improve their policies and institutions, the additional foreign aid required to reach the Millennium Development Goals by 2015 is between US$75-$136 billion a year.\textsuperscript{988} Additional funding will be needed to restore natural capital and

\textsuperscript{980} Additional spending from J. Joseph Speidel et al (2007) \textit{Family Planning and Reproductive Health: The Link to Environmental Preservation}, Bixby Center for Reproductive Health and Research Policy, University of California, San Francisco, p 10, and from J. Joseph Speidel, discussion with J. Matthew Roney, Earth Policy Institute, 16 October 2007.
\textsuperscript{982} UK Treasury (2005) From Commitment to Action: Education Department for International Development, UK Treasury, London.
\textsuperscript{984} Ibid.
ecosystem services globally, along with additional aid needed for capacity building and improving
developing countries institutional capability to provide these additional services.

However, in a global economy of over US$60 trillion dollars this is a price the OECD nations can
easily afford. Professor Sachs explains in detail how our generation is the first in history to have the
technologies, knowledge and financial resources to actually eradicate extreme poverty. The
achievements in poverty reduction and economic prosperity in Asia have been significant and can now
underpin efforts by the OECD to invest in the necessary activities to eradicate extreme poverty. Lester
Brown explains:

“China’s annual economic growth of nearly 10 percent over the last two decades, along with India’s
more recent acceleration to 7 percent a year, have together lifted millions out of poverty. The number of
people living in poverty in China dropped from 648 million in 1981 to 218 million in 2001, the greatest
reduction in poverty in history. India is also making impressive economic progress. Several countries in
Southeast Asia are making impressive gains as well, including Thailand, Viet Nam, and Indonesia.”

In 2007, the world appeared to be on track to meet this goal as a result of the progress made in
China, India and Asia. Assuming no major economic setbacks, the gains in Asia appeared likely to
guarantee that the U.N. Millennium Development Goal (MDG) of halving poverty by 2015 would be
reached. In its 2007 assessment of progress towards that Goal, the World Bank reported that, with the
exception of sub-Saharan Africa, the developing world was already on track to reach the goal of
halving the number of people living in poverty by 2015.

Sachs writes:

“The truth is that the cost now [of ending extreme poverty] is likely to be small compared to any relevant
measure – income, taxes, the costs of further delay, and the benefits from acting. Most importantly, the
task can be achieved within the limits that the rich world has already committed: 0.7% of the gross
national product of the high-income world, a mere 7 cents out of every $10 in income. All the incessant
debate about development assistance, and whether the rich are doing enough to help the poor, actually
concerns less than 1% of rich-world income. The effort required of the rich is so slight that to do less is
to announce brazenly to a large part of the world, “You count for nothing”. We should not be surprised,
then, in later year’s the rich reap the whirlwind of that heartless response.”

Sachs asks the question, ‘Can the US afford 0.7% of GDP?’ The US’ current donor assistance is
0.15% of GDP. To go from that to 0.7% would be an extra 0.55% tax on the US GDP. Econometrics
shows that the US economy, growing at 1.9% per annum, would reach the same level of increased
prosperity in May 1 of 2010 paying 0.7% of GDP rather than January 1, 2010 if it continues paying

0.15%. Sach’s writes, ‘So, for a four month delay in achieving higher levels of prosperity, a billion people could be given an economic future of hope, health and improvement, rather than a downward spiral of despair, disease and decline’. To put this further in perspective, the US spent 30 times as much on its military as it does on overseas aid in 2004: $US$450 billion on the military compared to $15 Billion on overseas aid. By comparison some European countries only spend two to four times as much on their military as foreign aid.

The lopsided ratio of the US in this area reflects several myths. Most Americans when surveyed assume that the US is already giving far more overseas aid than is in fact the case. Surveys by the Program on International Policy Attitudes show that Americans on average believe that foreign aid accounts for 20 percent of the federal budget, approximately 24 times the actual figure. In 2002 the USA gave $3 per sub Saharan African. Taking out the parts for US consultants, food and other emergency aid, administrative costs and debt relief then the aid per sub Saharan African from the USA comes to six cents each in 2002991.

Whilst it is difficult to calculate exactly how much money is needed to break the extreme poverty traps globally once and for all, the general consensus is that it will involve the OECD nations paying 0.7% of their GDP in effective developmental aid. Several European countries already pay this, including Finland who currently tops the Global Competitiveness Index by the World Economic Forum. Hence clearly investing in overseas aid does not have to harm a nation’s competitiveness at all. The price that needs to be paid is so small that all of the wealthy nation’s have at different times promised to at least make every effort to pay this amount992.

Three times the wealthy nations of the world have committed to the 0.7 per cent of GDP target for their ODA. In 1992 the United States, Australia and most of the nations of the world were signatories of Agenda 21, the document adopted at the Rio Summit on Sustainable Development in 1992 which contained the following statement in Chapter 33:13:

“Developed countries reaffirm their commitments to reach the accepted United Nations target of 0.7 per cent GNP for ODA and, to the extent that they have not yet achieved that target, agree to augment their aid programmes in order to reach that target as soon as possible and to ensure prompt and effective implementation of Agenda 21.”

A decade later, at Monterrey, the Monterrey Consensus, adopted by the United States and the other participating countries, stated:

“We urge developed countries that have not done so to make concrete efforts to towards the target of 0.7 per cent of GNP as ODA to developing countries…..”

991 Ibid, p310.
992 Ibid. pp337-339.
A few months after Monterrey, at the World Summit on Sustainable Development (WSSD) in Johannesburg, South Africa, the conferees agreed on the WSSD Plan of Implementation to

“Make available the increased commitments in official development assistance announced by several developed countries at the International Conference on Financing for Development. Urge the developed countries that have not done so to make concrete efforts towards the target of 0.7 percent of GNP as ODA to developing countries.”

6.2.8 Is there a Correlation between OECD Countries Investing in Development Aid and the Economic Growth of Developing Nations?

Effective overseas development aid certainly has the potential to help countries escape the poverty trap. It is important to ask whether there is a correlation between foreign development aid and the economic growth of developing countries or whether such a correlation is conditional. This question has drawn the attention of many scholars over time. Papanek found a positive connection between aid and growth in developing countries. So too did Fayissa and El-Kaissy. Snyder found a positive relationship between aid and growth when country size is taken into account. Burnside and Dollar claim that aid works well in the good-policy environment. The World Bank has found that

“Developing countries with sound policies and high-quality public institutions have grown faster than those without them, 2.7% per capita GDP and 0.5% per capita GDP respectively. One percent of GDP in assistance normally translates to a sustained increase in growth of 0.5% per capita. Some countries with sound policies received only a small amount of aid yet still achieved 2.2% per capita growth. The good-management, high-aid groups grew much faster, at 3.7% per capita GDP.”

Others, however, have found that foreign aid can have a negative impact on growth. Knack argues that a high level of aid has a negative impact on growth because it damages the quality of institutions and encourages rent-seeking and corruption. Easterly, Levine and Roodman re-examined the work of Burnside and Dollar. They used a larger sample size and found that the results were less robust.

998 Ibid
Gong and Zou\textsuperscript{1001}'s study found that aid decreased growth. Pedersen\textsuperscript{1002}, on the other hand, maintains that it is not possible to conclude that foreign aid positively affects growth. Morrissey\textsuperscript{1003} has taken the position that aid works well but accepts that other variables have an impact on its effectiveness.

By and large, the relation between aid and economic growth remains neither definitely positive nor negative because there are so many other variables affecting whether or not aid stimulates economic growth significantly. In addition, geography is found to be influential on economic growth but so far this factor normally is neglected in many of the aid and economic growth analyses\textsuperscript{1004}. As the World Bank states

“Foreign aid has at times been a spectacular success. Botswana and the Republic of Korea in the 1960s, Indonesia in the 1970s, Bolivia and Ghana in the late 1980s, and Uganda and Vietnam in the 1990s are all examples of countries that have gone from crisis to rapid development. Foreign aid played a significant role in each transformation, contributing ideas about development policy, training for public policymakers, and finance to support reform and an expansion of public services...Internationally funded and coordinated programs have dramatically reduced such diseases as river blindness and vastly expanded immunization against key childhood diseases. Hundreds of millions of people have had their lives touched, if not transformed, by access to schools, clean water, sanitation, electric power, health clinics, roads, and irrigation—all financed by foreign aid. On the flip side, foreign aid has also been, at times, an unmitigated failure. While the former Zaire’s Mobuto Sese Seko was reportedly amassing one of the world’s largest personal fortunes (invested, naturally, outside his own country), decades of large-scale foreign assistance left not a trace of progress. Zaire (now the Democratic Republic of Congo) is just one of several examples where a steady flow of aid ignored, if not encouraged, incompetence, corruption, and misguided polices. Consider Tanzania, where donors poured a colossal $2 billion into building roads over 20 years. Did the road network improve? No. For lack of maintenance, roads often deteriorated faster than they could be built. Foreign aid in different times and different places has thus been highly effective, totally ineffective, and everything in between.”

Clearly then simply increasing overseas development aid will not be sufficient to ensure poverty is eliminated. Overseas development aid will most likely succeed in good policy and governance environments free of corruption.


6.2.9 Eliminate Corruption in all Public and Private Institutions.

The UN Earth Charter outlines that to achieve this it is necessary to “Eliminate corruption in all public and private institutions.” The World Bank has identified corruption as, ‘the single greatest obstacle to economic and social development’; an obstacle that can cause the growth rate of a country to be 0.5-1.0 percent lower than that of a similar country with little corruption. As a result the World Bank runs a Governance and Anti-Corruption program. The World Bank sees eliminating corruption as one of the four most important tasks to helping countries create good business environments. Addressing corruption is also vital for achieving other broad social sustainability goals, such as access to adequate education and health services. Transparency International, the leading NGO working on these issues, highlights how damaging corruption is to achieving the full breadth of social sustainability goals.

“On the political front, corruption constitutes a major obstacle to democracy and the rule of law. In a democratic system, offices and institutions lose their legitimacy when they are misused for private advantage. Though this is harmful in the established democracies, it is even more so in newly emerging ones. Accountable political leadership cannot develop in a corrupt climate. Economically, corruption leads to the depletion of national wealth. It is often responsible for the funnelling of scarce public resources to uneconomic high-profile projects, such as dams, power plants, pipelines and refineries, at the expense of less spectacular but more necessary infrastructure projects, such as schools, hospitals and roads, or the supply of power and water to rural areas.”

Transparency International

Susan Rose-Ackerman has written widely on corruption and lists the following ways through which poor people are hurt by corruption:

- The poor will receive a lower level of social services
- Infrastructure investment will be biased against projects that aid the poor
- The poor may face higher tax or fewer services
- The poor are disadvantaged in selling their agricultural produce.

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Using cross-country regressions over the period 1980-97, Sanjeev Gupta, Hamid Davoodi and Rosa Alonso-Terme, in an International Monetary Fund paper,\textsuperscript{1011} showed that high and rising corruption, as measured by the ICRG index, increases income inequality and poverty. Mauro also found tentative evidence that corruption alters the composition of public expenditures, stating that, ‘higher levels of corrosion are correlated with lower levels of spending on education.’\textsuperscript{1012}

“Corruption hurts the poor disproportionately by diverting funds intended for development, undermining a government’s ability to provide basic services, feeding inequality and injustice, and discouraging foreign investment and aid.”

Kofi Annan, United Nations Secretary-General, 2003\textsuperscript{1013}

The problem of corruption highlights more clearly than any other issue that social, environmental and economic challenges are intertwined. Corruption is widely regarded as one of the biggest impediments to economic growth and social and environmental sustainability. This is shown by a myriad of studies and reports.\textsuperscript{1014} In 1995, Paolo Mauro presented an article titled, ‘Corruption and Growth’\textsuperscript{1015} which empirical evidence to helped to demonstrate the negative relationship between corruption and long-term economic growth. His paper showed, using extensive cross country data that corruption has the effect of reducing confidence and investment in nations and thus reducing economic growth. Mauro’s 1995 study has been backed up by a number of empirical studies which have generally concluded that the economic costs of corruption and weak governance are substantial.\textsuperscript{1016}

Given that there is increasing recognition that corruption has substantial, adverse effects on social, environmental and economic outcomes, the question needs to be asked why don't countries strive to improve their institutions and root out corruption? Why do many countries appear to be stuck in a vicious circle of widespread corruption and low economic growth, often accompanied by ever-changing governments through revolutions and coups? Mauro argues in his 2002 paper\textsuperscript{1017} that a possible explanation is that when corruption is widespread, individuals do not have incentives to fight it even if everybody would be better off without it. Another is that they simply do not know how to


effectively address and stamp out corruption. Transparency International\textsuperscript{1018} is the peak international NGO addressing this complex questions and building global coalitions of organisations wishing to address this major global problem. They seek to empower people wherever they are in society to help play their part to stamp out corruption.

Countries like Botswana\textsuperscript{1019} have shown that it is possible to stamp out corruption and maintain this through a pro-active approach. Botswana since independence in 1966, has been politically stable, with a multi-party democracy. The country has enjoyed four decades of economic growth, underpinned by its diamond industry. It is the largest producer of diamonds - by value - in the world. Botswana has successfully kept corruption in check. According to the corruption watchdog, Transparency International, Botswana is the least corrupt country in Africa. The poster on the wall in the arrivals hall at Gaborone Airport is a clear pointer. "Botswana has zero tolerance for corruption. It is illegal to offer or ask for a bribe," it reads. Lebang Mpotokwane, chairman of Transparency International in Botswana, says that in a fast-growing economy, there are temptations, but the government has led by example. "The government is forever preaching to the nation about corruption, and I can't think of any corruption involving government ministers", he says.

The success of Botswana demonstrates that it is worthwhile to investigate the underlying causes of low corruption. Some of the reasons for Botswana’s success story owe to unique historical developments such as the discovery of diamonds after independence, a peaceful struggle for independence and political leaders who refrained from seizing the nation’s wealth. Although this lucky course of events cannot be replicated, others can: Botswana’s economic policies are characterised by a remarkable prudence as regards the use of diamond rents. Moreover, the deals with diamond multinational De Beers were negotiated very carefully and evolved into a real partnership which is often absent in the relations between multinationals from the North and governments in the South. Botswana’s over-all success would have been impossible without a National Integrity System (NIS). Botswana’s NIS includes high levels of democratic accountability, an independent and efficient judicial system, an Ombudsman to report irregularities in the public service and free media.\textsuperscript{1020}

Botswana is not the only success story. When government officials, politicians, judges or the police are earning very low wages they are vulnerable to corruption. Singapore showed that corruption of this type can be quickly eliminated by strong penalties and by raising salaries. However not all countries and governments have the capacity to do this. In Uganda, to fight corruption, the government publicizes all cheques sent to the local level, so that villagers know what they should be receiving and can make sure that those between the national government and the villages are not taking a cut. In

\textsuperscript{1018} See Transparency International at \url{http://www.transparency.org/} (Accessed June 2007)
Nigeria, the government publishes how much money it is getting in oil royalties so that citizens can see where the money is going. In Thailand, the new constitution includes a provision that citizens have a basic right to know what their government is doing with taxes and money.

Addressing corruption not only helps economic growth and social sustainability goals, it also allows environmental sustainability goals to be achieved. This is shown simply by comparing Transparency International’s (TI) 2000 Corruption Perceptions Index (CPI), which ranks 90 countries, with the performance of these same countries in the Environmental Sustainability Index (ESI). The 2000 TI CPI revealed a 0.75 correlation with ranking of environmental performance.\(^{1021}\)

‘Corruption and environmental destruction go hand in hand’, TI Chairman Prof. Dr. Peter Eigen stated. ‘The ESI underscores that the battle to preserve the world’s natural heritage can only be won if there is transparent and accountable government’, Eigen said at the World Economic Forum in Davos in 2001.

The strong causal relationship between corruption, environmental destruction, lack of social justice and poor economic growth in many countries are around the world creates a remarkable synergy around which business, government to all NGOs can form coalitions. A good example of this is what is happening globally to address illegal logging and forest degradation. Forest-related corruption is one of the major factors in the environmental destruction of forests globally. It has many manifestations, ranging from fraudulent logging concessions, to log smuggling and illegal logging, to the laundering of illicit proceeds, fraud, tax evasion and illegal trade. Yet, in a search for global sustainability, corruption remains one of the hardest challenges to address. Researchers and reformers at all levels-national and international, official and non-governmental, public and private-see their efforts to tackle corruption frustrated by lack of political will and lack of information, as well as lack of common methodologies, appropriate tools of analysis and concerted action. Combating forest corruption thus urgently requires multi-strategy, multi-stakeholder and multi-level action in order to be successful in the short and long run. Transparency International has helped to catalyse the global international coalition Forestry Integrity Network\(^{1022}\), born from this sense of urgency, to respond to this pressing challenge.

Transparency International provides numerous resources outlining how to tackle corruption. The World Bank’s 1997 World Development Report, The State in a Changing World also covered the topic in detail.\(^{1023}\) These two sources provide a detailed overview and plan for action to reduce and eliminate corruption based on years of experience.


6.2.10 Breaking the Poverty Trap - Reducing Farm Subsidies and Debt.

The UN Earth Charter also calls for us to “Ensure that economic activities and institutions at all levels promote human development in an equitable manner” and “Enhance the intellectual, financial, technical, and social resources of developing nations, relieve(ing) them of onerous international debt.” This is because eradicating poverty involves much more than international aid programs and ensuring good policy and corruption free environments. The relief of debt and the reform of farm subsidies in countries giving aid may be just as important. Lester Brown explains:

“A successful export-oriented farm sector— taking advantage of low-cost labour and natural endowments of land, water, and climate to boost rural incomes and to earn foreign exchange—often offers a path out of poverty. Sadly, for many developing countries this path is blocked by the self-serving farm subsidies of affluent countries. Overall, industrial country farm subsidies of $280 billion are roughly 2.5 times the development assistance flows from these governments. (EU) is staggering, accounting for over one third of its total annual budget. It also looms large internationally. In 2005 the EU-25 accounted for $134 billion of the $280 billion spent by affluent countries on farm subsidies. The United States spent $43 billion on farm subsidies.\footnote{Brown, L (2008) Plan B. Mobilising to Save Civilisation. The Earth Policy Institute. Available At \url{http://www.earth-policy.org/Books/PB3/Contents.htm} Accessed 17.02.2008}

The reality is that subsidies can encourage the overproduction of farm commodities. They will then be sent abroad with the assistance of export subsidies. The end result is the depressing of world market prices, which harms the poorest countries. For example, the European Union provides more than half of the $104 billion in development assistance from all countries. But much of the economic gain that would flow from this assistance has been reduced because of the impact of the EU’s farming subsidies and annual dumping. The Catholic aid agency CAFOD has calculated that the money spent by the EU to protect its farmers could pay for an annual world trip for each of its 21 million cows. Every cow in the EU is subsidized by EU$2.50 per day which is more than what over one billion people currently earn each day. But EU cows are not the most heavily subsidized. Japanese cows are subsidized $7.50 per day. Change in this area will not be politically easy in the EU and thus come with political costs. To minimise these political costs structural adjustment packages would be needed. Ideally this would be part of a genuine effort to progress global trade negotiations to create a fairer world trade agreement. Stiglitz and Charlton have in 2006 published a detailed study\footnote{Stiglitz, J. Charlton, A (2006) Fair Trade for All: How Trade Can Promote Development. Oxford University Press. Available at \url{http://www.andrewcharlton.com/ftfa.htm} Accessed 17 February 2008} addressing the question of how can the poorer countries of the world be helped to help themselves through freer, fairer trade.\footnote{See Fair Trade for All Book Launch Speech by Australian Treasurer, Wayne Swan. Available At \url{http://www.andrewcharlton.com/ftfa.htm} Accessed 17 February 2008}
In addition to eliminating harmful agricultural subsidies, another essential part of any attempt to eradicate poverty is debt forgiveness. For example, sub-Saharan Africa spends four times more on debt servicing than it does on health care. Forgiving debt in such a situation can help to boost living standards.

In July 2005, in Gleneagles, Scotland, the heads of the G-8 group of industrial countries, agreed that debts owed by a number of the poorest countries to the World Bank, the International Monetary Fund, and the African Development Bank be cancelled. The countries affected were 18 of the poorest countries (14 in Africa and 4 in Latin America) and the proposal offered them a significant boost. It was also agreed that, subject to them meeting the qualifications, up to another 20 of the poorest countries could also benefit in this way. A combination of public pressure by non-governmental groups campaigning for debt relief in recent years and strong leadership from the U.K. government were the keys to this poverty reduction breakthrough.

The year after the Gleneagles meeting, the International Monetary Fund had eliminated the debts owed by 19 countries, the first major step toward the debt relief goal set at the G-8 meeting. For Zambia, the $6 billion of debt taken off the books enabled President Levy Mwanawasa to announce that basic health care would be now free. Burundi cancelled school fees, permitting 300,000 children from poor families to attend school and committed to a poverty action fund, some of which would be used to train thousands of new teachers. The continuation of debt forgiveness by the international community would give strong support towards eradicating poverty. But there is still room for further progress. The Gleneagles’ commitment eliminated only a small part of poor-country debt to the three international lending institutions. Further there are at least another 40 more countries with low incomes that would benefit from the cancellation of their international debt to those bodies.

6.3 Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner

6.3.1 Promote the equitable distribution of wealth within nations and among nations.

Another core goal of social sustainability as outlined in the Earth Charter is reducing global and national economic inequality. The Earth Charter mentions the importance of equity several times. The two titles for this sub-section are taken from the Earth Charter. In addition, in the Earth Charter’s preamble it states that “The benefits of development are not shared equitably and the gap between rich and poor is widening.” Global inequality does continue to rise. In 2005 two major reports published on the issue, both agreeing that global income inequality continues to increase. The UNDP Human Development Report 2005 recorded that only nine countries (4% of the world’s population) had reduced wealth inequality, while 80% of the world’s population experienced an increase in wealth.

inequality. The Report noted that the combined income of the 50 richest people in the world was greater than the combined income of the poorest 416 million. 2.5 billion people (40% of the world’s population) were living on less than $2 a day receiving 5% of global income. The wealthiest 10% of the world’s population received 54% of global income.

The UN’s Report on the World’s Social Situation 2005, *The Inequality Predicament*, examined other aspects of global inequality that were causing and worsening poverty. They included the areas of health, education and employment, gender and opportunities for participation in society and politics. Where these inequalities were institutionalised they resulted in greater marginalisation within communities. The report emphasised the inevitable consequences flowing from such inequality including the disintegration of society, violence and terrorism, both national and international. The World Bank has recognised the seriousness of the problems created by these extreme inequalities.

The 2006 Development Report was focussed on the issue and on what needs to be done to address it and the benefits that will flow from doing so.

### 6.3.1.1 Addressing Inequality Helps to Reduce Poverty Faster

Broad-based economic growth is critical to accelerating poverty reduction. The most successful East Asian countries in the 1970s and 1980s showed that rapid growth, combined with low initial inequality and pro-poor distributional change, could significantly reduce poverty.

Analysis of changes in poverty levels across a sample of developing countries in the 1980s and 1990s also highlights the importance of fast growth for poverty reduction. But income inequality also affects the pace at which growth is translated into poverty reduction. Growth is less efficient in lowering poverty levels in countries with high initial inequality or in which the distributional pattern of growth favours the rich.

In the late 1990s the term pro-poor growth became popular as economists recognized that

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accelerating poverty reduction required both more rapid growth and lower inequality.\textsuperscript{1033} Thus two of
the key goals of the Earth Charter, namely to eliminate poverty and reduce global inequality appear to
be mutually re-inforcing.

6.3.1.2 Addressing Inequality Helps to Reduce Violence, Conflict and War

Another central aim of the Earth Charter is to encourage people to work to end violence and foster
peace. Section IV of the Earth Charter is simply titled “Democracy, Non-Violence and Peace.” The
most well-established environmental determinant of levels of violence is the scale of income
differences between rich and poor. More unequal societies tend to be more violent. The World Bank
has found that greater income inequality increases the risks of criminal violence and armed violence
between warlords in various nations. Civil war and unsafe streets reduce economic growth
dramatically.\textsuperscript{1034} Economists Alberto Alesina and Dani Rodrick’s work also demonstrates that
inequality impedes economic growth by promoting ‘distributional conflicts’ that cost real resources
and impede genuine progress within nations.\textsuperscript{1035} The likelihood of armed conflict affecting states
increases as their human development ranking declines. 5.5 per cent of the countries ranked as High
Human Development states by the UN Human Development Index (HDI) 2004 experienced one or
more armed conflicts during the ten-year period 1995-2004. This figure rises to 29.1 per cent of those
ranked as Medium Human Development states. For Low Human Development states, there was
almost as much likelihood (47.2 per cent) that they were at war during the decade as not.

Inequality also directly correlates with increased violent crime and homicide. There are over 50
studies showing a clear tendency for violence to be more common in societies where income
differences are larger. The empirical evidence comes from international studies of developed and
developing countries as well as from empirical studies within specific nations. Fajnzylber and
colleagues found a clear correlation between homicide rates and inequality using international data
from over thirty nine countries.\textsuperscript{1036} In 2001, Daly et al\textsuperscript{1037} showed at least a tenfold difference in
homicide rates related to inequality for 50 US states and 10 Canadian provinces. By as early as 1993
there were enough studies on this issue to allow a meta-study to be done. In 1993, Hsieh and Pugh
compared over 40 published studies and concluded that the relationship between inequality and


\textsuperscript{1034} Ibid.

Economics, vol.109, no. 2.

45, no. 1.

violence was a robust one.\textsuperscript{1038} In fact, the relationship between inequality and violent crimes like homicide is regarded by many criminologists as the most well established relationship between homicide and any factor. This leads to many direct and indirect costs to society which harms economic growth. Over 2 million residents of the US are currently incarcerated. In 2002, for every 100,000 residents in the US, 700 were in jail, while for England and Wales only 132, Canada 102, France 85 and only 42 were locked up in Japan. Therefore, reducing inequality will have a positive effect on reducing violent crime and the costs of such crime to society. Ironically, the diversion of social development funds to national/international security and military operations produces further deprivation and marginalization, thus creating a vicious cycle.

6.3.1.3 Addressing Inequality Helps to Create a Healthy Society
Reducing inequality also correlates with greater health,\textsuperscript{1039} which in turn correlates with a productive workforce and economic growth.\textsuperscript{1040} There is a significant health gradient from rich to poor for many diseases. It is worst in those countries with the greatest inequality and is noticeably less prominent in those societies that are noticeably both more equitable and have a greater ethic of working together and trusting each other, such as Japan in the OECD and Kerela, India in the developing countries.\textsuperscript{1041} Life expectancy is a health factor that is also closely related to inequality; within each of the OECD countries the average life expectancy is five, ten, fifteen years shorter for people living in the poorest areas compared to those in the richest. Those OECD countries with some of the greatest inequality, like the US, rank low amongst the OECD in terms of health outcomes even though the US is the richest country in the world. Life expectancy, for example, is 20 years less in black downtown Washington, DC, in comparison to rich and white Montgomery County just 20 miles away.\textsuperscript{1042}

6.3.1.4 Reducing Inequality Boosts Economic Growth
The evidence suggests that long term extreme inequality with extreme poverty does not assist economic growth as much as a more egalitarian approach. Oxfam, in its 1997 report \textit{Growth with Equity}, found that.\textsuperscript{1043}

“Policies for economic growth and poverty reduction are mutually reinforcing, rather than contradictory. This is because widespread poverty represents a vast waste of productive potential, reducing output and productivity, limiting the scope for savings and investment, and restricting market opportunities. Simply put, poverty represents not only a denial of basic rights, but also a source of economic inefficiency. Overcoming that inefficiency should be a central policy objective for all governments.

Rapid progress towards poverty reduction and human development is possible through policies which combine growth with equity. East Asia demonstrates that such policies, which are good for equity, are good for growth, and good at converting growth into poverty reduction. Over the past three decades the region has experienced the most rapid and sustained growth recorded this century. Less widely appreciated is the fact that economic success has been accompanied by a silent revolution in poverty reduction. More people have moved out of poverty more quickly than at any time in history. The message which emerges for governments, which are serious about economic growth, is clear: get serious about poverty reduction and human development.”

6.3.2 Ensuring Access to Education and Health Services

Given the success of the social investment in education and health in the Asian economies, why aren’t all countries following Asia’s lead? Some popular opinion, and the opinion of many economists, sees social spending - spending on poverty reduction and investment in human development, unemployment benefits, public health care, public pensions, housing subsidies, and public education and training - as being a drag on economic growth. In the 1960s and 70s, Arthur Okun, the Keynesian economist and policy advisor to presidents Kennedy and Johnson, argued that there was a ‘big trade-off between equality and aggregate economic efficiency’. He argued that government policies to distribute income more fairly through social legislation and job creation schemes would necessarily intrude into market relationships, causing the society to forego private gains elsewhere. More recently, however, Okun’s ideas have been disproved.

Experts now argue that public spending on education, for instance, helps productivity and economic growth, rather than hindering it. For instance, Nobel Prize winning economist Amartya Sen in Development as Freedom argues that:

“The pioneering example of enhancing economic growth, through social opportunity, especially in basic education, is of course Japan. It is sometimes forgotten that Japan has a higher rate of literacy than Europe had even at the time of the Meiji restoration in the mid-nineteenth century, when industrialization had not yet occurred there but had gone on for many decades in Europe. Japan’s economic

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development was clearly much helped by the human resource development related to the social opportunities that were generated. The so-called East Asian miracle involving other countries in East Asia was, to a certain extent, based on similar causal connections. These economies went comparatively early for massive expansion of education and later also health care, and they did so in many cases before they broke the restraints of general poverty."

Sen argues that whether countries invest or not in social capital and human development has a significant impact on what economic growth rates are achieved. Sen illustrates this by comparing the Asian tiger economies and India and their literacy rates. Sen writes:

“When China turned to market liberalisation in 1979 it had already a highly literate people, especially the young, with good schooling facilities across the country. Whilst when India turned to market liberalisation in 1991, half the Indian adult population could not read and…. the situation is not much improved today.”

In other words, ensuring that the whole population has a good education and useful skills can assist development and economic growth in many ways. Productivity gains do not simply depend on the skills of employees in a company but also on the abilities of the other companies in the supply chains, sector or cluster, at least within the region. Thus, a company operating out of any regional economy will benefit if there is a high skill-base in that region where workers can learn from each other. This supports faster economic growth in a regional economy, urban economists call these ‘neighbourhood effects’. This explains why, empirical evidence shows that when inequality is allowed to grow, this in fact slows subsequent economic growth, particularly over the longer term. One of the reasons for this is that inequality causes an under-investment in education by the poor. When a large fraction of the population under-invests in education, compared to the investment being made by the economies with which one competes, productivity growth falters. This is one of the reasons why

‘the relatively egalitarian states of East Asia have grown economically three times faster than the highly unequal economies of Latin America.’

Such beliefs are backed up by *Growing Public*,1054 by economist Peter Lindert. Lindert has examined the history of social spending from the late eighteenth century to the present day. What he found was surprising, namely that 200 years of empirical evidence shows that wise social spending and the welfare state has contributed to, rather than inhibited, economic growth. Contrary to traditional assumptions, Lindert’s book shows the net national costs of government social programs to be virtually zero. Lindert examined the question of whether social spending, that overall redistributes income imposes constraints on economic growth. Lindert shows that no Darwinian mechanism has punished the welfare states, but shows why effective welfare helps economic growth over time.1055 Other books investigating these issues, such as *Growing Prosperity: The Battle for Growth with Equity in the 21st Century* by Bluestone and Harrison,1056 come to similar conclusions. Investing in improving the skills and education of today’s workforce and the next generation is now widely acknowledged as sound investments to lift the productivity of the economy and help business to compete in a globalised economy. Investing in people’s skills and education is seen by many political leaders as the key to creating a new round of improved productivity. There is also now a great deal of empirical data which shows that investing in public health1057 is highly cost effective.1058 Also it has been shown that taxing “bads” such as tobacco has also led to a decrease in the numbers smoking in many OECD countries. The savings to the national health budget of such reductions in tobacco usage are very significant.

Studies suggest that there is significant potential to improve OECD countries population health and significantly reduce healthcare system costs simply by addressing lifestyle choices. The Australia Institute of Health and Welfare found that:

> By world standards Australians are living long lives, health risks are being actively tackled, and access to high quality health services is very good and generally improving. But much of the burden of ill-health

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1055 While there is a small relationship between greater social spending and higher unemployment in OECD countries, the unemployed are often the least productive, so increases in unemployment have little effect on GDP growth. Lindert argues that, ‘the broad universalism in taxes and entitlements [found in more fully developed welfare states such as Western Europe] fosters growth better than the low-budget countries’ [such as the US] preference for strict means testing and complicated tax compromises’. Lindert concludes that high-spending countries face more pressure from the electorate to design their tax-and-spend plans with care to avoid affecting growth prospect.
to individuals and society as a whole can be reduced through attention to a few lifestyle factors, such as smoking, poor nutrition, excessive alcohol consumption, and inadequate physical activity - in other words, the public health message of prevention being better than cure. AIHW Medical Adviser Dr Paul Magnus says there is plenty of scope for improvement. For example, 50% of adults have high cholesterol levels, and this hasn't improved for the past 20 years. The major culprit is a diet too high in saturated fats. Diabetes is now a major disease for older people, with much of it probably due to increasing prevalence of overweight and obesity. Overweight and obesity affect about 65% of men, 45% of women, and 1 in every 5 children.  

Similar trends apply to most other OECD countries. Exploring this phenomenon in all OECD countries is beyond the scope of this thesis, so let’s consider the potential gains for Australia through a focus on lifestyle choices.

Physically inactive Australian adults are already costing the Australian healthcare system an avoidable AU$1.5 billion a year. Obesity already costs Australia AU$21 billion annually. Seven million Australians are estimated to become obese by 2025. If nothing is done to address obesity and the diseases of inactivity, the average taxpayer will have to spend thousands more per annum in taxes to meet rising costs of the public health system. The Australian Government health spending is projected to almost double by 2050 due, in large part, to the costs of these diseases of inactivity in an aging population. Paul Gross, from the Institute of Health Economics and Technology Assessment argues that for every dollar invested by Government in encouraging people to be active and live healthier lifestyles, the government would save six dollars in improved productivity, reduced absenteeism and reduced drain on the health care dollar. It is possible for governments to invest in incentives and infrastructure to make it easier for people to walk and ride to work or the shops. Investing in sustainable transport solutions which make our cities walkable and cyclable would improve public health, reduce congestion and reduce greenhouse gas emissions. This is one of the main justifications for greater government investment into sustainable forms of transport which help people to be more physically active through catching the train or bus, walking and cycling. A 30 minute cycle trip a day provides all the exercise you need to halve the chance of becoming obese or diabetic. As former CEO of BHP Billiton Chip Goodyear stated:

"Cycling to work is a great way of incorporating exercise into my daily routine. Cycling provides an outlet from the demands of the job and gives me time to think. It also beats sitting in traffic. For some employees the ride to work is 30 minutes quicker than driving or catching public transport. Regular exercise is a key to staying focussed and productive at work, so I’m happy to invest in facilities and programs that make riding to work easier.”

There are other quantifiable economic benefits of investing in people. More of these are considered next.

6.3.3 The value of social capital and trust to economic growth

The impact of social norms, trust, relationships and community on economic growth has also recently been investigated. Here again, social capital and trust have been found to positively effect economic growth. Two studies on social capital illustrate its importance to economic growth: Robert Putnam’s study of the workings of social capital in northern Italian communities, and the World Bank study on household incomes and social capital in rural Tanzania. Both show that social capital and trust have a positive effect on traditional economic growth.

Robert Putnam’s work has highlighted that Italy provides one of the best examples of the value of social capital and trust to the genuine wealth of a region. While the north of Italy is now significantly more prosperous than the south, 1000 years ago the opposite was the case. Why has this changed? Several leading academics have investigated this. In 1958, sociologist Edward Banfield’s concluded in his book, The Moral Basis of a Backward Society, that the culture of the south ran contrary to members of society banding together to act for the common good. Instead, they were oriented towards the ‘maximise the material, short-run advantage of the nuclear family: assume all others will do likewise’. They were more competitive than co-operative - and poorer for it. For example, Robert Putnam, Harvard University, notes that in both northern and southern Italy there were considerable investments in social relationships. However, northern Italy tended to be characterised by

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1066 Robert Putnam has done much to put social capital on the academic and political agenda as a key and important measurable factor in human well-being and welfare.
1069 Banfield, E. (1958) The Moral Basis of a Backward Society, Free Press. New York. This book is a study of underdevelopment in a village at the southern tip of Italy. ‘The extreme poverty and backwardness of which’, he wrote, ‘is to be explained largely (but not entirely) by the inability of the villagers to act together for their common good’.
1070 In the 1970s, Putnam began a collaboration with Robert Lonardi and Raffaella Y. Nanetti that, nearly 20 years later, resulted in the seminal work, Making Democracy Work: Civic Traditions in Modern Italy (1993). Based on a study of Italian politics and, in particular, the experience of the move to regional government post-1970, this book displays a number of the classic Robert Putnam hallmarks. These include: sustained and detailed attention to empirical data; a commitment to
egalitarian relationships that grew out of a long history of guilds and co-operative efforts. Robert Putnam was surprised to find that the most powerful correlation for regional wealth was with the number of soccer clubs and choral societies. Sport and recreation are critical to building social capital, to creating the networks and trust between business, government and community, which are totally inter-mixed and integrated when people join sporting groups and voluntary community associations. He argues that the ‘horizontal civic bonds have under girded levels of economic and institutional performance generally much higher than in the south, where social and political relations have been vertically structured’. Robert Putnam’s article, Bowling Alone, built on this to show that the roots of the difference go back to the 1100s, when the north never knew the centralised, autocratic, vertical power-structure rule of the Normans, and instead had small autonomous republics for many centuries. While the southerners lived in a hierarchical society, with every family dependent on the patronage of landowners and bureaucrats, the northerners depended on one another for work, help and for money.

They formed hundreds of low-level, horizontal-bond organisations, such as guilds and credit associations, which built mutual trust instead of competition. In studying why particular regions of Italy were wealthier than others, Putnam was surprised to find that the most powerful correlation was with the number of soccer clubs and choral societies. He wrote, ‘Good government in Italy is a by-product of singing groups and soccer clubs’. His analysis provided the basis for understanding how social capital – both the historical legacy and current social networks – has a significant effect on an economy. Markets are available to develop everywhere, but to bring together the required components of finance, government approval and community support requires the social infrastructure of networks and trust. The enduring ‘tragedy of the commons’ nightmare of southern Italy suggests that any part of the world high in social capital should place an extremely high priority on its preservation. This human dimension is being increasingly acknowledged as being key to achieving both better economic and environmental outcomes. Following the results of Putnam’s work, US Government authorities are developing an awareness of social capital and making increased efforts to establish relevant databases. In Europe, a study entitled Social capital and regional economic growth, by Sjoerd Beugelsdijk and Ton van Schaik, backed Putnam’s finding. This study of a

producing material that could help with the task of enhancing the quality of social and political discourse; and grounded and accessible writing. The book’s concern with civic community and social capital was a direct precursor to Bowling Alone (1995, 2001) - Putnam’s very influential study of the decline in civic engagement in the US.


cross-section of 54 European regions during the period 1950-1998 asked whether social capital, in the form of generalised trust and associational activity, is related to regional differences in economic growth. Based on extensive robustness tests, they found evidence that social capital, measured as associational activity, is positively related to growth differentials in European regions. Hence, their results suggest that Putnam’s 1993 thesis on social capital in Italian regions can be generalised. Their analysis also suggests that it is not only the mere existence of network relationships that stimulates regional economic growth, but also the level of actual involvement in these relationships.

Another significant study demonstrating the importance of social capital in creating genuine wealth and economic prosperity was that of The World Bank’s on Tanzanian social capital. This study used data from the 1995 Social capital and poverty survey. This data came from a larger poverty assessment survey, which surveyed about 5,000 rural households on the extent and characteristics of their associational activity and their trust in various institutions and individuals. A measure of social capital was constructed from their answers, which was matched with data on household expenditures in the same communities as a proxy for aggregate income. The conclusions are robust: that social capital is indeed related to higher incomes, and that it is social, in that the higher household incomes depend on the village level of social capital and not on the household’s measure of participation. The magnitude is quite impressive: an increase in social capital of one standard deviation increases household expenditures per person by 20 to 30 percent, an impact as large as an equivalent increase in non-farming assets or a tripling of the level of education. The data also reveals some of the channels through which social capital affects incomes - improved public services, greater use of modern agricultural inputs, more community activity, and greater use of credit.

Stephen Knack and Philip Keefer have endeavoured to explore additional aspects of social capital, providing evidence that the level of trust and civic norms has correlated with improved economic performance in 29 market economies over the last two decades. The World Bank is now sponsoring a large number of follow-up studies to the Tanzania one, using developments of the original methodology in different countries.

This literature is having an effect in changing the perceptions about the importance of social capital within organisations, ranging from the IMF to the former Australian Treasurer, Peter Costello.

Peter Costello made an important speech on the importance of social capital in which he acknowledged Putnam’s work and the literature on the value of social capital and trust:

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“If you want to run a successful modern liberal economy then trust and tolerance between citizens gives you a long head start. Trust facilitates compliance. Trust enhances efficiency. It reduces transaction costs because you do not have to ascertain and negotiate the bribe on each transaction. Trust in the legal system and the enforceability of contract underpins the willingness to invest. Trust and tolerance are sometimes described as social capital. In an IMF paper on second generation reform, Francis Fukuyama argued: ‘Social capital is important to the efficient functioning of modern economies and is the sine qua non of (without which there would not be) stable liberal democracy.’

Peter Costello, Treasurer of the Australian Federal Government, 2003

What is often ignored in this renewed interest in social capital and the strength of community life is the fact that increases in social capital are almost entirely dependant on greater social equality. There are now several important studies showing that the more equitable a society is, the more they are also trusting and healthier. Eric Uslaner, in his 2002 book, The Moral Foundations of Trust, draws attention to the fact that more egalitarian societies also tended to be more trusting. He shows that people trust each other less in countries with larger income differences. Uslaner looked at studies of countries across the globe, including the 1997 study by Kawachi and Kennedy which showed that in the US more people were much more trusting of each other in those states with the least inequity. They found significant differences between the more equitable states, where only 10-15 percent of the population felt that they could not trust others, compared to the less equitable states, where 35-45 percent felt they could not trust others. Interest in these links between social capital, social trust, and strength of community life and participation rates goes back to Alexis de Tocqueville’s Democracy in America, in which he describes his visit to the US in 1831. Academics writing on social capital often quote his book and its coverage of the strength of community life in the US at the time. However, they fail to acknowledge that Alexis made this linkage explicitly, even though he does this on the first page of the book where he writes:

“Among the new objects that attracted my attention during my stay in the United States, none struck me with greater force than the equality of conditions. I easily perceived the enormous influence that this primary fact exercises on the workings of the society. It gives a particular direction to the public mind, a particular turn to the laws, new maxims to those who govern and particular habits to the governed.”

Tocqueville explained why he believes greater equity leads to a stronger civic life:

“When the chroniclers of the Middle Ages, who all, by their birth or their habits, belonged to the aristocracy, report the tragic death of a noble, they express infinite sorrows; whereas they recount in one breadth and without batting an eye the massacre and tortures of the common people... [However,] when ranks are almost equal among a people, with all men having more or less the same manner of thinking and feeling, each of them can judge in an instant the feelings of all the others... There is thus no misery that he cannot easily conceive of and whose dimensions are not revealed to him by a secret instinct. It does not matter whether it is a question of strangers or enemies: his imagination puts him immediately in their place. It mixes something personal into his pity and makes him shudder himself when the body of his fellow man is torn apart.”

6.3.4 Creating Jobs and Livelihoods.

Ensuring those who want a job can find one is regarded by most as a key social sustainability goal. In developing countries, many of which have no social welfare net, it can be the difference between life and death. The International Labour Organisations (ILO) 2006 annual jobs report says global unemployment continues to grow and youth now make up half those out of work. The number of people unemployed worldwide climbed to new heights in 2005, as robust economic growth failed to offset an increase in people seeking work - especially among the vast and growing legion of jobless youth, the International Labour Office (ILO) said in its annual Global Employment Trends. What's more, the ILO report said the weakness of most economies in turning GDP growth into job creation or wage increases, coupled with a spate of natural disasters and rising energy prices, hit the world's working poor especially hard. The ILO trends report showed that despite 4.3 per cent global GDP growth in 2005, only 14.5 million of the world's more than 500 million extreme working poor were able to rise above the US$1 per day, per person poverty line. According to the ILO, in addition, in 2005, of the more than 2.8 billion workers in the world, 1.4 billion still did not earn enough to lift themselves and their families above the US$2 a day poverty line.

According to official estimates, the unemployment rate remained unchanged after two successive years of decline at 6.3 per cent. The total number of jobless stood at 191.8 million people at the end of 2005, an increase of 2.2 million since 2004 and 34.4 million since 1995. The ILO found that while more people are actually "in work", at the same time, more people are unemployed than ever before. ILO Director-General Juan Somavia stated:

1083 Ibid, p 249.
This year's report shows once again that economic growth alone isn't adequately addressing global employment needs. This is holding back poverty reduction in many countries... We are facing a global jobs crisis of mammoth proportions, and a deficit in decent work that isn't going to go away by itself. We need new policies and practices to address these issues... Economic shocks as well as natural disasters hit those who are already poor disproportionately hard, and, in the recovery process, they are the last to return to pre-shock conditions. The current pattern of globalization continues to have an uneven social impact with some experiencing rising living standards and others being left behind. 

According to the report, recognition that poverty reduction can only be reached via the route of more and better jobs is more widespread today, especially in Africa. Increased awareness of the importance of placing employment at the centre of economic and social policy-making, is an important step forward.

Unemployment has also been a major recurring social problem throughout the twentieth century for OECD countries, and a permanent feature of economic life in many OECD countries since the early to mid 1970s. Hence ensuring that all people in OECD and developing countries have access to secure and meaningful livelihoods is a critical goal for achieving socially sustainable world.

6.3.4.1 Negative Effects of Unemployment on Health

We all know friends or family who have at times not been able to find work. It can be devastating to self-confidence, and physical and mental health. But until the 1980s there was not much solid data to contradict arguments from politicians who stated that unemployed people have worse health because it is hard for sick people to get a job. This brings up an interesting point - what is the cause and what is the effect? The work of John Fox and his team in the early 1980s dramatically changed thinking on this issue. They followed a one percent sample of people identified in the national census in Britain in 1971. They showed that people who became unemployed had 20 percent higher mortality than those who remained employed at the same socio-economic level. The critics on the right and in government argued that this was because the unemployed were already sick. Fox argued that if the unemployed had higher mortality because of the existence of life-threatening illness prior to becoming unemployed, this effect should wear off as the sick people died out. It did not. At the same time a related book, Unemployment and Health: a disaster and a challenge, Richard Smith drew

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widespread attention to the effects of unemployment on health. Since then, numerous studies have highlighted the range of physical and mental illness caused by unemployment.\textsuperscript{1088}

More recently Michael Marmot’s\textsuperscript{1089} work demonstrates that the degree of control people feel they have over their lives is one of the most important factors for their health and well-being. When people are deprived of the opportunity to work altogether this significantly removes the degree of control they have over their lives and the choices and options available to them. Losing a job also leads to loss of social status and for many people shame and additional stresses that can negatively affect important family relationships. For instance, financial pressures are a significant factor in many divorces.

6.3.4.2 The Economic Costs of Unemployment are Significant

In 1994, Quiggan calculated that the economic costs to Australia of unemployment meant that the Australian national income was around $35 billion a year lower than it would be if unemployment were only about three percent - a rate close to full employment. This massive waste reduces the living standard of every Australian, and dwarfs the costs of other inefficiencies. The direct budget cost of unemployment from increased outlays on income support and loss of revenue is at least AUS$20 billion. The persistence of high unemployment is largely responsible for the severe pressure on government budgets. This clearly has a negative effect on economic growth, but economists support it because, in theory, having structural unemployment helps to keep inflation in check through providing a downward pressure on wage rises. The question then is: what is the point at which unemployment is alleviated and the percentage of unemployed becomes so small that it leads to increased worker confidence to seek increased wages leading to inflation rises? Economists have an acronym for this point, NAIRU, which means the non-accelerating inflation rate of unemployment.

Until a few years ago, the NAIRU point was considered to be about 5 percent unemployment - if you went below that, you would get inflation. But in practice this does not have to be true. In Australia in the 1980s the Labour Government’s Accord locked-in agreed real wage cuts of about 15 percent from 1983-1996 relative to inflation. Therefore, it is possible with understanding in the community to reach a consensus, like the Hawke Labour Government did in 1983, to reduce real wage rises to keep inflation in check, thereby allowing unemployment to come down. In the past, many countries, including Australia, had a strong tradition of seeking to provide full employment.\textsuperscript{1090}


\textsuperscript{1090} Australia was the first country in the world in which full employment in a free society was made official policy by its government. On May 30, 1945, The Australian Labor Party Prime Minister, John Curtin, and his Employment Minister, John Dedman, tabled a white paper in the Australian House of Representatives titled Full Employment in Australia. It was the first time any government apart from totalitarian regimes had unequivocally committed itself to providing work for any person who was willing and able to work. Conditions of full employment lasted in Australia from 1941 to 1975.
Governments and citizens are very concerned to lower unemployment and create more jobs. Also due to globalization, economic deregulation, and reduction of tariffs there is much greater competition in the marketplace. Since the fall of the iron and bamboo curtains, hundreds of millions of cheap workers have been added to the world’s workforce. Since the late eighties developed nations and their companies have embarked on significant cost-cutting exercises. Downsizing and outsourcing have been adopted to such an extent that in the past 12 years, for example, Australian organizations have retrenched one in two full time employees. Citizens are looking for greater job security than they currently have. Competition policy and changes in workplace relations has meant very few people have more than one to two year performance based contracts. This leads to much greater insecurity and uncertainty in the workplace. Economy-wide, inflation adjusted hourly wages for male workers are in a twenty year decline in many OECD countries. Many male workers once they lose their jobs from established industries do not recover their former salaries quickly. Therefore citizens are understandably concerned about highly visible government environmental policies that seem to them likely to further destabilize their communities and potentially lead to job losses. Much of the concern about job loss in the case of miners, timber workers and fishermen is related to the disappearance of high paying union jobs that were available to hard working high school graduates and that made up the backbone of the blue collar middle class of the 1960s and 1970s. Also, these fears about environmentalists destroying jobs persist from the fact that timber worker’s, coal miner’s and fishermen’s identify and sense of who they are is so closely tied up in these jobs. Many are third and fourth generation working in these industries. Many do not have experience doing any other jobs. Hence they understandably fear anything that could affect their way of life. This understanding helps to explain why so many people fear that environmental protection will lead to job losses.

In Chapter 3 it was shown that virtually all economists who have studied the jobs-environment debate over the last thirty years agree that the fears that environmental protection will lead to job losses and capital flight are false.\(^{1091}\) And at the local level, in sharp contrast to the conventional wisdom, layoffs


from environmental protection have been very, very small. Even in the most extreme cases, such as protection of forests or closing down fisheries or steps to address acid rain, job losses from environmental protection have been minute compared to more garden-variety downsizing and layoff events.\textsuperscript{1092} The real economy-wide effect of environmental regulation is to shift jobs without increasing the overall level of unemployment. But this is little comfort to fishermen and woman, timber or mine workers who do not have any other skills to do anything else.

So to effectively diffuse the myths and move the environment versus jobs sustainability debate forward rational economic facts and figures will not be enough. There will need to be structural adjustment and compensation packages and re-training to those workers and businesses in the sectors and regions of an economy that will be significantly negatively affected – such as fisheries, forests, farming, coal mining. Workers in regional economies that are dependant on one main industry are understandably very concerned about anything that would affect that industry. With more social services, better adjustment assistance programs and most importantly universal health care workers can free themselves from a desperate fear of layoffs. Structural adjustment packages are not new. They have been widely used in Australia to help sectors that have been hard hit by changes in international competition. In Australia for instance the Federal government in the last 20 years has run the following structural adjustment packages – The car plan, the steel plan, the sugar industry bailouts and finally the recent 2005 $220 million structural adjustment package for the domestic Australian fishing industry.

Finally, another key factor why these myths resonate with mainstream voters is that many are now exposed to higher personal levels of debt either through mortgages, credit cards or lay buy purchases. With the size of personal debt and mortgages having increased significantly over the last two decades in most OECD countries, voters are very concerned about whether economic growth and employment rates are going up or down because they simply cannot afford to lose their job or for interest rates to rise on their mortgage. For the last ten years the mortgage belt of Australia has consistently voted for the Liberal Party of Australia. At the last federal election the mortgage belts of Australia overwhelmingly voted for the return of the Liberal government again. Hence the focus in this thesis on the jobs, competitiveness and “growth” versus environment debates. These are not just academic debates they relate to peoples’ real fears and concerns that if they had supported strong social and environmental policies at the last election in Australia that this would have harmed economic growth, jobs and interest rates.

This thesis in Chapters 5 proposed one way to turn the economic growth versus sustainability debates around is through showing how sustainable development can help achieve as good or higher economic

\textsuperscript{1092} Ibid.p15
growth as business as usual. In Chapter 5 a number of studies were quoted to support this claim. Here now in Chapter 6 the proposal is made that a transition to sustainable development will create higher jobs growth than business as usual as well. If this is combined with good structural adjustment and retraining packages for workers as outlined above it is possible to significantly advance and resolve the jobs versus environment debates.

The reason that a transition to sustainable development can lead to higher jobs growth than business as usual is threefold: (i) the greater labour intensity of new ways of doing things where the technology and the manufacturing and operational techniques are not yet highly refined; (ii) the pump priming affect of investments brought forward to replace scrapped capital; (iii) the recycling of revenues from eco-taxes to reduce payroll taxes or other costs of employing labour.

Many decision makers have failed to date to appreciate the possibilities of the progressive use of eco-taxes, which internalise negative environmental externalities, to fund the reduction of non-wage labour costs and thus increase employment through many sectors of the economy. Currently employment (a social good) is taxed in a variety of ways such as payroll taxes whilst environmental pollution (a social bad) received almost no taxation in all OECD countries. Today, nearly 95% of the current US$7.5 trillion raised annually in tax revenues world wide, comes from levies on payrolls, personal income, corporate profits, capital gains, retail sales, trade and built property; all essentially penalties for work and investment. The present governments of the world are mostly applying 20–50% taxes on wages and profits and almost none on pollution and waste of resources. Governments are overtaxing social ‘goods’ and under-taxing social and environmental ‘bads’. A tax-neutral shift would result in no citizen and few businesses being worse off whilst internalising the presently externalised negative costs to the environment. In fact, many people and businesses will be significantly better off with such a tax neutral shift. Using tax neutral shifts is thus a smart way to implement the goal of the Earth Charter to “Internalize the full environmental and social costs of goods and services in the selling price, and enable consumers to identify products that meet the highest social and environmental standards.”

6.3.4.3 Tax Neutral Shift

Numerous studies have shown that levying taxes on waste and pollution and removing them from social benefits, such as work, can both protect the environment and create jobs – an outcome often referred to as the environment and jobs ‘double dividend’. In 1975, Agnar Sandino argued in the Swedish Journal of Economics that substantial ‘Pigouvian’ taxes should be included in any ‘optimal’ revenue to place the the costs of pollution on the polluters and reduce the need for income and other taxes. Environmental Tax Reform (ETR) places taxation on practices that pollute and damage the environment and remove them from sound environmental and social practices. ETR has the potential to improve the protection of the environment, while, at the same time boosting the economy and jobs. It has the potential to drive the modernisation of the protection of the environment and the economy.
In 1994, Data Resources Inc (DRI) and other consultancies commissioned by the European Commission modelled a scenario where all the revenues from pollution taxes were used to reduce employers’ non-wage labour costs such as social security payments, superfund payments and payroll tax. The study showed that employment in the UK would be increased by 2.2 million through such tax shifting.\textsuperscript{1093} A number of other studies have produced similar results.\textsuperscript{1094} The employment dividend can be made even greater if there is full recycling of eco-taxes in a cost neutral way to replace employers’ non-wage costs. For instance, studies show that with full recycling of revenues, employment could be increased by 3\% and unemployment reduced by 2.7\%.\textsuperscript{1095} Other studies support this finding.\textsuperscript{1096} Whilst it has been much maligned in some countries, there is strong evidence that, as long as carbon tax revenue is recycled effectively, a carbon tax would have a strong employment dividend and assist the economy to become far more energy efficient. Part of the benefit of this derives from the relative labour intensity of the low carbon intensive sectors (services, retail, finance, education and health). These sectors could significantly benefit from such a relative price shift. This effect was thoroughly studied by Proops \textit{et al.}\textsuperscript{1097}

\begin{table}[h]
\centering
\begin{tabular}{|l|p{10cm}|}
\hline
\textbf{Country} & \textbf{Tax/levy shift} \\
\hline
Denmark & New or increased environment related taxes, including a carbon tax, have been used to reduce employer and income taxes. \\
\hline
Finland & New landfill and energy taxes used to lower income and labour taxes. \\
\hline
Netherlands & New energy tax used to reduce employer social security levy. \\
\hline
Norway & Proposal by Tax Commission to introduce new eco-taxes and to reduce environmentally harmful subsidies and payroll tax. \\
\hline
Sweden & New environment related taxes used to reduce income taxes, with reductions in employer taxes being considered. \\
\hline
United Kingdom & New landfill and energy taxes used to reduce employers’ social security \\
\hline
\end{tabular}
\caption{International Environmental Tax/Levy Reform\textsuperscript{1098}}
\end{table}


\textsuperscript{1095} Ibid. p393, table viii.

\textsuperscript{1096} Infras. (1996) ‘Economic Impact Analysis of Eco-tax Proposals: Comparative Analysis of Modelling Results’, final report of a project conducted in co-operation with the 3\textsuperscript{rd} Framework Programme of DGXH of the European Commission, INFRAS, Zurich.


\textsuperscript{1098} Ashiabor, H., Deketelaere, K., Krelser, L., Miine, J. (2005) \textit{Critical Issues in Environmental Taxation: International and Comparative Perspectives}, Richmond Law & Tax ltd, Richmond, UK. Volume II provides the most up to date overview of the field and developments internationally.
contributions.

| Germany | New energy taxes to reduce employer and employee pension contributions. |

Source: OECD (1997)\textsuperscript{1099}, Hamilton et al\textsuperscript{1100} (2000).

During the transition to a fully operational ecologically and socially sustainable economy, which would be a period of several decades at least, the economy would have a strong structural tendency to higher levels of employment. This is because investment in industries such as renewable energy creates more jobs than the equivalent investment in coal power stations. The structural tendency to favour higher employment is caused by three things:

1. The recycling of revenues from eco-taxes to reduce payroll taxes or other costs of employing labour.
2. The greater labour intensity of new ways of doing things where the technology and the manufacturing and operational techniques are not yet highly refined.
3. The pump-priming effect of investments brought forward to replace scrapped capital. It is also important to note that the avoidance of social and economic costs associated with unemployment would also offset some of the adjustment costs of the transition.

6.3.4.4 Are Eco-Taxes Regressive?

Some green tax shift proposals have been criticized as being fiscally regressive (a tax with a marginal rate that decreases as the taxpayer's income increases). Taxing negative externalities usually entails exerting a burden on consumption, and since the poor consume more and save or invest less as a share of their income, any shift towards consumption taxes can be regressive. However, conventional regulatory approaches can affect prices in much the same way, while lacking the revenue-recycling potential of eco-taxes. One of the strengths of the eco-tax approach is precisely that, unlike regulations, it provides revenue for ensuring low-income groups are not worse off. So correctly assessing the distributive impact of any eco tax requires an analysis of the specific instrument design features. There are a range of design options for an eco-tax instrument to reduce or eliminate any regressivity. Firstly, an ecotax policy package can include revenue recycling to reduce or eliminate any regressivity. Recycling of revenue can offset the regressivity of an eco-tax by a decrease in income tax levels for the poor or by reductions in (regressive) consumption taxes or increasing welfare payments such as providing additional payment to the unemployed, pensioners and the disabled.

In the case of a carbon tax, for instance, revenue can be recycled and invested in providing insulation and energy efficiency lighting/appliances for the poor and pensioners to dramatically reduce their

\textsuperscript{1099} OECD (1997) Environmental Taxes and Green Tax Reform, OECD, Paris

electricity bills and thus offset any increase cost from a carbon tax. For example, an eco-tax can be designed so that modest consumption levels are priced relatively low (even zero, in the case of water), and higher consumption levels by business are priced at a higher rate. Furthermore, pollution and other forms of environmental harm are often felt more acutely by the poor, who cannot "buy their way out" of being receptors of air pollution, water pollution, etc. It is important to note that such losses, although externalities have real economic welfare impacts. Thus by reducing environmental harm, such instruments have a progressive effect. An ecotax has been enacted in Germany by means of three laws in 1998, 1999 and 2002. The first introduced a tax on electricity and petroleum, at variable rates based on environmental considerations; renewable sources of electricity are not taxed. The second adjusted the taxes to favour efficient conventional power plants. The third increased the tax on petroleum. At the same time, income taxes were reduced proportionally so that the total tax burden remained constant.

Economic theory has predicted that where pollution is diffuse and the cost of reaching agreement is high Pigouvian taxes will be an efficient way to improve the quality of life (measured by the Genuine Progress Indicator and other recognised indicators), raise Gross domestic product (GDP) and better serve the public interest.. Economic theory also has predicted that, under certain conditions, a double dividend could be achieved. The double dividend results from simultaneously achieving a reduction of pollution and using government revenue from the green tax to reduce or eliminate economically inefficient taxes. A green “eco-tax” enables government to maintain a constant overall level of tax revenue because it increases revenue through the eco-tax whilst economically inefficient and distortional taxes such as payroll tax are reduced. Research suggests that there was a significant correlation during the 1990s between a country's level of green taxes as a percentage of total tax revenues and its ranking on the UN Human Development Index (HDI) per fixed amount of GDP. In addition, countries like Norway, Sweden and Netherlands that had higher green tax rates experienced higher GDP growth and higher HDI growth rates over periods longer than 5 years. However, it cannot be confirmed that an increase in green tax rates causes higher GDP growth and higher HDI growth rates. It may be a correlative effect as opposed to a causal effect.

6.3.4.5 Is there an Inevitable Trade-Off between Ensuring Progressive Labour Standards and Unemployment?

Simply creating jobs is not going to be enough to truly create a socially sustainable society. Reasonable labour standards need to be established to ensure the well-being of the vast majority. Seeking to have good labour standards is widely regarded as another key social sustainability goal. The Earth Charter states “Ensure that all trade supports sustainable resource use, environmental protection, and progressive labor standards.”

Yet many currently argue that if labour standards were lower, employers would be able to employ more employees more easily and this would assist unemployment. What does the data suggest about
correlations between labour standards and unemployment in OECD nations? Is there an inevitable trade-off of higher labour standards leading to higher unemployment? Unfortunately, unemployment rates are a highly unreliable indicator for comparing the health of labour markets between countries. They are flawed because they can leave out a large group of potential employees: those individuals who have dropped out of the jobless statistics.

Therefore, a more informative measure is the proportion of the working-age population in each country who have a job. The OECD provides these figures for each of its member countries. It has also created an index of employment protection, designed to measure the strictness of employment protection legislation of OECD nations. The index takes into account, ‘Regulations governing the terms and conditions of permanent contracts in case of individual dismissals; additional provisions in the face of mass lay-offs; and regulations governing the possibility of hiring on temporary contracts’.

When employment rates and the job protection index is compared, of the six countries with the highest levels of employment, only one has less employment protection than Australia. The other five countries - Switzerland, the Netherlands, Norway, Sweden and Denmark - have more protection, yet are performing better in terms of providing employment. What about the US, Britain and New Zealand? The social cost can be very high, and the benefits - an extra 1.7% in employment above Australia's rate - are easily matched by the more generous systems in Switzerland, the Netherlands, Norway, Sweden and Denmark. But the US has a significantly higher percentage of incarceration which makes the extra 1.7% look much less impressive because they are not counted amongst the unemployed. Also, four of those five countries out-perform the other low-protection countries - Britain, New Zealand and Canada - in providing jobs. The performance of Switzerland, the Netherlands, Norway, Denmark and Sweden shows that alternative policies can be just as successful in providing jobs.

6.3.4.6 What Correlation is there between Progressive Labour Standards, Productivity and Economic Growth?

There has been significant pressure to reduce labour standards from the process of globalisation. With the opening of the Berlin wall and the Chinese markets it has made it very hard for labour intensive industries in the OECD to compete with manufacturers in countries like China. As a result, industry groups and political parties in the OECD have argued that a significantly more ‘flexible’ labour market is essential to create more jobs and greater economic growth. Many currently believe as a result that there is an inevitable trade-off between labour standards and economic growth. It is true that labour standards - the level and coverage of the minimum wage, extent of collective bargaining, number of weeks notice workers need to be given before plants close, laws and regulations dictating weeks allowed for holiday and sickness, rights of workers to challenge ‘unfair’ dismissal - do effect economic growth, but not always in the way that many current commentators believe. One of the first comprehensive studies of this was undertaken by Robert Buechele and Jens Christiansen; an
international cross-section analysis of the connection between labour standards, productivity and economic growth.\textsuperscript{1101} They constructed an index consisting of seven indicators of worker’s rights. They then compared this index with productivity improvements in the G7. The index turned out to strongly correlate with growth in labour productivity across the G7 for the period 1972-88. This was still true after accounting for differential growth in capital-labour ratios - he amount of plant and equipment and software per worker. Higher wage and working time standards and respect for equality can lead to better and more contented workers and lower staff turnover. Investment in vocational training leads to a better-trained workforce and higher employment levels. Safety standards can reduce costly accidents and health care fees. Importantly, employment protection provides enough security to encourage workers to work with their managers, take risks and innovate. Freedom of association and collective bargaining can lead to better labour-management consultation and cooperation, thereby reducing the number of costly labour conflicts and enhancing social stability.\textsuperscript{1102} The beneficial effects of labour standards also appeal to foreign investors. Studies have shown that in their criteria for choosing countries in which to invest, foreign investors rank workforce quality and political and social stability above low labour costs. Also to date there is little evidence that countries, which do not respect labour standards, are more competitive in the global economy.\textsuperscript{1103} This all sounds convincing, but a closer examination of these studies and others in this field shows that it is not so simple. Whilst it is true that nations with more progressive labour standards (Norway, Sweden, France, Germany) have experienced higher productivity growth, these countries have also experienced higher unemployment rates. The unemployed are, relatively speaking, less productive in the workforce. So if the country has a large percentage of relatively unproductive people outside the workforce, then of course the productivity of the average worker will be higher.\textsuperscript{1104}

6.3.5 Ensure gender equality and equal opportunity

In developing countries poverty is not just about the lack of income and financial resources. Poverty also encompasses the notion of inequalities in access to and control over the material and non-material benefits of any particular society. Gender is an important determinant of inequality in access to and control over these resources and benefits, which include human and basic rights, political voice, employment, information, social services, infrastructure and natural resources. At the international level, this is recognised by the 1979 Convention on the Elimination of All Forms of Discrimination against Women, the 1994 Cairo Programme of Action, the 1995 Beijing Platform of Action and the

Millennium Development Goals. In developing countries there is a well established positive correlation between gender mainstreaming\textsuperscript{1105} with participative approaches\textsuperscript{1106} and the success of aid programs and projects. It is well established that gender mainstreaming and equality in developing countries significantly helps women, their families and communities escape the poverty trap and build more prosperous futures.

In OECD countries there is a strong correlation between gender equity and economic growth. Gender equality strengthens long-term economic development. This assertion is based on a new analysis of the relationship between birth rates and attitudes toward gender equality in a range of countries. What researchers\textsuperscript{1107} have found is that more traditional family structures in modern economies face chronically low birth rates, whereas the birth rate trend is positive and the demographic structure more balanced in countries where gender equality with good maternity leave and childcare provisions in the workplace. More progressive gender equity policies in OECD countries enable women to both pursue a career and afford to raise children thus enabling birth rates to be closer to replacement rates. For these countries, slightly higher birth rates will assist those societies afford the costs of increasingly aging populations as well as providing over time higher labour activity and a more robust economy. Thus there are numerous benefits of implementing the Earth Charter’s aim to “Affirm gender equality and equity as prerequisites to sustainable development.”

6.3.6 Giving Expression to Human Potential through Creativity and Innovation – the Secret for lasting Economic Growth

Significant advances in economics in the last two decades have highlighted that it is exactly this creativity and technological innovation that are vitally important to achieving ongoing productivity gains and lasting economic growth. Economists such as Keynes\textsuperscript{1108} and Schumpeter had argued this over 70 years ago.

Building on the work of Keynes, Schumpeter and Schultz a new field called ‘new growth theory’ is now showing that new designs, new ideas and innovations are very important to achieving lasting economic growth. And whether societies are good at this relates directly to how wisely and effectively a nation invests in education and R&D; in other words, whether that nation has wise social spending. For over 60 years now, economists have recognised the importance of social capital as

\textsuperscript{1105}Mainstreaming a gender perspective is the process of assessing the implications for women and men of any planned action, including legislation, policies or programmes, in all areas and at all levels. It is a strategy for making women's as well as men's concerns and experiences an integral dimension of the design, implementation, monitoring and evaluation of policies and programmes in all political, economic and societal spheres so that women and men benefit equally and inequality is not perpetuated. The ultimate goal is to achieve gender equality.

\textsuperscript{1106}See Participation Resource Centre at \url{http://www.pnet.ids.ac.uk/prc/index.htm} Accessed 18 February 2008


\textsuperscript{1108}Keynes, J. (1930) 'Economic Possibilities For Our Grandchildren' N&A and Saturday Evening Post.
being a key factor in determining economic growth. They have been emphasising that it is social and human capital that has as much, if not more, significance for economic growth as physical capital. By human and social capital, economists mean individual talents, the accumulated knowledge of society, and society’s forms of interaction, institutions, organisation and culture. In the middle of last century, Joseph Schumpeter and Theodore Schultz demonstrated that human resources are now a more important factor of production, in achieving economic growth, than natural resources.\textsuperscript{1109} Schumpeter laid the foundations for our understanding of the critical role of entrepreneurship in the innovation process, one form of human capital.\textsuperscript{1110} For this and other work he won the Nobel Prize for Economics. Schultz focused on investment in human capital (the acquisition of skills and knowledge, or improvements in health, for example) as a means for poorer nations to develop and grow. For this work he shared the Nobel Prize in Economics in 1978. Building on from their work is one of the chief architects of ‘new growth theory’, Stanford economics Professor Paul Romer.\textsuperscript{1111} His work shows that economic growth does not arise just from accumulating more capital. He shows that economic growth also arises from new and better ideas expressed as progress in technology and design. Before new growth theory, economists recognised that technology contributed substantially to growth, but they could not figure out how to rigorously and completely incorporate that insight internally into their economic models. Romer’s innovation, expressed in technical articles with titles such as ‘Increasing returns and long-run growth’ and ‘Endogenous technological change’, has been to find ways to describe how technological progress brings about economic growth. In the old growth models the rate of technological progress was assumed to be a given and was not modelled explicitly. Rather, it was simply set at a constant rate of productivity growth. New growth theorists make technological progress internal to their economic growth model, including the explicit modelling of R&D and technological changes in production. In new growth models, the rate of technological progress is determined by aspects of the model itself rather than simply being set at a constant rate of progress as it was in the old growth models.

This provides, at least, a start for building economic models that link how positive changes in the productivity at the firm level influence economic growth at the macro economic level: the theoretical foundation needed to rigorously model how improvements in design, technological processes at the firm level (outlined in chapter 2) can positively affect macro-economic growth. Paul Romer writes that:

\begin{itemize}
\end{itemize}
“We now know that the classical economic suggestion that we can grow rich by accumulating more and more pieces of physical capital is simply wrong. The problem an economy faces is what economists call ‘diminishing returns’. In handling heavy objects a forklift is a really useful piece of equipment. When there are few fork lifts in the economy, the return on an investment in an additional lift is significant. But eventually buying additional forklifts would have no value and become a nuisance (to the firm). The return on investment in an additional fork lift diminishes and eventually becomes negative. As a result, an economy cannot grow merely by accumulating more and more of the same kind of capital goods.”\(^1\)

Rather,

“Economic growth occurs whenever people take resources and rearrange them in ways that are more valuable. A useful metaphor for production in an economy comes from the kitchen. To create valuable products, we mix inexpensive ingredients together according to a recipe. The cooking one can do is only limited by the supply of ingredients, and most cooking in the economy produces undesirable side effects. If economic growth could be achieved only by doing more and more of the same kind of cooking, we would run out of raw materials and suffer from unacceptable levels of pollution and nuisance. Human history teaches us however that economic growth springs from better recipes, not just from more cooking. New recipes generally produce fewer unpleasant side effects and generate more economic value per unit of raw material.”\(^2\)

Berkeley economist Gene Grossman comes to the same conclusion through a simple thought experiment. He tells us

“Imagine how the world economy would have evolved if none of the major inventions of the last 200 years had materialised—no steam engine, no electricity, no transistors, no computers, and so on. Would growth have proceeded none the less in ever more capital (more field animals and hand instruments?) and continued increases in levels of schooling?”

Simply posing this question shows why ideas and technological innovation, not just capital accumulation on its own, are essential for understanding the potential for monetary economic growth. These developments in economics in the last 20 years mark a significant paradigm shift in modern economics. Bluestone and Harrison, in their publication *Growing Prosperity*, discuss this paradigm shift and its implications for economic growth prospects and government policy in great detail.\(^3\) The importance of these developments in economics is impossible to underestimate. This new paradigm offers a new understanding from which a ‘constellation of high productivity, high-wage, high-skill growth’ can emerge.

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institution-rich developments can be thought of as offering the possibility for a high road to economic growth with equity.  

Not only are creativity, new ideas and new designs important for long-term economic growth; they are also, as mentioned above, key for businesses. The key to success in the knowledge-based economy is what economists call high human capital - what most of us would call talent. Nobel Prize-winning economist Robert Lucas maintains that the driving force in the growth and development of cities and regions can be found in the productivity gains associated with the clustering of talented people. So today when businesses make location decisions, they are on the lookout not for iron ore or forests, rivers or highways, but for people with ideas. In his book, The Creative Class, Richard Florida shows that cities and regions that attract a ‘creative class’ of highly professional, innovative and motivated people are the most prosperous.

6.3.7 Attracting the Creative Class – the Key to achieving High Economic Growth Regions and Cities

What brings talented workers to those areas? How do they make their residential decisions? What sets high-technology centres such as San Francisco, Boston, and New York apart from other metropolitan areas? Why have some cities - many home to some of the nation's most prestigious university research centres and college graduates - been unable to attract talented technology workers? These people are highly mobile and will seek out cities and regions with good environments and social services. Hence, the cities and regions that are succeeding are those that care about their environment and their most precious resource: their people. Other factors, such as a regions level of tolerance for a wide range of people, also seem to be important. This seems to be key to a region’s success in attracting talented people. Richard Florida and Gary Gates make this argument in their piece on Technology and Tolerance: Diversity and High-Tech Growth.

They argue that diverse, inclusive communities that welcome unconventional people - gays, immigrants, artists, and free-thinking ‘bohemians’ - are ideal for nurturing the creativity and innovation that characterise the knowledge economy. They have brought together data analysing the diversity of human capital which, they argue, is a key component of the ability to attract and retain high-tech industry. When they sum the rankings of their three diversity indices to make their composite diversity index (CDI), the result strongly correlated with the Milken Tech-Pole ranking. There is a higher statistical correlation between the Tech Pole and CDI than that between the Tech Pole and any of the individual diversity measures taken. It is also higher than the correlation between

1115 Ibid, p206.
the Tech Pole and measures such as the share of college graduates in the population and other simple measures. Significantly, the CDI strongly predicts growth in high-tech areas, a result found when making a comparison with the Milken Institute's Tech-Growth Index. They also found that there was a significant positive correlation between their diversity measure and high-tech growth from 1990 to 1998 when they estimated the effect of the CDI on high-tech growth and took account of population, the share of college graduates in the region, and measures of climate, culture and recreation. These findings strongly support the importance of the combined effects of cultural, ethnic and social, diversity for both the location of high-tech industries and their growth.

6.3.7.1 The Hidden Economic Value of Tolerance and Diversity

It is not suggested that having a large representation of gays, bohemians and immigrants in a community will directly lead to technology industries springing-up in that community. It is more that people working in the technology area appear to be drawn to communities that are inclusive, open-minded, and creative - attributes often found in a cosmopolitan community with a diverse local population. The reality is that high-tech professionals are attracted to communities to which gays, bohemians and immigrants are attracted.

Austin, Texas is a university town that has aspired to be a high-tech economic growth centre. It has made the traditional investments in R&D and business incubation. But Austin has also invested heavily in its lifestyle and music scene. When a high-tech company, Vignette, recently sought to expand downtown with a new office, they agreed to set up a million-dollar fund to support the local music scene. Austin Mayor Kirk Watson has had a clear vision that seeks to build on this convergence between technology, talent and tolerance, as he puts it.

There's a message here for cities. Talent powers economic growth, and diversity and openness attract talent. Companies remain important but talented people no-longer work for the one company for their whole lives. The location decisions of people are just as important - maybe even more so. So companies by necessity have to go where talented people want to live. Building a vibrant technology-based region therefore requires not just investing traditionally in R&D, supporting entrepreneurship and generating venture capital. It requires the creation of an environment that attracts talented people. From the empirical data, that seems to mean encouraging diversity and vibrancy. This evidence, therefore, is showing that even pursuing the social sustainability goal of tolerance and respect for cultural diversity helps economic growth.

6.3.8 Strengthen democratic institutions

The Earth Charter next recommends the important step of “Strengthening democratic institutions at all levels, and providing transparency and accountability in governance, inclusive participation in decision making, and access to justice” This is a large topic in itself. Since the central hypothesis of
this thesis is whether or not it is possible to have it all: economic growth, environmental protection and social justice here we will just consider how democracy correlates with economic growth rates.

6.3.8.1 Is There A clear Correlation with Democracy and Economic Growth?

There have been numerous econometric studies investigating the relationship between political liberties and economic growth.\textsuperscript{1118} In general, one can make arguments that go both ways. The existing literature has developed various arguments that link democracy to both greater and lower economic growth of all. By definition, democracies allow populations to peacefully and regularly oust inept, inefficient and corrupt government administrations, while allowing people to keep more efficient, successful regimes, thus tending to make the quality of governance on average higher in the longer term. Authoritarian regimes may randomly provide high-quality governance, but if they do not, they can only be changed by force, which may take years or decades longer than under democratic institutions. As Sen succinctly summarizes: “[in considering the effects of democracy relative to authoritarian regimes] we have to consider the political incentives that operate on governments and on the persons and groups that are in office. The rulers have the incentive to listen to what people want if they have to face their criticism and seek their support in elections.” The potentially high cost of sustaining poor government policies under authoritarian regimes have been noted forcefully by Goetzmann in relation to recent financial crises:

Suppose bankers lend to a dictatorship, as Indonesia was, suppose further that debt piles up, and the government of the borrowing country cannot service its obligations...This is in fact what has happened. Tens of millions of people in emerging markets have recently fallen back into poverty. Without a democratic voice, they had no control of the risks their governments assumed. Even more outrageous, without transparent political institutions and a free press they had no way to understand these risks...Some would call this taxation without representation. In fact, history is filled with examples of non-democratic governments causing great harm to their citizens.

On the other side of the coin, a number of authors have noted that the proliferation of interest groups lobbying for power or for rents under democratic institutions may lead to policy gridlock, preventing the major decisions that are required in the development process. The view that democracy is a critical ingredient for economic growth is untenable. There is no robust statistical relationship to support it. But democracies perform better than authoritarian regimes in a number of respects. Dani\textsuperscript{1119} shows four results in particular:

1. Democracies yield long-run growth rates that are more predictable.


2. Democracies produce greater stability in economic performance
3. Democracies handle adverse shocks much better
4. Democracies pay higher wages.

The first proposition implies that economic life is less subject to chance under democracy. The second proposition suggests that there is less economic instability in a democracy than under an autocracy whatever the long term growth level may be. The third proposition suggests that democracies are better able to adjust to changes in the economic environment and raises the question whether it is the presence of political rights and civil liberties that improves the capacity of democratic communities to adjust to change. The final proposition may be the result of democracies having superior distributional outcomes. In combination, the above propositions support the conclusion that most of us, particularly the risk averse and capital poor, will be better off living in a democratic community.

6.3.9 Promote a Culture of Tolerance, Non-violence, and Peace

The final section, (number 16) of the Earth Charter focuses on creating a culture of tolerance, non-violence and peace. The reasons for and benefits of such a focus were covered at the start of Chapter 3 in the discussion of the costs of war. Hence the reader is asked to refer to that part of the thesis for a discussion of the benefits of pursuing non-violence and peace.

Conclusion

Chapter 6 has overviewed in detail the empirical evidence that shows that investing in many of the social sustainability goals such as building social capital, reducing corruption and inequality, providing equitable access to education and health services, building social trust, can have a positive effect on economic growth, not a negative effect. This chapter has shown that many leading economists are now making such arguments about specific aspects of social development.

Chapter 6 has for the first time brought such evidence together to shows that seeking to simultaneously achieve significant social sustainability goals has negligible negative effects on OECD GDP growth whilst at the same time dramatically increasing economic growth in many poor countries that currently have negative economic growth.
Chapter 7 Decoupling Economic Growth from Greenhouse Gas Emissions to Achieve Environmental Sustainability.

Introduction: (Rationale and Outline of the Chapter)

The discussion in Chapter 6 has shown that there is now a significant body of empirical evidence which shows that many of the social justice goals encapsulated in the Earth Charter correlate with improved economic prosperity. The evidence assembled in Chapter 6 suggests that higher economic growth of developing nations correlates with effective investment in health, education, poverty reduction and family planning. Chapter 6 showed that achieving basic standards in health and education, poverty reduction, stabilising population growth and reducing corruption have assisted, and certainly not harmed, the creation of sustained quality economic growth.

However, in achieving the social justice goals of the Earth Charter and eliminating poverty this will create an additional 2-3 billion people aspiring to consume just as much as is currently consumed unsustainably in OECD countries. As discussed in Chapter 1, it is physically impossible for all developing nations to achieve Western material living standards with previous modes of development, as the global ‘ecological footprint’ (the equivalent land and water area required to produce a given population’s material standard, including resources appropriated from other places) is already greater than the carrying capacity of our planet. The 2002 UNEP Sustainable Consumption Global Status Report, put the predicament starkly stating that

“If China were to consume seafood at the per capita rate of Japan, it would need 100 million tonnes, more than today’s total catch. If China’s beef consumption was to match the USA’s per capita consumption and if that beef was produced mainly in feedlot, this would take grain equivalent to the entire US harvest.”

If we also assume that the Chinese will spend their income more or less as Americans do today, then we can translate their income into consumption. As Lester Brown explains

“If, for example, each person in China consumes paper at the current American rate, then in 2030 China’s 1.46 billion people will need twice as much paper as is produced worldwide today. If we assume that in 2030 there are three cars for every four people in China, as there now are in the United States, China will have 1.1 billion cars. The world currently has 860 million cars. To provide the needed roads, highways, and parking lots, China would have to pave an area comparable to what it now plants in rice.

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1121 UNEP (2002) Sustainable Consumption: Global Status Report 2002, UNEP, Paris (report written by Professor Chris Ryan, RMIT University, Melbourne, Australia, and the International Institute for Industrial Environmental Economics (IIIEE), Lund University, Sweden)
By 2030 China would need 98 million barrels of oil a day. The world is currently producing 85 million barrels a day and experts from the International Energy Agency have warned in 2007 that we may never produce much more than that.\textsuperscript{1122}

What China and India’s economic growth is reminding us is that the western first industrial revolution model - the fossil-fuel-based, automobile-centered, highly waste producing—is not physically sustainable on a global scale.

Eliminating poverty and raising living standards globally could also significantly increase demand for renewable and non-renewable resources, increase the risks of rising pollution levels and global climate change. Whilst the reduction in poverty in India and China is a great achievement, it is currently coupled with rising demand for all resources. Today China consumes more basic resources than the United States.\textsuperscript{1123}

Global demand for oil is outstripping supply and increasing the price of oil which rebounds to hit the poor the hardest. Already food commodity prices globally have risen due to the perfect storm of climate change and drought, increased demand for grain fed food, urbanisation reducing available farmland, plus a shift of agricultural land to biofuels. The poorest of the world, who spend 80-90 percent of their incomes on food, are being priced out of the market.\textsuperscript{1124}

Already, a quarter of the world’s armed conflicts of recent years have involved a struggle for natural resources. Security experts warn that rising demand for non-renewable and renewable resources such as oil, minerals and water respectively could increase the number of resource wars this century.\textsuperscript{1125} The Stern Review warned that climate change would reduce the availability of water to significant proportion of the world potentially setting of water wars. The Stern review stated

"Drought and other climate-related shocks risk sparking conflict and violence, with West Africa and the Nile Basin particularly vulnerable given their high water interdependence."\textsuperscript{1126}

Climate change is but one environmental pressure which, if not addressed, has the potential to undermine global efforts to achieve the social justice goals of the Earth Charter. As the Stern Review stated:

\begin{itemize}
\item \textsuperscript{1123} BBC (2006) China emerges as global consumer. BBC News Available at \url{http://news.bbc.co.uk/2/hi/asia-pacific/4272577.stm} Accessed 17.02.2008
\item \textsuperscript{1126} Stern, N \textit{et al.} (2006) \textit{The Stern Review: The Economics of Climate Change}, Cambridge University Press, Cambridge.p104 Available at \url{www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/Sternreview_index.cfm} Accessed 14 April 2007
\end{itemize}
“Climate change poses a real threat to the developing world. Unchecked it will become a major obstacle to continued poverty reduction. Developing countries are especially vulnerable to climate change because of their geographic exposure, low incomes, and greater reliance on climate sensitive sectors such as agriculture. For low-income countries, major natural disasters today can cost an average of 5% of GDP. Health and agricultural incomes will be under particular threat from climate change. Millions of people will potentially be at risk of climate-driven heat stress, flooding, malnutrition, water related disease and vector borne diseases. Up to an additional 145-220 million people could be living on less than $2 a day and there could be an additional 165,000 to 250,000 child deaths per year in South Asia and sub-Saharan Africa by 2100 (due to income losses alone).”  

Chapters 3 and 4 of the Stern Review expand on this and outline in detail the devastating ways that climate change will further undermine efforts to achieve poverty reduction as was discussed in detail in Chapter 6 of this thesis. Thus environmental protection and sustainable use of resources will be needed to ensure that poverty reduction is able to be sustained long term. But this challenge of achieving simultaneously the reduction in poverty, a rapid transition to environmental sustainability whilst maintaining strong economic growth to enable the required investment to be possible will not be easy. This chapter, and the following Chapter 8, cover strategies which enable the developing world to leapfrog the OECD to become ecologically sustainable economies. This chapter and chapter 8 outline options and strategies which provide all nations with an opportunity to make a rapid shift to ecologically sustainable development to try to prevent planetary ecosystems losing significant resilience by passing irreversible ecosystem thresholds and tipping points.

Chapter 1 outlined a range of environmental pressures - greenhouse gas emissions, urbanisation and sprawl, loss of biodiversity and loss of species, drought and loss of freshwater availability, soil degradation, over-consumption of resources and production of waste, air, land and water pollution, and toxic chemicals.

This chapter investigates environmental pressures from rising greenhouse gas emissions and discusses potential costs and benefits of making the necessary investments to decouple economic growth from greenhouse gas emissions on a global scale.

Chapter 8, which follows, looks at the other main sources of environmental pressure and investigates the costs and benefits of decoupling economic growth from environmental pressures.

This chapter first considers greenhouse gas emissions, of all these environmental pressures, for three main reasons.

First, as the OECD has argued mitigating climate change is the most important of all environmental challenges because if humanity does not succeed climate change will undermine and make far worse

1127 Ibid. p104-105
all other environmental and social problems. According to the OECD’s Secretary General, Angel Gurria:

“Climate change is mankind’s most important challenge…In two decades, unchecked (climate change induced) environmental damage could leave half the world’s population without adequate drinking water.”

Climate change from greenhouse gas emissions will result in greater intensity of natural disasters, a decline in water availability, loss of biodiversity both on land and in the ocean due to ocean acidification and rising sea temperatures bleaching coral reefs. As Lester Brown wrote:

“Efforts to save wildlife traditionally have centred on the creation of parks or wildlife reserves. Unfortunately, this approach may now be less effective, for if we cannot stabilize climate, there is not an ecosystem on earth that we can save. Everything will change. In the new world we are entering, protecting the diversity of life on earth is no longer simply a matter of setting aside tracts of land, fencing them off, and calling them parks and preserves. Success in this effort depends also on stabilizing both climate and population.”

Since greenhouse gas emissions are a significant environmental pressure strongly coupled with other environmental pressures, economic growth must be decoupled from greenhouse gas emissions as part of any serious strategy to reduce environmental pressures overall.

Secondly, many of the actions required to decouple economic growth from greenhouse gas emissions will also simultaneously decouple economic growth from other environmental pressures and help achieve overall sustainable development.

- Mitigating climate change will require the world to reduce rapidly its dependency on oil, coal and gas thus reducing dependency on non-renewable resources. Similarly the mining and processing of non-renewable mineral and petrochemical resources is highly energy intensive compared to metal and plastics recycling. Thus efforts to mitigate climate change will lead to a transition to higher levels of metal and plastics recycling.

- Mitigating climate change successfully will involve reducing waste to landfill to prevent methane emissions. This will have the effect of encouraging recycling of all materials thus helping to reduce over-consumption of resources. This will help to reduce environmental pressures from increasing material flows and waste streams globally.

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- Addressing climate change will also require the world to transform its resource dependant cities into sustainable cities. Cities are currently responsible for over 60 per cent of all global greenhouse gas emissions. Better urban design will be crucial elements of any holistic strategy to decouple economic growth from transport greenhouse emissions. But actions to do this will also reduce other environmental pressures such as air pollution. As the 2008 OECD Environmental Outlook for 2030 stated “Cutting motor vehicles’ greenhouse gas emissions would improve air quality in cities.”

Urban air pollution is a serious problem in the cities of many developing and fast growing economies. The health costs from urban pollution and poor urban and building design are significant. There are clear opportunities for simultaneously improving health and cutting GHG emissions most obviously through policies related to transport systems, urban planning, building regulations and household energy supply. These influence some of the largest current global health burdens, including approximately 800,000 annual deaths from ambient urban air pollution, 1.2 million from road-traffic accidents, 1.9 million from physical inactivity, and 1.5 million per year from indoor air pollution.

The fact that actions to reduce greenhouse gas emissions will also reduce these tragic statistics and reduce by 100s of billions projected health costs this century is seen by many developing country governments as a key reason to support action to mitigate climate change.

One of the most cost effective ways to mitigate climate change would be for the OECD countries to pay developing countries a fair price to reduce rapidly deforestation and farm soil losses to better maintain their forests and soils as carbon stores. This provides renewed impetus for the OECD helping their own farm and forestry sectors as well as those in developing countries to shift to genuinely sustainable management of forests and soils. As The Stern Review states

“A study commissioned for the Review looking at 8 countries responsible for 70 per cent of emissions from deforestation found that…emission savings from avoided deforestation could yield reductions in CO₂ emissions for under $5/t CO₂, and possibly for as little as $1/t CO₂.”

If done, this will have significantly positive biodiversity benefits as most of the world’s species are found in the world’s rainforests and forests. Countries like Indonesia would benefit from this approach. Indonesia has two of the world’s biodiversity hotspots and is the second most mega-diverse nation after Brazil.

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The OECD’s 2030 Environmental Outlook points out other less obvious environmental pressures which will be reduced from strong action on climate change stating that:

“Ambitious climate change policies (to achieve 450ppm stabilisation) would also lead to reductions in sulphur oxides of 20-30% and in nitrogen oxides of 30-40% by 2030. Similarly, regulations to limit agricultural water pollution from nitrogen fertilisers can also reduce atmospheric emission of nitrous oxide, a potent greenhouse gas.”

Thus, if it is possible to demonstrate that environmentally sustainable cuts to greenhouse gas emissions can be achieved whilst maintaining strong economic and jobs growth this result also holds for a significant portion of what is needed to achieve environmental sustainability.

Thirdly, focusing first on decoupling economic growth from greenhouse gas emissions enables us to reinforce the earlier (Chapter 1, 2 and 5) discussion of negative rebound effects. Rebound effects, if not properly managed with good policy can undermine energy, water and materials efficiency gains. If not properly managed with good policy negative rebound effects can significantly undermine efforts to mitigate climate change through energy and fuel efficiency improvements. This chapter re-inforces the main message of the thesis concerning rebound effects: that to avoid negative rebound effects policy, regulation, information and incentives are needed to ensure that the profits made from energy, water and materials efficiency do not multiply into more unsustainable consumption patterns but instead are redirected and invested in further sustainability initiatives such as investment in renewable energy and carbon offsets which also protect biodiversity. Effective policy is needed to do this. Due to word limit restrictions this chapter is unable to cover a discussion in detail of policy options. But policy issues are listed in Appendices 7.3-7.5. Appendix 7.3 of this chapter provides an overview of leadership on climate change policy globally. Appendix 7.4 overviews existing Australian climate change policy and programs which can be built upon, and Appendix 7.5 outlines briefly a range of policy options needed to provide the best chance of achieving the necessary levels of decoupling.

7.1 An Historic Challenge - Decoupling Economic Growth from Greenhouse Gas Emissions Fast Enough to Achieve Environmental Sustainability.

Decoupling economic growth from greenhouse gas emissions fast enough on a global scale is one of the hardest challenges humanity has ever faced because of a number of factors:

First, the scale and speed of change needed to the global economy to avoid dangerous climate change, and achieve stabilisation of greenhouse gas levels. A number of climate scientists and policy analysts are advising that developed nations must make GHG emission cuts of at least 30 per cent relative to 1990 levels by 2020, in order to ensure an effective 2050 global target is achieved. The Stern

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Review has explained clearly the economic and environmental sustainability imperative of ensuring global greenhouse gas emissions peak, and start reducing as soon as possible. The sooner global greenhouse gas emissions peak, the less stringent annual reductions will need to be thereafter to meet future targets. (See Figure 7.2 and Table 7.1)

![Illustrative emissions paths to stabilise at 550 ppm CO2e. The figure shows that delaying emissions cuts (shifting the peak to the right) means that emissions must be reduced more rapidly to achieve the same stabilization goal. (Source: Stern Review (2006))](#)

**Table 7.1 Illustrative Emissions Paths to Stabilisation** *(Source: Stern Review (2006))*

<table>
<thead>
<tr>
<th>Stabilisation Level (CO2e)</th>
<th>Date of peak global emissions</th>
<th>Global emissions reduction rate (% per year)</th>
<th>Percentage reduction in emissions below 2005* values</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>2050</td>
</tr>
<tr>
<td>450 ppm</td>
<td>2010</td>
<td>7.0</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>-</td>
<td>75</td>
</tr>
<tr>
<td>500 ppm</td>
<td>2010</td>
<td>3.0</td>
<td>50</td>
</tr>
<tr>
<td>(falling to 450 ppm in 2150)</td>
<td>2020</td>
<td>4.0 - 6.0</td>
<td>60 - 70</td>
</tr>
<tr>
<td></td>
<td>2030</td>
<td>5.0[1] - 5.5[2]</td>
<td>50 - 60</td>
</tr>
<tr>
<td></td>
<td>2040</td>
<td>-</td>
<td>75 - 80</td>
</tr>
<tr>
<td>550 ppm</td>
<td>2015</td>
<td>1.0</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>2020</td>
<td>1.5 - 2.5</td>
<td>25 - 30</td>
</tr>
<tr>
<td></td>
<td>2030</td>
<td>2.5 - 4.0</td>
<td>25 - 30</td>
</tr>
<tr>
<td></td>
<td>2040</td>
<td>3.0 - 4.5[3]</td>
<td>5 - 15</td>
</tr>
</tbody>
</table>

Table 7.1 shows the sensitivity of rates of emissions reductions to the stabilisation level and timing and size of the peak in global emissions. The table covers three stabilisation levels and a range of

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1135 Ibid. p227
peak emissions dates from 2010 to 2040. The centre column shows the implied rate of global emissions reductions.

Table 7.1 shows that the challenge of stabilization is significant. If the positive feedbacks, outlined above, are unleashed significantly further, it will make stabilization very hard to achieve. The IPCC is calling for global greenhouse gas emissions to peak by 2014-15 to minimize the risk of the positive feedbacks being unleashed. The Stern Review states that

“The long term, global emissions will need to be reduced to less than 5 GtCO2e, over 80% below current annual emissions, to maintain stabilisation. The longer emissions remain above the level of natural absorption, the higher the final stabilisation level will be. Stabilisation cannot be achieved without global action to reduce emissions. Early action to stabilise this stock at a relatively low level will avoid the risk and cost of bigger cuts later. The longer action is delayed, the harder it will become. Delaying the peak in global emissions from 2020 to 2030 would almost double the rate of reduction needed to stabilise at 550 ppm CO2e. A further ten-year delay could make stabilisation at 550 ppm CO2e impractical, unless early actions were taken to dramatically slow the growth in emissions prior to the peak. To stabilise at 450 ppm CO2e, without overshooting, global emissions would need to peak in the next 10 years and then fall at more than 5% per year, reaching 70% below current levels by 2050.”1136

Few countries have ever achieved more than one per cent greenhouse gas reductions per annum. Hence achieving at least five per cent reductions in GHG emissions per annum reductions in greenhouse gas emissions in every country globally simultaneously is an historic challenge.

Since the Stern Review was published in 2006, global CO2e emissions are tracking higher than Stern predicted and have even exceeded the IPCC’s worst case scenario’s. Since the Stern Review was published, higher economic growth than predicted in China and India is seen to have caused greenhouse gas emissions to be higher than predicted in 2008. As the Garnaut Review Interim report explains:

“Global economic growth, the energy intensity of growth, and the carbon intensity of energy in the early twenty first century have all been exceeding expectations that had been built into the most influential assessments of climate change...Over recent years, average annual global economic growth has been around five per cent (using purchasing power parities (PPPs), as one should, rather than market exchange rates (MERs)). This is much higher than in the last quarter of the twentieth century. This accelerated expansion has been led by growth rates of ten to twelve per cent in China and eight to nine

per cent in India. The evidence is accumulating that these high average growth rates of the early twenty-
first century are not temporary phenomena.\textsuperscript{1137}

Also in the last 2 years, since the Stern Review was published, there has been evidence published
which shows that global warming is accelerating under the action of several amplification/positive
feedback processes that was summarized in Chapter 1 of the thesis.\textsuperscript{1138} As noted in Chapter 1, these
predictions of the Stern Review were taken without taking into account the historic summer Arctic ice
melt in the summer of 2007. As a result of these developments the Australian and State Government’s
Garnaut Review’s Interim report\textsuperscript{1139}, other experts\textsuperscript{1140}, Australian State Premiers and the mainstream
media\textsuperscript{1141} have acknowledged that the assumptions about the potential rates of greenhouse gas
emission used in the scenario’s that Stern and the IPCC based their conclusions upon are already out
of date. Garnaut said to The Age newspaper:

“Major reports of recent years, including the UN Intergovernmental Panel assessments and the Stern
report, have used scenarios that are already out of date.”\textsuperscript{1142}

As the Garnaut Review’s interim report stated:

“The Stern Review estimated that to keep below 450 ppm at all times would require sustained annual
reductions of seven per cent. Recent acceleration of global emissions growth has made the task even
harder than anticipated just two years ago.

Developments in mainstream scientific opinion on the relationship between emissions accumulations
and climate outcomes, and the Review’s own work on future “business a usual” global emissions,
suggest that the world is moving towards high risks of dangerous climate change more rapidly than has
generally been understood. This makes mitigation more urgent and more costly. At the same time, it
makes the probable effects of unmitigated climate change more costly, for Australia and for the
world.”\textsuperscript{1143}

Hence the level of decoupling required quickly to avoid high risks of dangerous climate change and
achieve environmental sustainability across all sectors simultaneously and globally will take an even
more serious and concerted effort. The Garnaut Review Interim Report incorporated this into its new
modelling that suggests that to achieve a global stabilization of 450 ppm or 550ppm will require even tougher short term and long term targets to be met.

Secondly, for most of the last century energy usage and greenhouse gas emissions have been strongly coupled with GDP economic growth.\textsuperscript{1144} Decoupling economic growth from greenhouse gas emissions is harder than achieving decoupling of most other pollutants and environmental pressures because modern economies have been built upon energy from cheap fossil fuels. There is over 100 years worth of infrastructure and industry development based on the use of cheap fossil fuels as a resource. At present, fossil fuels provide 80% of global energy requirements.\textsuperscript{1145} In addition, greenhouse gas emissions arise from virtually all sectors of the economy in different ways. Unlike acid rain from sulphur dioxide pollution, which was relatively easy to fix technically in coal fired power stations, almost all activities in the economy contribute to creating greenhouse gas emissions, hence there is no one technical fix which can solve the climate change challenge. Rather a more sophisticated portfolio approach of strategies will be needed including at least a transition to greater demand management, energy efficiency, low carbon technologies and energy supply systems, sustainable transport, and carbon sequestration within an effective global and national policy framework.

Thirdly, mitigating and adapting to climate change requires unprecedented global co-operation and agreement. No one country can solve this problem. Global action on climate change suffers from free rider issues. Virtually every aspect of the economy is producing greenhouse gas emissions through its economic activity and thus needs to reduce emissions. This means that a whole of economy approach is needed or else positive achievements in parts of the economy of one nation will be swamped by greenhouse gas emission growth in another part of the economy. Developing countries are understandably concerned about the fairness of any potential cuts they are going to be asked to make under a post Kyoto framework. Also efforts to stop deforestation and create carbon stores in developing countries will be extremely challenging due to current levels of corruption in many timber exporting developing countries.

Fourthly, the challenge of decoupling economic growth from greenhouse gas emissions is also due to the fact that it has to be addressed at multiple scales and in different ways due to the complex nature of the problem. In many OECD countries at least 20% of greenhouse gas emissions result from the cumulative effect of our personal choices of how we use energy in the home and our daily personal transport choices. The projected increases in emissions from personal air travel threaten to swamp whatever improvements people make in other parts of their lives. Hence decoupling economic growth from greenhouse gas emissions is not a problem we can entirely leave to international UN meetings


and the policy experts to solve. Rather it will require the concerted efforts of all citizens to take
responsibility to reduce their own carbon footprint. This requires additional policies and incentives to
specifically address this individual and household scale of greenhouse gas emissions.

Fifthly, since some corporations produce or use significant amounts of fossil fuel energy they and their
workers have feared that action on climate change would reduce their business competitiveness and
profit margins and lead to loss of jobs. This has led to significant vested interests forming blocking
coalitions to prevent action on climate change since the early 1990s. By 1990, some industries had
concluded that greenhouse action would hurt them. They (helped by some misinterpretation of
economic modelling results and ill-informed media) convinced many in business and in conservative
governments that the economy will be hurt by almost any form of comprehensive greenhouse
response. Many economic policy advisors in governments have generally accepted and promoted this
view. Beliefs that a response to climate change will hurt the economy are based on misinterpretations
of economic modelling. These misinterpretations however cannot be ignored as they have resonated
with the general public and with political and business leaders due to common prejudice that that
helping the environment must hurt the economy. This chapter seeks to resolve this tension.

- Hence the first part of this chapter shows how some have mis-interpreted economic modelling about
  the costs and benefits of action on climate change and how the vested interests have used this for
  their own interests.

- The second part of this chapter discusses ten major strategies to decouple economic growth from
  greenhouse gas emissions for OECD and developing countries. The second part of this chapter looks
  at how assumptions by economic modellers about the cost and benefits of these ten strategies
  significantly affect the results of their modelling.

This thesis recognises that rational discussions about the economic impacts of a wise approach to
action on climate change is not going to be sufficient to address the barriers to progress on action to
mitigate climate change because of vested interests and blocking coalitions. As Diesendorf writes:

“Greenhouse solutions demand major social change that is in the common interest of the vast majority of
citizens, but runs against the vested interests of powerful organisations. Such changes cannot be
achieved simply by convincing government decision makers or the best interests themselves by rational
argument. While continuing dialogue is essential, most politicians and other powerful interests will only
respond to “convincing political arguments.” Rational arguments are more important for the community at
large. There are two kinds of Convincing Political Argument. One is the creation of a new vested interest
that is as powerful in terms of political donations, influence in the media and contributions to the
 economy as the old vested interests...The second type arises from the more diffuse kind of power or
empowerment that can be exercised by a mass movement of (progressive organisations and) citizens...If

the vast array of groups and individuals, making up such a movement can agree on common principles, goals and strategies, the movement can be almost irresistible to any government that wishes to stay in office and to any opposition party wishing to achieve office. Such a mass movement would include sympathetic businesses, professional organisations, trade unions, churches and environmental non-government organisations (NGOs)."\(^{1147}\)

So the third part of this chapter overviews progress on strategies to both create new vested interests for positive change and build a global mass movement for action on climate change. But as outlined in Chapter 1 and above, the Stern Review target of 60 per cent by 2050 is now regarded by many eminent climate scientists as insufficient. So now economists are modelling scenarios, with even tougher targets, for greenhouse gas reductions than contemplated by Stern. The Australian Garnaut Review has argued that OECD countries like Australia should commit to a 90 per cent reduction target by 2050 as part of a Post Kyoto International Agreement. Thus currently economic modelling is researching broadly the costs of mitigating climate change under broadly three possible scenarios.

\(i)\) **A Firm Scenario**, which aligns with the current target committed to by many national governments of 60 per cent by 2050 with a 20 per cent by 2020 target. This is what many EU nations have already committed to undertaking, and what the Stern Review\(^ {1148}\) and most economic modelling to date has investigated.

\(ii)\) **A Strong Scenario**, which aims to achieve, under a global agreement, a peaking of global greenhouse emissions by 2015, a reduction of 25-40 per cent by 2020 and a target of 80-100 per cent by 2050. This aligns the long term target, recommended by the Garnaut Review Interim Report\(^ {1149}\) for Australia to adopt, if the rest of the world commits to a binding global agreement. This also includes the short term target discussed at the UN Bali Summit. This is what the IPCC 4\(^{th}\) Assessment\(^ {1150}\), the Australian Climate Institute\(^ {1151}\), the McKinsey Group\(^ {1152}\) and Schneider and Azar\(^ {1153}\) have economically modelled.

\(iii)\) **A Global Emergency Scenario** – which examines the economic, social and technical feasibility of trying to reduce emissions as fast as by 2020 and by 2050 without


preconceptions. Modelling of this scenario is yet to be published but this is what increasingly climate scientists are arguing nations and companies to do. Already four nations have committed to becoming net climate neutral rapidly. Thus in this chapter we bring together relevant literature to help inform future economic modelling of this third and ambitious scenario.

The three scenario’s are chosen to represent the wide range of opinion currently about what level of speed and scale of decoupling of economic growth and greenhouse gas emissions is needed to prevent overshoot, reduce the risks of dangerous climate change and achieve environmental sustainability. It is useful therefore to look at recent economic modelling under three scenario’s including the 60 per cent by 2050 and two tougher scenarios to see whether adequate decoupling to achieve environmental sustainability can be achieved without harming the economy significantly and thus test the central hypothesis of this thesis.

7.2 Under Different Scenarios, Can Decoupling of Economic Growth from Greenhouse Gas Emissions Always be Achieved Without Significant Cost to the Economy?

7.2.1 The Firm Scenario. Global cuts of 10-20 per cent by 2020 and a Firm Long Term Target of 60 per cent by 2050.

The Stern Review is the most thorough economic modelling study of this firm scenario on a global scale. Many nations have committed to at least 60 per cent reduction target for greenhouse gas emissions by 2050. Hence there is a wealth of technical and economic modelling to show how OECD nations can achieve this target (See Appendix 7.1 and 7.2). Using energy efficiency, renewable energy, demand management, sustainable transport approaches and Clean Development Mechanism opportunities, a wide range of economic studies show that at least 60 per cent can be achieved by 2050 with strong economic and jobs growth. (See Appendix 7.1 and 7.2)

The Australian Business Roundtable on Climate Change’s (ABRCC) economic modelling is a good example of what the consensus is saying about the economic impacts of a 60 per cent by 2050 target.\textsuperscript{1154} The ABRCC has had a significant impact on the economic debates on climate change in Australia. Hence it is worth featuring as an example.

The ABRCC commissioned studies were significant in that they demonstrated for the first time the economic and business case for early action on climate change in the same report. The Roundtable showed that increasingly business in Australia is calling for early action on climate change as lack of certainty about future climate policy in Australia heightens the risks associated with investment. All

\textsuperscript{1154} Formed in 2005, the Business Roundtable is made up of CEOs from BP, Insurance Australia Group, Origin Energy, Swiss Re, Visy Industries and Westpac with The Australian Conservation Foundation
sectors of the economy will be affected by climate change, and by emissions trading schemes and/or a carbon tax. For instance, The Energy Supply Association of Australia (ESAA) estimates that $30 billion of investment is required in the electricity sector over the next decade. Lead times for base load generation are four to six years and these assets have long lives. In the absence of carbon risk, these investments would be driven by well known factors. But climate change is now a key factor in the decision-making process for base load generation. In the absence of a clear long-term framework on climate change, investor appetite for new large plants is likely to remain low due to potential risk. The ESAA has clearly stated that ‘One of the biggest sovereign risk issues facing the energy sector is [the uncertainty surrounding] future Government policy and measures on emissions’.

One of the major barriers to business and government committing to a carbon price signal (and to the sustainable cuts needed), has been the perception that the costs of a carbon price (and committing to targets of 60% GHG reductions by 2050) would be prohibitive to business and the economy. The Australian Business Roundtable on Climate Change’s reports, published in April 2006, found there is no justification for such fears and concerns. They found that early action on climate change is far better for business than delaying it. They found that early action on climate change, to achieve a 60 percent reduction in greenhouse gas emissions by 2050, can still achieve strong economic growth. Specifically the economic modelling they commissioned found that:

- GDP still continues to grow by 2.1 percent pa and by 2050 will increase from AU$0.8 trillion in 2005 to AU$2 trillion in 2050. This occurs while Australia reduces emissions by 60 percent. Australian Bureau of Agriculture and Resource Economics’ (ABARE) modeling shows GDP continuing to grow by around 2.1-2.2 percent pa with a 15-40 percent reduction in emissions.

- Real income per person, in 2050, will double from what it was in 2005. Put another way, in 1984 Australian GDP per person was AU$22,000 and it is now AU$44,000. Even if we reduce emissions by nearly two thirds this would double again to AU$88,000 by 2050. Employment would grow by 38.7 percent over the period of 2050 leading to the creation of 3.5 million jobs by 2050.

- Electricity costs would be lower as business invests earlier in low and zero emission technologies, when compared to taking delayed action. Future electricity price rises would be three times higher in the delayed action scenario in comparison with the early action scenario.

Conversely, if action on climate change is delayed in Australia then the costs of adoption will be far greater to business and governments at all levels, leading to a major disruptive shock to the Australian economy.

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1156 Ibid.
1157 Ibid
economy. The Australian Business Roundtable found that GDP growth would be limited to an average of 1.9 percent pa to 2050, or AU$1.84 trillion. Employment growth would only be 36.2 percent; 250,000 fewer jobs created than under early action.

Figure 7.2: Decoupling economic growth and energy use from greenhouse gas emissions – projections for Australia without (Left) and with (Right) policy action, 2002–2050. (Source: Hatfield-Dodds, 2006)

Introducing an emissions constraint (a strong carbon price signal) gives economic value to emissions reductions and motivates action. Direct emitters, such as electricity generators, change their fuel mix (away from coal towards natural gas and renewables), and introduce new technologies such as carbon capture and storage as these become cost effective in light of a rising ‘carbon price’. Energy users including consumers and other businesses

- choose more energy efficient appliances and technologies, which can reduce energy use while maintaining or improving the underlying energy service provided (such as a hot shower or commuter travel).

- change consumption patterns over time towards products and services with lower embodied emissions and energy. The increased attention to emissions and energy efficiency also has an important role in supporting environmental awareness and helping to identify win-win opportunities to reduce costs and improve the efficiency of resource use.

Invest in carbon offset programs. Revegetation projects also benefit from the introduction of the carbon signal, which provides a new revenue source for biodiversity plantings and other ‘carbon sinks’ that offset emissions.

The UK Stern Review and the ABRCC economic models now show that a combination of emissions trading and/or a carbon tax plus other smart regulations and policies can effectively decouple greenhouse gas emissions and energy use from economic growth. In countries and states where smart regulations or emissions trading/carbon taxes have been brought in like California, USA and Sweden respectively there is already decoupling of economic growth and greenhouse gas emissions occurring as was shown in Chapter 5.

The UK Stern Review’s conclusions on the effect of climate change on economic growth align well with the findings of the Australian Business Roundtable on Climate Change (ABRCC). The key message from the UK Stern Review, as with the Australian Business Roundtable, is that climate change poses a significant risk to the world economy and it will be cheaper to proactively address the problem than to deal with the consequences of inaction.\endnote{1159} The ABRCC found that delayed action on climate change would put significant sectors of the Australian economy at risk, wreaking havoc with major tourist destinations, and hitting agriculture and forestry sectors hard with increasing risks of regular bush fires, and decrease in water flows. This has been corroborated by the IPCC’s recent national assessment of Australia.\endnote{1160}

7.2.2 The Strong Scenario –25-40 per cent by 2020 below 1990 levels, and a strong long term target of a net 80-100 per cent cut in greenhouse gas emissions by 2050

As discussed in Chapter 1 and in this chapter, many scientists now are warning that the 60 per cent by 2050 target will not be sufficient to avoid dangerous climate change. The IPCC 4\textsuperscript{th} Assessment has published economic modelling to support their argument that the post Kyoto International Agreement should adopt future targets of at least 25-40 per cent by 2020 and 80 per cent cut by 2050. The IPCC’s economic modelling shows that such targets could be achieved with negligible negative effect on the global economy. As Liz Minchin reported

“The world has less than eight years to arrest global warming or risk what many scientists warn could be catastrophic changes to the planet. Its conclusion that global emission cuts of between 50 to 85 per cent would be needed to stop the temperature rising beyond two degrees. It found that slashing greenhouse

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Consider the 2007 CSIRO, The Climate Institute, Monash University and McLennan Magasanik Associates economic modelling and report.\footnote{Hatfield-Dodds, S., Jackson, E.K., Adams, P.D. and Gerardi, W. (2007), Leader, follower or free rider? The economic impacts of different Australian emission targets, The Climate Institute, Sydney, Australia. Available At http://www.climateinstitute.org.au/images/stories/CI058_ER_FullReport_NEW.PDF Accessed 4th March 2008} This is a significant report, written and researched by many of Australia’s best climate change mitigation economic modellers, backs up the 90 per cent by 2050 recommendation of the Garnaut Review’s Interim Report. These experts examined a range of scenarios including one where leadership Australia goes further than 90 per cent by 2050 and instead goes net carbon neutral by 2050 (They assume Australia is part of a global CDM or emissions trading scheme and thus can achieve a net carbon neutral target). The analysis also did not factor in the climate change impact costs of inaction which The Stern Review have been estimated to be between 5-20% of global economic activity in 2100. Yet their critical report shows that if Australia’s emissions
peak by 2012, reduced by 20% by 2020 and then eventually became net carbon neutral\textsuperscript{1169} by 2050 that:

- Australian economic activity is projected to increase from less than $1 trillion now to around $3 trillion by 2050. To 2050, the economy grows at 2.8% annually versus 2.9% annually with no action on climate change (i.e. a 0.1% annual reduction in GDP growth).
- Employment increases from 9.7 to 16.7 million jobs by 2050.
- Long-term impacts on energy prices and affordability are manageable with average energy consumer bundle (electricity, petrol and gas) falling from 6% of average income today to 4% by 2050. (While electricity, petrol and gas prices increase this is more than offset by increases in real income.)
- The report concludes that, “making very substantial reductions in Australia’s net greenhouse emissions is affordable, and compatible with continuing growth in incomes, employment and living standards.”

The report’s authors state that

“The key finding of this report is that the leadership premium associated with Australia committing early to very substantial cuts in our net greenhouse emissions is modest and affordable, and would help manage the economic risks to Australia as well as contributing to the global momentum and concrete actions required to avoid dangerous global climate change.”\textsuperscript{1170}

This CSIRO et al study\textsuperscript{1171} is significant as it shows that an 80-100 per cent target by 2050 using smart approaches to climate change mitigation and clean development mechanism projects is technically and economically viable for an OECD economy like Australia.

There has been significant opposition from certain sections of business in Australia to the Garnaut Report.

As we argued in Chapter 4, business can also benefit from a strong and purposeful approach to climate change. Most assume that if nations adopt a strong approach to reducing greenhouse emissions that their businesses will lose competitiveness. In Chapter 4 we showed that competitiveness issues for trade exposed companies can easily be managed with a range of policy initiatives.\textsuperscript{1172} As we will show in 7.4 in this chapter there is now a wide range of studies which

\textsuperscript{1169} The modeling and report assume that Australia and Australian business will be able to invest in Clean Development Mechanism Projects as part of a Post Kyoto Framework. These investments make achieving a net carbon neutral target technically possible.


\textsuperscript{1171} Ibid.

\textsuperscript{1172} Saddler, H, Muller, F & Cuevas, C (2006) Competitiveness and Carbon Pricing: Border adjustments for greenhouse policies, Discussion Paper 86, Australia Institute, Canberra, April
show there are significant energy efficiency opportunities for business.\textsuperscript{1173} Also climate change solutions, whether as products or services, will be the major next wave of innovation. Innovation in this area is occurring so fast that nations which do not commit strongly to the necessary investment in R&D for climate change solutions risk missing another wave of innovation just like most nations missed the ICT wave of innovation due to lack of public and private sector investment. Progress on innovation in LED lighting has quadrupled resource productivity in just four years since 2003. Commercialization of innovation in climate change mitigation called clean tech now receives as much venture capital in Europe as biotech and nanotech.

7.2.3 A Global Emergency Scenario – Achieving Greenhouse Gas Reductions as Fast as Possible to achieve at least 50 per cent Global Reductions by 2020 and Low Stabilization Targets by 2050.

The reason to include an even more ambitious global emergency scenario is that there are positive feedbacks within the world’s biosphere to climate change which, once triggered, threaten to raise global temperatures significantly irrespective of what other greenhouse gas reductions are achieved. These were outlined in detail in Chapter 1 of this thesis and in Chapter 1 of the Stern review. The latest science published in 2007 shows that some of the positive feedbacks in the earth’s biosphere are being activated faster than even the IPCC predicted for their 4\textsuperscript{th} Assessment published in 2007. For instance, the artic sea ice could be completely melted as early as the summer of 2013, decades ahead of what the IPCC had predicted.\textsuperscript{1174} Even before this critical development in the rate of artic sea ice melt, Al Gore has called, what is occurring now with climate change, a planetary emergency in his address to several committees of the US Congress and Senate.\textsuperscript{1175}

It is important to discuss the implications of the latest science on the question of what rate of decoupling needs to be achieved of economic growth and greenhouse gas emissions? Stephen Schneider and Azar\textsuperscript{1176} showed that over a 100 year time scale very deep cuts to greenhouse gas emissions can be achieved with negligible effect on economic growth. But if deep cuts have to be achieved by 2020 or 2050 and the rate of decoupling needed globally now is greater than seven per cent per annum, (as argued by Garnaut in the Garnaut Review Interim report). Can this be done with still negligible effect on economic growth?


This thesis assumes that humanity needs to avoid dangerous climate change, as defined by the IPCC in their 4th Assessment, as a pre-requisite to being able to achieve environmental sustainability. Climate scientists of the calibre of NASA’s James Hanson are arguing that, due to the latest scientific evidence from the 2007 summer ice melt, even 25-40 per cent reduction in global emissions by 2020 and 80 per cent by 2050 is insufficient to sufficiently reduce the risks of dangerous climate change.1177

Spratt and Sutton have brought together the latest science published since the IPCC 4th Assessment stopped taking new evidence to argue that there is need for nations to commit to decoupling economic growth from greenhouse gas as fast as possible. They argue that pursuing even this very rapid transition to a low carbon economy need not harm economic growth but rather could help it. They point to historical examples of nations undertaking rapid restructuring of the whole of the economy in WW2 through which it is possible to examine the effects of such a rapid restructuring on economic growth. WW2 provides a large body of empirical data of what happened during a extremely rapid transition of the economy. The historical evidence, for example of the emergency mobilization in the USA for the 1939-45 war, shows that a rapid restructuring of the economy in WW2 led to an economic boom. In the USA, between 1940–1945, unemployment in the USA fell from 14.6% to 1.9%, whilst GNP grew 55%. In the USA in 1942 economic growth was 12 per cent for that year. Wages grew 65% over the course of the War to far outstrip inflation, and company profits boomed, all at a time when personal consumption was dampened by the sale of war bonds, some basic goods and foods were rationed and at the height of the mobilisation 40% of the economy was directed towards the war effort. WW2 wartime economic history suggests that a rapid restructuring to achieve a low carbon economy need not crash the economy, rather it can boost economic growth since restructuring boosts investment and thus increases GDP.

But such historic evidence does not prove that the world could undertake such a war economy like rapid transition to a low carbon economy whilst maintaining strong economic growth. This historic evidence about GDP growth rates during WW2 merely suggests that it is worth further investigating and researching further whether or not an as rapid as possible scenario is achievable by 2020 to quickly decouple economic growth to achieve a low carbon economy.

Further evidence of the value of undertaking new research into a still more ambitious scenario, comes from other business reports. The Environment Business Australia Targets for Our Future report outlined vital research which, for the first time, argues that Australia could achieve 50 per cent cuts to greenhouse gas emissions by 2020.1178 The report stated that


“With a rapid introduction of new policies and systems the following approaches could deliver over 50% GHG emissions cuts by 2020 through the following strategies. Energy efficiency 20%, recycling 10%, fuel switching 10%, hot rock geothermal 2%, solar thermal 10%, photovoltaics 2%, and wind 5%.”

The Environment Business Australia’s (EBA) report emphasizes the significant opportunities for Australian industry and business if the Australian government leads. Thus this report addresses significantly one of the major areas of research for the Garnaut Review namely

“The economic and strategic opportunities for Australia from playing a leading role in our region's shift to a more carbon-efficient economy, including the potential for Australia to become a regional hub for the technologies and industries associated with global movement to low carbon emissions.”

McKinsey Consulting is a highly respected global business group. They have recently released detailed studies\textsuperscript{1179} which should how Australia could achieve 30 per cent cuts by 2020 and 60 per cent cuts by 2030 highly cost-effectively through investing mainly initially in energy efficiency, co-generation and carbon offsets from stopping forest burning and deforestation in Asia. Under a global or national emergency scenario it is not inconceivable that the level of investment required to achieve 60 per cent cuts by 2030 could be brought forward to achieve at least 50 per cent cuts by 2020.

The EBA and McKinsey have been accused of being overly optimistic. As I will show in section 7.4, detailed energy efficiency research for the Australian economy funded by CSIRO and NFEE\textsuperscript{1180} shows that they have not exceedingly over-estimated Australia’s energy efficiency opportunities, rather they are in accord with both existing NFEE studies\textsuperscript{1181} and findings from government programs and energy efficiency consultants. But, at the very least, such research does uncover important lessons and cost effective ways to rapidly achieve rapid greenhouse gas reductions in specific sectors of the economy. For instance a new report\textsuperscript{1182} released in late 2007 by Telstra identifies seven ways that telecommunications can reduce Australia’s national greenhouse gas emissions by five per cent by 2015. Just 12 months ago Telstra did not know this. Just 12 months ago such information was not available for decision makers to estimate what are realistic targets for Australia. There are similarly large information gaps in many countries now


trying to estimate realistic targets for 2020 and 2050 to take to the next UN Climate Change meetings.

Another reason for considering the global emergency scenario is that climate change is emerging as one of the major national security threats of coming decades. To avoid future conflicts and wars governments and citizens may decide that it is politically acceptable to have greater government intervention to achieve a faster transition to a low carbon economy.

In defence and security circles, it is common to examine all possible scenarios when assessing risks. Now that some security experts are arguing that climate change is a significant security risk this century, in the next decade it could be well seen as appropriate to fund a proper investigation of a national emergency scenario of rapidly mitigating climate change as fast as possible. Head of Australian Federal Police, Mike Kelty fears climate change more than terrorism. The region of the Asia Pacific will be particularly negatively affected by climate change increasing the risks of conflict, refugees, and lawlessness. Climate change will reduce by at least half the available water from rivers which depend on snow melt from the Himalayan plateau. In China by 2040, climate change could mean 30 per cent less land for rice and grain at a time when it needs to be boosting its food production by 40 per cent to meet rising population demands. As Mick Kelty stated:

"We could see a catastrophic decline in the availability of fresh water. Crops could fail, disease could be rampant, and flooding might be so frequent that people en masse would be on the move. Even if only some and not all of this occurs, climate change is going to be the security issue of the 21st century. It's not difficult to see the policing implications that might arise in the not too distant future."

Already islands are being overwhelmed by sea level rises in the Pacific and Bangladesh only needs a half a meter to a meter rise in sea levels to force 50-100 million to migrate. Most of the mega cities in Asia are on low lying river deltas which are very vulnerable to the slightest sea level rises. Professors Dupont and Pearman have outlined the security risks of climate change in detail in their Lowy Institute paper in 2006.

Another reason for investigating a very rapid decoupling global emergency scenario is that in many nations investment for rapid restructuring of the economy is needed anyway in

- Cities and the transport sector to address record high oil prices, peak oil, congestion, urban pollution and diseases of inactivity such as obesity.

- The agricultural and forestry sector to address drought, declining water availability, extreme weather events and temperature changes.

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- Broadband infrastructure to improve national productivity and communications which will also enable video-conferencing and smart meters which will reduce greenhouse gas emissions. 

- Tourism globally which are dependant on coral reefs or ski fields

- Cities, infrastructure and businesses operating on land currently below 1 meter above sea level.

Hence governments, business and citizens may decide that, since significant investment, restructuring and compensation is needed anyway, why not ensure that future restructuring also brings about a transition to a low carbon economy.

Whichever short and long term greenhouse gas reduction targets are chosen by nations, achieving those targets will be greatly helped by a bipartisan approach to climate change to help ensure a consistent investment environment for business and the community. Every nation has precedents where there has been a national crisis so big that both major political parties agreed to take a bipartisan approach to solve a problem.

Whichever greenhouse gas reduction targets are chosen to decouple economic growth from greenhouse gas emissions, it is important analyse the most cost effective ways to rapidly reduce emissions.

- If you subscribe to the firm or the strong scenario, then you will still agree that it is important to research and implement the most cost effective ways to achieve rapid decoupling because the greater the reductions achieved by 2020, the less annual reductions in greenhouse gas emissions are required from 2020 to 2050 to achieve 60 to 100 per cent by 2050 from 1990 levels.

- If you subscribe to the global emergency scenario like NASA climate scientist Hansen, or Spratt and Sutton, then all you are interested in is how to rapidly reduce emissions by 2020.

The next part of this chapter investigates a portfolio approach of ten key climate change mitigation strategies to enable the rapid decoupling of economic growth from greenhouse gas emissions. These ten key climate change mitigation strategies are considered to investigate how realistic it is for rapid decoupling to occur without harming economic growth and because an understanding of them influences the assumptions economists make in their economic models on the costs and benefits of climate change.


As the Stern Review clearly states, the choice of assumptions made by economists explains largely why studies on the economic costs of emission reduction predict a range of 1.0 per cent to 3.5 per cent of global GDP. In other words the choice of assumptions is so significant that it changes the conclusion of the economic modelling from either finding that action on climate change helps, barely effects or slightly harms economic growth. By necessity economic modelling requires assumptions to be made. A number of studies have shown that some economists historically have underestimated the costs of inaction and overestimated the economic costs of rapid action to achieve a transition a low emission economy quickly. How these assumptions effect economic modelling is important for policy makers to understand because these assumptions which are sensitive variables in the economic modelling highlight areas where government, through good policy, can make a difference.

Professor John Weyant has identified key areas where assumptions made by economists significantly affect the results of their modelling in this area. Professor John Weyant identified five key areas where assumptions made by economists significantly affect the results of their modelling in this area. One of the key assumptions in the models that Weyant refers to is the way in which the models deal with technological change, which is the critical issue that we are dealing with here. Weyant concludes that it probably does not make much difference in the short term but, over the longer term, say ten years or more, induced technological change could be a very substantial contributor to reducing the costs of reducing emissions. That makes sense, because we are actually talking about not only the development but also the adoption of new technologies which you would expect to take a decade or more to really have a big impact on the economy.

Economic modellers tend to be conservative in the assumptions they make but recent events suggest that it may be possible for very rapid diffusion of more energy efficient products and appliances to occur.

When the previous Federal Government announced that it would phase out inefficient lighting by 2012, the European Union, California, and even the Philippines rapidly followed suit. This is having a significant flow-on effect by driving a change among global manufacturers in China, Europe and North America to focus on more energy efficient lighting products. The same concept could be applied tactically to other appropriate household, office, catering/hospitality and industry appliances or

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1189 Weyant, J. (2000) *An Introduction to the Economics of Climate Change Policy*, prepared for the Pew Center on Global Climate Change, Stanford University, July


1191 Weyant, J. (2000) *An Introduction to the Economics of Climate Change Policy*, prepared for the Pew Center on Global Climate Change, Stanford University, July

equipment. The lighting precedent suggests that if Australia committed to a phasing out the least energy efficient of these it more than likely would encourage the EU and California, for example, to rapidly follow, providing direct incentives to global manufacturers to fast-track more energy efficient products globally. As the next part of this chapter will show there is also much that can be done to ensure the rapid uptake of existing highly energy efficient products in developing countries. The rate at which energy efficient products from the OECD are taken up in developing countries will also significantly affect the costs predicted by economic models.

The next ten climate mitigation strategies are also discussed because they demonstrate where the main opportunities are for the world and business to achieve the most cost effective and largest greenhouse gas reductions quickly by 2020. Thus an understanding of these ten areas of opportunity to reduce greenhouse gas emissions quickly will provide a sophisticated portfolio approach from which nations can apply to help bring about a global peaking and then rapid reduction in greenhouse gas emissions under either a firm, strong or global emergency scenario’s outlined above.

i) Assumptions about energy efficiency potential in the global economy.

ii) Assumptions of potential reductions through demand management.

iii) Assumptions about the potential of energy efficiency and demand management to delay the need for new electricity power plants and grid infrastructure.

iv) Assumptions about the viability and costs of renewable energy to meet peak and base load requirements.

v) Assumptions about the costs of a transition to a low carbon transport sector.

vi) Assumptions about the costs of reducing non-co2 emissions.

vii) Assumptions about what greenhouse abatement is possible through clean development mechanism projects in a post kyoto framework.

viii) Assumptions about how money from emissions credits is recycled and rebound effects.

ix) Assumptions about rebound effects

x) Assumptions about the costs of inaction on climate change

7.3 Costs and Benefits of Taking Rapid Action to Decouple Economic Growth from Greenhouse Gas Emissions

7.3.1 Assumptions about Energy Efficiency Potential in the Global Economy

The first and most important assumption made by economists when analysing costs and benefits of action on climate change is their assumptions concerning to what extent energy efficiency opportunities still exist in the economy. As discussed in Chapter 4.12, conventional micro-economic
theory assumes that the firm maximizes profits by incorporating an optimal mix of labour, capital and other inputs in accordance with a standard production function, using fixed technologies freely available to all industry participants. It assumes that under perfect competition any inefficiency will be eliminated. Under these assumptions, efforts to reduce greenhouse emissions would be expected to add costs to an idealized firm that has already maximized its profits through implementing any cost effective cost cutting strategies. All economists know that real markets are far from theoretical perfection. However, many climate/economy models assume that close to perfect markets do exist and hence that most profitable energy savings must have already been achieved. On this basis, the modellers suppose, buying significantly bigger savings will be worthwhile only at higher energy prices. They then use complex computer models to calculate how high an emissions trading scheme and a carbon energy tax is needed (based on historic elasticity), and hence what the ‘cost’ of protecting the climate must be.

On the other hand, bottom-up technological engineering modelling approaches recognize barriers that may have inhibited firms from taking advantage of potentially profitable energy-saving opportunities. There are significant market failures which daily prevent energy efficiency opportunities from being taken up. These bottom-up estimates typically predict that policy initiatives can induce reductions in energy consumption. As a result, bottom-up technological engineering modelling approaches typically suggest less economic disruption from government or private sector initiated energy efficiency programmes to reduce global greenhouse gas reductions. Not only do other economic models derive the opposite answer from actually acknowledging that savings are possible through energy efficiency measures, but an enormous body of overlooked empiricism, including government-sponsored studies and worldwide business practice, shows that many of the technological breakthroughs that we need to at least get started already exist.

McKinsey & Company has found that, through investing in energy efficiency, global emissions could be reduced by 20 per cent by 2020 without harming economic growth. This aligns well with UK Carbon Trust and EU studies which have investigated the energy efficiency potential for the EU economy. Economic modelling by the National Framework for Energy Efficiency has shown that if Australia as a whole implemented 50 per cent of available energy-efficiency opportunities having a four-year or less payback, this would increase real GDP by AU$1.8 billion and create 9000 new jobs in addition to the environmental benefits.


As Chapter 4 outlined using energy more efficiently offers an economic bonanza for business because saving fossil fuel is a lot cheaper than buying it. Energy-efficiency savings are the quickest, easiest and most cost-effective way for business and Australia to reduce greenhouse emissions. Energy efficiency gains for industry can come in a variety of ways, including lower capital costs and operating costs, increased yields, and reductions in other resource use such as water. Any energy efficient industrial technology improvement will incorporate one or more of these improvements. Some energy efficiency improvements may primarily be aimed at one goal, but also generally include beneficial impacts on other aspects of a production process. For instance, as Lawrence Berkeley National Laboratory’s explain:

“certain designs or technologies that are identified as being ‘energy-efficient’ because they reduce the use of energy will bring a number of additional enhancements to the production process.”

These improvements include lower maintenance costs, increased production yield, safer working conditions, and many other ‘productivity benefits’ or ‘non-energy benefits’, because in addition to reducing energy, they all increase the productivity of the firm. Several authors have studied the relationship between productivity and energy efficiency and found a direct relationship using different methodologies and datasets.

Our 640 page synthesis textbook resource, funded by CSIRO and NFEE, shows that business, governments, organisations and households can reduce greenhouse gas emissions significantly through energy efficiency and then using the savings from energy efficiency to invest in renewable energy, carbon offsets, sustainable transport and changes in consumption patterns within a few years once they commit to act. This resource features existing real case studies and/or designs of

- Households rapidly retrofitted reducing emissions by over 60 per cent.
- (virtually) net climate neutral buildings.
- Low carbon ways to process minerals and recycle metals.

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1198 Ibid.
- Net climate neutral manufactured products.  
- Net climate positive paper and pulp mills.  
- Food processors that can reduce emissions by 30-80 per cent through energy efficiency, onsite co-generation and/or renewable energy.  
- Supermarkets and bakeries that use 40 per cent less energy than market average through energy efficiency initiatives.  
- Fast food retail outlets that use 40-70 per cent less energy than market average through energy efficiency and better design.  
- Lighting, HVAC and motor systems, that use at least 10-30 per cent less energy than the industry average.  
- Office IT systems and servers that together use over 60 per cent less energy and  
- public street lighting that is at least 50 per cent more energy efficient than current mercury street lighting.

Also, in the transport sector

- Overseas cities that are rapidly shifting to sustainable transport patterns.

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1201 Ibid. See Lecture 5.1 Opportunities for Energy Efficiency in the Aluminium, Steel and Cement Sectors at http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture5_1
1202 Ibid. See Lecture 5.2: Opportunities for Energy Efficiency in Manufacturing Industries at http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture5_2
1203 Ibid. See Lecture 5.2: Opportunities for Energy Efficiency in Manufacturing Industries at http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture5_2
1204 Ibid. See Lecture 6.2: Opportunities for Energy Efficiency in the Food Processing and Retail Sector at http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture6_2
1205 Ibid. See Lecture 6.2: Opportunities for Energy Efficiency in the Food Processing and Retail Sector at http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture6_2
1207 Ibid. See Lecture 2.2: Opportunities for Energy Efficiency in Commercial Buildings http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture2_2
1208 Ibid. See Lecture 2.3: Opportunities for Improving the Efficiency of HVAC Systems http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture2_3
1209 Ibid. See Lecture 3.1: Opportunities for Improving the Efficiency of Motor Systems http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture3_3
1210 Ibid. See Lecture 5.3: Opportunities for Energy Efficiency in the IT Industry and Services Sector http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture5_3
1211 Ibid. See ICLEI Public Street Lighting at http://www.iclei.org/index.php?id=6473

- Cars\textsuperscript{1212} and trucks\textsuperscript{1213} that are at least 50 per cent more fuel efficient than those using the internal combustion engine.

- The telecommunications sector can help Australia reduce Australia’s greenhouse gas emissions by 5 per cent by 2015.\textsuperscript{1214}

Other evidence showing how technically such large energy efficiency reductions can be achieved over the next couple of decades is outlined in the 2009 publication Whole System Design\textsuperscript{1215}. This research and that of Alan Pears\textsuperscript{1216} shows that there is still significant potential for energy efficiency savings in household appliances, office, catering and industrial equipment.

Since urgent action is needed on climate change and energy efficiency offers the most cost effective way to rapidly achieve greenhouse gas reductions, it is worth considering what are other barriers to the uptake of energy efficiency opportunities.

7.3.1.1 What are the Barriers to the Uptake of Energy Efficiency Opportunities?

The Australian Government’s Discussion paper on a National Framework for Energy Efficiency\textsuperscript{1217} highlights a range of barriers to the uptake of energy efficiency, outlining for instance the need for greater capacity building among business and technical professionals concerning energy efficiency opportunities. In the UK government, the UK Carbon Trust\textsuperscript{1218} is developing education and training on energy efficiency opportunities by technology\textsuperscript{1219} and by sector.\textsuperscript{1220} These modules do the same for Australia.

There are other market, informational and institutional barriers to the uptake of energy efficiency opportunities which also need to be addressed if Australia is to realise the billions of dollars of potential economic savings possible from energy efficiency. As shown in Chapter 4, market failures,
such as split incentives can lead to energy efficiency opportunities being ignored. There have been a number of barriers like these to the uptake of energy efficiency opportunities, but around the world there are examples where governments, business and professional organisations have addressed and overcome such perverse barriers. Amory and Hunter Lovins summarised examples of where such barriers have been overcome to the implementation of energy efficiency opportunities in their seminal 1997 paper *Climate: Making Money, Making Sense*.1221

7.3.1.2 What are the Major Barriers to Energy Efficiency Opportunities in Developing Countries

The 2007 study, by McKinsey & Company, which shows that investing in energy efficiency could reduce global emissions by 20 per cent by 2020, included the major fast growing countries like China and developing countries.1222 Countries such as China1223, India1224 and Brazil, are now making increasingly significant commitments to energy efficiency in recognition of the win-win opportunities. But there are still significant barriers to investment in energy efficiency in many developing countries, such as low awareness of the benefits of energy efficiency, finance reservations, and the general lack of energy efficiency training amongst the global pool of engineers.

Yet there are already examples of projects that have begun to successfully address these barriers from which both OECD and non-OECD countries can learn a great deal. The starting point is raising community awareness about the benefits of energy efficiency. For example, since all citizens, organizations and government agencies need lighting, investing in energy efficient lighting is an ideal place to start to raise community awareness about the benefits of energy efficiency generally. Poland’s Efficient Lighting Project (PELP),1225 funded by the Global Environment Facility (GEF),1226 is widely regarded as the model success story here.

In Poland, in 1995, though economical in the long run, a compact fluorescent lightglobe (CFL) required an off-putting upfront investment of as much as US$15.00. An incandescent bulb cost just 40 cents. But under the Poland Efficient Lighting Project, OECD nations, through The Global Environment Facility (GEF), committed 5 million dollars to provide an incentive to Polish CFL manufacturers, wholesalers and retailers to help bring down the upfront cost of CFLs.

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1223 See China Energy Bulletin [www.energybulletin.net/3566.html](http://www.energybulletin.net/3566.html)


1226 The Global Environment Facility (GEF), established in 1991, helps developing countries fund projects and programs that protect the global environment. [www.gefweb.org/default.aspx](http://www.gefweb.org/default.aspx)
As a result, more than 1.6 million new compact fluorescent lights (CFLs) were installed through Poland from 1995 to 1998. This increased the uptake of globes from one in every ten homes to one in every three homes by 1998. At 2004, about one in two homes in Poland used a CFL and the project had saved an estimated 2320 gigawatt-hours of electricity – a reduction of 2.8 million tons of CO emissions.

The GEF’s incentives were carefully administered. CFL manufacturers had to engage in competitive bidding to be part of the program and this led to pledges of additional manufacturers’ discounts. A manufacturer’s discount of, say, 50 cents (US$), would mean that a GEF CFL price reduction incentive of $1.50 led to a total price reduction of $2.00. Importantly, negotiations with wholesalers and retailers ensured that they too adjusted their margins accordingly. If the original manufacturer’s price was then $6.00, the price to the wholesaler was subsequently only $4.00. The wholesalers’ and retailers’ reduced markups, as well as value-added tax, were then also calculated on a lower original price. So instead of a manufacturer’s price of $6.00 resulting in a retail price of $12.00, a manufacturer’s adjusted price of $4.00 led to a sales price of only $8.00. Of course all this required the initial commitment of US$5 million, twelve years ago, but it illustrates the power of the mechanism. There has also been a fall in CFL costs over that time to consider.

Such was the success of this program that the GEF then funded the $15 million dollar Efficient Lighting Initiative (ELI) from 2000-2003 to foster the efficient lighting market in Argentina, the Czech Republic, Hungary, Latvia, Peru, Philippines, and South Africa.

There is a significant opportunity for OECD countries to fund similar energy efficiency incentive schemes through the GEF to encourage more countries to adopt energy efficient products and services, thereby changing community attitudes to energy efficiency.

Another opportunity arises from the potential of light emitting diodes. Advances in ultra efficient lighting, such as LED, creates another significant opportunity. As Professor Mills, from the US Lawrence Berkeley Labs wrote in the journal Science:

“An emerging opportunity for reducing the global costs and greenhouse gas emissions associated with this highly inefficient form of lighting energy use is to replace kerosene fuel-based lamps with white solid-state ("WLED") LED lighting which can be affordably solar-powered. Doing so would allow those without access to electricity in the developing world to affordably leapfrog over the prevailing incandescent and fluorescent lighting technologies in use today throughout the electrified world.”

1227 CFLs last eight to ten times longer than normal incandescent electric bulbs and consume only a quarter of the electricity.
1228 See International Finance Corporation Energy Efficient Lighting Initiative Story at www.ifc.org/ifcext/enviro.nsf/AttachmentsByTitle/p_ELI$FILE/ELI_FINAL.PDF
Australian company Barefoot Power\textsuperscript{1230} is working on such LED projects in developing countries. There are a range of global initiatives addressing these opportunities to help developing countries with CFLs and LEDs to leapfrog the west.

Meanwhile, the Three Country Energy Efficiency Project (3CEE\textsuperscript{1231}) – involving China, India, Brazil – has run from 2002 to 2006 to address barriers to lack of local investment in energy efficiency. ‘Many energy efficiency projects quickly pay for themselves, with typical returns on investment of 20-40%,’ says Chandra Govindarajalu, a senior World Bank environmental specialist working with the 3CEE program. Despite the demonstrated benefits, though, companies often cite other, more immediate investment and borrowing priorities. Meanwhile, commercial banks in these countries are generally unfamiliar with financing projects designed to achieve cost savings, rather than develop new product lines or other tangible assets.\textsuperscript{1232}

To address these issues, the 3CEE Project has worked with the banking and finance sector to promote energy efficiency projects. It is a joint initiative of the World Bank, the UN Environment Programme’s Denmark-based Risoe Centre (URC), and partners in Brazil, China and India.\textsuperscript{1233} World Bank consultant Jeremy Levin, who worked on the project, said:

\begin{quote}
“Chinese commercial banks were wary of making any investments that weren’t practically guaranteed. Because of this, the World Bank effectively co-signed the loans from the banks to Chinese ESCOs for up to 90 percent of the loan amounts. In the end, the World Bank guaranteed U.S. $36.4 million in loans over 52 projects, which resulted in energy savings that cut 102,700 tons (93,100 metric tons) of Chinese carbon dioxide emissions per year.”
\end{quote}

The 3CEE project has been instrumental in making local banks recognize the soundness of investments in energy efficiency projects. It is a matter of getting the first couple of loans going. With wider uptake, confidence in the mechanism grows and barriers to financial facilitation for such projects reduce.

As more countries commit to stronger energy efficiency targets, and different avenues for cooperatively reducing emissions are found there will be a great need for more expertise to assist with developing the mechanism.

\textsuperscript{1230} See Barefoot Power at \url{http://www.barefootpower.com/aboutus.html}
\textsuperscript{1231} See 3 Country Energy Efficiency Project At \url{http://3countryee.org/}
\textsuperscript{1233} The UN Foundation and the World Bank Energy Sector Management Assistance Program provided financial support, with complementary activities supported by the Asia Alternative Energy Program and the UK Department for International Development.
7.3.2 Assumptions of Potential Reductions through Demand Management

Reducing greenhouse gas emissions through rapid reductions in peak\textsuperscript{1234} and base load\textsuperscript{1235} demand can be achieved through targeting energy efficiency and demand management strategies. International case studies suggest that it is possible for peak load electricity demand to be reduced in a matter of months with tariff reform and smart metering backed up by government programs to assist the energy efficient retrofitting of homes.\textsuperscript{1236} In states around the world where they have implemented smart metering and tariff reform to provide lower rates during off-peak periods, significant reductions in peak electricity loads have occurred. In Florida, electricity suppliers Georgia Power and Gulf Power have implemented smart meters and real time pricing with remarkable results. For Georgia Power, large customers reduced electricity demand by 20-30 percent during peak periods. For Gulf Power, a 41 percent reduction in load during peak times was achieved.\textsuperscript{1237} One of the reasons why smart meters and tariff reform can lead to such dramatic reductions is that there are significant energy efficiency opportunities in the residential sector. In most OECD countries the residential sector contributes significantly to summer and winter peak electricity demand.\textsuperscript{1238} Most energy efficiency savings in the residential sector can be identified and implemented very quickly. The recent ABC TV series \textit{Carbon Cops}\textsuperscript{1239} illustrates this point. Six family and student households all reduced their greenhouse gas emissions by over 60 per cent in a matter of weeks, while also halving their energy bills.

Similarly base load electricity demand in Australia could be reduced in half. Baseload electricity describes the electricity used by the economy 24 hours a day, seven days a week. Given the size of the Australian service industry, commercial building and residential market, it is clear that there should be a significant reduction in electricity used at night and over the weekend. However this is not the case. Research by Genesis Auto shows that in NSW and Victoria there is very little variation between electricity base-load between weekdays (when one would expect the highest base-load) and between 10pm-5am or weekends (when one would expect the lowest base-load electricity demand). (See Figure 7.7)

\textsuperscript{1234} Smith, M., Hargroves, K., Stasinopoulos, P., Stephens, R., Desha, C., and Hargroves, S. (2007) \textit{Energy Transformed: Sustainable Energy Solutions for Climate Change Mitigation}, TNEP. See Lecture 4.2: Demand Management Approaches to Reduce Rising \textquoteleft Peak Load\textquoteright Electricity Demand at
\url{http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture4_2}

\textsuperscript{1235} Ibid See Lecture 4.3: Demand Management Approaches to Reduce Rising \textquoteleft Base Load\textquoteright Electricity Demand at
\url{http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture4_3}

\textsuperscript{1236} Smith, M. and Hargroves, K (2007) \textquoteleft Smart Approaches to Electricity Use\textquoteright, CSIRO ECOS, Issue 135, pp12-13

\textsuperscript{1237} Ibid.

\url{www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx#EnergyTransformedLecture4_1}

\textsuperscript{1239} See ABC TV \textit{Carbon Cops} at \url{http://www.abc.net.au/tv/carboncops/} Accessed 13. February 2008
Figure 7.3: Victoria’s Summer Electricity Demand (GW) Saturday 22 January 2005 to Friday 28 January 2005. Includes Australia Day public holiday showing much higher load than the Saturday and Sunday. (Source: Genesis Auto, 2007)

This suggests that there is significant potential to reduce base-load electricity demand in Australia between 10pm and 5am and on weekends through using timers to switch off what does not need to be left on. In Italy they have instituted regulations that require commercial buildings to turn their lights off after 12am to save electricity and reduce greenhouse gas emissions. Research by energy efficiency experts Alan Pears and Geoff Andrews suggests that most organisations leave at least 5-10% of equipment, lighting or appliances on that does not need to be.1240

Australia is blessed with very cheap energy compared to most OECD countries, due to abundant coal reserves. This has led to many businesses, commercial buildings and households simply leaving on machinery, lighting, appliances, air-conditioning and heating throughout the night and over weekends rather than ensuring that such equipment turns off when it is not needed. Government energy efficiency programs have found that commercial buildings can save as much as 70 percent over the weekend simply by ensuring that more efficient lighting and air-conditioning is used and turned off when not needed. Australia wastes over 10 percent of all electricity generated simply through leaving domestic appliances on standby which could otherwise be turned off. This results in Australia’s base load electricity being a higher percentage of total electricity usage than other OECD nations. Australia’s base load electricity usage is 70 percent while the UK’s is 40 percent. Significant

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reductions in base load and peak load electricity demand can be achieved through investing in even half of the 70 percent energy efficiency potential in the Australian economy. Such investment could be assisted if government and industry worked together to address barriers to the uptake of more energy efficient practices. Geoff Andrews, Director of Genesis Auto, says that, after twenty years as an energy-efficiency consultant

“Our experiences have led us to conclude that roughly 50 per cent of the base load electricity usage we find should not be there. For instance street lighting at night can easily be made 50 per cent more energy efficient. Hospitals run 24 hrs, 7 days a week, so it might be reasonable to expect a flat load profile. But then you ask about the areas in a hospital which aren't 24 hrs 7 days a week – consulting rooms, admin, laundry, kitchen, x-ray, central sterilising, maintenance, pathology – and more often than not there is still a flat load profile. Also I am still amazed at the portion of base load contributed by storage-based electric water heaters both for commercial and residential buildings. A huge portion of the buildings we see have electric water heaters inconspicuously losing heat supplied with electricity from coal.”

7.3.3 Assumptions about the Potential of Energy Efficiency and Demand Management to Delay the Need for New Electricity Power Plants and Grid Infrastructure

Improvements in end-use energy efficiency and demand management on a large enough scale could save tens of billions in infrastructure costs by delaying permanently the need to build new power stations and extend the electricity grid over coming decades in Australia. Improvements in end use energy efficiency on a large enough scale can also reduce infrastructure costs from reducing peak and base load electricity demand, thus helping to keep electricity costs down. As the authors of Natural Capitalism wrote

“From the power plant to an industrial pipe, inefficiencies along the way whittle the energy input of the fuel - set at 100 arbitrary units in this example - by more than 90%, leaving only 9.5 units of energy delivered to the end use. Small increases in end-use efficiency can reverse these compounding losses. For instance, saving one unit of output energy will cut the needed fuel input by 10 units, slashing cost and pollution at the power plant.”

Hence by focusing on end use efficiency a cascade of savings can be created all the way back to the power plant. (See Figure 7.4) This is why a focus on achieving end use energy efficiency gains in engineered systems such as motors, HVAC systems, commercial buildings, appliances and office equipment can help Australia reduce greenhouse gases significantly.

Such energy efficiency opportunities exist in all countries globally and thus provide a way to achieve rapid cuts to greenhouse gas emissions globally.

There are many potential beneficiaries of a greater uptake of energy efficiency and peak and base load management in Australia: retailers can gain financially through lower exposure to peak price risks for wholesale energy; business and consumers through lower energy bills and better energy services; and the community generally through better utilisation of resources and fewer environmental costs.

Demand management is a proven least-cost approach to meeting customers’ needs for electricity services. Reducing the demand for electricity not only reduces the cost to business and the consumer but also reduces the requirement to maintain and build new electricity generation infrastructure, especially the additional infrastructure required to meet peak period demands that is then redundant for the rest of the time. As the *NSW Independent Pricing and Regulatory Tribunal Inquiry* found in 2002:

“This is the situation NSW is increasingly facing. If no action is taken on the demand side of the market, additional capital expenditure of $1.5 billion to $3 billion may be required over the next 10 years. This is in addition to foreshadowed network capital expenditure of $5 billion, a significant proportion of which may be required to meet growth in demand.”

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The Tribunal summed up the seriousness of this issue when it stated

“The Tribunal is very concerned about the potential for substantial increases in capital expenditure and worsening asset utilisation, with adverse consequences for costs faced by end-users. Already, 10 per cent of network capacity is required for less than 1 per cent of the year. This will worsen if demand continues to get peakier and networks have to invest in new network capacity to meet this demand. Potentially massive increases in network expenditure to meet demand growth highlight the importance of getting demand management right.”

The National Framework for Energy Efficiency (NFEE) has commissioned a wide range of modelling that has revealed major economic benefits to Australia from significantly reducing electricity demand and thereby delaying the need for new infrastructure and networks. This can help the economy, as shown in the analysis undertaken by McLennan Magasanik Associates (under business-as-usual assumptions)

“[About] 1,000 MW of new capacity per annum is required across the electricity supply sector from about 2009/10 onwards. Although not all of this capacity will be base load, about 500 MW to 700 MW is likely to be required for high load duty. Energy efficiency initiatives, which target base load sources, will delay the need to invest in this new capacity... Benefits were estimated to range from $2.4 billion to $6.6 billion. Energy efficiency initiatives that both reduce running costs to business and delaying the need to invest in new capacity can provide between $2.54 and $6 Billion in benefits to Australia.”

There are also commercial benefits to electricity utilities in delaying the need to build new plants because it reduces the risks of potential economic losses if

- Forecast demand fails to meet projections, or
- If the construction of plants runs over schedule, or
- If there are sudden changes to energy and climate policy that makes different supply options more economical.

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1245 Ibid.
1248 Ibid.
There is considerable evidence from overseas that where electricity utilities have encouraged energy efficiency in the community it has helped to boost the local economy and thus improve the bottom line of the electricity utility as well.

Take the now classic case of the town of Osage, Iowa, where the Municipal Utilities Department successfully implemented an energy efficiency program as far back as 1975. The principal beneficiary of the program has been the town’s economy. Osage Municipal Utilities has been able to reduce electricity rates by 19 percent during the last eight years and natural gas rates by five percent during the last five years. In addition the program reduced unemployment to half that of the national average as the lower electricity rates has attracted more factories and companies to town, while reducing the emissions and costs of the utility itself.

There is significant experience globally in re-aligning incentives to reward electricity utilities for encouraging greater energy efficiency for their customers. This policy reform is a great example of how smart regulation can improve business profitability and the environment thus helping economic growth.

Governments could improve the existing regulatory frameworks to reward electricity utilities for helping their customers to use electricity more efficiently. Currently there is little incentive for electricity utilities to move in this direction

“Electric utility experts have recognised for a long time that under regulatory structures (eg: traditional rate-of-return regulation, rate caps etc) utilities do not have an economic incentive to provide programs to help their customers be more energy-efficient. In fact, they typically have a dis-incentive because reduced energy sales reduce utility revenues and earnings. The financial incentives are very much tilted in favour of increased electricity sales and expanding supply side systems.”

Hence in the past, electric utilities have often opposed and lobbied against sustainable development type initiatives such as a utility run customer energy efficiency program and carbon emissions trading schemes. A new report has investigated how to re-align incentives and regulations to ensure that electric utilities and customers can create a win-win situation from sustainable development.

Their report has found that there are at least 25 states in the USA with serious utility rate-payer-funded energy efficiency programs in operation, all with very positive results. All of these states have

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1252 Ibid
addressed the traditional disincentives by introducing some type of cost recovery mechanism for these energy efficiency programs for the electric utility (e.g. a public benefits charge plus the ability to recover additional energy efficiency costs in rates). Other examples include:

- Decoupling of utility revenues and profits through legislation to reward utilities for selling less energy. Generally in these new regulatory frameworks customers received 85 percent of those savings as lower bills, while the utility's shareholders received the rest as extra profits, not to mention the direct savings in infrastructure from the reduced peak load generation requirement - the perfect win-win option for the energy supply sector. This was first introduced in California in 1992.

“Retaining 15% of the savings inspired Pacific Gas and Electric (PG&E) in 1992, the U.S.’s largest private utility, to put a halt to building or planning any new conventional power plants. PG&E found that they could address any subsequent increase demand for electricity through renewables. Using this method in California in 1992, PG&E invested over US$170 million to help customers save electricity more cheaply than the utility could make it. That investment created US$300–400 million worth of savings. Customers received 85% of those savings as lower bills, while the utility's shareholders received the rest—over US$40 million.”

- Providing shareholder ‘performance incentives’ for achieving energy efficiency program objectives. These can take several forms such as

‘providing utilities with a specific reward for meeting certain targets, allowing utilities to earn a rate of return on energy efficiency investments equal to supply side and other capital investments or providing utilities with an increased rate of return either on the energy efficiency investment specifically or overall.’

7.3.4 Assumptions about the Viability and Costs of Renewable Energy to meet Peak and Base Load Requirements

Carbon geosequestration and nuclear power will take at least ten years to make a significant difference to global greenhouse gas emissions. Renewable energy technologies can be implemented rapidly between now and 2020 to reduce emissions. Hence assumptions about the costs and benefits of renewable energy are critical in estimating the likely costs of short term greenhouse gas reduction targets for Australia.

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1253 This sensible program was mothballed when the ‘deregulation’ mania swept California, and set the state down the path to exporting billions of dollars to Enron and other Texas energy companies. But in the wake of the 2001 California Energy Crisis, it is coming back into fashion. Today, PG&E now runs an extensive Customer Energy Management Program that provides customers with access to energy efficiency experts in order to address demand-side energy efficiency and conservation.


1255 Ibid
Another major blind spot amongst many decision makers is that they cannot conceive of good demand management, energy efficiency and renewable energy addressing and meeting Australia’s rising peak and baseload demand. This is because still many people incorrectly assume that renewable energy sources cannot supply base load electricity. Few appear to be aware of the range of sources that have refuted this belief since the early 1980s. In fact, renewable distributed energy now accounts for one-quarter of California’s installed capacity, one-third of Sweden’s energy, half of Norway’s and three-quarters of Iceland’s. Since 2003, Denmark has also generated 20 per cent of its electricity from wind.

Many forms of renewable energy – such as hydro, biomass and geothermal – do not depend on day-to-day weather variations and hence can provide electricity all day, every day. Australia, with its wealth of gas and geothermal energy options is well positioned to compliment wind and solar power to, over time, reduce Australia’s local dependency on coal. Wind, wave and tidal power can also provide base load electricity when used on a large scale separated by several hundred kilometres and subject to different wind, wave or tidal regimes. The total output of such systems generally varies smoothly; only rarely would such a system be in a situation of no wind, waves or tidal change at any site.

Graham Sinden from Oxford University has investigated the potential contribution of wind, solar, tidal, wave power and other renewable energy sources for electricity in the UK. He concluded that most of the UK’s electricity could be generated from renewables, with wind from dispersed sites providing the greatest contribution.

Solar energy can also be stored at low cost as heat in water, rocks or thermo-chemical systems such as ammonia, enabling it to provide electricity 24 hours a day. Solar thermal electric power plants convert solar energy to heat in order to drive a thermal power plant. Solar thermal electricity can supply base load and is just as reliable as base load coal. Solar thermal base load electric systems have been around for 20 years.

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Australian scientists have made world-class contributions to solar thermal research over the last 50 years. As was recently reported on ABC TV’s 7.30 Report, two of America’s biggest power utilities have unveiled plans for a multi-billion dollar expansion of solar power supply based on technology developed by a former Sydney University professor, David Mills, now based in California. The utilities have confidently predicted that their solar power will soon be providing base-load electricity at prices competitive with coal. Indeed, according to a review by CSIRO scientists for the CRC for Coal in Sustainable Development, some experts now argue that the cost of concentrated solar thermal will become competitive to coal-fired generation when the former’s installed capacity reaches 5000 MW worldwide by 2013. The study’s lead author, Dr Louis Wibberley from CSIRO, said ‘What makes solar thermal particularly attractive is the fact that it integrates very well with existing technologies including coal, gas, biomass, photovoltaics and wind power.

The 20 per cent Minimum Renewable Energy Target by 2020 is a good start but for minimal extra cost Australia could achieve a 25 per cent target by 2020. Combined with medium energy efficiency measures, the target would conservatively deliver: 16,600 new jobs, $33 billion in new investment, 15,000 MW new renewable capacity, 69 million tonnes reduction in electricity sector greenhouse emissions (almost as much as the total emissions from road transport), and enough renewable electricity to power every home in Australia. More than 17,000 Australians are already employed in renewable energy or energy efficiency. A 25 per cent target would increase the number of clean energy jobs to over 33,000.

Allen Consulting’s modeling shows that if Australia implements energy efficiency opportunities these approximately offset over time the costs of rolling out renewable energy infrastructure. In 2002, The Economist magazine ranked Rocky Mountain Institute’s publication, Small is Profitable: The Hidden Economic Benefits of Making Electrical Resources the Right Size as its book of the year. This is because this book, for the first time, outlined 207 reasons why renewable distributed energy sources can often be a lower financial risk option to meet peak and base load electricity demand when combined with effective energy efficiency and demand management programs. Clearly covering all

207 reasons is beyond the scope of this thesis. Here we consider four of the 207 hidden economic benefits that need to be taken into account by economic modellers to gain a more accurate cost benefit analysis of the costs of investment in renewable energy to business and the economy.

1. Distributed renewable energy has significantly shorter lead times for construction than large scale centralised plants. Shorter lead time means that the utility does not have to keep as much capacity under construction (which costs money and increases financial risk), to meet expected load growth in a timely fashion. Nearly twenty years ago, M.F.Cantley noted that, *The greater time lags required in planning [and building] giant power plants mean that forecasts [of demand for them] have to be made further ahead, with correspondingly greater uncertainty; therefore the level of spare capacity to be installed to achieve a specified level of security of supply must also increase.*

It takes only 4-7 months to install wind farms for instance while most nuclear power plants take at least five years to build. Coal plants can vary but similarly take some time to build.

2. Slower to build, larger centralised power station’s capacity overshoots demand in three ways. The yellow/lightly shaded areas of Figure 7.5 show the extra capacity that large centralised units require to be installed before they can be used. Small distributed-generation modules do not overshoot as much; they can be added more closely in step with demand.

![Figure 7.5. Comparison of capacity and cost implications of adding distributed generation (DG) versus centralised energy sources. (Source: Swisher, J. (2002))](https://www.rmi.org/images/PDFs/Energy/U02-02_CleanerGreener.pdf)
Note: The central source is available in large capacity increments and has a long lead-time. The DG source is available in flexible capacity increments and has a short lead-time. Option value benefits of DG compared to the central source include 1) increased lead-time and cost of central sources, 2) increased cost of idle capacity that exceeds existing load, and 3) increased cost of overbuilt capacity that remains idle.

Large centralised stations risk overshooting demand permanently if demand for electricity plateaus or declines, at any point, as shown by the red area. Given the energy efficiency opportunities to reduce peak and base load demand outlined in 7.3.1, it is possible for electricity demand to plateau and fall in the future. Historically there are examples where projections of future summer peak electricity demand have had to be ratcheted down significantly.

Figure 7.6 shows a comparison of annual 10-year forecasts of summer peak demand projections, and shows successive industry forecasts of US summer peak electric load continually reduced until they aligned with reality around 1984. The actual US peak load in the year 2000 (a summer about as hot as the 1949–2000 average) was 686 GW, slightly above the ‘Actual’ trend-line shown.
3. **Shorter lead time means investments in distributed renewable energy can start earning revenue earlier - as soon as each module is built rather than waiting for the entire total capacity to be completed.** Modular plants can start yielding revenue while big, slower to build, centralised power stations are still under construction. This benefit has been quantified in modelling using a model example of a 500-MW plant built in one segment over five years (to approximate a large centralised power station) vs. ten 50-MW modules with 6-month lead times (to approximate distributed energy generation approaches) (Figure 7.7). Assuming that each asset runs for 20 years, then under either plan, the same capacity operates identically with the same generation capacity for the middle 15 years, but the modular plant has higher revenue-earning capacity in the first five years. But because of discounting, the early operation is worth much more today. Using a 10 percent/year discount rate and $200/MWy revenues, the modular solution will have return 31 percent higher revenue over the 20 year period.

![Figure 7.7. Modular resources' early operation increases their present value.](image)

4. **Shorter lead time decreases the burden on utility cashflow** (as shown in Figure 7.8). Shorter lead time and smaller, more modular capacity additions can reduce the builder’s financial risk and hence market cost of capital. Distributed energy generation can be installed effectively in a modular fashion where additional wind farms are built if electricity demand is increasing.

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1272 Ibid, p. 22, fig. 7.
this modular fashion, such an approach can need 10 plus times less working capital than large centralised electricity power stations or nuclear power plants, reducing default risk.

Figure 7.8. Modular distributed energy plants reduce need for working capital.

(Source: Hoff, T.E. and Herig, C. (1997))

The four benefits were first shown by a 1985 Los Alamos National Laboratory system dynamics study. As Lovins et al described in *Small is Profitable*

"[The Los Alamos National Laboratory] analysts used a Northern California case study for Pacific Gas and Electric Company under the regulatory policies prevailing in the early 1980s. They examined how both the ‘lead time’ to plan, license, and build a generic power station and the financial or accounting cost of that lead time (due to real cost escalation and interest on tied-up capital) would affect its economic value over a 20-year planning horizon. However, to clarify choices, they inverted the calculation: Rather than modelling longer-lead-time plants as riskier or costlier (in present-valued revenue requirements), they simulated the utility’s financial behaviour and asked how much ‘overnight’ (zero-lead-time) construction cost could be paid for the plant as a function of its actual lead time in order to achieve the same financial objectives.

Adding also a similar analysis for a coal-fired utility and another for Southern California Edison Company, the Los Alamos team found that shorter lead times justified paying about one-third to two-

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thirds more per kW for a plant with a 10-instead of a 15-year lead time; that a 5-year lead time would justify paying about three times as much per kW; and that a 2.5-year lead time (analysed only for SCE) would justify paying nearly five times as much per kW. In each case, these far costlier but shorter-lead-time plants would achieve exactly the same financial performance as their 15-year-lead-time competitors under the same exogenous uncertainties, for the first five reasons listed above.

![Figure 7.9. Power-plant financial feasibility vs. lead time. (Source: Meade, W.R. and Teitelbaum, D.F. (1989) and Sutherland, R.J. et al. (1985))](image)

For these reasons, decentralised sources of electricity – co-generation (the combined production of electricity and heat, typically from natural gas) and renewables (such as solar and wind power) - surpassed nuclear power in global generating capacity in 2002. The annual output of these low and no-carbon sources exceeded that of nuclear power in 2003. Solar, biofuels, geothermal, tidal and hydropower now represent a global market of AUD$74 billion, which is forecast to grow fourfold by 2015. For all these reasons renewable distributed energy is finally being acknowledged as a very effective solution to helping business and the whole economy meet rising peak and base load electricity demand. Allen Consulting has shown the economic savings from energy-efficiency opportunities to be large enough to cover the cost of building new renewable energy infrastructure. In short, a smart combination of energy efficiency and renewable energy would have negligible negative effects on Australia’s economic growth. Many businesses and organizations in Australia are reducing

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their energy usage through energy efficiency and then purchasing at least a percentage of their energy from accredited green power sources. This sort of approach by millions of households and thousands of businesses globally is leading to a rapid expansion of the renewable energy sector globally.

As can be seen in Figure 7.10, the annual output of these low and no-carbon sources exceeded that of nuclear power in 2003. The European Union has committed to improved energy efficiency and use of renewables, which it sees as key to their competitive advantage in the 21st century. The Energy Intelligent Europe Initiative, signed by Parliamentarians from all 15 member countries, calls for the integration of energy efficiency and renewable energy as the basis for European competitiveness and high quality of life. The EU is seeking to source 22 percent of its electricity and 10 percent of its energy from such clean sources as wind within 10 years.\textsuperscript{1281} China, Japan, Canada and the North East and Western States of the USA are investing in renewable energy. Renewable energy is probably the greatest opportunity for developing countries to leapfrog the West. Developing nations can give the 2 billion people currently lacking access to electricity the energy they need, with for example, ultra energy-efficient lighting, solar cookers and renewable energy programs. Such an approach, as discussed in Chapter 6, can be relatively low cost and effective at getting the energy to where it is needed compared to building large, centralised power stations and a grid from scratch. This is partly because the cost of the electricity grid is typically about one third the overall cost of setting up a centralised electricity system. As discussed in Chapter 6, one more promising projects in this direction is the distribution of inexpensive solar cookers in Kenya by Solar Cookers International. Rapid advances in ultra efficient lighting, such as LED, over the last eight years creates another significant opportunity to combine energy efficiency improvements with renewable energy projects. There are other significant global energy efficient lighting global initiatives pursuing such strategies.\textsuperscript{1282}

\textsuperscript{1281} 'Intelligent Energy – Europe' (EIE) is the Community’s support program for non-technological actions in the field of energy, more specifically the field of energy efficiency and renewable energy sources. The duration of the program is from 2003-2006. The program was adopted by the European Parliament and the Council on 26 June 2003. It was published in the Official Journal of the European Union on 15 July 2003 (OJ, L 176, p 29-36) and entered into force on 4 August 2003.

\textsuperscript{1282} See the Lumina Project at \url{http://light.lbl.gov/}. 


7.3.5 Assumptions about the Costs of a Transition to a Low Carbon Transport Sector

Modern economies’ transportation needs are remarkably dependant on oil and natural gas, and yet oil production has now peaked in over 60 countries (e.g. in the USA in 1972). Resources do not need to run out in order to cause extra costs to the economy. In the case of metals, however, there are both many metals and numerous substitutes available in plastics and other materials thus ensuring that the market place can find cost effective alternatives relatively easily if any one metal becomes scarce. However, primary energy sources like oil are different. There are not, for instance, easy alternatives to oil for aeroplanes.

Since most experts warn that the rate of global oil production has, or is about to, peak, it is likely that oil prices will continue to be high over coming decades. Many experts argue that this will result in historically high oil prices becoming a permanent fixture of the economic landscape. This threatens the global economy and business in three ways.

First, oil prices directly raise transport costs to business. Second, higher oil prices have an inflationary effect increasing the price of most goods and services and thus increasing purchasing costs to business. Higher oil prices have a strong inflationary effect causing the Reserve Bank to lift interest rates and thus making it harder for business to borrow and reducing consumer confidence and disposable income. Finally, high oil prices threaten countries balance of payments. Consider Australia as an example. Australia is already importing 50 percent of its oil, a figure set to reach 100 percent by 2020.

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By 2015, “… imported oil would subtract about $30 billion a year from the Australian national export bill.”\textsuperscript{1284} Such a blow out in Australia’s balance of payments deficit will leave the Australian Reserve Bank with little choice but to raise interest rates again to dampen local demand. The Australian economy’s vulnerability to high oil prices makes the Australian economy vulnerable to recession.

Since 1965 there have been five peaks of world oil price, all of which were followed by economic recessions of varying degree. Former US Reserve Bank Governor Alan Greenspan has pointed out that “All economic downturns in the US since 1973 have been preceded by sharp increases in the price of oil.”\textsuperscript{1285} Yet nations could rapidly decrease their dependency on oil, reduce greenhouse emissions and avoid a peak oil induced economic recession by

a) Rapidly shifting at least part of the domestic vehicle industry to manufacturing low emission vehicles.\textsuperscript{1286}  
b) Shifting to low emission, and cheaper, freight transport options. Wal-Mart in the USA, for instance, is investing in trucks with double the fuel efficiency of traditional trucks to both reduce greenhouse gas emission and reduce operational costs.\textsuperscript{1287}  
c) Investing in faster national broadband coverage to bring down the costs of video-conferencing to reduce the need for so many interstate business meetings.  
d) Reducing congestion costs, which currently cost the global economy US$100’s of billions.

Investing in sustainable transport and urban design therefore is a wise investment yielding multiple benefits to improve quality of life and economic prosperity. Increasingly cities in OECD countries are pursuing this wisdom. Amsterdam has developed a diverse urban transport system, where nearly 40 percent of all trips within the city are taken by bicycle. Paris has a transport diversification plan that also includes a prominent role for the bicycle and is intended to reduce car traffic by 40 percent. London is relying on a congestion tax on cars entering the city centre and investing that money in sustainable transport infrastructure to attain a similar goal.

One of the reasons that OECD cities can rapidly shift to a lower carbon transport system with the right infrastructure and incentives is that at least 40 per cent of trips made in all OECD cities are five


\textsuperscript{1285} Porritt, J (2005) \textit{Capitalism As if The World Matters}. Earthscan Publishing


kilometers or less. Thus it is easy for such trips to be made by walking, cycling and or public transport if these are invested in. But it is not just OECD cities which can rapidly shift to becoming more sustainable. With oil prices reaching record highs, there is great interest currently from developing countries for ideas on how to meet local transportation needs without having to import and use ever increasing quantities of oil. Model sustainable cities in developing countries like Curitiba in Brazil, and Bogota in Columbia, are showing the way by demonstrating how sustainable transport - cycling, walking and buses – can comfortably manage over 70 per cent of all commutes, with better health and economic outcomes. 85 per cent of residents in Bogota now live within 500 metres of a bus service. Both Curitiba and Bogota achieved their sustainable transportation transformation within 10 years.

Investing in sustainable transport helps the economy in a wide range of ways which, to date, have been largely ignored by macro economic climate mitigation modelling. For instance, businesses which encourage staff to cycle and walk to work, are reported to benefit from increased productivity as a result of improved fitness and mental health. Staff who cycle are reported to be more punctual and take less sick days. One study has shown that absenteeism can be reduced from between 14% to 80% by encouraging cycling to work. A 2005 study commissioned by Medibank Private in Australia found that healthy workers are almost three times more effective at work than unhealthy workers.

Creating walkable cities, with safe cycling options and reliable public transport, thus could be a key strategy to encourage greater public health and combat spiralling health costs with an aging population. Australian Government health spending is projected to almost double by 2050 due in large part to the costs of diseases of physical inactivity – obesity, diabetes, cardiovascular - in an aging population. Paul Gross, from the Institute of Health Economics and Technology Assessment argues that for every dollar invested by Government in encouraging people to be active and live healthier

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lifestyles, the government would save six dollars in improved business productivity, reduced absenteeism and reduced drain on the health care dollar.\textsuperscript{1294}

To date, most economic cost benefit analyses on climate change, like the Stern Review, have ignored these additional costs and benefits to business from action on climate change. When additional issues, like health costs and benefits, reduced absenteeism, improved productivity are factored into the modelling then this significantly changes the economy wide return on investment of low carbon sustainable transport investments. The latest studies, which do factor in such hidden benefits, show that investing in sustainable transport options leads to higher economy growth than business as usual not less.\textsuperscript{1295}

It has long been believed that building roads is good for the economic growth of cities, while public transport is a financial drain. A 1999 report to the World Bank\textsuperscript{1296} prepared by researchers at Murdoch University is turning this way of thinking on its head. Professor Peter Newman says, ‘We’ve found that cities which emphasise walking, cycling and public transport are healthier financially and spend less of their wealth on transport costs than those cities investing in freeways’. This conclusion is based on a global empirical study of over 90 cities and their transport systems. Other studies also cover in detail how OECD nations like the USA could reduce oil dependency rapidly. The Rocky Mountain Institute has released \textit{Winning the Oil Endgame: Innovation for Profits, Jobs, and Security},\textsuperscript{1297} a Pentagon co-funded blueprint for making the US oil-free. New technologies are becoming available which will help the global economy decouple transportation from greenhouse gas emissions. Gas-electric hybrid cars with an enhanced battery and a plug-in capacity, combined with investment in renewable energy feeding cheap electricity into the grid, permit most daily driving to be done with electricity, and at a cost equivalent of less than $1-a-gallon gasoline.

### 7.3.6 Assumptions about the Costs of Reducing non-CO\textsubscript{2} Emissions

Economic modelling studies\textsuperscript{1298} indicate that a cost-effective abatement strategy would focus heavily on the non-CO\textsubscript{2} gases in the early years. This modelling also found that for smaller percent reductions, such as holding total GHG emissions in the US at year 2000 level through 2010, some of the most cost-effective cuts would come from the non-CO\textsubscript{2} gases. This economic modelling also found that the cost of an abatement policy including the abatement options available for these non-CO\textsubscript{2} greenhouse

\textsuperscript{1296} Ibid.
\textsuperscript{1298} Reilly, J, Jacoby, H, Prinn, R (2008) \textit{Multi-Gas Contributors to Global Climate Change: Climate Impacts and Mitigation Costs of Non-CO2 Gases}. MIT. Available At \url{http://www.pewclimate.org/global-warming-in-depth/all_reports/multi_gas_contributors}
gases would be two-thirds less than the cost of achieving the same level of abatement by reducing CO₂ emissions from fossil fuels.

CO₂ is the largest contributor to climate change flowing from the GHGs emitted by human activity. Its relative role is expected to increase in the future. A continuing emphasis in economic modelling on the costs of reducing CO₂ emissions is therefore needed. But, if climate policies are to effectively limit climate change, they must also take into account the importance of non-CO₂ greenhouse gases. As a result of improvements in recent years in the measurement and assessment of the non-CO₂ gases, it has become clear that their control is an essential part of a cost-effective climate policy. This applies particularly to developing countries, where these gases typically account for a higher percentage of total greenhouse gas emissions. For example, non-CO₂ gases account for well over 50% of the GHG emissions in Brazil and India, but account for 20% in the United States and 29% in Australia.

There are five classes of greenhouse gases, other than CO₂, recognised by the Kyoto Protocol as causing global warming. These gases have significantly higher global warming potential than CO₂. For instance, sulphur hexafluoride (SF₆) has a global-warming potential 23,900 times higher than that of CO₂. Non-CO₂ greenhouse gases are also noteworthy for their very high global warming potentials and atmospheric lifetimes.

Table 7.2 The Six Major Greenhouse Gases.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Name</th>
<th>Common sources</th>
<th>Atmospheric lifetime (years)*</th>
<th>Global warming potential</th>
<th>% of US emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
<td>Fossil fuel combustion, forest clearing, cement production, etc.</td>
<td>50-200</td>
<td>1</td>
<td>79.9</td>
</tr>
<tr>
<td>CH₄</td>
<td>Methane</td>
<td>Landfills, production and distribution of natural gas and petroleum, fermentation from the digestive system of livestock, rice cultivation, fossil fuel combustion, etc.</td>
<td>12</td>
<td>21x</td>
<td>9.5</td>
</tr>
<tr>
<td>N₂O</td>
<td>Nitrous oxide</td>
<td>Fossil fuel combustion, fertilisers, nylon production, manure, etc.</td>
<td>150</td>
<td>310x</td>
<td>5.8</td>
</tr>
<tr>
<td>HFCs</td>
<td>Hydrofluorocarbons</td>
<td>Refrigeration gases, aluminium smelting, semiconductor manufacturing, etc.</td>
<td>264</td>
<td>Up to 11,700X</td>
<td>1.8</td>
</tr>
<tr>
<td>PFCs</td>
<td>Perfluorocarbons</td>
<td>Aluminium production, semiconductor industry, etc.</td>
<td>10,000</td>
<td>Up to 9200X</td>
<td></td>
</tr>
</tbody>
</table>
The indices or weights known as global warming potentials demonstrate the relative value of controlling non-CO$_2$ gases. This is one of the key reasons for including the non-CO$_2$ gases in policies to address climate change; for it can be so effective in lowering implementation costs, especially in the short term. A further reason is that, in the past, economic instruments such as prices, taxes and fees have not been used to discourage or reduce emissions of non-CO$_2$ gases but have, through the price signals of energy costs been present to curb fossil-fuel emissions. For instance the EU emissions trading scheme only began including the non-CO$_2$ gases in trading in 2008. Bearing in mind the high carbon-equivalent values of the non-CO$_2$ gases, even a small carbon-equivalent price on such gases could provide a large incentive to reduce emissions of them.

### 7.3.7 Assumptions about what Greenhouse Abatement is Possible through Clean Development Mechanism projects in a Post Kyoto Framework

Events in late 2007 at the UN Bali Summit give cause for hope that a Post Kyoto Framework will be agreed to internationally by the end of the period of the Kyoto Protocol agreement in 2012. Currently, under the existing Kyoto Protocol, there are incentives for OECD nations to invest in projects and initiatives which help developing countries to reduce their greenhouse gas emissions. All OECD countries which have ratified the Kyoto Protocol, can qualify for involvement in developing country projects under what is called the Clean Development Mechanism (CDM) – a scheme run by the U.N. Framework Convention on Climate Change to stimulate both improved and environmentally effective initiatives in developing nations through the provision of internationally-tradeable carbon credits.

CDM credits offer OECD nations another flexible way to cost effectively help their 2012 Kyoto Protocol targets. There is every reason to expect that a form of the CDM will continue under a Post Kyoto International Framework to assist both OECD and developing countries mitigate emissions as quickly as possible. Currently a wide range of potential projects qualify under the CDM. These are explained well elsewhere so this thesis will not cover them in detail here. But two comments are worth making.

First, most people do not realise that energy efficiency and conversion energy efficiency projects count as CDM projects. As outlined above in 7.3.2 there are many significant energy efficiency

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**SF$_6$**

| Sulphur hexafluoride | Electrical transmission and distribution systems, circuit breakers, magnesium production, etc. | 3,200 | Up to 23,900X |

*SStandard industry classification

(Source: Energy Information Administration, (1998); IPCC, (2001))

projects being undertaken in developing countries which are achieving significant results. These should provide inspiration for many more such effective programs to be duplicated in other developing countries around the world. Australian NGO, CoolNRG is already initiating projects to increase the uptake of millions of compact fluorescents in Mexico and China. These projects are being funded by Clean Development Mechanism credits. Improving coal-fired power stations’ conversion efficiency in developing countries, for example, would count for CDM credits. In early March 2008, CSIRO announced that it had commenced a clean coal expertise partnership to assist China to equip its many coal power stations with greenhouse gas reducing technologies.

Secondly, if an OECD country compensates a developing country to stop deforestation of forests planted before 1990, this does not count under the Kyoto Protocol. Deforestation accounts for 18 per cent of global emissions, so it is likely that under the developing Post-Kyoto Framework, compensation schemes to stop large scale deforestation will count for CDM credits. The potential is significant in a post-Kyoto International Framework for OECD nations to be able to gain significant carbon credits whilst simultaneously developing countries earn income from preserving their forests. According to the Stern Review, and McKinsey the marginal cost per cut GHG abated from avoiding deforestation is the cheapest form of greenhouse abatement after energy efficiency. The Stern Review states

Almost 20 per cent (8GtCO2/year) of total greenhouse gas emissions are currently from deforestation. A study commissioned for the Review looking at 8 countries responsible for 70 per cent of emissions from deforestation found that, based on the opportunity costs of the use of the land which would no longer be available for agriculture if deforestation were avoided, emission savings from avoided deforestation could yield reductions in CO2 emissions for under $5/tCO2 possibly for as little as $1/tCO2. Given that, according to the McKinsey Global Institute, global emissions could be reduced by 20 per cent through energy efficiency, and up to 18 per cent through stopping deforestation, it could be possible, in theory, to achieve over 30 per cent global greenhouse gas reductions within a 5-10 year period just through these two strategies alone at negligible economic cost.

Since all OECD nations except the USA have ratified the Kyoto Protocol OECD nations and OECD business now have a wide range of low cost ways to gain additional carbon credits to count towards meeting both 2020 and 2050 GHG reduction targets.

7.3.8 Assumptions about how money from emissions credits is recycled and rebound effects.
A net gain in employment and increased GDP could result if the revenues from the money from selling emissions credits on greenhouse emissions were used to reduce payroll tax, or assist businesses in reducing their greenhouse emissions through targeting the most cost effective measures possible. But instead, to date, much of the economic modelling on the effect of emissions trading schemes on a nation’s economy has assumed the resulting revenue stream to government will flow through the economy according to past priorities, rather than in ways that would be most beneficial, such as being targeted to help industry achieve energy efficiencies rapidly.

7.3.9 Assumptions about Rebound Effects
As discussed in Chapter 5, how governments manage rebound effects with effective policies significantly affects the size and nature of rebound effects and thus what economic models predict for the costs of mitigating climate change. The reader is referred to Chapter 5 for more details on this.

7.3.10 Assumptions about the Costs of Inaction on Climate Change
As discussed in Chapter 5, The Stern Review has been the first team to really try to estimate the costs of inaction on climate change in detail. The Stern Review found that

“If we don’t act (on climate change), the overall costs and risks of climate change will be equivalent to losing at least 5 per cent of global GDP each year, now and forever. If a wider range of risks and impacts is taken into account, the estimates of damage could rise to 20 per cent of GDP or more. In contrast, the costs of action – reducing greenhouse gas emissions is to avoid the worst impacts of climate change – can be limited to around 1 per cent of global GDP each year.”

Historically many economists have underestimated or even ignored the costs of inaction on climate change. This was shown during the 2001 Australian Senate ‘Heat is On’ Enquiry. A representative from the Australian Bureau of Agriculture and Resource Economics (ABARE), who are responsible for the main economic modelling used by the previous Australian Government was asked by Senator Bolkus and Dr Clive Hamilton why ABARE had assumed there would be no negative costs on the Australian economy from climate change? Ironically, Australia will be one of the most negatively effected economically by climate change if GHG reductions are not achieved rapidly enough. The Great Barrier Reef will be lost to bleaching within two decades. If current trends continue

- In 2007, the Australian Bureau of Agriculture and Resource Economics (ABARE) has predicted that farm production could drop by 13-19 per cent by 2050, and Australian

1302 Commonwealth of Australia, Official Committee Hansard, Senate Environment, Communications, Information Technology and the Arts References Committee, Roundtable Reference: Global warming Wednesday, 16 August 2000 Canberra by Authority of the Senate.
agricultural exports of key commodities are projected to decline by 11–63 per cent by 2030 and by 15–79 per cent by 2050 as the result of the effects of climate change.\footnote{ABARE (2007) Australian Commodities > vol. 14 no. 4 > December Quarter 2007. Available at http://www.abare.gov.au/publications_html/ac/ac_07/a1_dec.pdf Accessed 13. February 2008}

- High probability of at least a one meter sea level rise by 2100 negatively affecting the real estate market and businesses located on low lying coastal areas of Australia. Risks that such low lying areas will be difficult to insure in decades ahead.

- A dramatic rise in the number of summer days over 35 degrees by 2050 leading to loss of productivity at work due to the heat plus higher peak load electricity costs for business and industry. A dramatic rise in the number of summer days over 35 degrees will lead to rising peak load electricity demand.

- Higher probability and intensity of extreme weather events leading to greater risks of bushfires, hail storms, cyclones, droughts and floods.
7.4 Addressing the Vested Interests: Creating Anti Blocking Coalitions and A Movement for Change

To enable, politically and socially, a rapid transition to a low carbon economy, anti-blocking coalitions are needed to counteract the strong and powerful vested interests opposing rapid decoupling on greenhouse gas emissions.\textsuperscript{1305} It is also vital that everyone plays their part individually to reduce their emissions as our emissions from our homes and transport collectively are significant globally. But just as important to achieve lasting social and political change is that more people are aware of how they can collectively work for change to counteract the significant vested interests. Everyone has an opportunity to play their part here.

- First, anyone can become members of an environmental NGO which demonstrates to politicians that voters are seriously engaged with an issue. This helps enable environmental NGOs to more effectively lobby governments and business. Support for NGOs has been critical as NGOs since the early 1970s played a key role in ensuring even basic ideas like energy efficiency opportunities were taken seriously by business.

- Secondly, more and more local communities are committing and achieving large cuts to greenhouse gas emissions. Anyone can help share tips and information on how individuals can reduce their greenhouse gas emissions in their community to help bring about more systemic change. Such an approach over a decade resulted in Australia in the Renew magazine\textsuperscript{1306}, which now reaches over 30,000 subscribers.\textsuperscript{1307} Local action has been important over the last four decades to demonstrate to people that it is possible to significantly reduce greenhouse gas emissions at the community level. Now in all capital cities and some country towns in Australia, solar house tours are run annually demonstrating this to communities.\textsuperscript{1308}

- Thirdly, those in environmentally orientated businesses can organise with other like-minded business leaders to form environmental industry groups and coalitions to lobby for change. This is increasingly occurring around the world. In November 2007 in the lead up to UN climate change negotiations in Bali, 150 of the worlds biggest corporations from around the world, including ANB AMRO, Philips, Sun Microsystems, Volkswagen, Johnson & Johnson, Tesco, Coco-Cola, Unilever, and Vodaphone, issued a remarkable statement – \textit{The Bali Communiqué}\textsuperscript{1309} - calling for a comprehensive, legally binding United Nations framework to tackle climate change to underpin rapid reductions of greenhouse gas emissions in line with scientifically based targets. The process has been led by The Prince of Wales’s UK and EU

\textsuperscript{1306} See Renew Magazine at \url{http://www.ata.org.au/publications/renew}
\textsuperscript{1307} Diesendorf, M (2007) \textit{Greenhouse Solutions with Sustainable Energy}, UNSW Press, Sydney
\textsuperscript{1308} See Australian Solar House Tour day at \url{http://www.anzses.org/}
\textsuperscript{1309} \textit{See Bali Communiqué} at \url{http://www.balicommunique.com/communique.html} Accessed 13 February 2008
Corporate Leaders Groups on Climate Change, which is hosted by the University of Cambridge Programme for Industry. The Bali Communiqué is significant in that its recommendations were based on its appreciation of the science rather than what is considered politically palatable or ‘reasonable’. In Australia, the environmental industry is represented by the Clean Energy Council and Environmental Business Australia. In addition the National Business Leaders Forum for Sustainable Development provides a forum for pro-sustainable business leaders. All three organisations have undertaken a range of studies, published significant reports and make recommendations to government. All have played a role in moving the climate change debates forward in especially the Australian business community.

- Fourth, economists can help to debunk myths about the costs of action on climate change. In the USA and Australia, economists have come together and signed petitions to this effect, which has helped to shift the debates about the economics of climate change in these countries.

- Fifth, since the poorest and most vulnerable on the planet will be the worst affected by climate change, churches and social justice organisations have increasingly chosen to take a stand on climate change on moral and ethical grounds. Any church or community organisation can help to disseminate information and provide a leadership role on the issue. If you are a member of a church or any community organisation you have an opportunity to help that community understand and take action on climate change.

**Conclusion**

There are a number of signs that action taken by individuals globally is starting to create a mass movement globally.

- Local and regional government around the world is showing significant leadership on climate change. Even in the USA, seven States, 227 cities and a number of influential members of Congress, both Republican and Democrat, have committed to emission reduction targets, renewable energy development and carbon trading. Anyone can lobby their local government to adopt targets for climate change reduction.

- Overdependence on oil and gas has resulted in a new impetus to reduce fossil fuel consumption. The widespread concern has resulted in a new group of advocates for energy security becoming proponents for climate change action.

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1313 See Australian Economists: Government Must Ratify Kyoto at [https://www.tai.org.au/?q=node/7&offset=3](https://www.tai.org.au/?q=node/7&offset=3)

- Around the world, companies are using climate change to drive their business strategies to address not only emissions reductions, but also the development of technologies, new markets, and other areas of investment. Significant corporate activity to exploit the upsides of climate change is superseding what has been the prevailing view that reducing greenhouse gases harms economies and profits.

- A significant increase in the quantity and quality of media coverage around the world has brought climate change out of the scientific journals to the forefront of public awareness. In 2006 The New York Times and Washington Post alone ran nearly 600 stories on climate change. In 2006, the topic of global warming appeared on the cover of Time and the programs of the BBC, ABC (US), CNN and HBO. The substance of the articles moved from scientific queries to calls for action. Public awareness of the issue has increased as a result of this increased coverage.

These are positive signs, upon which much can be built and achieved. To help ensure this renewed momentum for action on climate change achieves meaningful results an overview of world’s best practice on climate change policy and policy options are listed in Appendices 7.3-7.5.
Chapter 8: Decoupling Economic Growth from Environmental Pressures.

Introduction

“We do so much to prepare our children for the future, but are we doing enough to prepare the future for our children?” --Larry Chalfan

Chapter 7 has addressed the topic of decoupling economic growth from greenhouse gas emissions. Chapter 7 showed that urgent decoupling of greenhouse gas emissions from economic growth was needed to avoid dangerous climate change, that this was technically possible and economically affordable if we act now. Chapter 7 also showed that the costs of inaction significantly outweighed the costs of action. Climate change is particularly high on the political agenda now, but achieving sustainable development requires decoupling economic growth from all environmental pressures, such as irreversible biodiversity loss, restoring ecosystem resilience, ensuring clean water and adequate sanitation for all, and rapidly reducing pollution through end of pipe and green eco-efficiency and resource productivity improvements. The UN\textsuperscript{1315}, UNEP\textsuperscript{1316}, OECD\textsuperscript{1317}, the World Bank\textsuperscript{1318} and numerous scientific bodies have warned that humanity faces a number of serious environmental challenges in addition to climate change which require urgent action. The most urgent environmental challenges (see Table 8.1) are of a complex global nature, and their impacts often only reveal themselves when it is too late, once ecosystems have already passed ecological thresholds and are rapidly losing their resilience..

\textsuperscript{1315} UN Millennium Ecosystem Assessment, (2005) Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC
\textsuperscript{1316} UNEP (2007) Global Environment Outlook: Environment for development (GEO-4) report. UNEP. Available At http://www.unep.org/geo/geo4 Accessed 23.03.08
\textsuperscript{1317} OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
Thus a transition to environmental sustainability will involve a range of complex tasks from reversing biodiversity loss to restoring the environment, to better managing common natural resources such as water, to reducing environmental pressures, such as air and water pollution, through better pollution control and resource productivity improvements.

The first part of Chapter 8 looks at how to decouple economic growth from loss of biodiversity and natural resources. Then the following parts of Chapter 8 look at how to further decouple economic growth from a range of environmental pressures – air and water pollution, waste and material flows - through pollution prevention and resource productivity. The UN, UNEP, OECD and World Bank have all argued that greater efforts are required now whilst costs of action are relatively small to avoid greater long term costs of inaction. Without new (or more stringent) policies to better address environmental health issues, the adverse health effects of the most harmful environmental pollutants (e.g. air and water pollution) are likely to increase in many developing countries in the future.

Table 8.1 Environmental Protection Priority Areas (Red=Urgent, Yellow=Priority, Green=Well Managed)

(Source: OECD, 2008)

1319 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008

1320 UN Millennium Ecosystem Assessment, (2005) Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC


1322 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008

- Health impacts of air pollution are projected, based on current trends, to increase worldwide, with the number of premature deaths linked to ground-level ozone quadrupling and those linked to particulate matter more than doubling.

- A range of expert institutions now warn that water scarcity and water stress could increase from 1 billion to affect over 3 billion people by 2030 if there is not further action. In 2004, 17% of the world’s population did not have reasonable access to a non-contaminated water supply and 41% lacked access to basic sanitation and sewerage treatment. This is forecast by the OECD to deteriorate with population growth. By 2030, more than 5 billion people (67% of the world population) are expected to be without a connection to public sewerage if no further action is taken over the coming decades. A 2007 scorecard showed the 2015 sanitation goal of halving the numbers of people without access to clean water was likely to be missed by 600 million people worldwide on current trends.

- Already levels of unsafe water sanitation and hygiene are causing 3% of all deaths and 4.4% of all disability-adjusted life years (DALYs) around the world. Virtually all of these deaths and DALYs occur in developing countries; with 9 out of 10 of those dying are children. Indeed, unsafe water is the world’s biggest child killer.

- Chemical production volumes in fast growing and developing countries are rapidly increasing. There is a lack of data and information of the risks from the release of chemicals in these regions. Chemical substances can cause problems if either the chemical is toxic or hazardous or if they bio-accumulate to become hazardous. Also there are risks of combinations of chemicals causing serious damage to human health and the environment. The greatest environmental impacts will be felt by developing countries, which are less equipped to manage and adapt. But the economic and social costs of policy inaction or delaying action in these areas are significant. Given the globalisation of food and seafood production and given that chemical pollution can effect groundwater, water tables and rivers that cross national borders, poor chemical management and chemical pollution in one country can negatively effect people and the environment around the world.

- Whilst, OECD countries have improved recycling rates and waste management practices, globally still much needs to be done. According to UNEP, in Indonesia, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam, 50-80% of municipal waste is simply

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1324 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008

dumped. Only 5-30% of municipal waste in these countries is correctly landfilled and composted. In Brazil, studies show that approximately 60% of all municipal solid waste is disposed of inappropriately. In China, 48% of municipal waste is not treated. In India, up to 40% of the municipal waste across urban areas remains uncollected. This can create significant health risks and costs.

Therefore, there is a window of opportunity now to introduce greater investment coupled with robust and ambitious policy changes to tackle the key environmental problems and promote sustainable development. Lack of action now will only increase costs of action to future generations. Therefore, these environmental challenges will require greater investment especially by OECD countries to undertake the necessary urgent action to avoid irreversible decline of ecological resilience globally. These environmental risks require concerted policy action, and co-operation among countries, and between different ministries within countries. But given how daunting most environmental problems are today, many decision makers assume that the costs of action will be too great and hence doubt that it will be possible to make a significant difference with the funding they have.

The Stern Review has been very effective in shifting the debate on climate change because the Stern Review investigated both the costs of inaction as well as the costs of action on climate change. The Stern Review showed that since costs of inaction on climate change over the coming decades were significantly greater than the costs of action greater investment in climate change mitigation and adaptation is economically efficient. The Stern Review showed that wise investment in decoupling economic growth from greenhouse gas emissions will lead to higher economic growth over the longer term. The Stern Review showed that action on climate change is the pro-growth strategy for the 21st century.

So, this chapter will examine the risks and costs of inaction on environmental sustainability and compare these to the cost benefits of greater investment in early action. This chapter will investigate whether or not investing significantly more in environmental sustainability is economically efficient (the costs of inaction significantly outweigh the costs of action).

In the previous chapter, Chapter 7, a key result was that global investments of even a trillion dollars to address climate change would not harm global economic growth significantly in the short term if such investments were spent wisely and phased in over a couple of decades. Chapter 7 showed that, since

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the global economy is already worth over US$30 Trillion and will continue to grow at least two to three per cent per annum over the 21st century, investments by the global economy of even as much as a trillion dollars over a number of decades would have negligible negative effect on short term economy growth. And since the economic costs of inaction on climate change are, according to the Stern Review, significantly greater than the costs of action, investment on climate change mitigation and adaptation is justified.

Here in Chapter 8, I argue that a similar argument applies to investments in environmental protection to reduce the loss of biodiversity, water and air pollution, and the build up of chemicals and waste in the environment. This chapter will investigate what are

- the costs and benefits of action on each of these environmental pressures compared to the costs and risks of inaction and feature
- model examples from around the world where economic growth has been decoupled from these environmental pressures and where environmental degradation is being halted and reversed.

Protecting and restoring the environment will cost money, but the longer the world community delays serious action, the higher the costs will grow for future generations. The Chair of UNEP’s 4th Global Environment Outlook has stated in late 2007 that:

“The systematic destruction of the Earth’s natural and nature-based resources has reached a point where the economic viability of economies is being challenged—and where the bill we hand on to our children may prove impossible to pay,”

Since there is a cost to restoring natural resources and ecosystems, it is important that investment in restoring natural systems and resources is done as economically efficiently as possible. Also it will make the transition to environmental sustainability more cost effective if there is simultaneously also investment in pollution control and resource productivity improvements to reduce environmental pressures. To protect the environment investment is needed both to restore the resilience of natural systems plus reduce environmental pressures rapidly and pollution through a wide range of strategies from end of pipe to more resource productive eco-efficient solutions.

This chapter seeks to bring together and overviews some of the more cost effective strategies for environmental protection. Part 8.1-8.4 looks at the costs of inaction versus the costs of action to restore natural systems and resources and reduce pollution. It is important to put the investment costs needed to achieve sustainable development into context against the costs of inaction. Parts 8.1-8.4 show that the costs of inaction are significant. But clearly there will be investment costs to restore

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nature’s ecosystems and replacing polluting and inefficient systems with those that will enable the achievement of environmental sustainability. Hence it behoves us all to work to find more cost effective ways to reduce environmental pressures.

Parts 8.2-8.5 look at cost effective strategies to reduce and prevent air, water, waste and chemical pollution. Reducing pollution reduces health costs and boosts labour productivity and the economy.

Parts 8.2-8.5 also investigates ways that pollution can be reduce cleverly through strategies which simultaneously also achieve resource productivity gains. Whenever resource productivity gains can be made this both reduces environmental pressures whilst also ensuring a good rate of return on the investment made by individuals, business or government. This chapter shows that using wise approaches it is possible to invest in solutions which both reduce pollution (air, water, waste, chemical) whilst simultaneously improving resource productivity. Taking this approach helps to increase the economic efficiency of such investments since they will provide both significant health and operational cost savings over the longer term.

Finally, the topics for this chapter have not been chosen randomly. The types of environmental pressures discussed in this chapter align with those chosen by the OECD Environment Directorate in their work over the last decade on decoupling economic growth from environmental pressures. As discussed in Chapter 5, the OECD has created a set of specific decoupling indicators. Thus by using the OECD framework, within which to have this discussion about the costs of inaction versus action, this chapter seeks to compliment and value add to the OECD’s work. It is beyond the scope of this thesis to provide a detailed overview of the best policy frameworks needed to achieve decoupling on all of these environmental pressures. Hence the chapter instead references relevant OECD and other literature on the policy front. Since this chapter seeks to cover a wide range of environmental pressures this chapter is more a summary and synthesis compared to Chapter 7.

8.1 Decoupling Economic Growth from Loss of Biodiversity and Renewable Natural Resources

8.1.1 Estimating Costs of Inaction

The OECD Environmental Outlook to 2030 outlines in detail a range of issues regarding the vexed topic of estimating the costs of inaction on environment protection. Discussing this vexed field in detail is beyond the scope of this thesis but a few comments need to be made to inform the following discussion on the costs of inaction versus action.

First, it is important to note that when assessing the costs of inaction on environmental sustainability, the total costs of environmental policy inaction always involves several different types of costs. As the OECD Environmental Outlook to 2030 stated:
“These include public finance expenditures (e.g. health service costs, restoring contaminated sites, restoring degraded habitat); direct financial costs borne by households and firms (e.g. increased insurance costs, reduced productivity in resource-based sectors); indirect costs, such as those which arise through markets affected by environmental factors (e.g. employment markets, real estate markets); and social welfare costs, which are not reflected in market prices or national accounts at all – including some non-use values of environmental damage (e.g. ecosystem degradation).”

Creating a total aggregate cost of policy inaction on biodiversity and natural resources according to the OECD is not possible given the different nature and units of these different types of costs. Such a topic requires discussions of issues of valuing non-market goods and externalities, detailed discussion of which is beyond the scope of this thesis.

In the OECD Environmental Outlook to 2030 a key point is made concerning the costs of inaction on environmental protection versus the costs of action. The OECD Environmental Outlook to 2030 report states that:

“Environmental pressures can also embody complicated non-linear impacts, including thresholds and irreversible changes. Three issues seem to be especially important in this regard:

- Cumulative effects: Some environmental impacts will become significantly greater as a result of cumulative environmental pressures over time.
- Thresholds: Impacts may increase sharply once a particular level (threshold) of environmental pressure is exceeded.
- Irreversible changes: While some environmental impacts are potentially “reversible” (allowing for the restoration of environmental conditions to their prior state), there are many areas in which this is not the case (once degraded, environmental values are lost permanently). Species loss associated with unsustainable fisheries management is one example. In the presence of such non-linear effects, the costs of preventing environmental degradation in the first place (mitigation) will be less than the costs of addressing the impacts of the environmental problem once it has occurred (restoration). For many types of impacts – and particularly for those involving irreversible changes – it is not possible to restore the environment to its previous state.”

Because of these threshold effects, in most cases the economic costs of destroying ecosystem services becomes apparent only when the ecosystem services cross these thresholds and start to break down.

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1331 OECD (2008) *OECD Environmental Outlook to 2030*. OECD. Available At [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008


1333 OECD (2008) *OECD Environmental Outlook to 2030*. OECD. Available At [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008
8.1.2 Costs from Deforestation

The Worldwatch Institute cites the following examples.¹³³⁴

- Bangladesh suffered its most extensive flood of the century in the summer of 1998. Two-thirds of this low-lying nation at the mouth of the Ganges and Brahmaputra rivers was inundated for months, 30 million were left temporarily homeless. Ten thousand miles of roads were heavily damaged, and the rice harvest was reduced by two million tons. Damage estimates exceed US$3.4 billion. Logging upriver in the Himalayas of north India and Nepal exacerbated the disaster, as did the fact that the region's rivers and floodplains have been filled with silt and constricted by development. Climate change and rising sea levels are projected to make Bangladesh even more vulnerable to flooding in the future.

- In China’s Yangtze basin in 1998, heavy rainfall plus upstream deforestation triggered flooding that killed 3,700 people, dislocated 223 million and inundated 60 million acres of cropland. That US$30 billion disaster forced a logging moratorium and a US$12 billion crash program of reforestation. The damage was caused not just by heavy rain but also by deforestation and extremely dense settlement on the floodplain. The Yangtze catchment had lost over 85 percent of its forest cover.

More countries are beginning to recognize the economic, social and environmental costs associated with deforestation. China, New Zealand, the Philippines, Sri Lanka, Thailand, and Vietnam all have total or partial bans on deforestation.¹³³⁵ Most brought in these bans after similar experiences to Bangladesh and China. But simply stopping logging is often not enough to ensure environmental sustainability. Restoration of forests will also be required. South Korea offers one of the best examples of reforestation. When the Korean War ended, half a century ago, the mountainous country was largely deforested. Since around 1960 the South Korean government has invested in a major national reforestation effort utilizing village cooperatives involving overall hundreds of thousands of people to dig trenches and create terraces for supporting trees on barren mountains. Se-Kyung Chong, researcher at the Korea Forest Research Institute, writes

“The result was a seemingly miraculous rebirth of forests from barren land. Today forests cover 65 percent of the country, an area of roughly six million hectares. While driving across South Korea in November 2000, it was gratifying for me to see the luxuriant stands of trees on mountains that a generation ago were bare. We can reforest the earth!”¹³³⁶


South Korea has also shown that there is great but unrealised potential to reduce the demand for forest timber. It has achieved paper recycling rates of 77 per cent, the highest in the world.

Deforestation reduces the environment’s resilience to shocks enabling storms to cause greater havoc. Deforestation leads to greater rainfall runoff and the associated flooding and soil erosion. Worldwide, areas with a high level of erosion risk from water are projected to increase from 20 million km² in 2000 to nearly 30 million in 2030 (Figure 8.2\textsuperscript{1337}). The increase will occur in all regions. This will make more regions more vulnerable to natural disasters.

![Figure 8.1 Land area under high soil erosion risk by surface water runoff, 2000-2030.](source, OECD, 2008\textsuperscript{1338})

8.1.3 Costs from Natural Disasters

The IUCN\textsuperscript{1339} has found that often supposedly natural disasters are increasingly man made because nature’s natural resilience to shocks has been removed.\textsuperscript{1340} The World Bank\textsuperscript{1341} has estimated that, for the poorest countries, the cost of natural disasters represents more than 13% of GDP. While only some of this cost can be attributed to environmental factors, that which can in turn be influenced directly by public policy (e.g. flood control, GHG mitigation, preventing deforestation, soil erosion and mudslides etc.), “inaction” concerning natural disasters is clearly resulting in significant costs. The World Bank and the US Geological Survey have estimated that the worldwide economic losses from natural

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\textsuperscript{1337} In Figure 8.2 BRIC refers to Brazil, Russia, India and China and ROE refers to rest of world.

\textsuperscript{1338} OECD (2008) OECD Environmental Outlook to 2030. OECD. Available at [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008


\textsuperscript{1340} In Asia, the 2004 tsunami would have been less disastrous if the mangroves, serving as a natural barrier, had not been destroyed for tourism and shrimp farming; in the Northern Pakistan earthquake of 2005, local people claim that intact forest cover prevented landslides which caused extensive damage elsewhere.

disasters in the 1990s could have been reduced by US$280 billion, if US$40 billion had been invested in disaster preparedness, mitigation and prevention strategies.\textsuperscript{1342} With 50 per cent of the world’s population now living in cities, it is easy to forget that the economy, indeed our existence, is wholly dependent on the earth’s biodiversity, natural systems and resources. Those that pose the question of whether the economy can afford to make the necessary investments to achieve environmental sustainability ignore the fact that the economy is dependent on the earth’s natural ecosystems whether it be clean water or seafood, and also dependent on the services it supplies. As the Earth Charter states

“The Earth has provided the conditions essential to life’s evolution. The resilience of the community of life and the well-being of humanity depend upon preserving a healthy biosphere with all its ecological systems, a rich variety of plants and animals, fertile soils, pure waters, and clean air.”\textsuperscript{1343}

If the environmental support systems of our civilization continue to decline, so will civilization itself until it reaches a point of collapse. This has been shown by Joseph Trainter,\textsuperscript{1344} Clive Ponting,\textsuperscript{1345} Charles Redman,\textsuperscript{1346} Fagan\textsuperscript{1347} and more recently popularised by Jarod Diamond’s book \textit{Collapse}.\textsuperscript{1348} Environmental factors have been shown to be significant factors in the decline and collapse of over ten of the most advanced ancient civilisations.\textsuperscript{1349}

\section*{8.1.4 Ecosystem Services Which Are Not Substitutable}

The costs of biodiversity and natural resource loss through continued policy inaction will be significant in both measurable economic loss and difficult-to-measure non-market terms. Getting a precise total figure for that loss is not possible, but there is good reason to suspect that it is large. As mentioned previously in Chapter 5, sub section 5.4, experts in ecology and economics at least have tried to put a figure on it and estimated that the worth of the world’s ecosystem services was US$43 billion.\textsuperscript{1350} They also showed that most of these ecosystem services are not substitutable by technology. The Millennium Ecosystem Assessment and the UNEP’s 4\textsuperscript{th} Global Environment Outlook have shown that such ecosystem services are now threatened by multiple environmental pressures, all of which cause biodiversity loss.

\begin{flushleft}
\textsuperscript{1343} See UN Earth Charter at \url{http://www.earthcharter.org/} Accessed 26.03.2008
\textsuperscript{1350} Robert Costanza \textit{et al.}, (1997) \textit{The Value of the World's Ecosystem Services and Natural Capital}, Nature, 15 May 1997,
\end{flushleft}
8.1.5 Market Failure and Environmental Degradation.

As chapter 1 and 3 explained, the 2005 Millennium Ecosystem Assessment (MEA) estimates that two-thirds of all of the world’s ecosystems have already reached or are close to reaching such irreversible tipping points. According to the MEA,\textsuperscript{1351} the main sources of biodiversity loss are land use changes (usually associated directly or indirectly with increasing populations, e.g. conversion to agriculture); unsustainable use and exploitation of natural resources (especially fisheries and forestry); invasive alien species; global climate change; and pollution (e.g. nutrient loading).

As the OECD states:

:\textit{"While these are the immediate sources of the loss of biodiversity, the underlying problem is that biodiversity is usually not fully accounted for by consumers in the market place\textsuperscript{1352} – there is often no distinction between biodiversity-friendly goods and those that damage biodiversity. Without government intervention, the market place has difficulty making that distinction. That so few policies have been enacted to mitigate biodiversity loss is an indicator of the strength of the underlying market failure, especially since there is considerable evidence for direct and indirect values of biodiversity that are not reflected in the market."}\textsuperscript{1353}

Good examples of environmental degradation caused by market failure are pointed out in Table 8.2. These examples of environmental degradation have serious social costs such as from the collapse of fisheries upon which many vulnerable and poor people depend.

\begin{table}[h]
\centering
\begin{tabular}{|l|p{0.7\textwidth}|}
\hline
\textbf{Fisheries} & Fisheries are collapsing throughout the world. In the Atlantic, stocks of bluefin tuna have fallen 94\% as a result of heavy fishing. If fishing was stopped it would take many years for that species to recover. In the Caspian Sea the harvest of sturgeon, the source of the most prized caviar, fell from a peak of 27,700 tons in 1977 to 461 tons in 2000. A 2003 study by a Canadian-German research team (published in Nature) has concluded that, in the last 50 years, 90 percent of the large fish in the oceans had disappeared.\textsuperscript{1354} \\
\hline
\textbf{Deforestation and} & Haiti, a country of 9.6 million people, was once largely covered with forests, but \\
\hline
\end{tabular}
\caption{Signs of EcoSystems Under Stress and Collapsing}
\end{table}

\textsuperscript{1351} Millennium Ecosystem Assessment (2005), \textit{Ecosystems and Human Well-Being}, Island Press, Washington DC.
\textsuperscript{1353} OECD (2008) OECD \textit{Environmental Outlook to 2030}, OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
\textsuperscript{1354} Myers, R. Worm,B. (2003) \textit{“Rapid Worldwide Depletion of Predatory Fish Communities,”} Nature, vol. 432 (15 May 2003), pp. 280–83; Charles Crosby, \textquote{\textquoteright\textquoteright\ Blue Frontier\textquoteright\ is Decimated,\textquoteright\ Dalhousie News, 11 June 2003.}
loss of biodiversity of Forests
growing firewood demand and land clearing for farming have left forests standing on scarcely 4 percent of its land. First the trees go, then the soil. Environmentalists warn that current rates of deforestation mean that Madagascar could soon become a landscape of scrub growth and sand. Malawi, in East Africa (population 14 million people) has lost close to a quarter of its forest cover since the early 1970s – up to 1 million hectares. Trees have been cut down to be used to produce charcoal and cure tobacco creating a chain of events similar to those that occurred in Haiti.

Losing Soil
Topsoil loss is occurring faster than the formation of a new soil on about a third of land used for growing crops with a resulting loss of productivity. Soil erosion has accelerated over the last century and can be seen in the dust bowls that have formed. Examples can be seen in northwest China, and in the Sahelian region of Africa. Each was the result of overgrazing, deforestation, and agricultural expansion onto marginal land, followed by retrenchment as the soil began to disappear. Mountainous countries with steeply sloping land, like Ethiopia, lose topsoil each year to rain. It has been losing about 2 billion tons of topsoil each year in this way. Surface water run-off generally can seriously impair the capacity of soils to produce food. It has been projected that worldwide, the area of land with a high level of erosion risk from water will increase between 2000 and 2030 from 20 million to nearly 30 million km²

From Grassland to Desert
Ten per cent of the earth’s land surface is fertile enough for crops, but forty per cent is rangeland, which is land that is too steep, dry, or simply not fertile enough for crop farming. Rangeland supports more than 50 per cent of the world’s 3.3 billion cattle, sheep, and goats. An estimated 200 million people worldwide depend on rangelands to graze their cattle, sheep, and goats in countries in Africa, Middle East, Central Asia, Mongolia, and northwest China. Most rangelands are held in common and suffer from overgrazing due to the tragedy of the commons effect. China is a good example of this. In China, responsibility for farming has shifted from state-organized production teams to farm families. This has led to a

References:
1356 Ibid.
1357 Ibid.
1361 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
1363 Number of pastoralists from FAO, The State of Food Insecurity in the World 2003 (Rome 2003), p.15;
rapid increase in numbers of sheep and goats being farmed. As Lester Brown writes "While the United States has only 9 million sheep and goats, China has 366 million. Concentrated in China’s western and northern provinces, sheep and goats are destroying the land’s protective vegetation. The wind then does the rest, removing the soil and converting productive rangeland into desert."\(^{1364}\)

### Advancing Deserts

In Africa and parts of Asia the spread of desertification is a serious threat to 100s of millions of people and the environment. In the north of Africa the Sahara is advancing.\(^{1365}\) Nigeria is losing 351,000 hectares of rangeland and cropland to desertification each year. China’s desertification is also a serious problem. A leading Chinese scholar on the issue, Wang Tao, writes on the exponentially rising levels of desertification in his country. He writes that “From 1950 to 1975 an average of 1,560 square kilometres of land turned to desert each year. Between 1975 and 1987, this climbed to 2,100 square kilometres a year. From then until the century’s end, it jumped to 3,600 square kilometres of land going to desert annually.”\(^{1366}\)

### Disappearing Plants and Animals

The UNEP GEO 4 stated “Current biodiversity changes are the fastest in human history. Species are becoming extinct a hundred times faster than the rate shown in the fossil record.”\(^{1367}\) The IUCN's latest findings on the percentage of birds, mammals, and fish that are vulnerable or in immediate danger of extinction is as follows: 12 percent of the world’s nearly 10,000 bird species; 20 percent of the world’s 5,416 mammal species; and 39 percent of the fish species analysed.\(^{1368}\)

(Source, Brown, L\(^{1369}\), 2008)

### 8.1.6 Case Study: Global Fisheries

The state of global fisheries illustrates this phenomenon well. Fisheries management is limited by imperfect information and imperfect control. It is impossible to know precisely the size of the stock, its growth, and its relationship with other stocks. In addition to imperfect information, regulation is imperfect, especially for the high seas fisheries which are not controlled by any one government. There are now many examples of stocks being fished to commercial extinction. In 2007, the Food and

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\(^{1369}\) This table has been constructed based on studies and literature from Brown, L (2008) Plan B. Mobilising to Save Civilisation. The Earth Policy Institute Available At http://www.earth-policy.org/Books/PB3/Contents.htm Accessed 17.02.2008, Accessed 23.03.08
Agricultural Organisation (FAO) has reported that the proportion of over-exploited and depleted stocks rose from 10% in 1974 to 25% in 2005.\textsuperscript{1370}

Unsustainable fishing practices in many parts of the world mean that there is no potential in the short or medium-term for further expansion of the fisheries sector. As shown in Chapters 3 and 5, the fisheries sector is one where environmental pressures can lead to irreversible collapse of the whole fishery. Thus the long term costs of unsustainable fishing practices are significantly greater than costs of action to ensure that future generations can also realise the economic, social and environmental benefits of sustainable fishing. The OECD has listed some of the different types of costs arising from unsustainable fisheries management.

“There are direct economic consequences, such as lost receipts for fishers and vessel owners from falling catches. There are also indirect consequences, such as lost earnings for workers and foregone profits of fish-processing and related industries. Then there is the additional loss of “use values”, including those costs which can be difficult to value due to their non-market characteristics, such as reduced recreational opportunities. And finally, there are costs associated with damage to marine ecosystems.”\textsuperscript{1371}

The costs of unsustainable fisheries management can be considerable: the OECD\textsuperscript{1372} highlight this through reference to a number of studies including one study of thirteen overfished fish stocks in US waters by Sumaila and Suatoni.\textsuperscript{1373} In this study they compared the lost direct income from reduced commercial fishery yields and reduced recreational fishing associated with continued excessive fishing with a case in which the stock “rebuilding” plans developed by Regional Fishery Management Councils were adopted. They found that the lost income of continuing the existing excessive fishing management regime was US$373 million (US$193.7 million, instead of US$566.7 million).

In addition to lost income from reduced population levels of fish, there are other costs from continuing unsustainable commercial and recreational fishing practice. When a fishery collapses, such as the Atlantic cod fishery discussed in Chapter 3 and 5, some of the costs may also be borne by others such as the taxpayers. In Canada, following the collapse of the cod fishery an estimated CAS$3.5 billion was spent on structural adjustment programmes\textsuperscript{1374} which included income support (including unemployment benefits for the fishermen) and government assistance programmes (directed, among


\textsuperscript{1371} OECD (2008) \textit{OECD Environmental Outlook to 2030}. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008

\textsuperscript{1372} Ibid.


other things restructuring and regional economic development). An estimated CA$3.5 billion was spent on these structural adjustment programmes.\textsuperscript{1375}

If nations do not heed the warnings from the UN, UNEP and the OECD concerning currently unsustainable fishery practices the long-term costs globally to future generations will be significant. The fisheries sector employs about 40 million fishers and fish farmers, most living in developing countries,\textsuperscript{1376} who depend on fisheries worldwide.\textsuperscript{1377} In many of these countries, fish is an essential part of the diet, providing 22% and 19% of animal proteins consumed in Asia and Africa.\textsuperscript{1378} Fishery resources also contribute to the livelihoods of coastal or island communities. Fish is also recommended as a healthy part of any diet due to the presence of eicosapentaenoic acid (EPA) which have significant health benefits. On September 8, 2004, the U.S. Food and Drug Administration gave "qualified health claim" status to EPAs and docosahexaenoic acid (DHA) ω−3 fatty acids, stating that "supportive but not conclusive research shows that consumption of EPA and DHA ω−3 fatty acids may reduce the risk of coronary heart disease."\textsuperscript{1379} People with certain circulatory problems, such as varicose veins, benefit from fish oil. Fish oil stimulates blood circulation, increases the breakdown of fibrin, a compound involved in clot and scar formation, and additionally has been shown to reduce blood pressure.\textsuperscript{1380} There is strong scientific evidence, that ω−3 fatty acids significantly reduce blood triglyceride levels\textsuperscript{1381} and regular intake reduces the risk of secondary and primary heart attack.\textsuperscript{1382}

For all of these reasons, it is important that fishery resources be managed sustainably.

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\textsuperscript{1376} FAO (1999) The State of World Fisheries and Aquaculture 1998, FAO, Rome


\textsuperscript{1378} Ibid.


A precautionary approach needs to be taken because the information is not perfect and if sustainability thresholds for particular stock are breached, they can be fished into extinction and the benefits associated with fishing lost.

8.1.7 Costs of Inaction on Invasive Species

Another statistic which helps highlight the costs of inaction on biodiversity loss is the economic cost of alien invasive species. They degrade water catchment areas and freshwater ecosystems, thereby decreasing water supply. They reduce the yields of crops and their control adds to costs. Alien plants introduced by tourists into national parks degrade protected ecosystems and increase management costs. Pests and pathogens of crops, trees and livestock can destroy plants, or reduce yields and add to costs because of the need to increase pest control. Commercially important fisheries have been degraded by bacteria and viruses and harmful aquatic organisms introduced by the discharging of ballast water. Significant social and economic consequences flow from the killing or disabling of people as a result of the spread of disease organisms. Biologist Edward Wilson has claimed that the introduction of alien species is second only to habitat loss as the leading cause of extinctions worldwide.

The cost of invasive species to the U.S. economy is estimated to exceed US$138 billion per year over the next 50 years. About 50,000 species have been introduced to the United States directly or indirectly by humans. The economic cost of invasive alien species on the Canada economy is estimated to be between CA$13 and CA$35 billion. Invasive alien species damage to the agricultural and forestry industries results in an estimated CA$7.5 billion of lost revenue annually in Canada alone.

Rapid economic growth and giant infrastructure projects have allowed invasive species to spread throughout China and inflict more than US$14.5 billion of damage to the nation's economy annually according to a study published in Bioscience. Over the past three decades the number of invasive species in the country has more than tripled while the number of international ports of entry to China has doubled and the total length of express highways has expanded by a factor of 40.

Whilst it should be acknowledged that there is considerable uncertainty in estimating the total economic costs of invasions, these estimates of the economic impacts on particular sectors indicate the seriousness of the problem. Most countries are now affected negatively by invasive alien species. For example, New Zealand it has been recently invaded by the varroa mite. The mite is a serious pest in

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honeybee hives. Its overall economic cost is expected to be NZ$267-602 million and will force beekeepers to change their management of their hives. Beekeepers attribute the invasion to the failure to follow border rules and argue that with earlier detection, the problem could have been avoided. It appears unlikely that the mite can be eradicated and it is estimated that the mitigation program required will cost NZ$1.3 million in its first stage.

The economic cost of the invasives include both the direct costs of their management and their indirect environmental consequences and non-market impacts. For example, invasives may disturb the hydrological cycle by causing changes in ecological services such as flood control, water supply, waste assimilation, recycling of nutrients, conservation and regeneration of soils, pollination of crops, and seed dispersal. Such services have both current use value and future value. The Cape Floral Kingdom in South Africa experienced decreased water supplies for nearby communities, increased fire hazards, and threats to native biodiversity as a result of the establishment of invasive tree species requiring manual and chemical control which required government annual expenditures of $40 million per year.

While most evidence of economic cost of invasive alien species has come from the developed world, there are strong indications that similar or greater losses are being experienced in the developing world.

It is costing developing countries more than US$100 million annually to try to deal with Water hyacinth and other alien water weeds affecting water use. Direct threats to food security are imposed by alien insect invaders like the white cassava mealybug and larger grain borer in Africa. The restoration of degraded land, the regeneration of forests and the improved use of water for irrigation and fisheries has been constrained by invasive weeds.

To conclude, whilst it is hard to put a price on the costs of inaction, it is clear from the scientific and economic evidence currently available that it is considerable. UN\textsuperscript{1386}, UNEP\textsuperscript{1387} and the OECD\textsuperscript{1388} all argue that significant and urgent investment is needed now to restore biodiversity, habitat and natural resources because over 60 per cent of the world’s ecosystems are severely degraded. To date governments have failed to invest sufficiently in biodiversity and natural resources: these issues tend to be low on the list of voter concerns. To build greater political will for investment in this area it is vital then that the economic case be presented for greater investment in biodiversity and natural resources.

\textsuperscript{1386} UN Millennium Ecosystem Assessment, (2005) Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC
\textsuperscript{1387} UNEP (2007) Global Environment Outlook: Environment for development (GEO-4) report. UNEP. Available At http://www.unep.org/geo/geeo4 Accessed 23.03.08
\textsuperscript{1388} OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
8.1.8 Estimates of Economic Benefits of Investing in Biodiversity and Natural Resources

There are direct and indirect sources of biodiversity value, the latter including the existence value of biodiversity, sources of agricultural production innovation and protection against major pathogens.

Eco-tourism based on charismatic mega-fauna and bio-diverse ecosystems such as the Great Barrier Reef are harder to estimate in total, but again clearly run to hundreds of billions of dollars internationally. The International Eco-Tourism Society estimates the global eco-tourism market will be worth US$473.6 billion by 2015.1389

The pharmacological value of biodiversity is in the multi-billion dollar range; a successful product can be worth US$5 to US$10 billion per year in revenues net of production costs, with a present value over its life of perhaps US$50 to US$100 billion. Indeed, finding just a small number of additional blockbuster drugs from the remaining biodiversity would justify significant conservation for bio-prospecting.1390

Eco-tourism and charismatic mega-fauna are harder to estimate in total, but again clearly run to hundreds of billions of dollars internationally.

The services provided by biodiversity through watersheds globally run into the tens of billions. New York City alone saved hundreds of millions of dollars by maintaining its source watershed rather than building a water purification plant.1391 As discussed in Chapters 1 and chapter 6, the UN set a millennium goal of halving the proportion of people with no access to sanitation - even simple latrines rather than sewers - by 2015. Currently 40 per cent of humanity or 2.6 billion people now do not have regular access to clean water. About 90 per cent of the sewage and 70 per cent of the industrial waste in developing countries are being discharged untreated into water courses. The ability of marshes and wetlands to play an integral part in filtering waste water is often overlooked. Novel schemes currently looking to utilise ecosystem services to purify water include a plan to build an artificial wetland at a jail in Mombasa in Kenya, to process sewage from 4,000 inmates that now flows untreated into a creek, or ponds in South Africa where algae purify waste and are then used as fertiliser. This is but one way healthy ecosystems positively impact on human health. UN Millennium Ecosystem Assessment demonstrated that there are significant human health benefits from restoring and maintaining healthy ecosystems likely again to be worth at least tens of billions of dollars per annum.1392

As discussed in Chapter 7, the Stern Review recommends not just slowing down but stopping completely further deforestation as a cost effective way to mitigate climate change. The Stern Review

1392 UN Millennium Ecosystem Assessment (2005) Health, Ecosystems and Human Well-being. World Resources Institute, Washington, DC
puts the opportunity cost of stopping deforestation in 8 countries responsible for 70% of emissions at US$5-10 billion per annum and the cost of ongoing management of the forests at US$12-93 million per annum. But the Stern Review did not investigate the cost benefits of also investing in restoration and reafforestation of the world’s forests. There is potential in currently semi degraded land to sequester carbon further and help to restore the landscape and reduce soil erosion and thus further reduce costs to society from environmental degradation.

Lester Brown writes about an important study by Swedish energy firm, Vattenfall, which has examined the large-scale potential for foresting wasteland to sequester carbon dioxide. This study shows that there are 1.86 billion hectares of degraded land in the world which was once forestland, cropland, or grassland. This study finds that half of this has a decent chance of being reclaimed for an affordable price. As Lester Brown writes

“Vattenfall estimates that the maximum technical potential of these 930 million hectares is to absorb roughly 21.6 billion tons of CO2 per year. If, as part of a global climate stabilization strategy, carbon sequestration were valued at $210 per ton of carbon, the company believes that 18 percent of this technical potential could be realized. If so, this would mean planting 171 million hectares of land to trees which would sequester 3.5 billion tons of CO2 per year, sequestering carbon at $210 per ton would be $200 billion. Spread over a decade, this would mean investing $20 billion a year to give climate stabilization a large and potentially decisive boost. A $210 per ton carbon price is higher than what is realistic to expect but the fact that the private sector is seriously considering this shows that there is potential for government working with the private sector to leverage private investment to solve this problem and thus reduce the amount of tax payer funding required to address climate change. Vattenhall recommend an independent body would be set up to administer, fund, and monitor the vast tree planting initiative.”

Many cities are planting trees. In Tokyo, for example, trees and shrubs have been planted on the roofs of buildings to help reduce the urban heat island effect and cool the city.

A study of the economic and social values of planting trees on the streets and in the parks of five western U.S. cities including for instance Cheyenne, Wyoming, and Berkeley, California, found that the community benefits were greater than two dollars for every dollar spent. Mature trees in cities can reduce air temperatures by five to ten degrees Fahrenheit. In cities which have extremely cold winters trees can help reduce wind speed dramatically and thus reduce heating bills.

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1394 Ibid.


There are agricultural practices that can increase the storage in the soil of carbon as organic matter. They include practices that reduce soil erosion and raise cropland productivity such as shifting from conventional tillage to minimum-till and no-till, increased use of cover crops, the return of all livestock manure to the land, more mixed crop-livestock farming, expansion of irrigated areas and the forestation of marginal farmlands.

The extent of potential carbon sequestration for many practices, such as those just cited, have been calculated by Rattan Lal, a Senior Agronomist with the Carbon Management and Sequestration Center at Ohio State University. For example, 68 million to 338 million tons of carbon worldwide could be stored each year by expanding the use of cover crops to protect soil during the off-season. Taking the practices he cites, and using the low end of the range for calculating the likely benefit for each, his calculations show a potential for sequestering 400 million tons of carbon each year. Calculating the likely benefit on the basis of the more optimistic of the range for each practice, he arrives at a total of 1.2 billion tons of carbon stored per year. For calculating a carbon budget, it is assumed, that 600 million tons of carbon can be sequestered by adopting such carbon-sensitive practices.1397

Another significant development which highlights the economic value of protecting the world’s biodiversity is biomimicry, innovation inspired by nature.1398 CSIRO states that ‘biomimetic engineering mimics natural systems, utilising molecular self-assembly as the key link between physics, chemistry and biology, creating novel advanced structures, materials, and devices’. The idea is that, during its 3.8 billion years of research and development, nature has evolved highly efficient non-toxic, benign systems and processes that can inform solutions to many of the waste, resource efficiency and management problems that humanity now grapples with today.

Hence the biodiversity of nature itself offers humanity a guide on how human systems can be designed and built to be sustainable and effective. Biomimicry has already provided some timely, standout sustainable innovations in areas such as sustainable agriculture, energy efficiency, water filtration and purification, aerodynamics, green buildings, benign adhesives and glues. Janine Benyus’s Biomimicry: Innovation Inspired by Nature1399 shows that innovators across many fields are learning from nature to innovate for sustainability.

8.1.9 Recognition of the Value of Biodiversity and Natural Resources is Growing

To conclude, the above discussion has shown that there are significant economic benefits from maintaining and preserving the world’s biodiversity. As of March 2008, this is recognised formally by

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190 countries which have ratified the UN Convention on Biological Diversity (CBD) with the aim of conserving biodiversity as well as ensuring the sustainable use of its components. A range of other multilateral environmental agreements also help to protect biodiversity, for example the Convention on International Trade in Endangered Species (CITES), the Convention on Wetlands (Ramsar Convention), the World Heritage Convention, and the Convention on the Conservation of European Wildlife and Natural Habitats. These measures attempt to ensure a co-ordinated process for addressing biodiversity loss. Hence there is widespread recognition globally of the importance of biodiversity conservation.

There has been progress over the last 20 years. Figure 8.3 shows that there has been particularly rapid growth in protected areas in the last three to four decades. By 2003, just under 12% of the world’s land area was devoted to protected areas.

There is also increasing recognition globally of the importance of biodiversity conservation and of restoring the Earth. There are numerous inspiring initiatives occurring globally driven by a range of concerns, from climate change to desert expansion, to soil conservation, to making cities more

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**Figure 8.2 Cumulative change in protected areas worldwide, 1872-2003.** (Source. OECD, 2008)

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1.402 OECD (2008) *OECD Environmental Outlook to 2030*. OECD. Available At [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008
habitable. Inspired by Kenyan Nobel laureate Wangari Maathai, who had earlier organized women in Kenya and several nearby countries to plant 30 million trees, the worldwide Billion Tree Campaign launched in 2007, is a stand out example. The United Nations Environment Programme is administering the Billion Tree Campaign. In October 2007, it reported that pledges had been made to plant 1.2 billion trees by the end of that year, 431 million of which had already been planted. Among the leading pledges were those of Mexico (250 million) and Ethiopia (60 million), Senegal (20 million) and Indonesia (80 million). The Ministry of Environment and Forestry of Turkey has confirmed that, this year, 150 million trees were planted as part of the Billion Tree Campaign.

There are numerous other re-afforestation initiatives occurring such as the Great Green Wall being planted in China, and the Saharan Green Wall of Africa, as well as a big push to expand tree plantations within a number of countries. As part of New Zealand’s commitment to become net climate neutral, Prime Minister Helen Clark, announced an impressive set of initiatives which included expanding areas of forests by 250,000 hectares (617,000 acres) by 2020. This would require approximately 125 million trees (30 per New Zealander).

8.1.10 A Costed Planetary Biodiversity and Ecosystem Restoration Plan

The international effort required to restore the earth will be enormous, far bigger, for example, than the Marshall Plan to help rebuild Europe and Japan after World War II. And it must be undertaken at wartime speed if environmental deterioration is not to result in economic decline and civilization collapse, just as it did for earlier civilizations as Jared Diamond has highlighted in his book *Collapse*. To restore the earth at least the following steps will need to be taken

- Stop further deforestation and loss of remnant vegetation
- Re-afforestation
- Protect topsoil
- Restore rangelands and fisheries
- Protect biological diversity.
- Ensure north south wildlife corridors so that species, including vegetation, can migrate to adapt to climate change.

Although we lack detailed data in some cases, the following provides a rough estimate of how much it will cost to stop deforestation, reforest the earth, protect topsoil, restore rangelands and fisheries, stabilize water tables, and protect biological diversity. What follows is a summary of Brown’s work plus other useful studies which estimate the costs of different aspects of a planetary ecosystem restoration plan.

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Costs of Stopping Deforestation: As outlined above, the Stern Review has found that the opportunity cost of stopping deforestation in eight countries responsible for 70% of emissions at US$5-10 billion per annum and the cost of ongoing management of the forests at US$12-93 million per annum. As the Stern Review has highlighted this provides significant climate change mitigation benefits. This was covered in Chapter 7 in detail.

Costs of Stopping the Removal of Remnant Vegetation: In addition to stopping deforestation, the other most cost effective way to stop the loss of biodiversity is to stop private landholders from removing and clearing remnant habitat and vegetation. Preserving remnant vegetation usually helps to preserve and sustain farming land and rangeland productivity. But from the farmers perspective remnant vegetation reduces their potential acreage for cropping. There is a strong case for governments regulating and compensating existing farmers for preserving remnant vegetation as this is one of the most cost effective ways to reduce the loss of biodiversity and ensure there is a basis to build connectivity between national parks and biodiversity protected areas across private landholdings. Currently many national governments, especially in the OECD, subsidize the farming sector significantly without requiring farmers to farm more sustainability. This is starting to change. Increasingly governments are looking at shifting at least some of the current farming subsidies to become subsidies for maintaining and enhancing ecosystem services on farming properties. Given the significant current government subsidies to the farming sector in OECD countries, OECD governments should be able to fund the preserving of remnant vegetation under existing subsidy arrangements by shifting the economic incentives to farmers in this way.

Costs of Further Re-Afforestation: Forested areas are already expanding in most OECD countries hence here we will focus on what is needed for developing countries. Lester Brown writes that:

"Meeting the growing fuelwood demand in developing countries will require an estimated 55 million additional hectares of forested area. Conserving soils and restoring hydrological stability would require roughly another 100 million hectares located in thousands of watersheds in developing countries. Recognizing some overlap between these two, we will reduce the 155 million total to 150 million hectares. Beyond this, an additional 30 million hectares will be needed to produce lumber, paper, and other forest products."^1406

With the clean development mechanism, it is likely that at least a reasonable share of this tree planting will come from plantations. But also part of the planting will be done by locals and volunteers on the

outskirts of villages, along field boundaries and roads, on small plots of marginal land, and on denuded hillsides.\textsuperscript{1407}

The World Bank has estimated that seedlings will cost US$40 per thousand. Assuming that the average planting rate will be roughly 2,000 per hectare, the seedlings cost per hectare will be US$80. The cost for planting trees (including seedlings and labor) has been estimated at US$1200 per hectare. If 150 million hectares are to be planted over the next ten years, this will require an average planting each year of 15 million hectares. At a cost of US$1200 per hectare, the annual cost will be of the order of US$18 billion.\textsuperscript{1408}

But planting trees achieves other objectives. It sequesters carbon, conserves soil, reduces flooding as well as supplying firewood. But because climate stabilization is essential, planting trees for carbon should be costed separately. The proposal of Vattenfall to reforest or afforest 171 million hectares of wasteland over 10 years can be costed. Using a value of sequestered carbon of US$210 per ton, it would cost close to US$20 billion per year.

Costs of Soil Conservation: Conserving the earth’s topsoil must involve at least the following two steps. The first step is to retire the highly erodible land that cannot sustain further farming—the estimated one tenth of the world’s cropland that accounts for perhaps half of all excess erosion. In the United States, that has involved retiring 14 million hectares at a cost of US$125 per hectare totaling US$2 billion over a ten year period.\textsuperscript{1409} The second step involves using conservation practices on the remaining land to restore eroded and degraded land. This initiative includes providing an economic incentive to encourage farmers to adopt conservation practices such as contour farming, strip cropping, and, increasingly, minimum-till or no-till farming. It costs roughly US$1 billion per year in the USA.\textsuperscript{1410} Lester Brown writes that

“In expanding these estimates to cover the world, it is assumed that roughly 10 percent of the world’s cropland is highly erodible and should be planted to grass or trees before the topsoil is lost and it becomes barren land. In both the United States and China, the two leading food-producing countries, which account for a third of the world grain harvest, the official goal is to retire one tenth of all cropland. In Europe, it likely would be much less than 10 percent, but in Africa and the Andean countries it could be substantially higher than that. For the world as a whole, converting 10 percent of cropland that is highly erodible to grass or trees seems a reasonable goal. Since this costs roughly US$2 billion in the United States, which represents one eighth of the world cropland area, the total for the world would be

\begin{footnotes}
\textsuperscript{1409} Ibid.
\textsuperscript{1410} Ibid.
\end{footnotes}
Costs for Rangeland Protection and Restoration. This has been fully costed by The United Nations Plan of Action to Combat Desertification. This plan, which focuses on the world’s dryland regions, containing nearly 90 percent of all rangeland, estimates that restoration of rangelands would cost approximately US$183 billion over 20 years. The key restoration measures include improved economic incentives to stop overstocking, revegetation with appropriate rest periods, when grazing would be banned and sustainable rangeland management. This is a costly undertaking, but Lester Brown argues that every dollar invested in rangeland restoration yields a return of US$2.50 in income from the increased productivity of the rangeland ecosystem.

The alternative to action would cause a loss not only of land productivity but of livelihood, and ultimately leads to both the loss of life and to millions of refugees. Though not quantified here, restoring this vulnerable land will also have carbon sequestration benefits. An example of the good use of restoring vulnerable land is the planting of jatropha in Africa and Asia. Jatropha is a four-foot high perennial shrub. Not only does it cover wasteland and sequester carbon but its seeds can be used to make biodiesel.

Costs of restoration of fisheries: The restoration of oceanic fisheries centers primarily on the establishment of a worldwide network of marine reserves, which would cover roughly 30 percent of the ocean. Costings by a UK team of experts have estimated expenditures around US$13 billion per year being required.

Costs for Wildlife and Biodiversity Protection: For wildlife and biodiversity protection, the bill is somewhat higher. The World Parks Congress estimates that US$25 billion in additional annual support is required to establish and maintain an effective global system of protected areas. Additional areas needed, including those encompassing the biologically diverse hotspots not yet included in designated

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1411 Ibid.
1412 Ibid.
parks, would cost between US$500 million-US$5 Billion a year over five years, yielding a total of US$30 billion per annum. Professor Norman Myers argues that it would be possible to set up the remaining biodiversity hotspots for US$500 million a year over five years. Globally, already US$10 billion is spent per annum on biodiversity so Professor Myers suggestion is not a great stretch financially.

Finally, with climate change, wildlife corridors north and south on the great continents of the world will be needed to ensure that species can migrate north and south as the planet warms. Former NSW Environment Minister Bob Debus showed that much progress can be made here for minimal extra cost if there is the necessary political will. In NSW two wildlife corridors are being created one up through central rural NSW and another up the great dividing range and east coast of NSW. The NSW government is achieving this relatively cost effectively because they have undergone effective stakeholder engagement with the relevant national parks and state forest authorities and private landholders. Nevertheless, there will be costs to achieving greater connectivity for wilderness corridors across the world’s great continents. Hence it would be wise to strategically align efforts and expenditure for re-afforestation, re-vegetation, reversing soil erosion, carbon sequestration and protection of biodiversity to simultaneously, where appropriate, also be building and maintaining these north south wildlife corridors on all the continents of the globe.

Altogether, stopping the further loss and rebuilding resilience of the world’s ecosystems will require additional global expenditures approximately US$108 billion per annum in addition to what is currently spent. Currently OECD nations spend approximately US$400 billion per annum on environmental protection as a whole. Hence an increase of US$108 billion is feasible given increased public concern and public will for action on climate change and the environment. To put US$108 billion in perspective, it is worth reiterating what was discussed earlier in the chapter, namely that nature’s ecosystem services contribute approximately US$43 trillion worth of free services to the global economy. Thus spending US$108 billion per annum to ensure the sustainability of US$43 trillion worth of ecosystem services is very small price to pay to restore resilience to the earth’s ecosystems. Also, given that the world economy currently is over US$30 trillion dollars per annum and growing exponentially, an extra expenditure of US$108 billion per annum would simply mean


that the same level of economic growth and average wage rises would be achieved by just months later as would be achieved by January 1, 2020. Diverting one month of global military expenditure would also cover this bill, as would diverting approximately one-tenth of current annual government perverse subsidies to companies which harm the environment. According to a range of studies global perverse subsidies which harm the environment amount to between US$650 billion to US$2 trillion. Thus such an additional investment especially by OECD nations and fast growing economies like China is affordable and justifiable to avoid irreversible loss of ecosystem resilience relative to other expenditures.

Of course it is vitally important that effective policy and economic frameworks are used to ensure such investment in biodiversity and natural resources is as efficient as possible. A wide range of OECD and other publications have covered what policies, economic incentives and institutional arrangements tend to be more effective than others. There have also been significant reviews of advances in adaptive governance to help address the tragedy of the commons. Hence this thesis will not cover these important areas.

To conclude, this first part of Chapter 8 looked at how to decouple economic growth from loss of biodiversity and natural resources. But as stated in the opening to this chapter, this is just one aspect of what is required to achieve environmental sustainability. The OECD Environmental Outlook to 2030 highlights other urgent environmental pressures which need to be reduced, such as ensuring clean air and water and adequate sanitation for all, and rapidly reducing environmental degradation and pollution through end of pipe and resource productivity improvements. (See Table 8.1 at the start of

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the chapter) As chapter 5 showed, some OECD countries, like the Netherlands, have made significant progress at reducing pollution and other environmental pressures from which we can both take encouragement and valuable lessons. In many OECD countries, pollution from industrial sources, air and water pollution has been reduced, ozone depleting substances have largely been phased-out and the use of natural resources, water and energy has to some extent been decoupled from continuing economic growth (i.e. become more efficient per unit of GDP). Similarly volumes of waste produced have also been relatively decoupled from economic growth. In OECD counties in the mid-1990s, approximately 64% of municipal waste was sent to landfills, 18% for both incineration, and recycling.  

In 2005, only 49% of municipal waste being disposed of in landfills, 30% being recycled and 21% being incinerated or otherwise treated.  

Despite these signs of progress, for the most part OECD countries have only achieved relative levels of decoupling. Local, regional and global environmental pressures are still often increasing and where they are being reduced, they are often not being reduced fast enough to avoid irreversible tipping points. The UN, UNEP, OECD and World Bank have all argued that greater efforts are required now whilst costs of action are relatively small to avoid greater long term costs of inaction. Without new (or more stringent) policies to better address environmental health issues, the adverse health effects of the most harmful environmental pollutants (e.g. air and water pollution) are likely to increase in many developing countries in the future. Hence we now explore the economic efficiency of decoupling of economic growth from these other environmental pressures by similarly integrating studies to date which explore the relative costs of inaction versus action.

1431 UN Millennium Ecosystem Assessment, (2005) Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC
1433 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
8.2 Decoupling Economic Growth from Air Pollution through Pollution Prevention and Resource Productivity

Air pollution is an important environmental pressure that needs to be decoupled from economic growth in large part because it causes significant adverse health effects. The World Health Organization states that more than 2 million people die prematurely each year from causes directly attributable to air pollution\(^{1435}\), with 1.6 million of these deaths caused by indoor air pollution\(^{1436}\). According to a WHO assessment\(^{1437}\) more than half of these deaths occur in developing countries. Also some air pollutants, such as sulphur and nitrogen oxides which cause acid rain, accelerate damage to materials, including historic buildings. Tropospheric\(^{1438}\) ozone\(^{1439}\) causes damage to rubber products due to its oxidizing effect. Acid rain and persistent organic pollutants contribute to the loss of resilience of ecosystems. Because of this, air pollution is a significant cost to economies.

8.2.1 Costs of Inaction

Different studies have reported economic losses of 2-4% of GDP of cities and countries because of air pollution\(^{1440}\). Most of the economic costs are due to health costs. For instance the World Bank in 2007\(^{1441}\) estimated Chinese air pollution health costs at about 3.8% of GDP.

Air pollution costs economies in numerous ways, some of which may surprise. For instance, a European study found that tropospheric ozone causes measurable, regional-scale reductions on crop yields for 23 arable crops costing Europe US$5.72–12 billion/year\(^{1442}\) in lost production. There is also evidence of significant crop yield reductions in other countries, such as India, Pakistan and China\(^{1443}\). China’s economic losses due to acid rain damage to forestry and agriculture are estimated to be worth

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\(^{1438}\) The troposphere is the lowest portion of Earth’s atmosphere. The average depth of the troposphere is approximately 11 km.

\(^{1439}\) Ozone, when it is in the stratospheric level of the atmosphere, carries out an important role in protecting the earth from harmful UV rays. However, when it is present near ground level in the tropospheric level, (near ground level) of the atmosphere it is a significant air pollutant.

\(^{1440}\) OECD (2008) *OECD Environmental Outlook to 2030*. OECD. Available at [http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html](http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html) Accessed 22.03.2008.


US$13.25 billion annually.1444 The World Bank in 1995 reported a study for 18 cities in Central and Eastern Europe, which found that 18,000 premature deaths a year could be prevented and $1.2 billion a year in working time lost to illness could be regained by achieving European Union pollution standards for dust and soot.1445 Air pollution also affects visibility and results in corrosion of buildings and heritage structures, such as Taj Mahal in India.1446 Air pollution can also harm the lucrative tourism sector. A survey of 150 tour guides in Hong Kong found that half of the tourist visitors had complained about the air pollution. The poll of tour guides also found that one in ten tourists suffered pollution-linked health problems while visiting Hong Kong.1447 In Kathmandu, 17% of tourists interviewed indicated that they would avoid visiting Nepal again because of poor air quality.1448

There can be significant short and long term health effects of air pollution. Short term negative effects on health include higher rates of lung, cardio and respiratory problems leading to an increase in mortality rates and hospital admissions. In addition to these short term effects, long term effects can include reduction in lung function in children and adults, increase in lung cancer and myocardial infarction rates, the development of atherosclerosis and a reduction in life expectancy.

The costs of lack of further action on air, water and chemical pollution and waste include a wide variety of “use” (e.g. the effects of water pollution on agricultural productivity) and “non-use” values (e.g. the existence value of affected species habitats). These costs can be further distinguished between costs which are generally reflected in existing “market” prices for different goods and services (e.g. lost employee productivity, medical costs, increased raw water treatment costs) and those which are not (e.g. health costs in terms of “pain and suffering”). Table 8.3 illustrates the diversity of impacts that are involved from air and water pollution.

1446 Ibid.
Table 8.3 Costs Incurred from Air and Water Pollution (Source, OECD, 2008^1440^)

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<th>Air pollution</th>
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<td>Material damages (including cultural heritage)</td>
<td>Increased drinking water treatment</td>
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<td>Reduced agricultural yields</td>
<td>Reduced commercial fish stocks</td>
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<td>Polluted freshwater sources</td>
<td>Reduced recreational opportunities</td>
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<td>Reduced visibility</td>
<td>Loss of biodiversity</td>
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<td>Loss of biodiversity</td>
<td>Adverse health impacts</td>
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While all impacts from policy inaction in the area of water, air and chemical pollution are potentially difficult to value, the most difficult are probably those relating to ecosystems (e.g. air-sheds, water courses) which are not directly related to some downstream economic activity. Valuation of some of the costs of inaction associated with human health is also not straightforward and tends to be estimated as a range of costs.

Many intangible health costs from air, water pollution and environmental degradation are difficult to value, and may not be reflected in any market. For instance, the “personal pain and suffering” associated with being ill will not be reflected in financial expenditures. In a study of acute cardiorespiratory cases in Canada, Stieb et al^1450^ estimated that, for some impacts (e.g. emergency department visits, asthma symptom days, etc.), “pain and suffering” represented 40% or more of the total health costs of particulate matter. In a French study, Rabl^1451^ found that, for other types of impacts attributable in part to pollution levels (e.g. cancer), the proportion of costs represented by “pain and suffering” may even exceed 90%. Pain and suffering costs are felt directly by individuals but the financial costs may be shared widely. One study of the costs of respiratory illness caused by air pollution^1452^ found that only a most of the financial and opportunity costs were borne widely. As well as the societal costs other health costs are borne by the government’s health care system paid for by tax payers. This was shown by a study by the Ontario Medical Association^1453^ which estimated that the healthcare costs associated with PM2.5 and ozone in Ontario were CA$507 million per annum.

A study by Pearce et al^1454^ shows that the health-related costs are usually more than 80% of the total costs of air pollution. Pearce et al also found that reduced health impacts were at least one-third of the

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1440 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008


total social benefits of pollution control. Given that health costs can be a significant proportion of the total costs of inaction on air and water pollution, environmental policy in this area can be understood as a form of “upstream prevention”.

Whilst, much of the attention has been on the impacts of outdoor air pollution, indoor air pollution is now being appreciated as a major issue. Poor indoor air quality in Australia's homes, offices, factories and buildings is costing Australia as much as AU$12 billion a year due to ill-health and lost production. In the UK poor indoor air costs the economy $30 billion a year, while in the US the cost is $170 billion.

Indoor air pollution is an even bigger problem in developing countries. More than two billion have no access to electricity and thus depend on crop waste or coal, dung or wood to meet their energy needs. As discussed in Chapter 6, this is a significant factor in deforestation globally. Cooking and heating with such solid fuels on open fires or stoves without chimneys or adequate ventilation leads to indoor air pollution. This indoor smoke contains a range of health-damaging pollutants including small soot or dust particles that are able to penetrate deep into the lungs. In many developing countries, indoor smoke is responsible for an estimated 3.7% of the overall disease burden. The multiple benefits of reducing outdoor and indoor air pollution are considered next.

8.2.2 Multiple Benefits of Reducing Air Pollution through Pollution Prevention and Resource Productivity

Where air pollution has been reduced, the economic benefits associated with reduced impacts have far outweighed the costs of action. The USA EPA, for instance, conducted an extensive study which found that the total benefits of Clean Air Act programs saved the US economy US$22 trillion from 1970-1990. In other words, if US air pollution trends in 1970 had continued to 1990, then the measurable economic, social, health and environmental costs to the US economy would have been an extra US$22 trillion. By comparison, the actual costs of achieving the pollution reductions observed over the 20 year period was US$523 billion, a small fraction of the estimated economic costs from inaction.

Significant advances have been achieved over the last few decades both in the scientific understanding of air pollution and technological innovations to reduce it. Through these advances, air quality has been improved dramatically in many cities, especially in the OECD, at much less cost than first anticipated. Investments to decouple economic growth from air pollution through pollution prevention, end of pipe approaches and fuel efficient transport technologies are economically efficient partly because the health costs associated with inaction on air pollution are significant.

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In many parts of the world the problem of air pollution is due to transportation. A World Bank study in 2001 calculated that transport was responsible for potentially 80 percent of poor air quality or even higher. In Chapter 7 it was shown that one of the co-benefits of investments to greater fuel efficiency was that such investments would also significantly reduce air pollution. In Chapter 7 it was discussed how cities like Curitiba and Bogota are showing the way by investing in sustainable transport options which significantly reduces both automobile dependency and air pollution compared to cities of a similar size. Chapter 7 also discussed how a shift to greater fuel efficiency in cars to reduce greenhouse gas emissions will also result in significantly less air pollutants being produced per vehicle. Thus there are significant co-benefits for nations seeking to improve both transport fuel efficiency and reduce air pollution. Accounting for the co-benefits of reduced air pollution and reduced greenhouse gas emissions can have significant impacts on the cost effectiveness of climate and air pollution policy. As the OECD states:

“The co-benefit relationship suggests that co-ordination of policy efforts in these areas could deliver important cost savings. For example, van Harmelen et al\textsuperscript{1457} found that to comply with agreed or future policies to reduce regional air pollution in Europe, mitigation costs are implied, but these are reduced by 50-70% for SO\textsubscript{2} and around 50% for NO\textsubscript{x} when combined with GHG policies. Similarly, in the short-term, van Vuuren et al\textsuperscript{1458} found that for the Kyoto Protocol, about half the costs of climate policy might be recovered from reduced air pollution control costs.”

Clearly, aligning investments to decouple economic growth from both greenhouse gas emissions and air pollution simultaneously will increase the economic efficiency of such investments.

Investments to reduce air pollution are politically very popular. Urban air pollution is an environmental pressure which immediately effects people’s health and sense of well being, Hence political will for action to decouple economic growth from air pollution is typically very high. This is illustrated through economic studies of the Kuznets curve and air pollution. As was discussed in Chapter 5, the Kuznets curve hypothesis does not apply to most environmental pressures but it does apply to urban air and water pollution where the population is directly and immediately affected. History shows that in most countries air quality reduces in the early stages of industrialization and urbanization. Then overtime, when countries per capita GDP increases, priorities on air pollution shift, whereupon they implement laws to reduce air pollution. This is shown by a number of studies. Smoke, for example, tends to peak in the urban air when a country’s per capita income reached approximately US$6000, after which this kind of air pollution tended to decrease. Lead pollution peaked and started


to decrease when per capita income reached about US$1,900. Whilst OECD nations have eliminated lead from their petrol, in much of the developing world lead additives are still widely used, especially in Africa. Economists have calculated that making gasoline unleaded rarely costs more than 2 cents a litre, and countries can save 5 to 10 times as much as that through health cost savings. When the United States converted to unleaded gasoline, it saved more than $10 for every $1 it invested thanks to reduced health costs, savings on engine maintenance, and improved fuel efficiency. Thus eco-innovation which simultaneously reduces pollution (in this case lead) whilst at the same time improving engine fuel productivity, provides a double dividend from reduced health costs and fuel costs to the population. Such eco-innovation enables decoupling between economic growth to occur in such a way that in the long term improves productivity and economic prosperity.

Recognizing the high costs of the damage to human health caused by lead emissions and adopting appropriate national policy are matters of high urgency for many developing countries. Since OECD nations have had significant success at reducing air pollution cost effectively, there is much from this experience from which developing countries can learn. But it is also important to recognise that there are differences too.

Unlike American and European cities, Asian and developing country metropolitan areas owe a substantial portion of their pollution to two and three-wheel motorized vehicles. Motorcycles and "baby taxis" constitute the majority of vehicles in many Asian and developing countries. Many of these small vehicles employ two-stroke engines which emit 50 times the amount of air pollution compared modern automobiles.

Envirofit[^1459], an independent, non-profit company established at Colorado State University in 2003, is now working to distribute affordable retrofit kits that will both reduce air pollutant emissions by 90 per cent whilst also improving fuel efficiency by 30-50 per cent of two-stroke engines.

“Originally developed for snowmobiles, the direct injection technology of the kits has been now adapted so that the retrofit system eliminates the carburettor and fuel is instead introduced directly into the engine cylinder, thus conserving more unburned fuel.”[^1460] Envirofit’s retrofit engine kit costs about US$300. This may sound a lot for people in a developing economy, but governments are sponsoring micro financiers to lend taxi drivers the money for their installation. At the moment, taxi drivers make US$3–5 a day, but after their motorcycles are fitted with the kit, they can expect their income to increase by US$1–2 a day due to the engines’ improved fuel efficiency. This provides the taxi driver with a 30 per cent pay rise which enables drivers to pay back their loans within a year. [^1461]

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[^1460]: Ibid

[^1461]: Ibid
Since retrofitting two stroke engines results in a 30-50 per cent improvement in fuel efficiency projects to roll this out will qualify as projects under the Clean Development Mechanism. This should attract further funding from governments looking for genuine CDM projects to invest in.

8.2.3 Multiple Benefits of Reducing Indoor Air Pollution through Pollution Prevention and Resource Productivity

As stated above, at least two billion people worldwide burn wood, dung and crop residues indoors for home cooking and heating. According to the World Health Organization, this widespread use results in the premature deaths of an estimated 1.6 million people each year from breathing elevated levels of indoor smoke, resulting in Indoor air pollution as the fourth leading cause of death in poor developing countries. The Partnership for Clean Indoor Air (PCIA), which involves over 160 partners worldwide, is addressing the problem by funding projects in Asia, Africa, and Latin America to identify and demonstrate effective approaches for increasing the use of clean, reliable, affordable, efficient, and safe home cooking and heating practices that reduce people’s exposure to indoor air pollution. PCIA for instance are promoting the design of more efficient wood burning cook-stoves heat cookers.  

These more energy efficient wood cookstoves and solar cookers dramatically reduce indoor air pollution.

The World Health Organisation’s analysis on “The health benefits of interventions to reduce indoor air pollution from solid fuel use.” concludes that

“From a public health point of view, there should be a continued emphasis on the promotion of improved stoves, as well as other locally appropriate means to reduce exposures within solid fuel-using households.”

The World Health Organisation’s analysis occurred before climate scientists discovered in early 2008 that black carbon, a form of particulate air pollution produced from biomass burning and cooking has a global warming effect in the atmosphere three to four times greater than prevailing estimates. Ramanathan and Carmichael have found that soot and other forms of black carbon could be a significant contributor to global warming. Between 25 and 35 percent of black carbon in the global atmosphere comes from China and India, emitted from the burning of wood and cow dung in household cooking and through the use of coal to heat homes. In their paper they write that

“Black carbon in soot is an efficient absorbing agent of solar irradiation that is preferentially emitted in the tropics and can form atmospheric brown clouds in mixture with other aerosols. These factors

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1462 See Partnership for Clean Indoor Air at http://www.pciaonline.org/site/c.krlWJ7PIkQ/b.2684649/ Accessed 23.03.08
1463 See Partnership for Clean Indoor Air at http://www.pciaonline.org/site/c.krlWJ7PIkQ/b.2684649/ Accessed 23.03.08
1464 See Scripps Media Release at http://scrippsnnews.ucsd.edu/Releases/?releaseID=891
combine to make black carbon emissions the second most important contribution to anthropogenic climate warming, after carbon dioxide emissions.\textsuperscript{1466}

Their report claims that

\text{}

\text{“... soot and other forms of black carbon could have as much as 60 percent of the current global warming effect of carbon dioxide, more than that of any greenhouse gas besides CO2.”}\textsuperscript{1467}

Black carbon particles only remain airborne for weeks at most compared to carbon dioxide, which remains in the atmosphere for more than a century.\textsuperscript{1468} Thus investments in more efficient wood and solar heaters and cookers would have a very rapid pay back in terms of greenhouse gas mitigation.

Indoor air pollution is not just a major health issue in developing countries. As stated earlier in section 8.2.6 in OECD countries poor indoor air quality is costing the economy US$10s of millions per annum from ill health, absenteeism and lost productivity. In most OECD countries, people spend most of their time indoors either in offices at work or at home.

For example, in Australia, people spend 90 per cent of their time indoors, seven per cent in cars and the remainder, only three per cent, outdoors. While indoors in a typical office or home, Australians could be inhaling a very damaging mixture of volatile organic compounds (VOCs) emitted by the building materials used, paint, carpets, furnishings and office equipment and other gaseous and particulate pollutants from other sources. The type and intensity of such pollutants will vary depending on the age of the building, the construction materials and the type of equipment used. Symptoms produced by indoor air pollution include, nausea, headaches sore throats and eye irritation and a feeling of general discomfort. As to illnesses, medical science has linked exposure to high levels of polluted air to illnesses including asthma and lung cancer.

Already in Australia and many OECD countries there are now many eco-friendly products on the market which are accredited as producing negligible indoor air pollution. In Australia there are online databases\textsuperscript{1469} which assess the indoor air pollution risks of products, materials, paints, glues and adhesives as part of a Life Cycle Analysis. This demonstrates that technical and relatively cost effective solutions already exist. Much more could be done though to require all new buildings to use these modern low emission indoor materials, paints, adhesives and glues. The studies referenced above suggest that such regulation would be economic efficiency given the significant health costs that would be avoided from a systematic approach to reducing indoor air pollution. Also reducing indoor air pollution is one of the reasons why higher labour productivity is reported in many green buildings.

\textsuperscript{1466} Ibid.
\textsuperscript{1467} Ibid.
\textsuperscript{1468} See PhysOrg (2008) \textit{Black carbon pollution emerges as major player in global warming.} Available at www.physorg.com/news125500721.htm
\textsuperscript{1469} See Ecospecifier at http://www.ecospecifier.org/
To conclude, for many decades now it has been clearly demonstrated that the costs of inaction on air pollution significantly outweigh the costs of action by an order of magnitude. Hence there is a strong imperative for governments to act to better regulate and provide the appropriate frameworks which encourage investment in technologies which decouple air pollution from economic growth. Providing a comprehensive overview of government policies and incentives to decouple air pollution from economic growth is beyond the scope of this thesis. Other publications have already provided such overview and the reader is referred to their publications in this area.

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8.3 Decoupling Economic Growth from Water Pollution and Water Stress through Pollution Prevention and Resource Productivity

8.3.1 Costs of Inaction

In non-OECD countries, the costs of inaction with respect to unsafe water supply and sanitation are particularly acute. At the global level, water stress is a major issue with 1.1 billion people without access to a safe water supply and 2.6 billion people do not have access to adequate sanitation facilities.\textsuperscript{1472} The associated health impacts are alarming: 1.7 million deaths per year, of which 90% are children under 5 years of age. In addition to the direct health impacts, the resources (time and money) devoted to obtaining safe drinking water can have appreciable negative impacts on employment opportunities and schooling. Achieving the MDG of halving the population without access to water and sanitation by 2015 is expected to cost about US $10 billion per year. But this figure could be far outweighed by the costs of inaction if the MDG is not achieved, in terms of impacts on human health and economic productivity.

Even in OECD countries, the number of disease outbreaks and droughts reported in the last decade demonstrates that, despite substantial advances in recent years, access to safe drinking water and ensuring water availability are major challenges.\textsuperscript{1473} In Australia and Asia declining water availability and water stress are already significant issues and likely to become more acute due to climate change this century as outlined in Chapter 1 and in the introduction to this chapter. Whilst OECD water quality and safety is significantly better than the water quality in most developing countries outbreaks of disease have occurred in many OECD countries in the last couple of decades. For instance, in 1993, in Milwaukee, the largest city in the US state of Wisconsin, there was a major outbreak of gastrointestinal illness. It was caused by a parasite commonly harboured by cattle, Cryptosporidium, 400,000 residents were infected, and more than 60 people died. Cost estimates for this outbreak exceeded $54 million. The outbreak revealed the vulnerability of OECD urban water systems. The outbreak occurred in water that met traditional guidelines for indicators of microbial contamination. The Milwaukee outbreak also brought home the severe consequences of waterborne diseases in OECD countries. More recently, in the Spring of 2000, there was an outbreak of E. coli O157:H7 in Walkerton, Ontario (Canada) resulting in over 2,300 cases of infection and six deaths. There have been other outbreaks.

It is likely that a mixture of causes was involved including the ageing of water treatment infrastructure, inadequate treatment, the discharge of greater quantities of wastewater, and the increase (or possibly the increasing recognition and detection), of organisms resistant to conventional


\textsuperscript{1473} CRC/IWA (2002) Drinking Water and Infectious Diseases: Establishing the Links
disinfection. Contamination of water distribution systems can have a variety of causes and explanations including corrosion, construction and repairs of the distribution system, cross-connections, and back-siphonage. Contaminated groundwater can also be responsible for waterborne epidemics. This was probably the explanation for the 116 outbreaks of waterborne diseases in Sweden from 1980 to 1999, which affected about 58,000 people. It is also the probable explanation for 41 outbreaks in the UK between 1991 and 2000, with more than 3,768 reported cases of illness. In most cases, the outbreaks were due to Campylobacter and Cryptosporidium. They are emerging pathogens. Many water supply systems have struggled to deal with them.

Table 8.4 Health Effects Associated with Selected Water Pollutants (Source, OECD, 2008)

<table>
<thead>
<tr>
<th>Disease/pollutant</th>
<th>Health impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bacterial</td>
<td>Abdominal pain, diarrhoea, dysentery</td>
</tr>
<tr>
<td>Amoebic dysentery</td>
<td></td>
</tr>
<tr>
<td>Campylobacteriosis</td>
<td>Acute diarrhoea</td>
</tr>
<tr>
<td>Cholera</td>
<td>Sudden diarrhoea, vomiting. Can be fatal if untreated</td>
</tr>
<tr>
<td>Cryptosporidiosis</td>
<td>Stomach cramps, nausea, dehydration, headaches. Can be fatal for vulnerable</td>
</tr>
<tr>
<td></td>
<td>populations</td>
</tr>
<tr>
<td>Chemical</td>
<td>Impairs development of nervous system in children; adverse effects on gestational age</td>
</tr>
<tr>
<td>Lead</td>
<td>and foetal weight; blood pressure</td>
</tr>
<tr>
<td>Arsenic</td>
<td>Carcinogenic (skin and internal cancers)</td>
</tr>
<tr>
<td>Nitrates and nitrates</td>
<td>Methaemoglobinemia (blue baby syndrome)</td>
</tr>
<tr>
<td>Mercury</td>
<td>Mercury and cyclodienes are known to induce higher incidences of kidney damage,</td>
</tr>
<tr>
<td></td>
<td>some irreversable</td>
</tr>
<tr>
<td>Persistent organic pollutants</td>
<td>These chemicals can accumulate in fish and cause serious damage to human health.</td>
</tr>
<tr>
<td></td>
<td>Where pesticides are used on a large scale, groundwater gets contaminated</td>
</tr>
<tr>
<td></td>
<td>and this leads to the chemical contamination of drinking water.</td>
</tr>
</tbody>
</table>

These cases emphasise the urgency of reviewing the effectiveness and reliability of methods, management approaches, and technologies for guaranteeing the safety of drinking water. The World Health Organisation and OECD have produced a guidance document as a basis for risk management decisions at every point in the system. It gives guidance on selecting and using various parameters and technologies to meet specific information needs and to support safe practice throughout the water system: catchment protection and assessment, assessment of source-water quality and of treatment efficiency, and monitoring of drinking water quality at the point of leaving the treatment facility and throughout the distribution system. It is in effect a total system approach for improved drinking water quality.

1474 OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
The aim is to control each treatment step so as to prevent contaminants from reaching the consumer. Consideration is also given to tolerable risk, water-quality targets, public health status, and education. Thus, risk management can no longer be confined to a single organisation or agency; national, regional and local governments, water authorities, water supply agencies, and public health authorities all play a role. This creates significant challenges for co-ordination as well as production of useful and compatible data since each of these stakeholders has specific responsibilities and information needs.

But systems are not enough, detection techniques also have to be improved. Emerging molecular methods\textsuperscript{1476} are likely to make a significant contribution by increasing the chances of detecting a pathogen from an implicated source of drinking water, particularly in the case of viruses with no readily available or rapid method of culture. These include the likes of rotaviruses, astroviruses, caliciviruses, and the hepatitis A virus.

Traditional methods for detecting viruses are based on tissue-culture techniques that can take several weeks. Thanks to rapid advances in biotechnological research of the last few years, a wide range of new genetic (nucleic-acid-based) and immunological tools are now available and some molecular techniques appear particularly promising. They can offer faster, more sensitive and specific ways of detecting micro-organisms. For example, genotyping, or molecular characterisation, is a powerful new tool for identifying the source of microbial contaminants and is already in routine use for detecting Cryptosporidium in some OECD countries. On the horizon are methods based on micro-arrays and biosensors. As ever, resources are needed to increase the usefulness and broad applicability of the new technologies in the pipeline.

**8.3.2 Cost Benefits of Investing in Reducing Water Pollution**

Investment to improve water quality by effectively removing water pollutants is economically efficient. The studies reviewed in OECD’s forthcoming reports\textsuperscript{1477} will show that national measures to reduce agricultural runoff and storm water management – including introducing targeted measures to reduce a variety of different pollutants such as arsenic and nitrates could result in health benefits costed to be in excess of US$100 million for large OECD economies. Recreational water quality improvements through sewage treatment in France, Portugal, the US and the UK and drink water quality improvements in the US show that health benefits of drinking water quality and sewage treatment often outweigh the costs of policy implementation.\textsuperscript{1478} A 2006 US Environmental Protection Agency\textsuperscript{1479} study calculating the annual cost of the Long Term 2 Enhanced Surface Water Treatment Rule: Final Rule, Federal Register, Vol. 71, No. 3, pp. 653-786.

\textsuperscript{1476} OECD (1997) *Biotechnology for Water Use and Conservation*, OECD, Paris
\textsuperscript{1479} ibid

Rule to improve drinking water quality found that the policy cost between US$93 and 113 million to implement. However the US EPA also found that such investment was more than justified from an economic efficiency perspective since the annual health benefits range from US$177 million to 2.8 billion. Georgiou et al.\textsuperscript{1480} showed a similar cost benefit result for the UK’s compliance with EU Bathing Water Directive.

8.3.3 Cost Effective Innovations in Water Supply and Treatment

Despite the significant cost benefits from reducing water pollution and ensuring water sanitation for all people, current levels of investment in the water sector are inadequate to achieve existing environmental and social sustainability goals. Successive reports by international groups on water issues have estimated that total global annual expenditure in the water sector would need to roughly double in order to achieve the Millennium Development Goal of halving by 2015 the proportion of people without sustainable access to safe water. The World Summit on Sustainable Development in Johannesburg, and the Fourth World Water Forum in Mexico focused global attention on deficits in water and sanitation services in developing countries and high capital needs of infrastructure development.

At the same time OECD countries, who have not faced major financial deficits in the water and environmental infrastructure sectors, now need to mobilise capital in the next one or two decades to replace ageing water infrastructure, identify and fix leaks, and to meet increasingly stringent environmental and health standards. A recent OECD report estimates that France and the UK will have to increase their spending on water as a proportion of GDP by about 20% just to maintain water services at their current levels, while Japan and Korea may have to increase their water expenditure by more than 40%. Hence water experts like Professor Stuart White from UTS are urging a fundamental rethink of how we deliver water services more cost effectively and socially and environmentally sustainably.

The real financial, environmental and social costs of supplying water services, as shown by the findings of the World Commission on Dams, have also provided impetus for a major rethink on how water services are provided and how water is managed. The ecological footprint and social impacts of humanity’s water usage are very significant. Many rivers are in crisis, whether due to salinity, pollution or simply due to the lack of natural environmental flows as a consequence of dams. Kader Asmal, Chairperson of the 2000 World Commission on Dams wrote

"On this blue planet, less than 2.5 per cent of our water is fresh, less than 33 per cent of fresh water is fluid, less than 1.7 percent of fluid water runs in streams. And we have been stopping even these. We dammed half our world’s rivers at unprecedented rates of one per hour."¹⁴⁸¹

Dams, inter basin transfers and water withdrawals for irrigation have fragmented 60 per cent of the world’s rivers. By the end of the 20th century, there were over 45,000 dams in over 150 countries. Some of the key findings of the landmark report¹⁴⁸² from the World Commission on Dams (WCD), were:

- dams, especially shallow dams in the tropics, are significant greenhouse emitters due to rotting vegetation
- performance data in the WCD knowledge base confirms that large dam projects often incur substantial capital cost overruns — for 250 projects examined. The average overrun was half again as much as the projected cost
- poor accounting in economic terms for the social and environmental costs and benefits of large dams implies that the true economic efficiency and profitability of these schemes remains largely unknown
- dams have been the biggest drain on aid budgets for the past 50 years, costing US$4 billion a year in the 1980s
- so far, dam building has driven up to 80 million people from their homes
- one of the most disturbing findings is that few dams have ever been looked at to see if the benefits outweigh the costs
- a quarter of dams built to supply water deliver less than half the intended amount. — in a tenth of old reservoirs, the build-up of silt has more than halved the storage capacity
- by stopping the flow of silt downstream, dams reduce the fertility of flood plains and invariably cause erosion of coastal deltas
- dam construction is one of the major reasons for the extinction of freshwater fish and the vanishing of bird species from flood plains.

Hence water experts like Professor Stuart White from UTS are urging a fundamental rethink of how we deliver water services more cost effectively and socially and environmentally sustainably.

"(Today) Urban water utilities and government have an opportunity to reverse a legacy of over 100 years... Many of the problems facing urban water systems had their roots in history, and the solutions required a fresh approach. The historical approach of the water industry was based on a simple premise.

¹⁴⁸² Ibid.
If demand rose, new dams and pipelines were built. If water ran out in one catchment, it was taken from the next. When water was piped into houses, offices and factories, it came out as sewage which needed expensive treatment and disposal. This "supply-side" thinking is pervasive — we see it still in the preference for desalination plants over real investment in demand management. This has led to an over-investment in the supply of water and to an under-investment in reducing demand. One of the water industry's best-kept secrets is this: it is cheaper, faster and less environmentally damaging to pay customers to save water rather than to supply it. This is the basis of "demand-side" thinking, which provides the biggest gains at the lowest cost. -There are huge cost and environmental advantages associated with reducing water demand through efficient appliances, low water using landscapes and reduced leakage. For example, while the US has had standards which regulate the efficiency of water-using equipment since 1994, federal and state environment ministers in Australia agreed only recently to introduce compulsory labelling. By itself this will be inadequate."

In the last two decades, whole system cost analysis has shown that water efficiency delivers far more benefits than previously imagined. Research undertaken by Stuart White’s group at UTS’ Institute for Sustainable Futures indicates that in cities and towns facing water supply augmentation, investment in water efficiency can result in water savings of greater than 30% at a unit cost that is less than supply augmentation, yielding net present value economic benefits in excess of AUD$100m for some capital cities.  

Most OECD nations’ water infrastructure assets total tens to hundreds of billions of dollars, at least half of which is for metropolitan water supply and sewerage. Demand management and water efficiency can significantly reduce the need for the construction of new dams, new treatment plants and reducing the maintenance of the pipes and associated infrastructure used to deliver and remove water, significant savings can be made.

The latest studies are showing that we can use water much more efficiently through water recycling, reuse and the redesign of urban water systems over the next 50 years (see Table 8.5).

Table 8.5 A sample of some of the cost effective options to improve water efficiencies.

<table>
<thead>
<tr>
<th>Using less water whilst still providing the same or better service</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Retro-fit homes</strong></td>
</tr>
<tr>
<td>Water efficient showerheads can save over half the water used by the traditional showerhead. One of the largest users of energy of the home is water heating, therefore such an investment in showerheads will typically pay itself back within months.</td>
</tr>
<tr>
<td><strong>Buy front</strong></td>
</tr>
<tr>
<td>In Australia, the Victorian Government has made it compulsory for all new</td>
</tr>
</tbody>
</table>


1484 Private Communication.
<table>
<thead>
<tr>
<th><strong>loading washing machines</strong></th>
<th>clothes washing machines to be front loading rather than top loading (which are 40–75% less efficient). Front loading machines also work better because the chemicals are more concentrated and clothes last longer because they are not agitated.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indoor taps/sinks</strong></td>
<td>Cheap gadgets that reduce the flow by at least 30% can be attached to indoor taps to reduce the amount of water flowing into sinks.</td>
</tr>
<tr>
<td><strong>AquaLoc</strong></td>
<td>A new invention called AquaLoc replaces the traditional tap seat and washer and lasts for at least 15 years. Reductions in flow rates of up to 70% are possible, and in most situations water consumption costs are reduced by up to 45% when the recommended models are installed. Organizations that also bear the cost of wastewater can often add another 20–25% on this figure from savings on sewerage usage. By reducing water consumption, AquaLoc reduces the energy required for heating hot water, and power cost reductions can be up to 60% with significant savings in CO₂ emissions as a result. The main benefit of this, however, is reduced maintenance.</td>
</tr>
<tr>
<td><strong>Science laboratories</strong></td>
<td>Some laboratories still use respirators with tap water running for as long as is needed to create vacuums. Small desktop electric diaphragm pumps create better vacuums, thereby increasing lab workers productivity as much as fourfold whilst eliminating significant noise. These also pay themselves back through the water saved within two years.</td>
</tr>
<tr>
<td><strong>Recycling/reusing water</strong></td>
<td><strong>Recycling water used for industrial cooling</strong> In the Dutch industry the majority of this water use concerns the use of surface water in once-through coolers. A so-called open recirculating cooling system forms an ideal compromise, in which the benefits of water-cooling are preserved and the environmental disadvantages are reduced. Inside these systems, cooling water is recirculated in a cooling tower. The evaporation of a small part of the circulating water carries the largest amount of the heat away. The water intake that is needed to refill this part is a factor of 50–70 lower than the water intake of a once-through system with the same cooling capacity. Worldwide, the advance of these systems led to a strong reduction of surface water for cooling purposes.</td>
</tr>
<tr>
<td><strong>Water recycling decreases discharge to sensitive water bodies</strong> Take, for example, the release of water from the San Jose/Santa Clara Water Pollution Control Plant into the south San Francisco Bay that threatened the area’s natural salt water marsh. In response, a $140 million recycling project was completed in 1997. The South Bay Water Recycling Program now has the capacity to provide 21 million gallons per day of recycled water for use in irrigation and industry. By avoiding the release of this water, the conversion of salt water marsh to brackish marsh was prevented and the habitat for two endangered species was protected.</td>
<td></td>
</tr>
<tr>
<td><strong>Embedding water recycling into major</strong> Mawson Lakes, in Adelaide Australia is a 31/2-thousand home development for approximately 10,000 people. Attached to it is Australia’s largest fully self-contained recycled water scheme. All the water for re-use is collected on site,</td>
<td></td>
</tr>
</tbody>
</table>
and up to 70% of the water used by residents is recycled. Every house is fitted with two sets of pipes and the recycled water is used for toilets and gardening. A key challenge for recycling is storage, because the bulk of water falls in winter while the demand is in the summer. Mawson Lakes will store the water underground with the help of CSIRO’s urban water project team (see below).

### Storing water for later use

#### Storing stormwater in aquifers

Preliminary work by CSIRO’s Urban Water Program shows that the Adelaide Hills could provide water for the city’s needs all year round, with some to spare. ‘The potential recovery from storm water alone would supply almost a third of Adelaide’s current water needs’, says Mr Andrew Speers, leader of CSIRO’s Urban Water Program. In a normal year, Adelaide derives 40% of its water or 70 billion litres per year from the Murray river and 60% comes from the Adelaide Hills. Recycling just some of the city’s wastewater and run-off could reduce Adelaide’s dependence on the Murray to zero and reduce the use of water from the Adelaide Hills to less than half the current demand. This team won the inaugural Great Man-Made River International Water Prize award. Granted by UNESCO, the prize is for innovation in water resources management in arid and semi-arid areas. It rewards eight years of research, exploring the use of aquifers to store urban stormwater and reclaimed water to be reused in irrigation.

#### Commercial buildings

Australian Conservation Foundation’s 60L Commercial Green Building in Melbourne, Australia uses 90% less water than standard commercial buildings through a variety of measures including: minimizing the demand for water by providing water efficient fixtures and fittings, including waterless urinals and low flush volume toilet pans; using collected rainwater to replace 100% of normal mains water consumption whenever possible; 100% on-site treatment and reuse of grey-water (basins and sinks) and black-water (sewage) streams to produce reclaimed water for flushing toilet pans and irrigating the roof garden and landscape features.

### Harnessing new sources of water more cost effectively

#### De-salination breakthrough

Those living in the world’s arid regions could enjoy fresh water courtesy of a British architect, Charlie Paton, and his revolutionary seawater greenhouse. The pioneer building, which has won a series of awards, uses sunlight to turn salt water into fresh water for growing vegetables and for drinking water. The building operates at a fraction of the cost of traditional desalination plants, costing 21p to make 1000 litres of distilled water. At the heart of the design is a steel-framed greenhouse with ‘evaporators’ at each end made from corrugated cardboard. This creates a huge surface area, allowing fresh water to evaporate, leaving salts behind. These strengthen the cardboard, so that it will last indefinitely. The roof lets in light in the red and blue spectrums, which is needed for photosynthesis and infra-red and ultraviolet are used to heat air in a roof cavity to help to drive the evaporation processes. This first seawater greenhouse was built on Tenerife, partly with European Commission funds. A second is under development in
Oman and there are plans for others.1485

<table>
<thead>
<tr>
<th>Savings to taxpayers</th>
<th>Cheaper ways to purify water</th>
</tr>
</thead>
<tbody>
<tr>
<td>A recent study showed that the provision of adequate clean water to New York City by forests in the Catskill Mountains was equivalent to a capital investment of US$6–8 billion and an annual operating cost of US$1–2 billion for a plant to carry out the same service. The City took the option of maintaining water quality via ecosystem services by purchasing some small parcels of land, applying some covenants on the use of fertilizers in the catchment, and making a one-off investment of approximately US$1 billion to upgrade a few local sewerage plants. Hence, by taking ecosystems into account, NYC saved US$10 billion.</td>
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</table>

Source: Hawken et al1486 (1999, ch 11) and Postel1487 (1999)

In Australia, CSIRO has run a five year Urban Water R&D and delivery programme working with the major European Urban Water Network on urban water issues. CSIRO’s Australian Urban Water Program concluded that, ‘Together with water conservation, water re-use and recycling provides a means of extending limited water resources. In some circumstances, there is potential to support three times as much activity as is possible under traditional water use practices where water is used once and then thrown away.’

Urban water systems were designed largely to meet the health concerns of over 100 years ago, and ensuring clean water sanitation has had a profoundly positive effect on the overall health of OECD nations. But now, in the 21st century, innovations in water recycling and water treatment are making it possible to re-design urban water systems anew. For instance, as CSIRO’s Professor Mike Young stated: ‘One of the really interesting ones is how we use sewage water. Recent work by CSIRO’s urban water programme is showing that the most profitable sewage treatment plants now are really ones that treat effluent, between 5000 and about 8000 or 10,000 houses, so rather than having sewage treatment plants right at the end of the city and taking all the sewage the whole way down, you would take the sewage from say, 5000 houses, treat it, and then actually pass it down in a dual system through the rest of the city.’ As Professor Stuart White writes

‘Designing our sewer systems differently, to reduce the capital and maintenance costs and to improve the performance is an imperative. The basic structure and principles of our sewer systems have not changed since the nineteenth century. While they have achieved their original goal of protecting public health, the economic and environmental costs are ballooning. This is a problem for cities like Brisbane, as it is for cities like Bangkok. New twenty-first century approaches will involve investing more in treatment, rather

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than transport of waste. Smaller pipes, distributed treatment and reuse systems, absolute maximum efficiency of water use, both here and in developing countries." New developments and buildings should have appliances and landscapes that offer best-practice efficiency in water use and reduce demand by more than 40 per cent. Rainwater can be captured and wastewater treated and recycled in a decentralised way - rather than using drinking-quality water to flush toilets and water lawns. These strategies can reduce the net water demand and sewage discharge by more than 80 per cent. New decision-making methods are needed.

Figure 8.3 Comparison of Centralised and Decentralized Approaches to Wastewater Service. STP indicates a centralised sewerage treatment plant. (Source: Draft Handbook for Management of Onsite and Clustered (Decentralised Wastewater Treatment Systems (US. EPA 2003)

Rocky Mountain Institute (RMI) have published a major report on distributed methods of supplying and treating water. The report reviews the full range of benefits and costs of decentralized wastewater systems relative to conventional centralized systems, and discusses techniques for valuation of the economic benefits of decentralized systems.

The RMI report provides much evidence to suggest that decentralised approaches to water supply and treatment offer significant cost savings to enable developing countries to more cost effectively afford water infrastructure and also help OECD nations upgrade and replace aging water infrastructure.

Decentralised approaches to water supply and treatment offer reduced costs for the same reasons outlined in Chapter 7.3.4 concerning the hidden costs benefits of decentralised energy systems. Decentralised water systems are smaller than centralised systems and thus have both lower up front costs (See Figure 8.4) and shorter construction time reducing the cost of tying up capital unproductively or needing to rely on loans from banks.

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1490 Ibid.
Decentralised approaches also overcome the main risks of centralised systems namely that demand will not match the new level of supply. In cases when future demand fails to meet expectations, additional scheduled increments of decentralized capacity can be foregone, avoiding the cost of overbuilt centralized capacity. (See Figure 8.5)
Water efficiency and decentralised approaches to water supply and treatment offer significant potential to improve water productivity. However, the largest potential water productivity potential lies in the agricultural sector. Rural agricultural regions are responsible for ~70 per cent of freshwater usage hence water productivity improvements in rural regions result in significant reductions in freshwater demand. Much greater water efficiency can often be achieved through sealing irrigation channels and/or investing in sealed irrigation pipes and drip irrigation technologies. At the present time, most farming irrigation still occurs without the channels being sealed leading to significant water loss from evaporation or seepage into the soils. Hence, in principle, it is now possible for farmers to use water much more productively and thereby allow environmental flows of half the world’s rivers currently damned to be at least partially restored.

The use of fresh water on farms has halved in Israel since 1984, while the value of production has continued to climb. Farmers in India, Israel, Jordan, Spain and the US have shown that drip irrigation systems that deliver water directly to crop roots can reduce water use by 30–70 per cent and raise crop yields by 20–90 per cent. In the Texas High Plains, farmers using highly efficient sprinklers raised their water efficiency to more than 90 per cent while also increasing corn yields by 10 per cent and cotton yields by 15 per cent. Rice farmers in Malaysia saw a 45 per cent increase in their water productivity through a combination of better scheduling their irrigations, shoring up canals, and sowing seeds directly in the field rather than transplanting seedlings. Recycled water has been used for a number of years to irrigate vineyards at California wineries (US), and this use is growing. Recently, Gallo Wineries and the City of Santa Rosa completed facilities for the irrigation of 350 acres of vineyards with recycled water from the Santa Rosa Subregional Water Reclamation System. At Ararat, Australia, treated and recycled grey-water and sewerage (which previously went into a river) is used for irrigation and fertilizer adding AU$40 million per annum to the local wine industry in partnership with Southcorp Ltd. An AU$4 million investment to re-use grey-water now reaps an additional AU$40 million per annum from wine sales.

The Australian private Pratt Water Initiative commissioned CSIRO to undertake economic modelling of investing on a large scale in options for water use efficiency and distribution in the Murrumbidgee Valley. Their report evaluates the economic effects of the various options in terms of increased regional income and employment. It takes a holistic view of the region in estimating the value of water savings and business opportunities identified by the Pratt Project. The focus of this project was to examine the following options to improve the economic, environmental and social outcomes from improved water management

- The identification of potential water savings;

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1492 Ibid.
- The trialling of low-cost technologies to reduce water losses both on farm and off-farm;
- Opportunities for developing greenfield sites at low cost using lay-flat piping;
- Modifying the existing reliance on surface water supply and refocussing the design of water delivery to aquifer recharge and recovery;
- Options for improving supply reliability and overcoming capacity constraints during times of peak demand; and
- Options for cost effectively meeting environmental demands.

The 2005 report by CSIRO showed that 295 gigalitres could be saved from the Murrumbidgee and Coleambally Irrigation Areas while maintaining the current area of crops and reducing significantly the environmental impacts of irrigation. The Pratt Water Initiative conducted a study which found that the various water savings, including horticultural and large area efficiency improvements, have the potential to increase regional income in the Murrumbidgee Valley by between $34 million and $45 million per year. This increase in income will be associated with employment increases of around 220 persons. The above results assume that the water savings are achieved relative to a baseline of current (non drought) water allocations. However, it could be expected that in years to come there will be increasing pressures for environmental flows. To account for this, they have also evaluated the water savings relative to an alternative baseline where total water availability in the region is reduced by 20 per cent. Under this alternative, the Initiative’s water savings increase regional income by between $97 million and $162 million per year. These income increases are associated with maintaining employment of up to 2000 jobs. This increase in income is between $1450 and $2400 per household in the Valley.

In addition to water savings, the Pratt Water Initiative also identified a number of business opportunities (including the establishment of plantations and new sources of demand for agricultural commodities) that, while valuable in their own right, could also be used to increase the value of the water savings. They project that these business opportunities, if taken up, will increase regional income by between $75 million and $155 million per year. This increased income is associated with additional employment of around 2500 persons.

The National Heritage Trust in Australia has published two “Innovation in Irrigation” publications featuring 18 individual case studies which broadly support at farm level the macroeconomic results of

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the CSIRO study. These case studies confirm that through using existing technologies and approaches significant levels of decoupling are possible. Two case studies from these publications illustrate well the above points

- **Stone Fruit Farmer Cuts Water Use 30%**

  MJ Hall and Son’s Stone Fruit Company in Shepparton Victoria is a third generation family company, managing properties for investment schemes as well as owning and leasing orchards around Mooroopna and Tatura. Reducing water costs is so important they have installed new mini-jet irrigation systems on all six farms. This has cut water use by 30 per cent from the flood irrigation they used to use. Peter Hall, the owner says, “Large orchards require complex control systems. We couldn’t find one we wanted, so worked with a supplier to develop the mini-jet sprinkler system and computer controls that produce accurate applications of water.”

  As a Director of the Northern Victorian Fruit Growers Association, Peter takes part in many workshops with other irrigators and those supplying them with water. “Water’s definitely becoming more expensive and more of an environmental issue overseas, so efficiency is a competitive advantage when we’re so far ahead,” he said. “In Europe, it’s also a marketing advantage. To sell fruit into the European Union (EU) these days you have to demonstrate your environmental credentials.”

- **Viticulturalist Cuts Water Use in Half**

  Many farmers like Peter Hall are achieving significant water efficiencies. Since Peter and Jacque Schulz took over Salmon Gum Estates in South Australia’s Riverland near Loxton in 1986, they have halved their water use and doubled their tonnage. The couple grow a number of different varieties of wine grapes across nearly 72 hectares of vineyard. In 1998 they installed moisture probes around the vines at five different levels; the first four levels (10, 20, 40 and 70 centimetres) measured the moisture in the root zone, while the fifth, at 120 cm, represented the drainage level. The second big change came in 2001, when the Loxton Irrigation System was regenerated delivering a different level of pressure, so Peter changed from an overhead sprinkler system to a drip system, and the third major change is that Peter’s entire irrigation system is controlled by computers. The system’s computer program tells growers how much water is available from their pipeline at any given time. Peter now orders his water on an as-needed basis. “One of the most water efficient things about this system is

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1496 Ibid.
that it has eliminated the use of channels and overflows” Peter said. “Using the drip system and the moisture probes... we have almost halved our water use.”

To conclude, there is significant potential and great need for the world to achieve greater decoupling of economic growth from freshwater extraction. As well as the technical options presented here there is a significant need for policy and institutional reform to enable this. A discussion of what policy reform is required is beyond the scope of this thesis. The reader is referred to the following publications which address this topic in detail.

8.4 Decoupling Economic Growth from Waste Production through Resource Productivity - Recycling, Re-use and Product Stewardship.

Municipal waste generation is still increasing in OECD countries, but at a slower pace since 2000. As the OECD has stated that

“With continuous growth in the global demand for materials and the amounts of waste generated and disposed of, conventional waste policies alone may not be enough to improve material efficiency and offset the waste-related environmental impacts of materials production and use. New integrated approaches - with stronger emphasis on material efficiency, redesign and reuse of products, waste prevention, recycling of end-of-life materials and products and environmentally sound management of residues - could be used to counterbalance the environmental impacts of waste throughout the entire life-cycle of materials.”

To significantly decouple economic growth from waste generation, emphasis needs to be on reducing the amount of resources needed in the first place, designing for re-use of materials, and recovery and recycling of resources as much as possible. Through this 4R approach of reducing, re-using, recycling and recovery of resources, waste of resources is minimised and significant decoupling can be achieved. There is significant potential for improvements in this area. Currently, ninety-five per cent of all raw materials used in production are transformed into waste products within six months of being sold.

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Ibid


OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
“In the American economy, the material that we extract from the planet, that we mobilise for economic purposes, and process and move around and ultimately dispose of, totals about 20 times your body weight per person per day… only about one per cent of it ends up in durable goods; the system is about 99 per cent waste.”

The world is moving steadily into the age of conservation with recovery and recycling as an integral part. Today, separation and recovery of resources/materials and recycling is a significant part of industry internationally. Technologies and techniques are available for a significant percentage of the major waste streams from cities and towns to be separated and recycled now. Ideally it is best to have separation of waste at source. But technologies and techniques exist to now separate the waste stream.

Recycling industries contribute now significantly to national GDP. Recycling employs over 1.5 million employees in more than 50 countries with an annual turnover exceeding US$160 billion dollars. Recycling processes over 600 million tonnes of commodities annually. A recent international review of life-cycle analysis (LCA) work on key materials that are collected for recycling clearly demonstrated that recycling usually has more environmental benefits and lower environmental impacts than other waste management options. From 188 scenarios that included recycling, the overwhelming majority (83%) favoured recycling over either landfilling or incineration. Recycling can also provide considerable economic and social (e.g. increased employment) benefits. The US EPA studies show that recycling and remanufacturing contribute significantly to the US economy. According to the study, the recycling and reuse industry consists of approximately 56,000 establishments that employ over 1.1 million people, generate an annual payroll of nearly $37 billion, and gross over $236 billion in annual revenues. This represents a significant force in the U.S. economy and makes a vital contribution to job creation and economic development. In addition to the economic activity of the recycling and reuse industry itself, other economic activity is supported because the industry purchases goods and services from other types of establishments (such as office supply companies, accounting firms, legal firms, building and landscape maintenance firms, etc.). Economic modelling estimated that nearly 1.4 million jobs are maintained in support businesses because of the recycling and reuse industry. These jobs have a payroll of $52 billion and produce $173 billion in receipts.

There are numerous success stories from which other cities and countries can learn. In most European countries landfill levies are significantly higher than for most USA and Australian cities which has

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resulted in higher levels of recycling. Numerous European countries and, for instance, Japan are introducing product stewardship legislation that places some responsibility on the manufacturer to take back their product and recycle it. European law already requires 90% of certain appliances and cars to be designed to be recyclable. Singapore, in their 10 Year Green Plan for 2002-2012, have committed to a 60% recycling target by 2012. Northern Island introduced a levy on plastic bags that reduced their usage by 90% within 6 months. Twenty-five years ago South Australia implemented a levy on soft drink, beverages and milk cartons that has resulted in 85% being recycled.

In the shorter to medium term, the technical knowledge already exists to cost effectively address the major waste streams of OECD and non OECD countries. There are cost effective recycling opportunities for paper, organics, plastics, oils, packaging, many chemicals and metals. There are also ways of designing plastics to biodegrade efficiently and even recycle construction waste, including concrete. Further, increasing proportions of components in electrical goods can be recycled.

Thus some governments now are even committing to 100 per cent decoupling of economic growth from waste generation. The ACT government was the first to commit to achieving zero waste to landfill. The Australian Capital Territory (ACT) Government became the first local authority in the world to commit to achieving ‘No waste by 2010’ in the mid 1990s. Since that time, the ACT has reached a point where it now recycles 66% of its waste stream, and in the process has created over 200 new jobs. Not only has this created an additional 200 jobs in the ACT, but also during this period the ACT region has experienced strong economic growth. Numerous local governments now are following suit globally to achieve targets of at least 70 per cent and in some cases 100% decoupling of waste to landfill.

Achieving significant decoupling of economic growth from waste generation globally will involve managing the environmental impacts of extracting, processing, using, recovering and disposing of materials, not only from an environmental perspective but also from an economic and trade perspective. More coherent management policies will be needed, based on a mix of integrated demand and supply-oriented measures. To be successful, such policies will need to be supported by reliable information on waste and material flows, and on resource productivity, and with sound analysis using material flow analysis, input output analysis, life-cycle analysis, cost-benefit analysis and so forth.\(^\text{1504}\)

Improving resource productivity and putting in place effective and integrated materials management policies within the context of economic development and globalisation are not easy. They require a good understanding of the economic efficiency and environmental effectiveness with which resources and materials are used throughout their life-cycle, and need to be supported by reliable information on material flows. Existing information is insufficient to give a coherent view of how different materials flow through the economy (from their extraction or import to their final disposal). It does not give

many insights into how these flows relate to environmental risks and impacts and to resource productivity, or how globalisation and foreign outsourcing affect international flows of materials and related environmental impacts. Knowledge gaps also remain about waste and recyclable materials. This is why the OECD countries have established a common knowledge and information base on material flows and resource productivity. The objective is to enable sound, fact-based material flow analysis at the national and international level and to inform related policy debates. The OECD is working on two concurrent streams of activity:

1. Improving the quantitative knowledge base, by providing guidance to countries on how to construct material flow accounts and indicators in a coherent framework and by compiling material flow information from existing data sources.

2. Improving the analytical knowledge base, by using material flows information in policy analysis and evaluation, including in OECD country environmental performance reviews, in work on sustainable materials management and in 3R (reduce, reuse, recycle) activities.

Efforts over the last 30 years have shown that waste policies which take an end of pipe approach have, at best, achieved relative decoupling. As a result of this now many countries have, or are developing, integrated waste and materials policies which address environmental impacts along the whole life-cycle of products and materials. Examples include Japan’s 3R-approach (Reduce, Reuse, Recycle), China’s Circular Economy, the European Union’s Thematic Strategy on Sustainable Use of Natural Resources and on Waste Prevention and Recycling (recycling society), and the US’s Beyond RCRA: Waste and Materials Management in the Year 2020. As the OECD states:

Common elements of these integrated policies are:

- Targeting primarily the environmental impacts rather than material use per se
- Putting wastes into the material balance context of societies
- Taking an integrated life-cycle approach
- Increasing use of economic instruments, such as taxes and tradable permits; and
- Building partnerships with stakeholders, rather than using command-and-control approaches.\(^{1505}\)

These integrated policies normally target the most environmentally harmful products, materials and activities. They place stronger emphasis on material efficiency, redesign and reuse of products, recycling of end-of-life materials and products (i.e. considering end-of-life materials and products as

\(^{1505}\) OECD (2008) OECD Environmental Outlook to 2030. OECD. Available At http://www.oecd.org/document/20/0,3343,en_2649_37465_39676628_1_1_1_37465,00.html Accessed 22.03.2008
resources rather than waste), and environmentally sound management of residues (management standards).

Integrated policies such as these are needed to do this because clearly the most cost-effective way to reduce waste is to redesign waste out of processes and products as was discussed and outlined in Chapter 5 and in Appendix 5.1. Encouraging design for greater recyclability through extended product responsibility legislation is key way that nations should try to shift from relative to absolute decoupling of economic growth from waste production.

**Conclusion**

This chapter has shown that the costs of inaction on environmental protection significantly outweigh the costs of action. This chapter has shown that wise and effective investment in environmental protection is economically efficient. This chapter has also begun to show that there are numerous tools already that can be used to significantly decouple economic growth from environmental pressures. Still decision makers see environmental protection as a cost. Certainly there are upfront investment costs, structural adjustment costs and social and political costs which need to be managed. This chapter has shown that many tools, new designs and technologies to enable cost effectively to reduce pollution whilst achieving higher resource productivity whilst achieving often better population health outcomes. The secret to achieving this is better and more effective sustainable design to meet humanity’s needs whilst both reducing pollution and improving resource efficiency.

Since reducing pollution reduces negative health costs and losses of labour productivity and improving resource productivity boosts company profits and the economy, these tools provide new sources of ‘green’ resource productivity growth which has a high probability of delivering higher long term economic growth than ‘business as usual’.

This chapter has shown that to decoupling economic growth from many environmental pressures is the best strategy for long term economic growth.

This chapter has shown that long term economic growth and prosperity are best served by decoupling economic growth significantly and rapidly from biodiversity loss, air, water, chemical pollution and waste generation.
Chapter 9. Conclusion: 10 Steps to Advance and Resolve the Great Sustainability Debates

This chapter revisits the main arguments and contribution of this thesis. It proposes ten additional steps to help advance and resolve the great sustainability debates. Finally, the chapter also reflects on the contribution needed by boundary organizations to progress these debates.

Whilst this thesis has sought to help advance and resolve significant sustainability debates, it is important to acknowledge that debating is a healthy activity: through it we recognize and acknowledge other points of view, expand our understanding of the world, its challenges and their potential solutions. One of the first things that dictators do is try to limit debate.

Why Advancing and Resolving the Great Sustainability Debates Matters?

Whilst it is wise to be able to agree to disagree there are some issues where it is important that consensus is reached sooner than later. This thesis argues that it is important that a new consensus is reached on sustainability issues as soon as possible. This is because the latest science tells us that there is a small window of three decades or so to avoid dangerous climate change, irreversible loss of biodiversity and habitat, land degradation and ecosystem collapse. This thesis has argued that similarly it is vital that greater efforts are made to help nations out of the poverty trap to save millions of lives, reduce the rate of population growth, and give millions the chance of sustainable livelihoods instead of allowing more nations to slip into vicious cycles of violence, conflict and human and environmental degradation. The poorest countries are the most politically, socially and environmentally vulnerable, unstable and prone to conflict. Often these conflicts spill over national borders and entrap regions in conflict for years further reducing their capacity to escape poverty. In an age of globalization, weapons of mass destruction and terrorist threats, this thesis has argued that it is vital that nations act on their commitments to work together to reduce global extreme poverty.

None of these issues can be addressed overnight: no matter how determined a company or a nation is to achieve sustainable development, these changes will take time to implement, hence there is no time to waste. The World Banks 2003 Development Report summed up the situation well:

Some problems of sustainability are already urgent and require immediate action; Another category of issues unfolds over a longer time horizon. These problems may not be urgent, but the direction of change is unmistakable. For these it is essential to get ahead of the curve and prevent a worsening crisis before it becomes too costly. Biodiversity loss and climate change are in this category...What is
clear is that almost all of the challenges of sustainable development require that action be initiated in the near term.\textsuperscript{1506}

Very simply, the sooner companies or nations start, the longer they have to phase in changes, the less disruptive and more beneficial this will be to business and society and the best chance we have of long term success. For instance, it has taken Australia almost two decades since the government mandated that all new cars purchased from 1st January 1986 run on unleaded petrol to achieve a shift in the dominant fuel source for vehicles (Figure 9.1)

\begin{figure}[h]
\centering
\includegraphics[width=0.5\textwidth]{australian_petrol_sales.png}
\caption{Graph of Australian Petrol Sales: 1987-2008, Leaded vs. Unleaded (Source: Robinson, B (2002))\textsuperscript{1507}}
\end{figure}

This thesis has sought to inform consensus by showing there are ways to reconcile and resolve jobs (Chapters 2 and 3), business competitiveness (Chapter 4) and economic growth (Chapters 5-8) with sustainability.

\textbf{Thesis Contribution to Advancing the Sustainability Debates and Ecological Modernisation Discourse}

This thesis highlighted the need for urgency in trying to raise awareness about these new frameworks and strategies to resolve sustainability debates and conflicts by showing that these debates have progressed surprisingly little over time. Chapter 1 demonstrated that the current trajectory of development and economic growth is not environmentally sustainable. Chapter 2 showed that debates about the environmental sustainability of development have come and gone since the ancient


civilization of Sumaria encountered problems of salinity. Chapter 2 also summarised key results from the works of Diamond\footnote{Diamond, J (2006) \textit{Collapse: How Societies Choose to Fail or Succeed}. Random House} and Tainter\footnote{Tainter, J. (1993) \textit{The Collapse of Complex Societies}. Cambridge: Cambridge University Press} to demonstrate this. Chapter 2 also showed that sustainability debates have been going on in a modern context far longer than most people realize. Chapter 2 for the first time integrated in a novel way a wide range of evidence to show that a significant opportunity was missed in 1908-9 when Theodore Roosevelt called on world leaders to meet at the Hague for a summit on the global environment and resources. In Chapter 3, it was shown that many factors contribute to the fact that so many past civilisations did not survive and why in modern times little progress has been made to achieve sustainable development. Chapter 3 provided much evidence to suggest that the problem of overshoot and delayed feedbacks, ignorance of ecological limits, unforeseen consequences of technology, war and conflict, and vested interests have been significant factors in why both ancient civilizations have not survived and why inadequate progress has been made.

Chapter 3 also argued that in modern times the rise of the corporation and the requirement under corporate law to maximise profits to shareholders has created a new driver which has motivated the funding of think tanks to run campaigns against aspects of sustainable development. Chapter 3 showed that a review of “independent” environmental scepticism literature from the past 30 years has found that the vast majority of sceptics are directly linked to politically oriented, conservative think tanks. The study\footnote{Jacques, P.; Dunlap, R.; Freeman, M. (2008) \textit{The Organisation of Denial: Conservative Think Tanks and Environmental Scepticism}. Environmental Politics, Volume 17, Issue 3 June 2008, pages 349 – 385 Available at http://www.informaworld.com/smpp/content-content=a793291693–db=all–order-page} analysed books written between 1972 and 2005 which deny the urgency of the need for environmental protection and concluded that more than 92 percent of authors were affiliated to right wing think tanks which promote anti-sustainable development ideas. Chapter 3 highlighted that the main strategy of the think tanks has been to

- Dispute the science and argue that environmental problems are not as bad as some scientists suggest, focusing on inevitable uncertainty.
- Argue that action by government on sustainable development issues will increase costs to business and harm business competitiveness, employment and the economy.
- Argue that the costs of action are so great compared to the costs of inaction that government should not take action.

Chapters 4 showed that action to achieve sustainable development need not harm business competitiveness. Chapter 4 showed that, with effective government policy, competitiveness risks can be virtually eliminated. Chapter 4 showed that the majority of sector based studies to date show that companies leading on environmental and social issues in their sector outperform their competitors.
Chapter 4 showed clear links between improved sustainability performance on the environmental and social dimensions, and a company’s financial results. Chapter 4 also integrated modern microeconomic theory to demonstrate why significant eco-efficiency opportunities still exist for many businesses. Finally, in the Appendices to Chapter 4 some of the genuine barriers to corporate sustainability were acknowledged and addressed.

Chapter 3 and 6 showed that a transition to sustainable development, with green tax shifting, can lead to higher employment not less. Chapter 3 showed that almost all economists who have studied the jobs-environment debate over the last thirty years agree that the three propositions identified above are false. In reality, at the economy wide level, there has simply been no trade off between jobs and the environment. Chapter 3 and 6 acknowledged the need for structural adjustment packages to compensate and retrain workers affected by the closing down of unsustainable industries as part of any serious attempt to achieve sustainable development.

Chapter 5 to 8 showed that the argument that pursuing sustainable development will harm economic growth significantly was also untrue. Chapter 5 to 8 also demonstrated that economic growth and environmental sustainability need not be incompatible. Chapter 5 addressed many of the main criticisms of ecological modernisation. Critics of ecological modernisation argue that economic growth cannot be decoupled from physical growth and environmental pressures. Chapter 5 to 8 brought together empirical evidence which demonstrated that the technological means and the policy tools needed to achieve decoupling have been deployed in one country or another in the world today.

Critics of ecological modernisation, even if they acknowledge that decoupling is possible, dispute that it will be sufficient to achieve environmental sustainability on the scale or speed required. Chapter 5 and Chapters 7 and 8 have shown that there is significant evidence to suggest that decoupling of Factor 4-10 could be achieved. Chapters 5, 7 and 8 showed that where nations have tried to achieve significant decoupling, large and rapid reductions in environmental pressures were achieved. The thesis also introduced the fact that there are now advanced strategies such as Whole System Approaches to Sustainable Design which has been able to achieve large Factor improvements through design.

Sophisticated critics of ecological modernisation also argue that negative rebound effects will undermine efforts to decouple economic growth from environmental pressures through eco-efficiency and resource productivity improvements. Chapter 5 outlined in detail how policy measures and incentives are needed as part of broad community awareness raising and education to turn negative rebound effects into positive amplification effects. Chapter 5 outlined modelling by Foran et al.

which shows that, through appropriate policy measures, the negative rebound effect can be significantly reduced.

By addressing these criticisms of ecological modernisation Chapter 5 sought to advance the “growth” debates. Chapter 5 outlined four main strategies to help advance the “growth debates”. In Chapter 5, four key insights were presented to assist in moving these “growth” debates forward to allow the creation of a new form of economic growth that is socially and environmentally sustainable:

- The first insight was that the main issues of concern—environmental degradation, pollution and global inequality—are in fact examples of market, informational and institutional failures. Chapter 5 showed that both the survivalist and the ecological modernisation discourse agree on the fact that market, informational and institutional failures are factors which cause unsustainable development. Chapter 5 showed that, when government does address the market, information and institutional failures through more effective policies and regulations, industry and R&D bodies have responded with innovations to achieve decoupling.

- The second insight is that economic growth and physical growth of the economy are not the same. By clearly differentiating between economic and physical throughput growth, and focusing on how to achieve significant decoupling, this chapter moves on from the traditional economist versus environmentalist debates about growth. Rather than arguing whether growth is good or bad and whether it should be increased or slowed, this chapter seeks to shift the debate to be about:
  
  a) How to achieve the decoupling of economic growth from negative environmental pressures and negative societal impacts?
  
  b) What progress has been made thus far to achieve such decoupling?
  
  c) What can we learn from those who have achieved significant decoupling?
  
  d) What do empirical studies suggest to be the policies to help achieve such decoupling?

- The third key insight chapter 5 used to move the “growth” debates forward was to explain why GDP defined economic growth does not correlate well with welfare and well-being once people earn more than $10,000 per annum. What matters is well-being, not whether the rate of GDP economic growth is 2.2 or 2.1 per cent per annum. This is an important result. Consequently, proponents of sustainable development only need to show that their initiatives will not harm economic growth significantly. All the studies to date show that achieving ecologically sustainable goals will at worst only reduce economic growth over the long term by an insignificant amount. In the past most politicians and some economists have still seen this as a significant cost to the nation. But slightly less economic growth by 2050 does not mean a cost to citizens because what it really means is that they will be slightly less richer by that date. Does
it matter if the Australian economy is 130% richer by X date in the future or 120% richer by X date in the future?

To test this argument, Chapters 6 and 8 looked at the estimates of costs of action to achieve sustainable development across a wide range of social and environmental issues and compared these, where possible, with estimates of costs of inaction. Chapter 6-8 showed that the upfront costs of action to achieve social and environmental goals are affordable and will have negligible negative effect on the economy. Chapters 6-8 investigated how seeking to achieve social sustainability and environmental sustainability goals correlates with strong economic growth.

Chapter 6 demonstrated that addressing many social goals such as reducing corruption, improving health and education outcomes correlate with higher economy growth. Chapter 6 also provided evidence to show that social sustainability goals such as ending extreme poverty were affordable and would have negligible negative effect on OECD economic growth rates.

In Chapter 7 it was shown that decoupling economic growth from greenhouse gas emissions, if implemented wisely as a transition, would not harm economic growth significantly. Chapter 7 outlined how most studies show that there would be a negligible effect positively or negatively on economic growth from a shift to ecological sustainable development. An example of this was the economic modelling by CSIRO1513 and Allen Consulting which showed that for the Australian economy achieving 60 per cent cuts to greenhouse emissions by would still achieve a 2.1 per cent per annum increase in GDP.1514

The well-being and happiness literature suggests that most people in OECD countries who have achieved a reasonable standard of living will support such modest reductions in GDP if, as a result, a significant public good such as avoiding dangerous climate change is achieved. Other studies suggest that an effective shift to environmental sustainability could help rather than harm economic growth.

Chapter 7 showed that the latest economics of climate change from Stern1515 and Garnaut1516 correspond with many of the central arguments of this thesis namely that

- Significant decoupling of economic growth from greenhouse gas emissions is achievable.
- Early action on climate change is cheaper than later action
- The costs of inaction significantly outweigh the costs of action.

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1514 Hatfield-Dodds,S (2006) Private Communication, CSIRO.


These results are significant to the overall argument of the thesis by indicating that many actions required to decouple economic growth from greenhouse gas emissions will also decouple economic growth from other environmental pressures and help achieve overall sustainable development.

Chapter 8 further explored the costs of action versus inaction on decoupling economic growth from other environmental pressures such as loss of biodiversity and natural resources, air and water pollution and waste production. It showed that the costs and risks of inaction outweighed the relatively modest costs of action. Chapter 8 quoted recent OECD studies which show that the costs of policy inaction on environmental pressures are significant. The OECD Environmental Outlook to 2030 showed that the costs of policy inaction were particularly high for water pollution, especially in developing countries; for air pollution, as much as a few percentage points of GDP in the US, the EU and China; important in the case of unsustainable natural resource management; and for climate change, in the range of 1 to 10 per cent of global output. Chapter 8 showed that where governments had overcome vested interests and taken strong action, significant decoupling had been achieved.

These topics in chapter 8 were not chosen randomly: they are the main areas for which the OECD has developed decoupling indicators. Thus chapter 7 and 8 provide nations with a useful resource to mount the case for adopting decoupling targets and indicators.

Chapters 5-8 showed that economic reasons are amongst the strongest to motivate early and urgent action to protect the environment, because early action to protect the environment costs far less than solving an environmental or social problem once it has passed irreversible tipping points. They showed that, at worse, action on sustainable development would have a negligible negative effect on OECD economic growth rates whilst helping to improve the quality of economic growth and development in developing countries.

Thus this thesis has shown that it is possible to create a new form of economic growth that is environmentally and socially sustainable. In Chapter one, I quoted Dryzek who stated that “Much of its (ecological modernisation’s) appeal lies in its promise that “we can have it all: economic growth, environmental conservation, social justice”. This thesis has shown that there is significant evidence to support this core hypothesis of ecological modernisation.

The results of chapters 5-8 also provide significant evidence for the first time to suggest that “greening” of economic growth to achieve “green growth” is not only technically feasible but also economically efficient. These results build upon earlier works on “green growth” and provide now significant evidence, when taken together, that it is in all nation’s long term economic interests to


pursue “green” growth - with a focus on decoupling economic growth from environmental pressures, restoring natural capital and increasing efforts to achieve poverty reduction.

Thus it is hoped that this thesis will help to significantly move forward many of the great sustainability debates. To further assist, I wish to conclude with reflections on key lessons from this thesis to assist those wishing to progress the sustainability debates.

**Step 1: Take a Solutions Based Approach.**

Firstly, the main lesson for those who wish to sound the alarm and warn the world about the problems listed at the start of this chapter is do not do so. It is wise, where possible, to wait until you have worked out an array of options and alternative paths forward. So often the reason that little progress has occurred in addressing the warnings of scientists has been the fact that no cost effective solutions or alternatives were presented. Until alternative solutions and approaches are available decision makers in business and government will have a tendency to deny the problem. Scientists mistakenly believe that the reason that so little progress has been made is because decision makers do not appreciate the scale of the problem. Such scientists spend their whole time trying to explain to decision makers and the general public that the problem (biodiversity loss, pollution, climate change, soil fertility loss, extreme poverty) is great. The reason that so little progress is being made is because decision makers, professionals and the general public are ignorant of the solutions, not the problems.

**Step 2: Seeing is Believing: The Importance of Benchmarking.**

As well as proposing solutions, demonstrable cases of success are needed. Lack of progress has been made on sustainable development because many politicians, business leaders and decision makers do not believe that it is possible. Even if a politician or a decision maker believes that some aspects of sustainable development can be achieved few believe that all social and environmental sustainability goals can be achieved simultaneously especially in developing countries. The case study of Curitiba, (see Chapter X) shows that social and environmental sustainability goals can be achieved simultaneously.

Despite case studies like Curitiba, the belief that major trade offs between social, environmental and economic goals are inevitable still dominates. This thesis has sought to integrate and bring together a selection of case studies of success for many of the social and environmental sustainability goals to challenge this assumption. Empirical case studies and properly calculated benchmarking help to move the debates forward by avoiding the need for lengthy debate about whether particular sustainability goals are achievable, proving that steps have already been taken by someone, somewhere, to achieve it. If benchmarked case studies in sustainable development or empirical studies are not presented then the debate can stall with a sceptic asking, “If this is such a good idea why has no one done it?” It is important therefore to identify where and how sustainability ideas have been implemented in practise to demonstrate that it can be done.
Step 3: Communicate Clearly the Costs of Action Earlier Rather Than Later

Thirdly, those who have been effective at moving the debates forward have communicated the costs of action versus inaction of aspects of sustainable development to business and political decision makers. The fact that the costs of inaction significantly outweighed the costs of action on removing ozone depleting substances was a significant factor in motivating countries to ratify the Montreal Protocol. The fact that the Stern Review has outlined clearly that the costs of inaction on climate change significantly outweigh the costs of action has been a major factor in shifting climate debates. The EU 2002 study “Late Lessons from Early Warnings: the Precautionary Principle 1896–2000” shows through an historical review that there are clearly benefits from a precautionary approach that identifies and addresses problems early rather than leaving them to worsen.

Step 4: Build Alliances and Create Processes to Resolve Uncertainties and Build Consensus.

Fourth, the quickest way to move debates forward is to build alliances and consensus. Historically, it has often been a minority scientific opinion that has sounded the original alarm about asbestos, smoking, PCB’s or ozone destruction. In Chapter 2, it was shown that by the 1770s the Academies of Science had reached consensus that deforestation caused desiccation, leading to regulatory changes around the world. More recently the IPCC played a similar role building consensus amongst over 3000 atmospheric scientists globally. No matter how solid the science when dealing with complex systems there is always uncertainty. It significantly helps the scientist who sounds the warning if many fellow scientists come out publicly in support. This may be difficult for scientists who work or are funded by for government or corporate funded laboratories that prevent them from making public comments on controversial matters. This suggests the importance of sustainability think tanks like the Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA). Such think tanks can play the role of consensus building facilitators, through involving multiple organisations in the development and review of research and communication projects.

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**Step 5: Identify Opponents of Sustainable Development and Seek to Find Common Ground.**

This thesis demonstrates the using decoupling using decoupling value in seeking to re-examine assumptions and beliefs to identify common ground. Traditionally many business and industry bodies have opposed the ideas encapsulated in sustainable development, but as Chapter 4 showed there is a strong business case for sustainable development. Similarly most people since the Limits to Growth debates have assumed that economists and proponents of sustainable development do not agree, but as Chapters 5-8 showed this is no longer the case. However, as Chapter 3 outlined, there clearly are vested interests and think tanks currently who have opposed many aspects of sustainable development systematically. Clearly trying to build consensus across all key stakeholders in business and in the right of politics on sustainable development is going to be a challenge. But even here it seems there are potential areas of agreement which allow sustainable development proponents and the Bush administration to work together effectively. A good example of this can be seen through the efforts of the Rocky Mountain Institute’s publication *Winning the Oil Endgame* which shows how nations can profitably get off oil within fifty years. Within four months of being released in 2004 over 160,000 copies had been downloaded freely from the Rocky Mountain Institute’s web site. Environmentalists have despaired in the last five years that it is possible to find any common ground with the US President Bush’s administration. In 2006, Bush announced that the US will seek to reduce oil imports by 75% by 2025. The Rocky Mountain Institute in the *Winning The Oil Endgame* sought to find common ground with conservative right wing thinkers by framing the issue of reducing oil usage and greenhouse gas emissions in terms of how to improve US national security. In other words RMI sought to find common ground with those who for national security reasons wish to reduce oil usage and greenhouse gas emissions. In addition in this study RMI put into practice Step 3 very effectively-namely communicating the costs of inaction versus action of an issue.

**Step 6: Present the Facts and Make the Linkages.**

One of the reasons RMI has been so successful is that they have contextualized the facts in ways that side step the compartmentalization and sensationalised style of debating in the media which outlined in Chapter 3. Also assisting RMI has been the fact that now it is possible to download their reports freely from the web, making it more difficult for governments and decision makers to ignore it. Thanks to the internet the mainstream media sources are now no longer the only way that most people access information. One of the main reasons that the world did not follow Roosevelt’s lead in 1908 is that most of the world was ignorant of the insights and innovations summarized in Appendix 2 of this

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thesis. No one in 1908 was working to bring this knowledge of sustainable development together. This is one of the reasons why sustainability think tanks such as Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA), are seeking to publish books and reports that bring together such information and make such publications freely available on the web.

**Step 7: Understand the Reasons Why These Debates Are Perpetuated**

Chapter 3 outlined reasons why these debates continue. It showed for instance, why corporations typically oppose anything that may harm their bottom line such as increasing environmental and social standards. Chapter 3 and 4 showed that the rise of the corporation has significantly affected the sustainability debates. Chapter 3 showed that corporations have regularly funded over the last 20 years studies by think tanks arguing that if certain environmental protection legislation is passed it will lead to catastrophic job losses, economic harm and capital flight. This has affected the popular psyche. This is why this thesis also brings together evidence for the business case for sustainable development in Chapter 4. In the context of the topic of this thesis, business and industry matter significantly to whether or not the sustainability debates progress. Even if a significant majority of companies genuinely embraced sustainable development it only requires a few well resourced interest fund think-tanks to challenge the entire case for sustainable development. Thus, pro-sustainability think tanks will be needed. Academics currently are increasingly overwhelmed with teaching and research requirements to have time to engage with the media on these debates. Hence sustainability promoting think tanks will be needed to counter the steady stream of reports, studies, articles and media appearances from think tanks that seek to perpetuate these myths. As stated in Chapter One this is the motivation for the formation of sustainability orientated think tanks such as Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA) and The Natural Edge Project (Australia).

**Step 8. Understand Why These Myths Resonate With Mainstream Voters.**

Globalisation, economic deregulation and reduction of tariffs has created increasingly intense competition in the marketplace. Since the late eighties developed nations and their companies have embarked on significant cost-cutting exercises. Competition policy and changes in workplace relations has meant more people are employed on short term performance based contracts, causing greater insecurity and uncertainty in the workplace. Economy-wide, inflation adjusted hourly wages for male

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workers are in a twenty year decline in many OECD countries. Many male workers, once they lose their jobs from established industries, do not recover their former salaries quickly. It is no wonder that people are concerned about highly visible government environmental policies that seem to them likely to further destabilize their communities. Also, these myths and debates persist from the fact that timber worker’s, coal miner’s and fishermen’s identify is closely tied up in these jobs. Many are 3rd or 4th generation working in these industries and do not know how to do any other jobs. Hence they fear anything that could affect their way of life. The environment movement has often not appreciated this fact. To effectively diffuse the myth that helping the environment will cost jobs, there will need to be structural adjustment and compensation packages and re-training to those workers and businesses in the sectors and regions of an economy that will be negatively affected. Workers in regional economies that are dependant on one main industry are understandably very concerned about anything that would affect that industry. Structural adjustment packages are not new, having been widely used in Australia to help sectors that have been hard hit by changes in international competition such as the car and steel industries, and sugar and fisheries.

**Step 9: Build linkages with other Central goals of Government: National Security, Economic Growth, Research and Development, Health and Education.**

As the The Bruntland Report - *Our Common Future*\(^\text{1526}\) wrote on pg 10;

> “Governments, pressured by their citizens, saw the need to clean up the mess and established agencies to do this…but much of their work has been after-the-fact repair of the damage. The mandates of the central economic and sectoral ministries are also often too narrow, too concerned with quantities of production or growth. The present challenge is to give the central economic and sectoral ministries the responsibility for the quality of those parts of the...environment affected by their decisions, and to give the environmental agencies more power to cope with the effects of unsustainable development.”

To achieve this it is vital that sustainability practitioners relate the goals of sustainability to the central goals of government and business respectively. In the case of government it is vital that sustainability practitioners learn how to relate sustainability to the central goals of government, namely achieving economic growth, competitiveness of industry, national security, health\(^\text{1527}\) and education. This thesis has addressed this in Chapter 4 (the competitiveness of industry) and Chapters 5-8 (economic growth). Other studies such as Rocky Mountain Institute’s *Winning the Oil Endgame* publication (national security) have also been mentioned. Other studies relating sustainability to health issues have


also been drawn upon in this thesis. This cumulative empirical evidence of this thesis therefore provides a compelling case of the multiple benefits in answer to Our Common Future challenge above.

**Step 10: Multi-Stakeholder Processes Within and Outside Government.**

The achievement of sustainable development is not possible by only one sector of society whether government, business or civil society. We live in a world where business, government and civil society all have power all must be involved in the process to achieve sustainable development.

To achieve sustainable development it is vital that goodwill to achieve sustainable development is underpinned by purposeful policy settings. If that can be achieved then this can help to minimize polarized debates, and open up possibilities for innovation and success. Therefore it is vital that, both within government and in broader society, institutions are set up to facilitate multi-stakeholder partnership for sustainability processes. Governments can significant help these processes by creating National Councils for Sustainable Development or equivalent councils at the regional government level to bring together representatives from key stakeholder/institutional groups.

In addition to new and effective institutions, “boundary organizations”, that bring representatives of the whole of society together, like Forum for the Future (UK), the International Institute of Environment and Development (UK), The Wuppertal Institute (Germany), The International Institute of Sustainable Development (Canada), The Earth Institute (USA), The Worldwatch Institute (USA), The Rocky Mountain Institute (USA) are also needed. Such new institutions and boundary organizations that can create processes and mechanisms to build consensus between business, government and civil society on many broad sustainability issues are vital.

At present, addressing the challenge of achieving sustainable development can involve political risks for government. A multi-stakeholder partnership approach can help to create processes to overcome that political risk. Such partnership approaches to sustainable development and new institutions and regulatory approaches will be vital also to move the globalisation debates forward. A race to the bottom is not inevitable, but it will take a partnership approach between civil society, government and business to achieve a race to the top involving deliberate strategic and collaborative choices (Table 9.1).

**Table 9.1: Do we want a race to the top based on best practise or a race to the bottom?**

<table>
<thead>
<tr>
<th>RACE TO THE BOTTOM</th>
<th>RACE TO THE TOP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Principle of Lowest Cost Location</td>
<td>Principle of World Best Practice</td>
</tr>
</tbody>
</table>

Government Response
<table>
<thead>
<tr>
<th>Corporate Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protect uncompetitive industry</strong></td>
</tr>
<tr>
<td>Leave it to the market</td>
</tr>
<tr>
<td>Leave costs of negative externalities to future generations</td>
</tr>
<tr>
<td>De-regulatory strategy</td>
</tr>
<tr>
<td>Total Faith in the 'Invisible Hand'</td>
</tr>
<tr>
<td>De-legitimizes NGO's</td>
</tr>
<tr>
<td>Set a level playing field</td>
</tr>
<tr>
<td>Provide information to address asymmetric information failures.</td>
</tr>
<tr>
<td>Tax shift from taxing labour ('societal goods'), such as payroll tax to taxing waste ('societal bads').</td>
</tr>
<tr>
<td>Utilize feebates</td>
</tr>
<tr>
<td>Strategic Trade Strategy</td>
</tr>
<tr>
<td>Improving National Systems of Innovation</td>
</tr>
<tr>
<td>Consult with legitimate NGO's</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Civil Society Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Opposition/radical</strong></td>
</tr>
<tr>
<td>Few links with industry or government</td>
</tr>
<tr>
<td>Re-active: Focused on stopping development</td>
</tr>
<tr>
<td>Creating independent certification schemes (Eco/Fair Trade labelling)</td>
</tr>
<tr>
<td>Building strategic alliances between business, government, and R&amp;D bodies to ratchet up standards nationally and globally</td>
</tr>
<tr>
<td>Pro-active: Setting the agenda by providing new models to tighten standards nationally and internationally by linking Porter’s Competitive Advantage of Nations analysis to best available technology and best available practise standards.</td>
</tr>
</tbody>
</table>
Conclusion: The Critical Role of Education for Sustainable Development

The debates discussed in this thesis concerning whether it is possible for to achieve sustainability and greater business competitiveness or higher economic growth are subject to a key condition. That condition is that people in decision making positions in business and government are talented at achieving at triple bottom solutions that improve social, economic and environmental outcomes simultaneously without any major trade offs. This thesis’s research in Chapters 4-9 shows that there is a strong case that environmental and social sustainability solutions are possible at the microeconomic and macroeconomic levels. But whether leaders and decision makers business and government and society act on this potential is another matter. Whether a company or a government achieves sustainable development depends on how well a company or a government implements these sustainable development principles and ideas. How well a company or a government implements a sustainability strategy depends on the decisions, technical choices or detailed policy decisions made by many people in that company or government over many years. How well people make decisions in this area depends on many factors including their knowledge and experience on developing strategies, processes and solutions for sustainable development. When it comes to implementing sustainable development for companies or government the devil is in the detail. A passion and real commitment to sustainable development is needed for decision makers in companies or government to achieve real eco-innovation or effective sustainability policy choices respectively. Whether decision makers make wise choices depends critically on whether these decision makers have had an appropriate education for sustainable development.

There is greater awareness now that, since many decisions affecting society are made by corporate boards of accountants, lawyers, engineers and economists, there is a need for professional development in the critical literacies related to sustainable development. Society currently require years of training for all specialists before they are expected to be world class at their profession. Yet currently there are few courses training the next generation in how to be world class at sustainable development at the tertiary level. There is a great shift in understanding in society of the need for change. For instance, UNESCO has responded by forming the Global Higher Education Partnership for Sustainability, involving over 1000 universities internationally.

Sustainable Development is the big challenge of the twenty first century and, if we are to meet this challenge, all need to be encouraged to play their part. The most cost effective way to reach millions of people with education for sustainable development is not only with the web but also through the

existing educational institutions. It is through institutional strength we have in Australia in our professional bodies, universities, schools and TAFE sectors that I believe Australia could lead the UN decade of Education in Sustainable Development. We have formal commitments to sustainability from many professional bodies in Australia and these bodies accredit university courses and so can lead and work with universities to develop materials to help universities change their curricula.

I have worked with industry groups, CSIRO, universities, professional bodies, and school education networks to find new ways to deliver education for sustainable development cost effectively. This has been achieved by partnering with education institutions to supply services and educational products that meet the needs of multiple audiences. This has involved seeking to achieve education for sustainable development through a multi-faceted, multi-media approach. More specifically, this means producing books, targeted education and training programs, industry sustainability reports and action plans, creating online databases. (See Appendix 1.1) Through these initiatives, myself and colleagues have sought to raise the level of critical literacies in sustainable development and thereby help more and more people to understand these critical issues. Through such efforts we have sought to help create the conditions under which ecological modernization, decoupling and environmental restoration are most likely to occur.

Books


Book Chapters


Journal

Refereed Conference Papers


Online Education and Training Publications


http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx


http://www.naturaledgeproject.net/Sustainable_Water_Solutions_Portfolio.aspx


http://www.naturaledgeproject.net/Whole_Systems_Design_Suite.aspx


http://www.naturaledgeproject.net/TNEP_ESSP_CLP_Introduction_to_Sustainable_Development_for_Engineering_and_Built_Environment_Professionals.aspx


http://www.naturaledgeproject.net/TNEP_ESSP_CLP_Principles_and_Practices_in_Sustainable_Development_for_the_Engineering_and_Built_Environment_Professions.aspx
Climate Change Publications


[http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx](http://www.naturaledgeproject.net/Sustainable_Energy_Solutions_Portfolio.aspx)


Universities and Sustainability Publications


Science Magazine Articles


**Industry Magazine Publications**


Awards

The Natural Edge Project:

- 2005 Banksia Award for Environmental Leadership, Education and Training
- 2005 Eureka Award Finalist in the Allen Strom Prize for Education in Sustainability

Individual:

- 2001 ANU Green Individual Environmental Award.
Appendix 1.2 The Earth Charter

PREAMBLE

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations.

Earth, Our Home

 Humanity is part of a vast evolving universe. Earth, our home, is alive with a unique community of life. The forces of nature make existence a demanding and uncertain adventure, but Earth has provided the conditions essential to life's evolution. The resilience of the community of life and the well-being of humanity depend upon preserving a healthy biosphere with all its ecological systems, a rich variety of plants and animals, fertile soils, pure waters, and clean air. The global environment with its finite resources is a common concern of all peoples. The protection of Earth's vitality, diversity, and beauty is a sacred trust.

The Global Situation

The dominant patterns of production and consumption are causing environmental devastation, the depletion of resources, and a massive extinction of species. Communities are being undermined. The benefits of development are not shared equitably and the gap between rich and poor is widening. Injustice, poverty, ignorance, and violent conflict are widespread and the cause of great suffering. An unprecedented rise in human population has overburdened ecological and social systems. The foundations of global security are threatened. These trends are perilous—but not inevitable.

The Challenges Ahead

The choice is ours: form a global partnership to care for Earth and one another or risk the destruction of ourselves and the diversity of life. Fundamental changes are needed in our values, institutions, and ways of living. We must realize that when basic needs have been met, human development is primarily about being more, not having more. We have the knowledge and technology
to provide for all and to reduce our impacts on the environment. The emergence of a global civil society is creating new opportunities to build a democratic and humane world. Our environmental, economic, political, social, and spiritual challenges are interconnected, and together we can forge inclusive solutions.

Universal Responsibility
To realize these aspirations, we must decide to live with a sense of universal responsibility, identifying ourselves with the whole Earth community as well as our local communities. We are at once citizens of different nations and of one world in which the local and global are linked. Everyone shares responsibility for the present and future well-being of the human family and the larger living world. The spirit of human solidarity and kinship with all life is strengthened when we live with reverence for the mystery of being, gratitude for the gift of life, and humility regarding the human place in nature. We urgently need a shared vision of basic values to provide an ethical foundation for the emerging world community. Therefore, together in hope we affirm the following interdependent principles for a sustainable way of life as a common standard by which the conduct of all individuals, organizations, businesses, governments, and transnational institutions is to be guided and assessed.

The Earth Charter

PRINCIPLES
I. RESPECT AND CARE FOR THE COMMUNITY OF LIFE

1. Respect Earth and life in all its diversity.
   a. Recognize that all beings are interdependent and every form of life has value regardless of its worth to human beings.
   b. Affirm faith in the inherent dignity of all human beings and in the intellectual, artistic, ethical, and spiritual potential of humanity.

2. Care for the community of life with understanding, compassion, and love.
   a. Accept that with the right to own, manage, and use natural resources comes the duty to prevent environmental harm and to protect the rights of people.
   b. Affirm that with increased freedom, knowledge, and power comes increased responsibility to promote the common good.
3. Build democratic societies that are just, participatory, sustainable, and peaceful.
   a. Ensure that communities at all levels guarantee human rights and fundamental freedoms and provide everyone an opportunity to realize his or her full potential.
   b. Promote social and economic justice, enabling all to achieve a secure and meaningful livelihood that is ecologically responsible.

   a. Recognize that the freedom of action of each generation is qualified by the needs of future generations.
   b. Transmit to future generations values, traditions, and institutions that support the long-term flourishing of Earth's human and ecological communities.

In order to fulfill these four broad commitments, it is necessary to:

II. ECOLOGICAL INTEGRITY

5. Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and the natural processes that sustain life.
   a. Adopt at all levels sustainable development plans and regulations that make environmental conservation and rehabilitation integral to all development initiatives.
   b. Establish and safeguard viable nature and biosphere reserves, including wild lands and marine areas, to protect Earth's life support systems, maintain biodiversity, and preserve our natural heritage.
   c. Promote the recovery of endangered species and ecosystems.
   d. Control and eradicate non-native or genetically modified organisms harmful to native species and the environment, and prevent introduction of such harmful organisms.
   e. Manage the use of renewable resources such as water, soil, forest products, and marine life in ways that do not exceed rates of regeneration and that protect the health of ecosystems.
   f. Manage the extraction and use of non-renewable resources such as minerals and fossil fuels in ways that minimize depletion and cause no serious environmental damage.

6. Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach.
   a. Take action to avoid the possibility of serious or irreversible environmental harm even when scientific knowledge is incomplete or inconclusive.
   b. Place the burden of proof on those who argue that a proposed activity will not cause significant harm, and make the responsible parties liable for environmental harm.
c. Ensure that decision making addresses the cumulative, long-term, indirect, long distance, and global consequences of human activities.

d. Prevent pollution of any part of the environment and allow no build-up of radioactive, toxic, or other hazardous substances.

e. Avoid military activities damaging to the environment.

7. Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well-being.

a. Reduce, reuse, and recycle the materials used in production and consumption systems, and ensure that residual waste can be assimilated by ecological systems.

b. Act with restraint and efficiency when using energy, and rely increasingly on renewable energy sources such as solar and wind.

c. Promote the development, adoption, and equitable transfer of environmentally sound technologies.

d. Internalize the full environmental and social costs of goods and services in the selling price, and enable consumers to identify products that meet the highest social and environmental standards.

e. Ensure universal access to health care that fosters reproductive health and responsible reproduction.

f. Adopt lifestyles that emphasize the quality of life and material sufficiency in a finite world.

8. Advance the study of ecological sustainability and promote the open exchange and wide application of the knowledge acquired.

a. Support international scientific and technical cooperation on sustainability, with special attention to the needs of developing nations.

b. Recognize and preserve the traditional knowledge and spiritual wisdom in all cultures that contribute to environmental protection and human well-being.

c. Ensure that information of vital importance to human health and environmental protection, including genetic information, remains available in the public domain.

III. SOCIAL AND ECONOMIC JUSTICE

9. Eradicate poverty as an ethical, social, and environmental imperative.

a. Guarantee the right to potable water, clean air, food security, uncontaminated soil, shelter, and safe sanitation, allocating the national and international resources
required.

b. Empower every human being with the education and resources to secure a sustainable livelihood, and provide social security and safety nets for those who are unable to support themselves.

c. Recognize the ignored, protect the vulnerable, serve those who suffer, and enable them to develop their capacities and to pursue their aspirations.

10. Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner.

a. Promote the equitable distribution of wealth within nations and among nations.

b. Enhance the intellectual, financial, technical, and social resources of developing nations, and relieve them of onerous international debt.

c. Ensure that all trade supports sustainable resource use, environmental protection, and progressive labor standards.

d. Require multinational corporations and international financial organizations to act transparently in the public good, and hold them accountable for the consequences of their activities.

11. Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity.

a. Secure the human rights of women and girls and end all violence against them.

b. Promote the active participation of women in all aspects of economic, political, civil, social, and cultural life as full and equal partners, decision makers, leaders, and beneficiaries.

c. Strengthen families and ensure the safety and loving nurture of all family members.

12. Uphold the right of all, without discrimination, to a natural and social environment supportive of human dignity, bodily health, and spiritual well-being, with special attention to the rights of indigenous peoples and minorities.

a. Eliminate discrimination in all its forms, such as that based on race, color, sex, sexual orientation, religion, language, and national, ethnic or social origin.

b. Affirm the right of indigenous peoples to their spirituality, knowledge, lands and resources and to their related practice of sustainable livelihoods.

c. Honor and support the young people of our communities, enabling them to fulfill their
essential role in creating sustainable societies.
d. Protect and restore outstanding places of cultural and spiritual significance.

IV. DEMOCRACY, NONVIOLENCE, AND PEACE

13. Strengthen democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision making, and access to justice.
   a. Uphold the right of everyone to receive clear and timely information on environmental matters and all development plans and activities which are likely to affect them or in which they have an interest.
   b. Support local, regional and global civil society, and promote the meaningful participation of all interested individuals and organizations in decision making.
   c. Protect the rights to freedom of opinion, expression, peaceful assembly, association, and dissent.
   d. Institute effective and efficient access to administrative and independent judicial procedures, including remedies and redress for environmental harm and the threat of such harm.
   e. Eliminate corruption in all public and private institutions.
   f. Strengthen local communities, enabling them to care for their environments, and assign environmental responsibilities to the levels of government where they can be carried out most effectively.

14. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life.
   a. Provide all, especially children and youth, with educational opportunities that empower them to contribute actively to sustainable development.
   b. Promote the contribution of the arts and humanities as well as the sciences in sustainability education.
   c. Enhance the role of the mass media in raising awareness of ecological and social challenges.
   d. Recognize the importance of moral and spiritual education for sustainable living.

15. Treat all living beings with respect and consideration.
   a. Prevent cruelty to animals kept in human societies and protect them from suffering.
   b. Protect wild animals from methods of hunting, trapping, and fishing that cause extreme, prolonged, or avoidable suffering.
   c. Avoid or eliminate to the full extent possible the taking or destruction of non-targeted species.
16. Promote a culture of tolerance, nonviolence, and peace.

a. Encourage and support mutual understanding, solidarity, and cooperation among all peoples and within and among nations.

b. Implement comprehensive strategies to prevent violent conflict and use collaborative problem solving to manage and resolve environmental conflicts and other disputes.

c. Demilitarize national security systems to the level of a non-provocative defense posture, and convert military resources to peaceful purposes, including ecological restoration.

d. Eliminate nuclear, biological, and toxic weapons and other weapons of mass destruction.

e. Ensure that the use of orbital and outer space supports environmental protection and peace.

f. Recognize that peace is the wholeness created by right relationships with oneself, other persons, other cultures, other life, Earth, and the larger whole of which all are a part.

THE WAY FORWARD

As never before in history, common destiny beckons us to seek a new beginning. Such renewal is the promise of these Earth Charter principles. To fulfill this promise, we must commit ourselves to adopt and promote the values and objectives of the Charter.

This requires a change of mind and heart. It requires a new sense of global interdependence and universal responsibility. We must imaginatively develop and apply the vision of a sustainable way of life locally, nationally, regionally, and globally. Our cultural diversity is a precious heritage and different cultures will find their own distinctive ways to realize the vision.

We must deepen and expand the global dialogue that generated the Earth Charter, for we have much to learn from the ongoing collaborative search for truth and wisdom.

Life often involves tensions between important values. This can mean difficult choices.

However, we must find ways to harmonize diversity with unity, the exercise of freedom with the common good, short-term objectives with long-term goals. Every individual, family, organization, and community has a vital role to play. The arts, sciences, religions, educational institutions, media, businesses, nongovernmental organizations, and governments are all called to offer creative leadership. The partnership of government, civil society, and business is essential for effective governance. In order to build a sustainable global community, the nations of the world must renew their commitment to the United Nations, fulfill their obligations under existing international agreements, and support the implementation of Earth Charter principles with an international legally binding instrument on environment and development. Let ours be a time remembered for the
awakening of a new reverence for life, the firm resolve to achieve sustainability, the quickening of the struggle for justice and peace, and the joyful celebration of life.

Other significant Charters, Declarations or Sustainable Development Principle Sets:

UN Millennium Goals (http://www.un.org/millenniumgoals/)
The Natural Step Principles (http://naturalstep.org/learn/principles.php)
Natural Capitalism Principles (http://www.rmi.org/sitepages/pid564.php)
Appendix 2.1 A Global Chronology of the History of Ideas and Concepts related to “Sustainable Development” and “Sustainability” pre-1926.

Below is a list of further evidence to support the argument of Chapter 2 that by 1910 humanity had most of what was needed to understand the need for and strive to achieve sustainable development globally.

BCE (Before Common Era)

-500 (approx)

Plato (~427~347 BCE) and other philosophers of antiquity recognized the desirability of a harmonious relationship between people and the natural environment.

During the Peloponnesian War 431 B.C – 421 B.C large tracks of countryside were transformed into barren waste and there are indications that much increased soil erosion and flooding resulted. These changes made a considerable impression on Theophratus of Erasia, Aristotle’s biographer and botanical gardener. Theophrastus was led by his observations of local forest changes to develop a theory which firmly linked deforestation to the decline in rainfall, which he believed was taking place in Greece and Crete. \(^{1529}\)

First Record of Passive Solar Design of Buildings: The Ancient Greeks re-oriented their buildings toward the sun (e.g the city of Priene) to give them access sunlight during winter. \(^{1530}\). The catalyst was a fuel shortage.

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\(^{1530}\) John Perlin*, co-author [with Ken Butti] of A Golden Thread - 2500 Years of Solar Architecture and Technology, provides here a short summary of the evolution of passive solar design - Passive Solar refers to an approach to heating and
The Hippocratic Oath outlined a code of ethics for medical physicians that included the notion of the needing a precautionary approach embodied in the phrase “First, Do No Harm.”\footnote{See Hippocratic Oath at \url{http://news.bbc.co.uk/2/hi/7654432.stm}}

350 BC

**Aristotle**: People generally disagree as to the nature and conditions of happiness. Some people believe happiness is ‘wealth, honor, pleasure.’ Aristotle thinks that wealth is not happiness, because wealth is just a monetary value, but can be used to gain some happiness. Aristotle wrote at the start of the Nicomachean Ethics, published in 350 BC, “wealth is evidently not the good we are seeking; for it is merely useful and for the sake of something else.”

**CE (Beginning of the common era)**

77

Pliny the Elder published an encyclopaedia of natural history.

1182 to 1226

St Francis of Assisi is known widely as a lover of nature. Many artistic portrayals of the Saint connect him with the environment. It was not surprising then, that the Pope declared him the Patron Saint of the Environment in 1979. Long before the environment became an issue, Francis saw human beings abusing nature. In what could be the first "ecological statement" Francis stated that: "These creatures minister to our needs every day; without them we could not live and through them the human race greatly offends the Creator every time we fail to appreciate so great a blessing." -  

1266

Roger Bacon publishes *Opus Maius* in which he discusses the possibility of early concepts of automobiles, aeroplanes and submarines. His work is only recognised centuries later for its brilliance and astonishing modernity.\footnote{See Roger Bacon at \url{www.bbc.co.uk/history/historic_figures/bacon_roger.shtml}}

1398

Parliament passes laws to prevent the pollution of rivers and waters in England.

1531

Governmental concern in Britain for the welfare of those less fortunate goes back to the 16\textsuperscript{th} century. The first UK statute dealing specifically with poor relief was that of 1531, which gave local justices the power to license aged and impotent persons to beg within their own neighbourhood.

\footnote{See Hippocratic Oath at \url{http://news.bbc.co.uk/2/hi/7654432.stm}}

\footnote{See Roger Bacon at \url{www.bbc.co.uk/history/historic_figures/bacon_roger.shtml}}
1535

Revolutionary draft proposals were produced suggesting that the able bodied poor should be employed on public works and that both central and local administrative machinery would be set up to make this possible. This however did not become law but in 1536 a new statute became law that concentrated on the organization of voluntary funds for the relief of those who could not work due to age or infirmity. This and the 1531 law are regarded as the first English “Poor Laws”. In 1547 the city of London found that voluntary contributions were insufficient and the local government decided to impose compulsory rates to provide funds for this purpose. In 1572 a compulsory rate was imposed on a national scale.

1545

First Botanical Garden in Padua, Italy: The direct involvement of European governments in botanical gardens began in Renaissance Northern Italy at the universities in Pisa and Padua with the official patronage of botany by the governments of Florence and Venice. Pisa had a botanical garden by 1547, Bologna by 1567, Leiden and Amsterdam by 1587, Montpellier by 1593, and Heidelberg by 1597.1533

1563


1587

Establishment of the Botanical Gardens in Leiden created a significant hub between all the key Botanical Gardens across Europe facilitating the sharing of botanical and environmental knowledge.1534

1600

East India Company founded and begins small-scale encroachments in the Indian subcontinent, resulting two hundred years later in a British domination that completely reshaped world trade and wealth. By the mid seventeenth century a coherent and relatively organized awareness of the ecological impact of the demands of emergent capitalism and colonial rule emerged, and developed into a fully fledged understanding of the limited nature of the earth’s natural resources and stimulated awareness of the need for conservation.1535

1600’s Novum Organum, Francis Bacon

1535 Ibid.
1600’s The Royal Society was formed and subsequently was copied by other nations. These scientific academies were very influential in the development and sharing of scientific knowledge of flora and fauna. They ensured that this knowledge was spread rapidly throughout Europe.

1600’s

English authorities’ began looking for energy sources other than wood because of its scarcity and cost. In 1603, King James I led by example, by directing his staff to burn anthracite coal in the fireplaces of his palaces. By 1700 London was relying mainly on imported coal.1536

1630s

Formation of the Jardin du Roi in Paris

By the 1630s the commercial and teaching significance of the Leiden Botanical Gardens was sufficiently established to lead to the French Government establishing and supporting the Jardin du Roi in Paris. The formation of the Jardin du Roi and the extent of government commitment to it was to be a critical factor in the subsequent development of environmental perceptions, particularly in view of the unprecedented opportunity it gave individual scientists both to acquire a global biological knowledge but also through the connection to government to exercise their knowledge in political ways. The subsequent formation of colonial Botanical gardens was very significant in advancing the scientific understanding and justification for conservation programs in the coming centuries.

1645

Frans Beverwyk voiced concerns about the excessive speed of deforestation that he had witnessed on Mauritius in 16441537. Similar concerns about deforestation were voiced at the Cape of Good Hope in 1654.

1654

Formation of the Botanical Gardens in Cape Town.

1666

The Royal Society issues instructions for travellers to where possible assist the Society in the systematic collection of botanical and other knowledge. This request was issued again in 17041538.

1681

The Dodo becomes extinct on Mauritius. This is widely reported in Europe. The awareness that humankind’s activities could lead to extinction of species especially on islands like Mauritius that have relatively unique species is widely acknowledged.\textsuperscript{1539}

**1700s-1763**

This period marked a significant rise and advancement in the discourse linking deforestation to changes in climate and weather patterns. Specifically many writers noted the experience in the colonies of deforestation leading to a desiccation of the environment. Leading thinkers here included John Woodward and Stephen Hales\textsuperscript{1540}.

**1713**

The use of the term sustainable in the context of concern for a resource running out originated in 1713 in a paper by Carlowitz, head of the Royal Mining Office in the Kingdom of Saxony. The term was used in the context of seeking to discuss conditions for the sustainable management of forestry resources in order to meet the challenge of a predicted shortage of timber.

**1735**

Carl Linnaeus publishes the first edition of his classification of living things, the *Systema Naturae*. Linnaeus loved nature deeply, and always retained a sense of wonder at the world of living things. His religious beliefs led him to natural theology, a school of thought dating back to Biblical times but especially flourishing around 1700: since God has created the world, it is possible to understand God's wisdom by studying His creation. As he wrote in the preface to a late edition of Systema Naturae: - The Earth's creation is the glory of God, as seen from the works of Nature by Man alone. The study of nature would reveal the Divine Order of God's creation, and it was the naturalist's task to construct a "natural classification" that would reveal this Order in the universe.

**From the mid 1700s and onwards**

Writers and artists in Europe and America demonstrated the importance and wonder of nature through their poetry, prose and art. This is probably prompted by the intensification of industrialism that occurred at this time.

**1749**

Georges-Louis Leclerc, Comte de Buffon publishes, *Historie Naturelle* (Natural History), a 44 volume encyclopaedia describing everything known about the natural world. Buffon challenges the Catholic Church doctrine of ‘separate creation’ (species are independently created and are not related) discussing the possible common ancestry of Man and apes.

\textsuperscript{1539} Strickland, H.E., Melville, A. G (1848) *The Dodo and its Kinred*, vol 1, London p26

1767-1772

Botanist Pierre Poivre, Commissaire-Indendant of Mauritius from 1767-1772, was responsible for initiating and implementing the most complex and integrated environmental policy to date. His physiocratic perspective led to the emergence of an overtly conservationist policy linked to a whole set of broader economic and social objectives. Pierre Poivre implemented some of the earliest experiments in forest conservation, water-pollution control and fisheries protection. Pierre’s success was built on key developments such as the renewed concerns and literature linking deforestation to climate change. Pierre marshalled the climatic arguments against deforestation, which were accepted by 1760s and persuaded the French Colonial Authorities of their importance.

1760s-1800

Inspired by Poivre the British implement forest conservation and other environmental policies in the Caribbean.1541

1768-1859

Alexander Von Humboldt: Naturalist, botanist, geographer, cartographer, and explorer. Considered to be one of the founding fathers of modern geography, and author of Kosmos. Humboldt is often considered a father of ecology. He was the first to take on the study of the relationship between organisms and their environment. He exposed the existing relationships between observed plant species and climate, and described vegetation zones using latitude and altitude, a discipline now known as geobotany. In 1804, for example, he reported an impressive number of species, particularly plants, for which he sought to explain their geographic distribution with respect to geological data. One of Humboldt's famous works was "Idea for a Plant Geography" (1805). Other important botanists of the time included Aimé Bonpland and Eugenius Warming.

1769

Using fossil fuel resources radically more productively was what drove the industrial revolution, not simply having an abundant resource – in this case fossil fuel energy sources. The steam engine was invented in 1710 to pump water out of coal mines. But it was not until sixty years later that James Watt re-designed the steam engine that it was possible for the industrial revolution to occur. Watt achieved both a radical resource productivity improvement with which the steam engine converted fossil fuel energy into motor energy and a redesign of the gearing system that converted the engine’s reciprocating motion into a rotary motion making it possible for the steam engine to now drive other machines. It was this ingenious highly efficient design that dramatically increased resource

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productivity that made the industrial revolution and significant increases economic growth and labour productivity possible.\textsuperscript{1542}

\textbf{1770s-1780s}

Adam Smith publishes The Theory of Moral Sentiments and Wealth of Nations:

The very first sentence of "The Theory of Moral Sentiments" puts to rest the claim that Smith considered people capable only of acting on narrow self-interest. Smith writes that, "How selfish soever may be supposed, there are evidently some principles in his nature, which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it." Smith also believed that each individual has a responsibility to avoid harming others. He was equally clear that the state must restrain those who disregard this responsibility. In this writing he outlines a justification for governments to address externalities that do harm people. "Proper resentment for injustice attempted, or actually committed, is the only motive which, in the eyes of the impartial spectator, can justify our hurting or disturbing in any respect the happiness of our neighbour. To do so from any other motive is itself a violation of the laws of justice, which force ought to be employed either to restrain or to punish. The wisdom of every state or common wealth endeavours, as well as it can to employ the force of the society to restrain those who are subject to its authority from hurting or disturbing the happiness of one another."

\textbf{1784}

Benjamin Franklin notes that the switch from wood to coal has saved what remained of England’s forests and he urged France and Germany to do the same.

\textbf{1792}

Mary Wollstonecraft writes and publishes \textit{A Vindication of the Rights of Woman}.

\textbf{1795}

James Hutton publishes \textit{Theory of the Earth with Proofs and Illustrations}. James Hutton is known as the father of geology. By the time Darwin died in 1882 the idea that the earth was very old, much older than the 6000 years that the biblical scholars claimed, was commonly held but it was not always that way. James Hutton was the first to challenge the biblical scholars with empirical evidence in his seminal work "The Theory of the Earth with Proofs and Illustrations". Hutton developed scientific geological theory demonstrating that pressure and extreme heat below the planetary surface were the keys to understanding geologic time. Hutton discussed how land surfaces are worn down by wind and rain, how the eroded sediment is washed downstream by rivers to the world’s oceans where it settles into the depths. Hutton understood that such matter is recycled by volcanic action. Hutton and Lyell who followed in Hutton’s footsteps opened the door for Darwin.

1796

In 1796 the British implemented the Speenhamland System which declared that wages below what was considered to be an absolute minimum should be supplemented by local parishes up to the appropriate level, according to the number of children that the individual had and the price of bread.

1780s

The 18th century rationalist Condorcet argued that fertility rates would come down with the “progress of reason” so that greater security, more education and more freedom of reflected decisions would restrain population growth.

1798

Rev. Thomas Malthus in his *Essay on the Principle of Population* states that poverty and famine would be the result of man’s overproduction of offspring. This was written partly in response to Condorcet.

1806

Serious health concerns were raised in the first Doctor’s report on the conditions of sanitation of water and sewerage treatment of the poor of Dublin.

1807

Abolition of Slavery in the British Empire.\(^{1543}\)

1810

Awareness of the role of humankind in causing extinctions developed much earlier in the colonies than in Europe. As early as 1810 Saint Pierre and Commerson on Mauritius, Alexander Anderson on St Vincent, Burchell on St Helena and Kyd and Roxburgh in Bengal had all developed insights into the phenomenon. It affected their recommendations to the state for environmental protection. Their work also greatly influence Charles Darwin\(^{1544}\).

1812

Charles John Huffman Dickens, (1812 –1870) was the foremost English novelist of the Victorian era, as well as a vigorous social campaigner. Considered one of the English language's greatest writers, he achieved massive worldwide popularity in his lifetime. Dickens's novels were, among other things, works of social commentary. He was a fierce critic of the poverty and social stratification of Victorian society. His descriptions of poverty and crime in Oliver Twist appalled readers and led to the clearing of the London slum that featured in the story. In Bleak House and Little Dorrit he provided powerful criticism of institutions such as the patent offices and unregulated capital markets.

\(^{1543}\) Clarkson, T. (1808) *History of the Rise, Progress and Accomplishment of the Abolition of the African Slave Trade by the British Parliament*, London,

1822

British MP, Richard Martin, leads the first anti-cruelty bill to be enacted in UK parliament giving cattle, horses and sheep a degree of protection. The Society for the Prevention of Cruelty to Animals is founded in 1824 by 22 people including Martin.

Charles Babbage, an eccentric British mathematician and inventor, conceives of the first device, called a Difference Engine, that might be considered to be a computer in the modern sense of the word. He is not able to commercialise the concept.

1823

James Fentimore Cooper writes *The Pioneers* writing that “people should govern the resources of nature by certain principles in order to conserve them.”

1824

In 1824, Jean-Baptiste-Joseph Fourier, a well-known French mathematician, wrote a paper entitled *General remarks on the Temperature of the Terrestrial Globe and Planetary Spaces*. In this work Fourier hypothesized that the atmosphere blocks outgoing radiation from the Earth and re-radiates a portion of it back, thereby warming the planet, i.e., the greenhouse effect. Fourier likened this thermal envelope to a domed container made of glass, a gigantic bell jar formed out of clouds and invisible gases. “In coming together, the water vapor and other gases simulate a vault that receives and conserves heat, without which life would surely perish.”

1828

Carl Sprengel publishes an extended journal article on soil chemistry and mineral nutrition of plants that contained in essence the Law of the Minimum (often attributed to Justus von Liebig in 1840/1855) – thus establishing agricultural chemistry.

1829

When the explorer Charles Sturt discovered the Darling River in the dry season of 1829 he found the water too salty to drink. A year later, again at the Darling, he found that "The waters, though sweet, were turbid and had a taste of vegetable decay as well as a slight tinge of green".

1830

Charles Lyell publishes *The Principles of Geology* which builds on from Hutton’s earlier work. Lyell promoted as did Hutton the theory of uniformitarianism—the premise that geologic processes have

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acted gradually and similarly throughout time—which became his major contribution to geology. This theory suggested that the Earth was considerably older than the 6000 year Biblical estimate. What set Lyell’s work apart from Hutton’s is that Lyell was helped by the construction and excavation spurred by the industrial revolution and he was able to focus on the fossilized shells within layers of rock. Lyell was able to show how as one moves from older to younger strata, one extinct species is succeeded by another until near the surface contemporary species start to appear. Lyell argued that the survival of species is dependant on the continuance of certain physical conditions in its environment. Geologic processes tend to alter these conditions in its environment both locally and across wide regions. A species may respond by shifting habitats while in more extreme cases it may be obliterated together with others dependent on its existence. Lyell first named certain of the major geologic eras in Earth’s long history, beginning some 4 Billion years ago.

1832


1833

William Forster Lloyd’s\textsuperscript{1546} in his Oxford lectures of 1833 describes the \textit{Tragedy of the Commons} idea, describing what happened to pasturlands left open to many herds of cattle. Lloyd pointed out that, with a resource available to all, the greediest herdsman would gain--for a while. But mutual ruin was just around the corner. As demand grew in step with population (while supply remained fixed), a time would come when the herdsman, acting as Smithian individuals, would be trapped by their own competitive impulses. The unmanaged commons would be ruined by overgrazing; competitive individualism would be helpless to prevent the social disaster. Lloyd was also clear that this meant that Adam Smith’s invisible hand did not work in this instance: The commons will be doomed by overgrazing. The argument was used by Lloyd to dispute Adam Smith's idea of the "invisible hand".

1836

Ralph Waldo Emerson writes \textit{Nature}

1838-1912

Octavia Hill, the first significant female environmentalist.\textsuperscript{v}

1840

Queen Victoria gives her permission for the SPCA to be called the Royal Society for the Prevention of Cruelty to Animals.

1840s-1860s

UK 1840s to 1860s: Public Health Movement catalyses a remarkable transformation of London and then Britain’s approach to water sanitation and waste treatment. It provides a great model for the environment and sustainable development movements of the 20th century.\textsuperscript{1547}

1841

Friedrich List publishes \textit{The National System of Political Economy} that criticised free-trade doctrines arguing that it was the government's responsibility to foster the "productive powers" of a nation and, once these were in place, \textit{then} free trade could ensue, but not before. This is akin to the modern "infant industry" concept. Lists ideas are the forerunner for the ideas of \textit{National Systems of Innovation and industry policy}.

Early 1840s

Ernst Dieffenbach, through his studies on the fauna of New Zealand and the Chatham Islands and then in his studies of Mauritius had become very aware of the real potential for rapid extinctions as Europeans spread over the whole globe.\textsuperscript{1548}

1844

Charles Goodyear patents vulcanization of rubber.

Rubber condoms invented and mass-produced providing a safe family planning method.

In 1844 legislation was passed in the UK to control smoke produced from industry in cities.

1848

UK Public Health Act enacted.\textsuperscript{1549}

John Stuart Mill\textsuperscript{1550} in 1848 discusses the concept of a "stationary state of capital and wealth" and said that despite the "unaffected aversion so generally manifested towards it by political economists of the old school ... I am inclined to believe that it would be, on the whole, a very considerable improvement on our present condition." He went on to point out that the lack of growth does not mean the end of improvement of the human condition; it would more likely lead to the improvement of "mental culture and moral and social progress..." At that early date, he challenged the stereotype that economic growth and progress are synonymous.


\textsuperscript{1550} Mill, J.S. (1848) \textit{Principles of Political Economy with Some of their Applications to Social Philosophy}, Longmans, Green & Co., London
First concerns and investigations into Fisheries in the UK.

1852

Cleghorn et al.'s report to the British Association for the Advancement of Science (BAAS) from the 1851 BAAS meeting brings together new evidence to support theories linking deforestation with run-off, rainfall and famine incidence. Supra-colonial scientific gatherings subsequent to this concluded that the colonies faced a worsening desiccation crisis, resolvable only by the wholesale extension of government forest reservation. Cleghorn’s report led to further initiatives in state conservation on Mauritius, in the Cape of Good Hope, and Australia. Unfortunately it seemed to require a crisis - a famine - for governments to act. In India serious droughts in 1835, early 1860s, 1877-8 were all rapidly followed by the initiation or renewal of state programs designed to strengthen forest protection, often with the specific aim of preventing further droughts. A similar pattern occurred in South Africa where after a disastrous drought in 1861-63 the early pioneer of state conservation in the Cape Colony, John Croumbie Brown, was able to secure government agreement to new measures on forest conservation and prevention of grassland burning. The threat posed by the economic and social consequences of desiccation, first effectively promoted by Butter, Gibson, Balfour and Cleghorn continued to be an official concern of government from the 1850s onwards.

1854

Mechanical windmill introduced in the American Midwest.

Henry David Thoreau writes Walden

1858

Mainstreaming of the potential for climate change linked to deforestation, dessication and issues similar to today’s climate debates found early advocacy in the writings of J.Spotswood Wilson. Presented a paper to the BAAS entitled “On the General and Gradual Desiccation of the Earth and Atmosphere.”

Alfred Russel Wallace, OM, FRS (January 8, 1823 – November 7, 1913) was a British naturalist, geographer, anthropologist and biologist. Wallace's independent proposal of a theory of evolution by natural selection prompted Charles Darwin to reveal his own more developed and researched, but unpublished, theory sooner than he had intended.

1859

Charles Darwin publishes *Origin of the Species* (On the Origin of Species by Means of Natural Selection) which establishes the idea of evolution.

**1862**

The drought in Southern Africa inspired a whole new school of studies on processes of desiccation and how to prevent it. This new school were convinced that most of the semi-arid tropics were undergoing long term aridification as part of the process aided by colonial deforestation. Theories of widespread climatic change acquired further credibility.

**1863**

John Tyndall published paper describing how he had experimentally proved that water vapour (and CO$_2$?) act as a greenhouse gases. In January 1859, Tyndall began studying the radiative properties of various gases such as water vapour, "carbonic acid" (now known as carbon dioxide), ozone, and hydrocarbons. He noted that oxygen, nitrogen, and hydrogen are almost transparent to radiant heat while other gases are quite opaque eg. water vapour, carbon dioxide, and ozone and that even in small quantities, these gases absorb much more strongly than the atmosphere itself. Tyndall concluded that among the constituents of the atmosphere, water vapour is the strongest absorber of radiant heat and is therefore the most important gas controlling Earth's surface temperature. He said, without water vapour, the Earth's surface would be "held fast in the iron grip of frost." He later speculated on how fluctuations in water vapour and carbon dioxide could be related to climate change.

1863 by a German scientist, Justus von Liebig "the law of the minimum"

**1864**

George Perkins Marsh writes "Man and Nature, or Physical Geography as Modified by Human Action". Among other things, he described the impacts of deforestation, canal building, and water pollution and explained the the Sahara deserts advance. His writings warn that nature may not be able to recover once pushed past certain thresholds. Marsh emphasized that some acts of destruction exceeded the earth's recuperative powers: "The ravages committed by man subvert the relations and destroy the balance which nature had established between her organized and her inorganic creations; and she avenges herself upon the intruder, by letting loose

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upon her defaced provinces destructive energies hitherto kept in check by organic forces destined to be his best auxiliaries, but which he has unwisely dispersed and driven from the field of action. When the forest is gone, the great reservoir of moisture stored up in its vegetable mould is evaporated, and returns only in deluges of rain to wash away the parched dust into which that mould has been converted." He continued, "The earth is fast becoming an unfit home for its noblest inhabitant, and another era of equal human crime and human improvidence .......would reduce it to such a condition of impoverished productiveness, of shattered surface, of climatic excess, as to threaten the depravation, barbarism and perhaps even extinction of the species."

Marsh’s work aided the development of the already existing belief in a dessication crisis of global dimensions that had been so painstakingly argued by Balfour and Cleghorn in 1849 and 1850 respectively. Marsh and Cleghorn corresponded regularly. Marsh corresponded with many of the colonial scientists helping them to develop their ideas and grow more confident in their theories.

1865

James Fox Wilson, a naturalist and traveller presents “On the Progressing Dessication of the Basin of the Orange River in Southern Africa,” in March 1865 to the Royal Geographical Society, London. He believed that the Orange River was ‘gradually becoming deprived of moisture’ and that ‘the Kalahari desert was gaining in extent.”

The First Indian Forest Act enacted: This marked a significant transition from uncontrolled deforestation to an ambitious program of state conservation. This Act resulted from a number of elements. Firstly the concerted campaign by the EIC Medical Service, based on the dangers of the potential climatic effects of deforestation which led to the formation of the Bombay Forest Conservancy in 1847. Additional lobbying by Joseph Hooker and the key advocacy of the economic case for sustainable forest management by McClelland convinced Dalhousie of the case for wholesale state intervention in the forest sector, against the wishes of private capital. This law was enacted with the full support of the Crown. Indeed, this letter from the secretary of state for India to the Governor General in Calcutta, shows the degree to which by the 1860s the science of potential for disastrous climate change from deforestation had been recognized.

The secretary of state wrote at this time that, “Most countries have suffered similar neglect [to that in India], not only in the dearth and consequent high price of timber, but very often in the deterioration of

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ibid

Published in the Proceedings of the Royal Geographic Society, 1865, pp 106-9.
climate, and in the barrenness of the land formerly cultivable, if not fertile, situated at the base of hills, when these have been stripped of the forests which clothed them, condensed the vapours into rain and gave protection to the country below them….it is very satisfactory to me to learn that you have come to the same conclusion as Her Majesty’s Government, that individuals cannot be relied upon for due care in the management of forests, inasmuch as private capital must be opposed in this instance to public interests.”

Gregor Mendel, the father of genetics, publishes his life’s work “Experiments in Plant Hybridization” When Mendel's paper was published in 1866 in Proceedings of the Natural History Society of Brunn, it had little impact, and was cited about three times over the next thirty-five years. It would take until the 1920s for a synthesis of Mendel’s and Darwin’s work to be completed.

1866

Ernst Haeckel, a German biologist, coins the word "ecology".

Manchester’s citizens among the most unhealthy in Britain and attributed their condition to the foul air that they breathed.

1867

John Stuart Mill discussed the problem of negative externalities (not using the term explicitly) in On Liberty. “Whenever … there is a definite damage, or a definite risk of damage, either to an individual or to the public, the case is taken out of the province of liberty, and placed in that of morality or law” (1859, p. 147). Looking at this principle from the perspective of the individual’s obligation, “The liberty of the individual must be thus far limited; he must not make himself a nuisance to other people” (1859, p. 101). Mill is not asserting this as a hypothesis to be examined and tested; rather, he says, is an “indispensable” principle (1859, p. 134).

1870s - 1880s

Louis Pasteur and other bacteriologists in the 1870s and 1880s discover the role of micro-organisms in infectious diseases thus laying the scientific basis for all nation’s to uptake the ideas of water sanitation and sewerage management globally.

1872

“Acid Rain” is first coined by British Scientist Robert Angus Smith. He outlines the first discussion on acid rain in “Air and Rain: The Beginnings of a Chemical Climatology.”

1873

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1558 Stebbing, E.P (1922) The Forests of India. 4 Vols, Edinburgh. p 551
First of a series of killer fogs in London.

1874
Stimulated partly by the work of Marsh the US Congress itself had decided to investigate options for government forest conservation in the early 1870s. F.B. Hough\textsuperscript{1560}, the main consultant and advisor on this topic in the US, proposed German, French and above all Indian methods of forest conservation as models that were worthy of imitation. Gilford Pinchot, another key US campaigner for North American Forest conservation was similarly influenced by the Indian example and the India Forest Service.

1875
Austrian Geologist, Eduard Suess, coined the word biosphere.

1879
Henry George publishes \textit{Progress and Poverty: An inquiry into the cause of industrial depressions and of increase in want with increase of wealth}. He launches a ‘single tax’ movement based on land rental rather than labour taxes. (This idea has some parallels to the tax shift idea that has been promoted by environmentalist in the last decade or so.)

1880s
Irish Home Rule campaign – with non-violent elements (rent strike) noted by Mohandas Gandhi studying in London.

1881
Norway tracks first signs of acid rain on its western coast

Samuel P Langley leads expedition to Mt Whitney to research solar heat and absorption by the Earth’s atmosphere.

1883
The economist, Henry Sidgwick published “Principles of Political Economy”, in which externalities, as a source of market failure, were first formally recognized.

1886

The First Audubon Society is formed.

1889
Baroness Bertha von Suttner publishes Das Maschinenzeitalter [The Machine Age] which was among the first to foretell the results of exaggerated nationalism and armaments. (She is awarded the Nobel Peace Prize in 1905)

1890s
Interdisciplinary research shows typhoid due to pathogens in sewerage water.

Salinity identified as a problem in Australia. Problems of rising water tables and soil emerged soon after the establishment of the first schemes: along the South Australian Murray in the 1890s; in parts of the Murrumbidgee Irrigation Area in the 1920s; in the Curlwaa Irrigation Area, NSW, in the mid-1930s; and in the early 1950s in the Wakool Irrigation District. Now, few irrigation areas are free of the problems and all the indications are that, without major remedial measures, they will get worse.

1891
Clarence Kemp patented the first solar water heater in 1891. By 1897 it serviced 30% of houses in Pasadena.

1892
Sierra Club forms in California, USA: The Sierra Club is a national environmental organization in the United States dedicated to the preservation and expansion of the world's parks, wildlife, and wilderness areas. Founded (1892) in California by a group led by the Scottish-American conservationist John Muir, the Sierra Club is made up today of more than 630,000 people devoted to the exploration, enjoyment, and protection of the natural environment. The club was instrumental in helping to create the National Park Service and the National Forest Service, as well as in the formation of individual recreation areas, such as Olympic and Redwood national parks.

1895
The concept of using vegetal oil as an engine fuel dates back to 1895 when Rudolf Diesel (1858-1913) developed the first engine to run on peanut oil, as he demonstrated at the World Exhibition in Paris in 1900. Diesel died 1913 before his vision of a vegetable oil powered engine was fully realized.

1896
J.W Tutt made the first connection between how man made changes to the environment were leading to evolutionary changes in the British moth. He argued that the common B Betularia moth had

http://www.energyquest.ca.gov/story/chapter15.html

\[1562\] Diesel, R (1912) (www.cyberlipid.org/glycer/biodiesel.htm)
virtually disappeared due to the alteration of its habitat. So long as the environment was stable, this moth could survive but when grey branches turned black due to soot and lichens disappeared the grey colour of the moth was suddenly exposed allowing predators a much easier task of doing their job.  

1896

The Swedish scientist, Svant Arrhenius, examined the influence of CO2 on the temperature of the earth. He was also the first person to examine the impact of doubling atmospheric carbon dioxide on the world’s climate. He was also the first person to examine the impact of a doubling of atmospheric carbon dioxide on the world’s climate. In order to proceed with his experiments, Arrhenius relied heavily on the experiments and observations of other scientists, Josef Stefan, Arvid Gustaf Högbom, Samuel Langley, Leon Teisserenc de Bort, Knut Angstrom, Alexander Buchan, Luigi De Marchi, Joseph Fourier, C.S.M. Pouillet, and John Tyndall.

Radiation: Harmful Affects first warned:

In 1896, for instance, Thomas Edison, Tesla and Grubbe reported skin and eye and skin injuries. Edison in particular warned against excessive exposure to X-rays, exposure that caused the death of his assistant, Clarence Dally in 1904. By the late 1890s, there were many reports in the scientific literature of skin burns and loss of hair as a result of radiation. At about that time a New York journalist, John Dennis, began a campaign for controls on radiologists and radiographers and argued that to injure a patient in this way was criminal conduct. This was not taken up by the authorities for many years.

1897

The harmful effects of benzene: Since the 1897 report of Santesson, who observed aplastic anaemia among young women engaged in the manufacture of bicycle tyres in Sweden, and the report in the same year by LeNoir and Claude, who observed haemorrhaging in a young man engaged in a dry-cleaning operation in France, benzene has been known to be a powerful bone marrow poison.

1898

Ecological transmission of yellow fever discovered.

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First warning on Asbestos: In 1898, Lucy Deane, a UK Factory Inspector, observed: ‘The evil effects of asbestos dust have also instigated: a microscopic examination of the mineral dust by HM Medical Inspector. Clearly revealed was the sharp glass-like jagged nature of the particles, and where they are allowed to rise and to remain suspended in the air of the room in any quantity, the effects have been found to be injurious as might have been expected.’

1899

Polychlorinated biphenyls (PCBs) are chlorinated organic compounds that were first synthesised in the laboratory in 1881. By 1899 a pathological condition named chloracne had been identified. Mass production of PCBs for commercial use started in 1929.

1899

The first international Peace Conference was held in The Hague. The Conference was called Czar Nicholas II of Russia and Queen Wilhelmina of the Netherlands and was attended by 26 nations. Its one notable achievement was the formation of the Permanent Court of Arbitration.

1901

President Theodore’s Roosevelt's message to Congress recommends action for forest, soil and water conservation.

The first Nobel Peace prize is awarded (jointly to Henry Dunant, founder of the Red Cross, and Frédéric Passy, the leading international pacifist of the time).

Mark Twain was vice-president of the American Anti-Imperialist League from 1901 until his death in 1910. This organisation had a membership in the 10,000s.

Beatrix Potter publishes her first book The Tales of Peter Rabbit. Beatrix Potter is the most commercially successful ever English speaking children’s writer. She used the profits of the sale of her books to purchase farming land in the Lake District of England that would have otherwise been sold to developers. Potter left almost all of her property interests to the National Trust — 4,000 acres (16 km²)


1568 See Environmental History Timeline at http://www.radford.edu/wkovarik/envhist/5progressive.html
ensuring that the beauty of the Lake District will be preserved forever as part of the Lake District National Park.

1902

Ebenezer Howard published “Garden Cities of To-Morrow”\(^9\) which launched the Garden City movement. Originally published in 1898 as To-Morrow: A Peaceful Path to Real Reform, and reissued in 1902 under its present title, Garden Cities of To-Morrow holds a unique place in town planning literature. The book led directly to two experiments in town-founding that have had a profound influence on practical urban development around the world. The book was also responsible for the introduction of the term Garden City, and set into motion ideas that helped transform town planning.

1903

President Theodore Roosevelt institutes the first ever National Bird Preserve on Pelican Island, Florida.\(^0\)

1905

George Washington Carver joins the Tuskegee Institute and publishes ‘How to Build up Worn Out Soil.’\(^1\)

1905

President Roosevelt and William Hornaday founded the American Bison Society (ABS) prevent the North American bison from becoming extinct. By 1905, only about 1000 bison remained. Today, their numbers have recovered significantly thanks to these early conservation initiatives.\(^2\)

1907

The second international Peace Conference was held in the Hague with 46 nations attending.

Edward Howe Forbush publishes “Useful Birds and Their Protection” which discusses the economic value of birds and strategies for their protection.

1908

\(^9\) Howard, E. (1892) Garden Cities of Tomorrow MIT Press (March 15, 1965)

\(^0\) See Environmental History Timeline at http://www.radford.edu/wkovarik/envhist/5progressive.html

\(^1\) Carver, G.W. (1905) How to Build Up Worn Out Soils, Tuskegee Experiment Station, Bulletin Six, Tuskegee

US President Theodore Roosevelt convenes the first conference of Governors met at the White House to consider problems of conservation.

US President Theodore Roosevelt sets up a National Conservation Commission to look at the use, wastage and conservation of natural resources to prepare first inventory of natural resources. 1573

Kenneth Grahame's Wind in the Willows is published. This book is a bestseller warning of the potential negative effects on community and the environment, from people’s obsession with having the latest technology, irrespective of cost.

1909

18 February, US President Theodore Roosevelt convenes the North American Conservation Conference at the White House. 1574

US President Theodore Roosevelt asks all the world’s powers to meet in the Hague for the purpose of considering the conservation of the natural resources of the entire globe. 1575 The meeting is never held as Roosevelt retires from office in March 1909 and the initiative is not continued by the new President.

1911

Joseph Schumpeter published The Theory of Economic Development where he first outlined his famous theory of entrepreneurship. He argued those daring spirits, entrepreneurs, created technical and financial innovations in the face of competition and falling profits - and that it was these spurts of activity which generated (irregular) economic growth.

Fur Seal Treaty was developed in response to sever over harvesting of fur seals from the North Pacific.

1912

FH King 1576, a US Dept of agricultural official, publishes in 1912, a study called “Farmers of 40 centuries”. F.H King had toured China on a fact-finding trip, 1907-1909, and reported on their methods of farming, that had stood the test of time. For the first time the West had documentation of farming methods that showed that if you farm in certain ways, and obey certain basic rules you can

1576 King, F.H. (1911) Farmers of Forty Centuries. F.H. King, Madison, WI. F.H King published prolifically on these issues (www.soils.wisc.edu/soils/people/poets/fh_king.htm)
farm the same piece of land sustainably for 1000’s of years. It outlined how farmers can do intensive agriculture over 1000’s of years. The Chinese farmers knew what their inputs and outputs were and had a 5000 year old system that balanced the two. When landscape is converted into a cropping landscape to bring about a change the productivity, one has to do it in certain ways (what are these?) The Chinese, and right across East-Asia, everyone understood this and did it pretty much for 1000’s of years. FH King’s book, without calling them as such then featured most of the principles of sustainability in agriculture. King had been sent forth to learn from the rest of the world how to better manage soils because serious problems were already emerging in the USA.

Frederick Soddy, Nobel Prize winning nuclear chemist, publishes *Matter and Energy*. [He later writes *Science and Life* (1920), and books based on Social Credit ideas *Wealth, virtual wealth and debt: The solution of the economic paradox* (1926) and *Money versus Man* (1933)] There books cover his ideas on economics, ecology, energy conservation, environmental ethics and social reform.

1913
Angell publishes *The Great Illusion* 1577

1913-1914
William T Hornaday writes *Our Vanishing Wildlife*

1914-1918
The First World War. The US joins the war in 1917.

1917
The Russian Revolution.

1919
The Peace Treaty of Versailles June signed ending WWI. Due in part to the US refusing to waive the war debts of Britain and France the victorious European powers imposed draconian war reparations on Germany – setting up the conditions for global economic instability and further conflict.

1919
Svent Arrhenius publishes *Chemistry in Modern Life* – introduces the sustainability notion of intergenerational equity.

Having lived against a backdrop of rampant imperialism and world war Arrhenius envisioned a return to international dark times. Arrhenius writes "Concern about our raw materials casts its dark shadow over mankind. Those states which lack [ them] throw lustful glances at neighbors, which hapen to

have more than they use. Still more tempting is the desire for gain from lands on the other side of the seas, inhabited by uncivilized natives, with interest unawakened in guardianship." The industrial world had given rise to a new kind of international warrior, who Arrhenius called the "Conquistador of waste." And what of future generations? Arrhenius wrote eloquently "Like insane wastrels, we spend that which we received in legacy from our fathers. Our descendants surely will sensor us for having squandered their just birthright."

"Statesman can plead no excuse for letting development go on to the point where mankind will run the danger of the end of natural resources in a few hundred yeares."

Arrhenius invoked the chemist's commandment "Though Shall Not Waste" to argue that legislation be enacted aimed at both reducing consumption and promoting conservation. Arrhenius argued in this book in 1919, "To conserve coal, half a tonne of which is burned in transporting the other half tonne to market...so Arrhenius advocates the building of power plants in close proximity to the mines. All lighting with petroleum products should be replaced with more efficient electric lamps, while aluminium, the virtually limitless metal should be substituted for iron, whose ore reserves are finite and rapidly dwindling. Engineers must design more efficient internal combustion engines capable of running on alternative fuels such as alcohol, and new research into batter power should be undertaken. Wind motors and solar engines hold great promise and would reduce the level of CO2 emissions. Forests must be planted, dams raised and atomic energy explored." Arrhenius above all believed in humanities capacity for innovation and foresight to solve these problems. "Doubtless humanity will succeed eventually in solving this problem....Herein lies our hope for the future. Priceless is that forethought which has lifted mankind from the wild beast to the high standpoint of civilized humanity." Arrhenius's political hero was Teddy Roosevelt. It was Roosevelt who added millions of acres of land to public ownership and between 1908 and 1909 had tried without success to rally the nations of the world and the US congress to the conservationist cause.

1920

The League of Nation formed.

Arthur Cecil Pigou, points out the hidden costs of externalities in his book *The Economics of Welfare*. He describes, for instance, how the externality of smoke pouring from factories and fireplaces in Manchester, England, has many hidden costs for the economy. Such costs, including extra laundry cleaning, repair of corroded buildings and the need for additional artificial lighting due to this smoke, are assessed at £290,000 annually. Through this basic estimation of costs, not even including health, Pigou showes that for every £100 steel makers earned, they were doing £200 worth of damage. In
effect, pollution victims (tax payers) were subsidizing pollution causers, whilst making society poorer as a whole.  

1920s

Lady Balfour was one of the first to started doing organic farming. There were others like William Morris’s followers.

Dryland Salinity identified as a problem in Australia

1922

Men Of The Trees: The International Society for the Planting and Protection of Trees was founded. Their web site states that “Our Vision - is a world in which all people recognise the value of trees in the environment Our Mission Statement - People and volunteers contribute to the planting and after care of trees and understorey and thereby set an example to all.”

1926

In Germany Rudulf Steiner was approached by farmers, concerned about the new trends in farming, and developed the biodynamic methods of farming in the 1920’s as well.

Arrhenius publishes Chemistry in Modern Life.

References:


Appendix 4.1: Addressing Barriers to Corporate Sustainability.

4.1.1 Overcoming Market Pressures for Short Term-ism.

Research shows that this pressure on companies from their shareholders and the super funds is currently having a critical effect on whether companies can pursue all that they would wish to do to achieve corporate social responsibility. Such a short-term immediate profit focus leads inevitably to companies being in a position where they feel they have no choice but to oppose any changes to regulation or community attitudes that will add costs to their bottom line. This creates a dynamic where companies feel they have no choice but to fund think tanks and experts to argue against even potential changes that might harm their bottom line. Such short-term profit focus also prevents boards and CEOs from making investments with anything more than a 3–12 month pay back, even though such investments may help the company save or make millions.

A recent survey of CEOs in Australia found that the biggest single reason they gave for lack of progress on implementing more sustainable development/corporate social responsibility practises is the significant short-term pressures placed on CEO’s and boards by investment houses to deliver quarterly reports. Professor Dexter Dunphy, University of Technology Sydney, has conducted a series of interviews with twenty leading CEOs in Australia and in stating his findings he says:

One of the things that quite a number of them pointed to was the difficulty of them actually running organisations which are sustainable in the longer term when, in fact, they've got the analyst breathing down their necks constantly asking for short-term returns, and there's an inherent conflict between managing for the short term and managing for the long-term. This is one of the things all managers face but the emphasis has been very strongly from economic rationalism to push for the short-term return and to see [the] organisation as [being] primarily there for their shareholders. I guess what I see emerging is a new view that says, shareholders are only one of a variety of stakeholders and we can in fact destroy organisations, quite effective organisations, if we only manage for the short term. So these senior executives were saying, until the financial analysts, the investments funds and so on actually reward us for taking a longer term and a broader view of what our responsibilities are, whatever our personal views about this, it's very hard for us to achieve this, we're sort of running up a staircase that's moving down faster than we can run up it.1582

The Business Council of Australia paper\textsuperscript{1583} cited earlier also identified the structure of the funds management market and the perceptions of short-termism by market participants as two of the three main causes of short-termism in Australia. Another significant change in the last twenty years in OECD countries has been the widespread rise of superannuation schemes. As the BCA report outlines, superannuums now constitute the major new force driving short-termism in Australia and overseas.

\textit{4.1.2 How investment funds could be driving decoupling.}

While superannuation investment occurs for a long period of time, on average for 20 years, funds’ performances are rated by the markets every quarter. As Fiona Buffini wrote in the Australian Financial Review, ‘Super funds…pay their money managers to beat the market over about 3 years, and their brokers value companies on what they will earn in the next 12 months.’\textsuperscript{1584} And in circumstances where fund performance is below average, quarterly performance can take on a heightened significance. Hence there has been a significant lack of initiative to invest in companies undergoing longer-term strategies for competitiveness by institutional superfund investors.

This is re-enforced by the fiduciary duty requirements of super fund managers and superannuation trustees. Fiduciary duty stipulates the responsibility of the pension fund trustees to take good care of the money that's entrusted to them and invest it so that at the end of the pension fund members' work life there will be money to pay a pension. The fiduciary duty requires the fund manager and superannuation trustee to maximise returns. This reflects the common law duty that trustees act in the best financial interests of beneficiaries of the trust.

Currently, most definitions of fiduciary duty for fund managers and superannuation trustees implicitly exclude making socially and environmentally orientated investments. The definition arose because of the belief that such investments were financially less attractive. Without a screened investment methodology that can satisfy this trustee duty, superannuation trustees have been, understandably, hesitant in committing funds to screened investments. Hence the historical lack of initiative in this area by institutional super fund investors.

But it has been shown by studies, such as those by Innovest and Goldman and Sachs mentioned above\textsuperscript{1585} that companies that do pursue corporate social responsibility are experiencing as good or better profits. This fact is allowing changes to the fiduciary duties of super funds and thus turning a current driver for unsustainability—superfund pressure for quarterly profit results—into a driver for sustainability.


\textsuperscript{1584} Ibid.

This was the subject of Hunter Lovins and Walter’s Link’s paper, Pension Funds: Key to Capitalizing Natural Capitalism and one of their contributions to the publication The Natural Advantage of Nations. Lovins and Link argue that changes to fiduciary duty regulation in the USA pertaining to super fund trustees has the potential to help significantly facilitate the next industry revolution towards sustainability.

These efforts to address the fiduciary duty laws of super fund trustees in the US have been mirrored globally. The longstanding conventional wisdom that fiduciary duty precludes environmental, social, or governance (ESG) considerations in institutional investment decisions was overturned by a report released at the United Nations Environment Programme Finance Initiative (UNEP FI) Global Roundtable in 2005.

The assessment, entitled ‘A legal framework for the integration of environmental, social and governance (ESG) issues into institutional investment’, was conducted pro bono by Freshfields Bruckhaus Deringer, the third largest law firm in the world.

‘A number of the perceived limitations on investment decision-making are illusory,’ said Paul Watchman, a Freshfields partner and lead author of the report. ‘Far from preventing the integration of ESG considerations, the law clearly permits and, in certain circumstances, requires that this be done.’

The last five years has seen a boom in research and integration of ESG considerations major banks and other investment institutions analysis. In 2003, the U.N. Environment Programme’s Finance Initiative commissioned leading financial institutions to assess whether ESG issues affected stock prices significantly. As a result of this Goldman Sachs, Deutsche Bank, HSBC and UBS and 7 others published 11 reports providing a solid foundation of research on how financial and sustainability performance correlate. In October 2004, this trend was further enhanced by the commitment of a global network of major investors agreeing to fund ongoing research on ESG factors and how they correlate and affect financial performance. This network includes in the UK a group of pension funds that manages $1.36 trillion now directs 5 per cent of commissions to brokers who best analyse extra financial factors such as corporate governance, social and environmental issues. It has contributed to a 500 per cent increase in research, and has further helped catalyse the formation of ESG teams at Goldman Sachs, Citigroup, URS, and the Deutsche Bank. As a result of this initiative it has become mainstream over the last 5 years for major banks and finance institutions to do and use ESG analysis to inform increasing amounts of their investment portfolio.

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This is reflected the number of institutions signing onto the United Nations Principles for Responsible Investment. Over 500 investment institutions have signed the principles and these institutions currently have US$13 trillion under management.

As the evidence mounts that environmental, social and corporate governance (ESG) issues can affect the performance of investment portfolios, investors fulfilling their fiduciary (or equivalent) duty therefore need to give appropriate consideration to these issues. However to date have lacked a framework for doing so. The Principles for Responsible Investment provides a clear framework. These investment houses have signed onto these principles because now recognise sustainability as a ‘useful indicator of corporate performance and as being an important indicator of corporate risk’. Shaun Mays, who founded the WestPac EcoFund in Australia, the first environmentally ethical mainstream banking fund, has published a major report in Australia of the business case for investment houses embracing sustainable development. One of the responses he received sums up the rationale for this shift well: ‘When asked why they were willing to invest time and effort in the pursuit of greater understanding of corporate sustainability, their response was, ‘because the more I look at these issues, the more I get to see the operation of the company and its management in a way I would not traditionally enjoy. The deeper my knowledge of the company, the better will be my investment decisions.’ In the end that is what matters.

There is much that governments can do to help support this shift occurring in the investment community. Government employees in many nations have significant superannuation that is often being invested without any ethical or sustainability screening. Governments and public service unions could work together to at least invest a percentage of all superannuation into social responsibly investment. Governments could also do much to clarify superannuation trustees their position in relation to allocating investments to sustainable responsible investment fund managers. Also governments could legislate for all companies above a certain size to mandatory report in line with the global reporting initiative.

In 2006, the AUD$13 billion Australian public sector fund PSS/CSS awarded a AUD$200 million investment mandate to AMP Capital’s sustainability fund that now has a total of just over AUD$1 billion under management.

Similarly, VicSuper in Victoria now ‘invests 10 per cent of the listed equity portfolio of VicSuper Fund's investment options in large Australian and international companies rated as having the best sustainability business strategies in their industry sector’. VicSuper also offers its members the option of investing 100 per cent of their superannuation in projects that meet set sustainability criteria.

Generation Investment Management, headed by Al Gore, and dedicated to long term investing around sustainability, as of July will manage AUD$75 million of the AUD$4.2 Billion from VicSuper.

VicSuper’s chief executive Bob Welsh has stated that, ‘We think over the long term this should become mainstream and the concept of having a separate option for sustainability will disappear because everyone will be managing their money this way. Super funds tend to talk long and act short but when they start to act long they will pick this up.’

‘We do need a cultural change,’ according to Mr Walsh, ‘but what will trigger it? We need leadership from industry, but also the right legislation. We should be asked to report 10-year rather than just 5-year returns, and fee disclosure should be required, in dollar amounts, to reduce competitive conditions. At present, fund performance is all that matters to everyone.’

‘All companies now face sustainability risk, so it is incumbent on them to be taking these seriously. I’d particularly like to see environmental costs being quantified through appropriate research and assessments. That requirement would sharpen minds to sustainability priorities.’

Further considering what would generate conditions conducive to prioritising sustainability investment criteria, Mr Walsh said ‘I’d also like to see Super funds report under the Global Reporting Initiative (international corporate social responsibility reporting guidelines) the extent to which they have contributed to sustainability investing. That would be a start.’

Reinforcing the power Super funds have to induce change, he said ‘There has been some encouraging recent movement on climate change related investment exposure. As significant ‘trustee’ investors in organisations, we (Super funds) now want to see the extent to which you take into account carbon impacts. But there’s a long way to go before supply chain management, broader waste management and other deeper sustainability factors are generally considered, although human capital development is crucial.’

The past decade has seen a marked increase in new sustainability reporting requirements around the world, with comprehensive disclosure laws or rules being enacted in France, Denmark, the Netherlands, Norway, South Africa and Sweden, among others. ‘France, for example, requires detailed disclosure of water, energy and other resource consumption, greenhouse and other emissions, waste management, impacts on biodiversity, management policies and procedures, and compliance issues. ‘Even more notably, the European Commission has issued a recommendation that all member states ensure environmental performance reporting in company annual reports, specifically mentioning

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quantitative disclosure of emissions and consumption of energy, water and materials.\textsuperscript{1590} Hunter Lovins reports that

"In the United States, the Sarbanes-Oxley Act\textsuperscript{1591} makes it a criminal offense for the Board of Directors of a company to fail to disclose information, including such environmental liabilities as GHG emissions that could alter a reasonable investor’s view of the organization. In France, The Netherlands, Germany\textsuperscript{1592} and Norway, companies are already required to publicly report their GHG emissions.\textsuperscript{1593}

In Australia corporations will be required to measure and publicly report GHG emissions by 1 July 2008. The National Greenhouse and Energy Reporting Act 2007 establishes a single, national system for reporting greenhouse gas emissions, abatement actions, and energy consumption and production by corporations from 1 July 2008. It’s from that date that some 700 Australian companies (such as electricity generators, coal mining companies and large manufacturers) and 1700 facilities (such as manufacturing plants) will have to report under the Act or face prosecution. The initial thresholds will apply to companies (or subsidiaries or facilities within a company group) that emit more than 125 kilotonnes of greenhouse gases annually, or produce or consume more than 500 terajoules of energy in financial year 2008/2009. Those thresholds will tighten each financial year until 2010, thus catching more and more companies. Data reported through the system will underpin the Australian Emissions Trading Scheme due to start in 2010.\textsuperscript{1594}

As it becomes compulsory for companies to report on many aspects of their extra financial performance such as greenhouse gas emissions, major companies will increasingly see it as essential business practise to annually report on ESG criteria. For medium to large sized companies this makes intrinsic financial sense.

\subsection*{4.1.3 Incentives for CEOs and Senior Management to Achieve Decoupling of Profits from Environmental Pressures}

External short term market pressures for ever increasing short term profit results is a serious problem, but it’s only part of the explanation of why still many corporations are yet to truly walk the talk on


\textsuperscript{1592} In Germany, only “heavy” industry is currently required to report greenhouse gas emissions.


\textsuperscript{1594} See Australian Government’s Department of Climate Change’s Greenhouse and Energy Reporting Available at http://www.greenhouse.gov.au/reporting/index.html
sustainable development and decoupling. Another part of the story is how a company chooses to reward its senior management speaks volumes about the company’s true priorities. In 2006, The Australian Industry Group, the largest industry group in Australia with over 5000 business members, published an article on this topic by Don Henry, Executive Director of The Australian Conservation Foundation. In it he stated

“In fact, if you want to know the depth of a company’s commitment to the environment and to the community, the place to look is not just the company’s environmental or social policy, but the CEO’s compensation package. This is because corporate managers will often do what they are paid to do, rather than what they are told to do. Actions speak louder than words, and pay packages speak much louder than policies. Compensation packages that reward only short-term financial performance send a very clear message about what the firm expects of its top brass. Managers operating under such contracts will rightly understand the directions of the Board or shareholders to “think long-term” or “have regard to a broad range of stakeholders” as hollow – and will act accordingly. There can be disconnection between corporate commitments to sustainability and the implicit instructions given by most top…companies to their senior management through their compensation packages.”

Senior management usually are rewarded with firstly a guaranteed salary and stock options but also other incentives such as annual bonuses. Bonuses are usually annual and pegged to short-term performance measures such as annual earnings per share or share price. Stock options are agreements between the company and its top executives that allow the executives to buy the company's stock at prices far below what the public pays. Companies don't pay anything to issue stock options, making it a form of ‘free money’. In 1993, the US Government's stock regulating agency, the Securities and Exchange Commission, and the nation's accounting authority, the Financial Accounting Standards Board, tried to change the rules to make sure companies paid for the options they were issuing. Congress blocked their attempt and the use of stock options exploded. Soon, many CEO salaries were mostly made up of stock options, with more given if the company's stock price went up. The current structure of most annual bonuses and stock options focuses CEOs on short-term thinking. It also has in the past provided a perverse incentive to some CEOs, such as those at Enron, WorldCom, and HIH to do anything to make their company's stock price rise, even if they had to falsify how the company was performing. Stock options are widely regarded as responsible for the unsustainable business practices of Enron and other recent corporate collapses.

In short, so long as executives are rewarded for short-term performance, they will have a personal incentive to adopt short-term policies and to actively resist policies (R&D, long-term environmental

1596 Ibid.
1597 The list of corporate scandals is long around the globe: Enron, Vivendi, WorldCom, Andersons Consulting, Vivendi, HIH.
risk management, transition to a sustainable corporation) that only pay out in the long term. They will also have alarm bells set-off by any scientist or environmentalist making warnings about the environmental or health effects of any of their products. It means that CEOs have a clear financial disincentive to make the necessary up front investments to achieve decoupling even if there is a significant longer term 3-10 year return on investment. The future benefits of decoupling require current expenditures, which are against the CEO and senior management’s short term financial interests. It doesn’t have to be this way. As Don Henry explains,

One way of increasing management’s incentives to manage long-term risks is to embed non-financial performance targets into executive compensation packages. This is already a common practice for mid-level managers with specific environmental responsibilities, such as plant managers, but remains rare at senior executive levels. In the US ethical investors and even the influential Institutional Shareholder Services have agreed to link compensation to a balance of financial, social and environmental performance indicators. A handful of large companies, such as BP and Shell, have linked at least a small component of their CEO’s annual bonus to greenhouse gas emissions targets. A few Australian companies, especially in high-risk sectors like mining, base some element of reward upon reaching social and environmental goals. However, non-financial performance indicators tend to constitute a small part of an executive’s ‘at risk’ remuneration and, in any case, they remain the exception rather than the rule.

Thus it is relatively straightforward to bring decoupling goals and targets into CEO and Senior Management’s executive compensation packages. The information upon which their performance would be judged is already being measured and collated and often publicly reported by now 1000s of companies, which have signed up to the Global Reporting Initiative. Many corporations are already publishing sustainability annual report upon which their CEOs and senior management performance is being publicly judged. Some of these reports such as that by 3M point to remarkable achievements in decoupling profits from environmental pressures over the last 15 years. For instance 3M has achieved a 96 per cent reduction in US EPA Toxic Release Inventory (TRI) releases, a 97 per cent reduction in a further 49% reduction in volatile organic air emissions and is on track to achieve its stated goal of 50 per cent greenhouse gas reductions in 2006 from 1990 levels. 3M reduced worldwide, absolute GHG emissions, in 2006, by 54% from a 1990 base year.
Given that we wish to see companies make a concerted effort to achieve decoupling over the coming decades and not just for a year and then rest on their laurels, ideally there would be short and longer term goals to decouple profits from environmental pressures made a part of CEO and senior management salary packages.

Some may be sceptical that it will be possible to change CEO and senior executive incentives so that they are rewarded for longer term financial and non financial results. The justification for the current arrangement is that it is the best way to align CEOs incentives with that of the companies. Stock options as a form of executive compensation grew out of the ‘shareholder value’ movement of the 1980s. Options, it was said, make the interests of the CEO and the interests of the shareholders the same. Share options are intended to align the long-term interests of executives with the interests of the shareholders. Unfortunately, they can have the reverse effect. Options can lead CEOs and senior managers to become preoccupied by short-term fluctuations in the value of their own shares instead of guiding the company to longer term success. As discussed in Chapter 4, Collins and Porras’s in

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Built to Last: Successful Habits of Visionary Companies, showed that the stock prices of visionary companies which take a long term approach were up to 15 times more profitable than the market average when compared with their major competitors. This evidence suggests that incentives for CEOs and senior managers should be aligned to reward them rather than penalising them for investing in innovation with long lead times and seeking to position the company to succeed under likely medium-term regulatory and environmental changes.

4.1.4 The need for Corporate Law Reform

4.1.4.1 Is Corporate Social Responsibility Illegal?

A number of significant experts believe, like Nobel Prize-winning economist Milton Friedman, that the only social responsibility of business was to increase its profits. Many corporate law experts argue that despite the popular rise of corporate social responsibility a troubling paradox currently exists. That is, that while there is nothing in the laws of most nations to define or control how corporations donate funds or disclose non-political donations, or clarify how CEOs and boards should address non-shareholder stakeholder interests in decision-making processes, there are specific corporate laws and a body of case law that requires those in charge of companies to act in the best financial interests of the company's shareholders. This has led to the belief of shareholder primacy. Robert Hinkley, a respected corporate lawyer, resigned from his job after 23 years because he felt that, ‘The law, in its current form, actually inhibits executives and corporations from being socially responsible.’

Hinkley writes that:

The provision in the law I am talking about is the one that says the purpose of the corporation is simply to make money for shareholders … In Maine, where I live, this duty of directors is in Section 716 of the business corporation act, which reads: … “The directors and officers of a corporation shall exercise their powers and discharge their duties with a view to the interests of the corporation and of the shareholders” … Although the wording of this provision differs from jurisdiction to jurisdiction, its legal effect does not. This provision is the motive behind all corporate actions everywhere in the world. Distilled to its essence, it says that the people who run corporations have a legal duty to shareholders, and that duty is to make money. Failing this duty can leave directors and officers open to being sued by shareholders. Section 716 and its counterparts explain two things. First, they explain why corporations find social issues like human rights irrelevant—because they fall outside the corporation’s legal mandate. Second, these provisions explain why executives behave differently than they might as individual citizens, because the law says their only obligation in business is to make money … Companies believe their duty to the public interest consists of complying with the law. Obeying the law is simply a cost. Since it interferes with

making money, it must be minimised using devices like lobbying, legal hairsplitting, and jurisdiction shopping...’

Hinkley argues that corporate law is one reason why these debates have failed to make progress and why, even if debates are won, corporations have to continue to avoid public-good actions whilst focusing on maximising quarterly profits. He continues:

Corporate law thus casts ethical and social concerns as irrelevant, or as stumbling blocks to the corporation’s fundamental mandate. That’s the effect the law has inside the corporation. Outside the corporation the effect is more devastating. It is the law that leads corporations to actively disregard harm to all interests other than those of shareholders. When toxic chemicals are spilled, forests destroyed, employees left in poverty, or communities devastated through plant shutdowns, corporations view these as unimportant side effects outside their area of concern. But when the company’s stock price dips, that’s a disaster. The reason is that, in our legal framework, a low stock price leaves a company vulnerable to takeover or means the CEOs’ job could be at risk.

The Australian Shareholders’ Association’s (ASA) recent draft ‘Shareholders’ Expectations’ policy agrees and asserts that the primary purpose of a corporation is to: ‘generate value for shareholders’. Similarly, the board of James Hardie cited a ‘duty to shareholders’ in initially refusing to cover a shortfall in the asbestos compensation fund to meet the obligations of its subsidiaries. The ASA’s deputy chairman, Stephen Matthews, was famously quoted on ABC morning radio criticising companies for donating money to tsunami victims in early 2005 because their first duty is to shareholders.1601 Peter Drucker, a guru of the business world and a respected systems thinker, believes that companies that try to pursue corporate social responsibility are embarking on a dangerous distortion of fundamental business principles. ‘If you find an executive who wants to take on social responsibility, fire him fast’, Drucker1602 has said.

On the political left many commentators, from Noam Chomsky to Professor Joel Bakan, the author of book of the film, The Corporation1603, to Naomi Klein all argue that the corporation is essentially an entity whose sole concern is to maximise profits and returns to shareholders. Noam Chomsky argues that (corporations must) ‘be concerned only for their stockholders and … not the community or the workforce or whatever’. Professor Joel Bakan goes further and argues in his thesis in the book, The Corporation, that corporate social responsibility is not just impossible; Bakan argues that it is illegal because of corporations’ primary duty to always maximise profits to their shareholders. Bakan argues that this complete focus on maximising profits and the unique legal structure of corporations is what leads corporations, for instance, to deliberately break the law because they believe that the fines are

1603 ibid
cheaper to pay than complying with the regulations. He demonstrates this through fascinating vignettes of hunts through garbage dumps for evidence of sweatshops in the developing world; descriptions of General Motors' cold calculus on the value of human life (worth US$200,000 in the late 1970s, when the Chevrolet Malibu had a fuel tank 11 inches from the rear bumper behind the axle); and the extraordinary list of General Electric's 42 major legal breaches from 1990 to 2001. But oddly, the publication, The Corporation, ignores other key cases and precedents and the recent developments in corporate law and fiduciary duty that show that Bakan’s conclusion is too simplistic. Reality is not so black and white.

4.1.4.2 Is Corporate Law a Fundamental Barrier to Corporate Social Responsibility?

Charles Berger, Australian Conservation Foundation’s Corporate Social Responsibility campaigner has challenged the assertion that corporate social responsibility is illegal. His work addresses a key issue in the corporate social responsibility debates and shows how they can be moved forward. The following is a synthesis of Charles’s research and is outlined here with his permission.1604

The belief that CEOs and boards are solely accountable to shareholders is not true and overly simplistic for several reasons: Firstly, under the Corporations’ Act the director’s general duty is to act, ‘In the best interests of the corporation’, not the best interests of the shareholders. But what does it mean to act in the best interests of a corporation? That very much depends on one’s view of what a corporation is. One point of view is that the corporation is no more than property of the shareholders. At the International Conference on Thinking in Melbourne in July,2005 the noted American management and leadership writer Peter Senge spoke of the error, from a management perspective, of regarding a business as a machine for making money rather than as a human community. A more sophisticated view then is that the corporation is a range of stakeholders with a series of relationships, contractual and otherwise, among investors, workers, customers, suppliers, communities and ecosystems. If one takes this perspective of a corporation, then the legal duty is to seek to achieve the collective best interests of all these stakeholder groups.

This perspective has received the approval of the Supreme Court of Delaware (the temple of US corporate law) in Paramount Communications vs. Time, Inc1605, where the court upheld the decision of the board of Time, Inc., to reject a bid by Paramount Communications in favour of a less attractive bid (from the shareholders’ financial perspective) that would better preserve the ‘culture’ of the organisation. Australian law does not define which perspective is the better one, and Australian courts have never squarely endorsed either perspective.

1604 The following is a synthesis of discussions with Charles Berger, ACF Corporate Social Responsibility Campaigner. I feature it here in the appendices because, whilst it is not an original piece of work, I believe that it is a crucial contribution that will greatly assist to move the corporate social responsibility debates forward

Secondly, directors, in fulfilling their duty to the company, must consider the interests of both present and future shareholders. This requires directors to balance the short-term and long-term interests of the corporation, and resolves whether there is a duty to maximise profits over any particular period of time as claimed by *The Corporation* and numerous commentators.

Thirdly, directors are duty-bound to consider the interests of creditors, at least when a company is nearing insolvency. The Supreme Court of Western Australia has endorsed a UK case, Winkworth vs. Edward Baron Development, holding that directors should consider the interests even of future creditors. The duty to consider creditors’ interests stands on equal footing with the duty to consider shareholders’ interests, although obviously creditors interests are more likely to come to the fore as a company approaches insolvency.

Fourth, in some parts of the world corporate laws have been changed to either allow or require CEOs and boards to take non-shareholder constituency laws into consideration. These corporate law changes have often arisen to allow CEOs and boards to resist hostile takeover bids from organisations, individuals or companies who, if successful, will more than likely break-up the company, sack workers and adversely affect the communities significantly. Because of hostile takeovers, 31 states in the US have changed their corporate law to ensure that the interests of the community can be taken into account. An example is Illinois Business Corporation Act section 5/8.85, which provides that:

> ‘In discharging the duties of their respective positions, the board of directors, committees of the board, individual directors and individual officers may, in considering the best long term and short term interests of the corporation, consider the effects of any action (including without limitation, action which may involve or relate to a change or potential change in control of the corporation) upon employees, suppliers and customers of the corporation or its subsidiaries, communities in which offices or other establishments of the corporation or its subsidiaries are located, and all other pertinent factors.’

Given the list of non shareholder stakeholders listed already it is not much of a stretch to add the word environment to this list. This, like most similar statutes, permits but does not require consideration of employees, etc. Still, it's a good start and better than what we have in Australia. Connecticut has gone further and the corporate law there has now made it a mandatory duty for corporations to consider the community. Again it is not much of a stretch for the Connecticut law makers to add the word environment after community. Similar changes are occurring in corporate law reform around the world. Under UK company law, directors are explicitly instructed to consider the interests of the company’s employees, as well as its members. Most European jurisdictions either have similar requirements, or have employee representatives on the board.

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In conclusion, it is incorrect for commentators, corporate lawyers, and company directors to excuse unethical social or environmental behaviour on the basis that they are legally constrained to maximise shareholder profits. Their hands are not so fettered as is often claimed, and they should not blame the law when it currently gives significant room to act responsibly. This means that company CEOs and boards should see their role as acting responsibly to constructively address social and environmental concerns without fear of retribution of short-term profit obsessed investors. Directors should be encouraged to act in the broad interests of stakeholders to ensure the success of the venture, whilst addressing social and environmental issues constructively.

Corporate Law Reform would help to more clearly clarify the responsibilities CEOs and boards. Australia's corporate laws are the very foundation of how companies operate and interact with the environment. Designed properly, they can encourage companies to act sustainably and in the long-term best interests of investors and society generally. Australia's and many countries corporate laws still have fundamental flaws that allow companies to focus on short-term profits and to hide the effects of their operations on the environment. It would help enable a systemically work towards sustainability if corporation laws where reformed to

- Ensure company directors can and must consider society and the environment, not just the short-term profits of the company's shareholders
- Require major companies to report to the public on the environmental impacts of their activities, their compliance with environmental laws, and their environmental risks
- Make companies responsible for their impacts overseas, especially in developing countries where environmental standards might be weaker or poorly enforced
- Incorporate impacts on the environment into financial accounting standards
- Make company ownership more transparent, to allow the public to easily determine who controls a company and who has invested in it
- Facilitate investment in superannuation and other funds that are environmentally sustainable
- Make it easier for individuals to obtain legal redress for environmentally harmful corporate actions
- Ensure that bilateral and multilateral trade agreements do not undermine environmental sustainability.\textsuperscript{1607}

Appendix 4.2: Industry Groups in Australia - Sample of Activity on Sustainable Development

Australian business coalitions and industry groups in Australia are beginning to take a pro-active approach to some aspects of sustainable development. In Australia, progressive pro-sustainability business groups which represent the environmental industry include the Clean Energy Council, Environment Business Australia and the National Business Leaders Forum for Sustainable Development. These business groups have for a long time published pro-sustainability reports and policy recommendations to government. But there is also signs now that more mainstream and traditional industry groups in Australia are at least starting to shift on aspects of the sustainability debates.

Manufacturing Sector

The Australian Industry Group (Ai Group), which represents over 5000 companies mostly in the manufacturing sector, has set up a member based steering committee to address the climate change issue. They have released principles upon which a national emissions trading scheme can be based and publish an annual ‘Environmental Management Handbook’ that includes information about reducing emissions that is annually sent to all Ai Group members. Ai Group also assists members by providing an expert advisory service to help members identify energy efficiency opportunities to meet energy efficiency regulatory requirements at the State and Federal level.

- Plastics and Chemicals Sector

The Plastics and Chemicals Industries Association (PACIA), the pre-eminent national body representing Australia's plastics and chemicals manufacturing sector, is developing a ‘Sustainability Leadership Framework’ in consultation with its members and stakeholders. A part of the Framework, PACIA have developed a ‘Discussion Paper’. PACIA have also produced a training course on how to implement an energy management system to help identify energy efficiency opportunities for their members.

- Plantations, Paper and Pulp Sector

The Australian Plantation, Products and Paper Industry Council (A3P), the peak national body for Australia’s plantation products and paper industry, has launched Performance, People and

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Prosperity: Sustainability Action Plan. The Plan includes targets, measures of performance and a commitment to public reporting. The Plan raises 21 issues and lists specific actions for addressing each. Included in the 21 issues raised are: reducing greenhouse gas emissions, using renewable energy sources and encouraging the use of ‘greenhouse friendly’ plantation products.

- Infrastructure Sector

The Australian Council for Infrastructure Development (AusCID) – now part of the Infrastructure Partnerships Australia, the peak infrastructure industry organisation – has published the Sustainability Framework for the Future of Australia’s Infrastructure Handbook. The Handbook outlines AusCID’s framework for the future of Australia's infrastructure and recommends that any infrastructure developments consider reducing energy consumption and increasing the use of alternative energy technologies.

- Insurance Sector

Insurance Australia Group (IAG) has partnered with WWF-Australia to establish the Australian Climate Group (ACG). The ACG published the Climate Change Solutions for Australia 2008 report, which recommends that the Australian Federal Government adopts measures to: stabilise national emissions by 2010; establish an emissions target for 2020 consistent with that of other developed countries; and ensure the success of the emission trading scheme and ensure its flexibility to respond to new information quickly. IAG, along with Swiss Re, were also members of the Business Roundtable on Climate Change. Most major insurance groups in Australia have now committed to becoming climate neutral.

- Telecommunications Sector

Telstra commissioned a report by Climate Risk Australia that analyses the opportunities to achieve nationally significant greenhouse gas abatement using telecommunication networks. The report estimates that the telecommunications sector can help reduce Australia’s total greenhouse gas emissions by 5 percent by 2015.

- Tourism Sector

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In April 2007, the Minister for Small Business and Tourism, the Hon Fran Bailey MP, announced the development of a ‘Tourism Action Plan on Climate Change’. Industry submissions to this process already demonstrate how seriously the Australian tourism industry takes the risks of climate change. In another initiative, Tourism Australia is in the process of creating a web resource to help member companies cost effectively reduce energy usage and waste to landfill.

- **Housing Industry Association**

  The Housing Industry Association (HIA), Australia’s largest residential building organisation, has established the ‘GreenSmart’ initiative. GreenSmart includes a national training and accreditation program that includes training on domestic energy efficiency which has been completed by over 3,000 individuals. GreenSmart also includes the production of resources such as the GreenSmart website and the *GreenSmart Magazine*.

- **Food and Grocery Sector**

  The Australian Food and Grocery Council (AFGC), the national body representing the nation’s food and grocery products manufacturers, publish a biennial ‘Environment Report’. The reports provide an industry-wide snapshot of the environmental performance of the Australian food and grocery industry and, in 2005, reported that per-finished-product energy use was down 14 percent and greenhouse emissions were down 29 percent since 2003. The UNEP Working Group for Cleaner Production in Food, located at The University of Queensland, has several publications and resources investigating the energy efficiency opportunities in the food processing industry and other industries.

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Appendix 5.1 Ten Step Checklist for Whole System Design to Assist Decoupling Economic Growth from Environmental Pressures.

Whole system (re)-design techniques provide a key approach to help identify win-win opportunities to radically improve the resource productivity of many engineered or designed systems. This has been added to show sceptics still more clearly how whole system design can contribute to making sustainable development economically achievable. The following piece therefore will help many see how an ecologically sustainable form of economic growth is possible. Understanding the following will also assist sceptics to understand how significant decoupling of economic growth and businesses profits with environmental pressures is possible. Whole system design (WSD) for big efficiency gains can be achieved by considering four WSD Principles as outlined by the Rocky Mountain Institute and Paul Hawken in *Natural Capitalism*.1621

1) **The whole system should be optimised.** With reference back to the definition of ‘systems thinking’, this first principle suggests that to optimise a system for big efficiency gains, one must consider all components and their interconnections within a system, rather than as single components in isolation.

2) **All measurable benefits should be counted.** By considering the whole system and its components, changes to design can be made that influence the whole system and achieve *multiple benefits* for single expenditures.

3) **The right steps should be taken at the right time and in the right sequence.** Gaining big efficiency savings is a process of multiplying little savings in the right sequence.

4) **Start downstream to turn compounding losses into savings.** Life Cycle analysis shows that end user efficiency is the most cost effective way to achieve large resource productivity gains. This is because saving energy and resources at this stage of the process prevents all the activities along the whole supply chain needing to occur.

Operationally to achieve effective whole system design, the following 10 steps, which include these 4 core principles, can assist. The following 10 steps are an integration of suggested steps from a range of sustainable designers.1622


10 Operational Steps and Checks to achieve Whole System Design.

Whole system design for big efficiency gains can be achieved by following this operational checklist.

1. Ask the right questions:
What needs and services are attempting to be met here. Is this the best way to do this? Are there other possible approaches? We need paper, not paper mills; mobility and access, not more gas guzzling cars. We need energy, not necessarily from fossil fuel power stations. (See Figure A5.1) People want glass or aluminum cans to drink out of but it does not matter to them whether the glass or aluminum is made of recycled material or not Significant resource efficiency gains are possible if we think backward from a service or product that we genuinely need, and discover ways to redesign the industrial process to provide just as good or better service with improved resource productivity. Energy and resources are not used for its own sake. It is one input to a system that produces an output that is considered useful or valuable within a cultural context, as shown in Figure 5.1. Choices are made in the selection of technologies and energy sources, and the interpretation of the nature of the useful service. Figure 5.2 shows just one example of what might be considered to be a simple service – that of providing clean clothes. This highlights the many choices that are available to produce any product or service, each with its own unique energy and environmental impacts.

Figure 5.1 A model of the inputs to useful services (Source:Pears1623, 2004)

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Taking a service-based approach helps to clarify the nature of the essential services that require energy inputs, and facilitates consideration of alternative ways of achieving the required outcome. This can lead to radically different energy requirements, usually involving savings. The correct definition of a service requirement is an important step towards identification of the potential for energy and resource efficiency improvement, as it facilitates consideration of options that lie ‘outside the square’.

Figure 5.2 Considering All Options to Provide a Service\(^1\)

2. **Understand the system and benchmark against what’s possible**

The first step towards achieving large energy savings is to understand the fundamentals of the process, clarify the essential services being provided, and clarify how the existing system compares with the ideal and the best practically achievable. Benchmarking against ‘Best Practice’ is a dangerous strategy: existing best practice is actually *best of a bad lot practice* because the reference cases typically were designed several years ago and the financial criteria used to evaluate investments in energy efficiency are likely to have been very stringent (less than a three year payback period is a typical threshold). Today we should be able to do much better.

3. **Review each step in processes and see what potential there is for energy and resource efficiency gains.**

Do not underestimate the potential importance of any potential energy efficiency gains. Identify waste in each step of the process. At most sites (from homes to large industrial plants), there is very limited measurement and monitoring of energy use at the process level. Further, rarely are there properly specified benchmarks against which performance can be evaluated. So rarely do the plant operators

\(^1\) Ibid.
know what is possible. An example of a situation where monitoring and benchmarking at the process level could save large amounts of energy was a situation in an oil refinery studied as part of the Energy Efficiency Best Practice program. Two pumps were installed in parallel to circulate fluid through a pipe system. In theory, the pumps were identical, although one motor was a high efficiency model while the other was a standard model. During plant operation, the two pumps would normally be alternated so that each runs for half of the time. When energy consumption was measured, it was found that the pump with the less efficient motor used 84% more energy than the other while doing the same task. The difference in motor efficiency could account for less than a third of this difference in energy use, so other factors were responsible for the bulk of the difference. It was not possible within the project to stop the equipment and inspect it to find the actual reason(s) for the difference, but this may be accounted for by factors such as a damaged or worn pump impellor, obstructions in the pipe-work around the pump, such as a poorly fitted gasket or surface roughness, poor motor shaft alignment, and so on. While ideally the problem should be rectified (with savings potential of over 40% because the inefficient motor/pump is used for half of the operating time), most of these savings could be captured simply by running the efficient motor/pump most of the time, using the inefficient one as an emergency back-up.

4. The whole system should be optimised.

With reference back to the definition of ‘systems thinking’, this first principle suggests that to optimise a system for big efficiency gains, one must consider all components and their interconnections within a system, rather than as single components in isolation. Engineers are led to believe that nowadays technology has become so complex and ‘optimised’ that only small, incremental improvements are left to be made. Whole system design leads the engineer to discover that the more complex a technology is, the more opportunities exist for major improvements.

5. All measurable benefits should be counted.

By considering the whole system and its components, changes to design can be made that influence the whole system and achieve multiple benefits for single expenditures. For example, the two-piece composite subframe of the Lotus Elise provides six performance improvement benefits to the vehicle other than that of crash energy absorption.

6. The right steps should be taken at the right time and in the right sequence.

Gaining big efficiency savings is a process of multiplying little savings in the right sequence. A good example that illustrates the importance of taking the right steps in the right order is the trend of people to invest in solar-power for their home energy supply. These solar cells are costly. So it is worth examining what energy is being used for and first focusing on reducing that energy demand. Energy demand can usually be reduced in buildings through thermal insulation, more efficient lighting and
appliances. This can reduce the amount of electricity needed and thus the amount of solar cells needed to run a house. The following diagram illustrates the way that achieving greater level of efficiencies through whole system design (in this case of a fridge) can bring down the costs of the amount of solar cells needed to run it.

**Refrigeration, energy efficiency and renewable energy**

<table>
<thead>
<tr>
<th>Refrigerator Type</th>
<th>Annual Energy Consumption</th>
<th>Solar Cell Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985 fridge - 1400 kWh/year</td>
<td>Solar cell cost: $10,000</td>
<td></td>
</tr>
<tr>
<td>2004 4-star fridge - 460 kWh/year</td>
<td>Solar cell cost: $3,300</td>
<td></td>
</tr>
<tr>
<td>Best future fridge - 200 kWh/year</td>
<td>Solar cell cost: $1,500</td>
<td></td>
</tr>
<tr>
<td>Future solar cell cost: $500?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 5.3** Improving refrigerator efficiency reduces the size and cost of the solar cells required to power it. (Source: A. Pears\textsuperscript{1625})

7. **Start downstream to turn compounding losses into savings.**

A typical industrial pumping system contains so many compounding losses – from the generation of electricity at the power station to transmission through the grid network and subsequently at the pump motor to deliver the required power to pump water – that only 10% of the useful energy created at the power station is available for the pump to use i.e. for every 10 units of fuel used, 1 unit of flow comes out of the pipe. The engineer would size the motor to overcome these losses to provide the required flow. However if we were to begin downstream i.e. at the pipe connected to the pump, we can turn 10-1 losses into 1-10 savings. Making the pipe more efficient such that 1 unit of energy is saved at the pipe (e.g. reducing friction) results in compounding savings upstream to save 10 units of energy at the power plant.

8. **It is desirable to model system behaviour**

Use field experience, lab tests and computer modeling together where possible to ensure that the absolute whole system design optimum has been reached. Such techniques are valuable to address more complex engineering problems. For instance the Melbourne University team that successfully re-

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\textsuperscript{1625} Pears, A (2005) Design for Energy Efficiency, Presentation Young Engineers Tasmania.
designed industrial pressurized systems used a great deal of computer modeling to ensure their re-design was indeed the optimum. Similarly CSIRO has used computer modeling to make significant breakthroughs in fluid dynamics. Modeling of fluid dynamics by CSIRO is yielding significant whole system design opportunities to achieve radical resource productivity. A better understanding of how liquids and gases flow offers great potential for increasing the efficiency of processing technologies in a wide range of applications. From such modeling CSIRO has developed a new industrial mixing technique that can mix industrial solutions and processes five times more energy efficient than traditional industrial mixers. The Rotated Arc Mixer (RAM) is also able to mix a range of fluids that were previously unable to be efficiently mixed by other technologies. Computer modeling has even been used to show that the standard everyday dishwasher could be re-designed to no longer need 1.2 kWh/wash but instead only 0.56 kWh/wash on normal program for a dishwasher. Re-optimising the system to use the least amount of water, operate at the lowest temperatures, minimise standby electricity consumption and heat capacity of components heated, whilst optimising pump and motor efficiency allowed such a reduction. Figure 5.4 shows the potential savings that computer modeling identified.

![Diagram showing energy savings](image)

**Figure 5.4.** The diagram shows that savings are possible to reduce the energy used from 1.2 kWh/wash but instead only 0.56 kWh/wash on normal program for a dishwasher.

(Source. Pears, A. 2005[1626])

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9. Track technology change – 6 months is a long time.

One of the main reasons that there are still significant resource productivity gains to be made is the rate of innovation in basic sciences and technologies has increased dramatically in the last few decades. The US web site Meta-Efficient shows the extent to which in many fields innovations are occurring. (www.metaefficient.com) Take the average refrigerator. The latest innovations in materials science in Europe have created a new insulation material that will allow refrigerators to be designed to be 50% more efficient since most of the energy losses in current systems relate to insulation. Innovations in composite fibres in materials science make it possible now to design cars to be significantly lighter than past car models. Innovations in light metals as well can now be used in all forms of transportation from air-travel to trains to cars to allow further whole system improvements.


Few environmental professionals seem concerned about how environmental planning and design decisions made today lock us into unsustainable options tomorrow. Even so-called ‘green’ development is limiting our future social choices, which is unfair to future generations. A basic tenet of sustainability is that future generations should have the same level of life quality, environmental amenities and range of choices as ‘developed’ societies now enjoy. But why should we not aim to ensure that future generations have even greater array of choices and ways to meet their needs and improve their well being? Most environmental professionals focus on the question of what is best practice rather than designing to increase the options and choices for future generations? Given the long design life of infrastructure it is vital that designers do not limit choices and options of future generations, rather extend them.
Designers are already doing this by

- Designing and building homes and buildings where the materials can be dismantled and used again. The award winning Newcastle University green buildings allow this to be done.

- Designing cars, electrical and office equipment so that over 90% of it can be re-manufactured at the end of its design life. In numerous countries in Europe, and Asia such as Japan legislation to extend product responsibility to the entire life cycle requires this now.

- Designing new urban development with dual pipes to allow grey water to be used on gardens. In numerous countries now this is required for new building developments to ensure that future generations can choose to re-use their grey water.

- Ensuring that new coal fired power stations built around the world can be used for geo-sequestration. There are significant concerns that many new coal fired power stations that are currently being built today are not being correctly sited nor designed to make geo-sequestration of CO2 emissions possible in the future.

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Designing pipelines today that can be used for the hydrogen economy in the future. Gas pipelines in China are being designed to also work for hydrogen in the future.

These 10 steps, first hypothesized in this thesis, have been tested by The Natural Edge Project colleague Peter Stasinopoulos as part of a Masters in Whole System Design at the University of South Australia. They have also been developed into an online training program which is now the subject of a forthcoming Earthscan publication titled *Whole System Design: An Integrated Approach to Sustainable Engineering*.

**Conclusion**

Whole system re-design utilising the above 10 steps offers the potential in the 21st century to significantly reduce humanity’s ecological footprint often with rapid returns on investment. Whole system design offers ways to find new efficiency gains that then can assist to open up new possibilities. Taking a whole system approach to sustainable design has enabled advanced practitioners to uncover new opportunities for eco-efficiencies which enable further positive design changes. A whole system approach to sustainable design is a key technique to enable and empower engineers and other designers to see that design for sustainability is possible. There is now a wealth of literature and experience on how to achieve radical resource productivity gains through whole system design. This literature is also referred to as the field of Design for Sustainability. Design for Sustainability and Whole System Design offer ways to not only achieve decoupling but also design systems to be restorative of natural capital. The follow titles listed offer further guidance to practitioners on how to not only achieve significant reductions of negative environmental pressures but even achieve net positive improvements in natural capital. Collectively this field of literature and knowledge provides the manual of how to achieve decoupling in detail.

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http://www.earthscan.co.uk/?TabId=30202&v=365879
Appendix 5.2 Review of the Limits to Growth Books

The original Limits to Growth book, published in 1972, put the sustainability “growth” debates into the mainstream. Dryzek described the book as a key publication of the Survivalist discourse in his 1997 book on Environmental Discourses. Over 9 million copies of the book were sold. The Limits to Growth books are perhaps some of the most misunderstood books ever written.

My colleagues of The Natural Edge Project were able to meet Dennis Meadows at an international conference. He kindly agreed to review this review of the Limits to Growth publications. In this review the point is made clearly that defining key terms - economic growth, physical throughput growth and decoupling of economic growth from physical throughput growth - still more clearly at the start of the Limits to Growth books perhaps would have saved the authors much undeserved criticism and some of their readers much confusion. Dennis Meadows concurred in his reading of this review and agreed that, ‘surely the goal is to decouple GDP growth from the growth of physical throughput growth’, one of the central points of this thesis.

In this book review I consider the three principal misunderstandings about the original publication Limits to Growth (1972), and how the authors have addressed these misunderstandings in their subsequent updates: Beyond the Limits (1992), and The Thirty Year Update (2004).

Common Misunderstanding #1: The 1972 Limits to Growth book predicted that resources like oil would run out soon. Clearly oil has not run out

The Limits to Growth model was not used to make predictions about oil availability. Oil was not a separate variable in the model, so World3 (the authors’ computer model) could not be used to make predictions of any sort about current or future oil availability. The Limits to Growth team knew this, and hence never made such forecasts.

Matthew Simmons, respected energy expert and advisor to the US Bush Administration and founder of Simmons & Company International (the world’s largest energy investment banking firm), describes well what the original Limits to Growth book actually said on this issue.

‘After reading The Limits to Growth, I was amazed. Nowhere in the book was there any mention of running out of anything by 2000. Instead, the book’s concern was entirely focused on what the world might look like in one hundred years time. There was not one sentence or one single word written about an oil shortage, or limit to any specific resource, by the year 2000.’

As the authors of Limits to Growth - Thirty Year Update explain,

1629 This book review was researched and drafted by Michael Smith, and edited by Karlson Hargroves

The term [Limits to Growth] is often misunderstood, and it is typically used today in a very simplistic way. Most critics believe that our concerns about limits result from a belief that fossil fuel or some other resource will soon be exhausted... Our concern about collapse does not come from belief that the world is about to exhaust the planet’s stocks of energy and raw materials. Every scenario produced by World3 shows that the world in the year 2100 still has a significant fraction of the resources that it had in the year 1900. In analysing World3 projections our concern rather arises from the growing cost of exploiting the globe’s sources and sinks – the world’s ecosystems, air and oceans... In fact our apprehension is more subtle, we worry that current policies will produce global overshoot and collapse through ineffective efforts to anticipate and cope with ecological limits... We failed in our earlier books to convey this concern in a lucid manner. We failed totally to get the concept of 'overshoot' accepted as a legitimate concern for public debate.

This *Thirty Year Update* is comprehensive in communicating the problem of ecological overshoot and ecological thresholds. One of the biggest impediments to progress on sustainability is that few decision makers appreciate the scale of the problem. The *Limits to Growth* 20 and 30 year updates have been two of the most honest books ever written on the extent to which humanity has already overshot the ecological limits of the planet’s ecosystems. Both updates synthesize the evidence that today humankind has already overshot the ecological limits through over-fishing, deforestation, consuming fossil fuels, phosphate pollution in rivers and lakes (leading to algae blooms), and unsustainable use of soils (leading to salinity problems and loss of fertility). Both books bring together authoritative, peer reviewed evidence that the resilience of the world’s ecosystems is in decline. Whole chapters in the twenty and thirty year updates of *Limits to Growth* are devoted to this. The relevance of this new overview and thesis in *Limits to Growth: The Thirty Year Update* has been confirmed by the 2005 publication of the UN’s *Millennium Ecosystem Assessment*\(^\text{1631}\), the 2007 IPCC 4\(^{th}\) Assessment\(^\text{1632}\), the UK Stern Review\(^\text{1633}\) and is also supported by evidence assembled by the global Resilience Alliance for their thresholds database.\(^\text{1634}\)

**So why does this first misunderstanding still persist?**

The *Limits to Growth* team published their book just before the 1973 OPEC oil shocks. The book became strongly associated in the media and public consciousness with that event. Table 4 and surrounding text in Chapter 2 of *Limits to Growth* is where the confusion arises. Allegedly, it in this

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table that the authors made the mistake of underestimating the non-renewable resource reserves of the world and predicted that they would run out in a matter of decades. At a glance without reading the surrounding text, Table 4 in Chapter 2 can appear to be stating that resource X will run out by year Y. However, the goal of Table 4 in Chapter 2 was to demonstrate how the exponential growth (i.e. the rate of usage) of non-renewable resource reserves will use up these reserves more rapidly than previously thought, and that society should therefore invest in greater material efficiency, energy efficiency and recycling. It provided data on oil and 18 other non-renewable resources\(^{1635}\) (see table excerpt below), using the current known estimates of global non-renewable resource reserves, and rates of usage, from a number of official United States government publications. The table included:\(^{1636}\)

- The static index (which calculates the number of years left of non-renewable resources if used at 1972 rates based on 1972 estimates of known ‘reserves’).
- The growth rate (the rate of growth of usage of X resource per annum using 1972 growth rates).
- An exponential index (the number of years left of a resource assuming 1972 ‘reserves’ and assuming exponential growth of usage at the 1972 per annum growth rate).
- The ‘5 Times Reserve Exponential Index’ (the number of years left of X resource assuming 5 times 1972 ‘reserves’ estimates of X resource and exponential growth rates of usage).

**Excerpt: Table 4 Non – Renewable Natural Resources\(^ {1637}\)**

<table>
<thead>
<tr>
<th>Resource</th>
<th>Static Index</th>
<th>Growth Rate</th>
<th>Exponential Index</th>
<th>5 Times Reserve Exponential Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>420</td>
<td>2.6</td>
<td>95</td>
<td>154</td>
</tr>
<tr>
<td>Gold</td>
<td>11</td>
<td>4.1</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td>Iron</td>
<td>240</td>
<td>1.8</td>
<td>93</td>
<td>173</td>
</tr>
<tr>
<td>Petroleum</td>
<td>31</td>
<td>3.9</td>
<td>20</td>
<td>50</td>
</tr>
</tbody>
</table>

Indeed, Table 4 was never intended to be an accurate description of the future of the world’s non-


\(^{1636}\) Ibid, p 55

\(^{1637}\) Ibid, pp 56-60
renewable reserves. The authors discussed in text surrounding Table 4 that there are many factors that affect the future of global non-renewable resource reserves, usage rates and levels of recycling. The authors note that ‘Of course the actual non-renewable availability in the next few decades will be determined by factors far more complicated than either the simple static reserve index or the exponential reserve index.’ They discuss these factors in a thorough way. They also conducted more modelling, investigating these factors which affect the future of the world’s reserves of non-renewable resources and discussed the results of their modelling studies in the pages following Table 4. So, the authors of Limits to Growth were not predicting that these resources would run out within 20-30 years. They concluded the discussion about Table 4 stating that, ‘Given present resource consumption rates and the projected increase in these rates, the great majority of the currently important non-renewable resources will be extremely costly 100 years from now.’

However, this did not matter to media critics and a few economists who delighted over the coming decades on using the fact that known non-renewable reserves since 1972 have increased dramatically, to unfairly, but effectively, discredit the Limits to Growth team (although very few economists did this in serious academic journal papers). A journalist, Ronald Bailey, started the saga of the ‘wrong predictions’ in 1989 with an article he published in Forbes. Such critics also played on the fact that the authors of the book did not explicitly make the key point that mining and oil companies have no financial incentive to prove out reserves much beyond about thirty years. Unfortunately, this misunderstanding is what most people remember about the book - that some of the specific predictions regarding resource shortages have not occurred. For example:

In 1972, the Club of Rome published Limits to Growth questioning the sustainability of economic and population growth... Limits to Growth estimated that by now we would begin to see declines in food production, population, energy availability and life expectancy. None of these developments has even begun to occur, nor is there any immediate prospect that they will. So the Club of Rome was wrong.

Exxon Mobile, 2002

The Limits to Growth modelling was undertaken to inspire humanity to take action, rather than to predict dates for shortages. The reality is that the 1972 models did not predict the end of oil for at least one hundred years, and then only if no actions were taken to improve resource efficiency or resource

\[1638\] Ibid, p 63
\[1639\] Ibid, p 66
substitution. Rather, the team’s concern was the resilience and sustainability of the planet’s sources and sinks; the world’s ecosystems. Thirty years on from the first publication, the *UN Millennium Assessment* shows global fish catch for example has peaked and declined. Ironically, because we have not adopted sufficient efficiency strategies or sufficient substitutes to oil, our world’s oil production will soon also peak. Oil production has now peaked in over 60 countries, peaking in the USA the year *Limits to Growth* was published, in 1972. As Matthew Simmons stated in 2004, *'It is time for the world to re-read Limits to Growth! The message of 1972 is more real and relevant in 2004, and we wasted 30 valuable years of action by misreading the message of the first book.'*  

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Common Misunderstanding #2: The Limits to Growth authors were pessimists who failed to take into account the potential for technological, social and institutional innovation, instead just predicting doom and gloom

Academics such as Cole and Freeman et al. critiqued the Limits to Growth modelling in the 1970s arguing that the assumptions made about technological innovation and efficiency improvements were too pessimistic. They argued that the modelling done by the team did not consider a wide enough range of assumptions about the rate with which economies could become more resource efficient. Specifically they felt further investigation was needed using the team’s model to more fully explore the potential for innovation, recycling, pollution controls, substitution of scarce resources with less scarce resources etc. to assist humankind to stay within the limits.

The Limits to Growth team generously gave Cole and Freeman et al. their model and sure enough when run with these new assumptions - dramatic improvements in resource efficiency and reductions in pollution levels – the model showed that it was possible for humanity to stay within the ecological limits of the planet. But the new modelling efforts were done without such tight restrictions on population or capital growth. Other modelling done to refute the Limits to Growth model was also flawed for several reasons such as a failure to fairly account for the dynamic nature of environmental and human systems.

These academics provide a valid argument, but it is a minor point and not significantly different from the message or the modelling described in Chapter Five (‘The State of Global Equilibrium’) of the original Limits to Growth book. It is important to emphasize that in this chapter the original team also modelled scenario’s where a sustainable society could be achieved and describes how humanity could create a truly sustainable society and live within the limits. Similarly as the title of Chapter 7, ‘Transition to a Sustainable System’ (which is Chapter 7 in both the 1992 Update - Beyond the Limits and the 2004 Limits to Growth – The Thirty Year Update) shows, the authors are more optimistic than most.

The authors of the 1992 and 2004 updates highlight the ozone case study as a significant example of humanity’s capacity to innovate new technologies to avoid catastrophic overshoot before it is too late. They do believe that humanity can achieve a truly sustainable society and outline how, and they emphasize the fact that trend is not destiny. They are seeking to help us to become aware of our choices, and emphasize that our choices today will affect the choices of our children, and their children’s children. In all these chapters and scenarios the Limits to Growth team show a great

appreciation of the roles of technological innovation, recycling, renewable energy, and efficient use of resources, and how these will assist humankind to stay within the ecological limits of the planet.

As the authors wrote in 1992, ‘The decline [of ecosystem services] is not inevitable. To avoid it two changes are necessary. The first is a comprehensive revision of policies and practices that perpetuate growth in material consumption and in population. The second is a rapid, drastic increase in the efficiency with which materials and energy are used.’

Donnella Meadows emphasized her optimism in a famous quote,

It seems to me a powerful message, worth repeating and repeating, that people want peace, simplicity, beauty, nature, respect, the ability to contribute and create. These things are much cheaper and easier to achieve than war, luxury, ugliness, waste, hate, oppression, manipulation. Some day, when everyone understands that nearly all of us truly want the same kind of world, it will take surprisingly little time or effort to have it.

Current member of The Club of Rome, Keith Suter summed it up well in his 1999 review of Limits to Growth.

To sum up, the warning from The Club of Rome remains valid. The British science writer H.G. Wells once said that life was a race between education and disaster. The Club went to the effort of issuing the warning not out of a sense that we are all destined to be destroyed in an environmental catastrophe, but in the optimistic belief that it is possible to build a better world and that humankind can be mobilized for that task.

Why then does this misunderstanding still persist?

Dennis Meadows kindly offered his perspective to the reviewers, on this important question:

I can think of five reasons. First, people prefer to have optimistic visions of the future. When someone raises the possibility of problems, it is easier to discredit the messenger than to seek fundamental change. Second, the authors of Limits deliberately decided not to spend time rebutting criticisms of their book. They felt global trends would soon enough validate their main conclusions. So the criticisms remained unchallenged. Third, the media gets its financial support principally from those who benefit from growth, not from those who criticize it. So there is a systematic bias in favour of those who say continued growth is possible and desirable. Fourth, many organizations, fear that antizrowth sentiment...
would lead to changes that reduce their short-term profit. So they do their best to discredit the critics, even if they believe them. We have seen the same behaviour vis-à-vis smoking-related cancers and climate change. Fifth, the title of the book was poorly chosen. The focus of our analysis is not on limits but on the features of the system that produce overshoot and collapse.

Common Misunderstanding #3: The Limits to Growth books are anti-economic growth and advocate zero growth

In both the 20 and 30 year updates, the authors quote Aurelio Peccei, founder of the Club of Rome, who pointed out in 1977 that, ‘Some of those... accuse the [Limits to Growth] report... of advocating ZERO GROWTH. Clearly, such people have not understood anything, either about the Club of Rome, or about growth. The notion of zero growth is so primitive – as, for that matter, is that of infinite growth, and so imprecise, that it is conceptual nonsense to talk of it living in a living dynamic society’

In response to this criticism the authors wrote in Beyond the Limits (1992),

A sustainable society would be interested in qualitative development, not physical expansion. It would use material growth as a considered tool, not a perpetual mandate. It would be neither for nor against growth. Before this society would decide on any specific growth proposal, it would ask what the growth was for, and who would benefit, and what it would cost, and how long it would last, and whether it would be accommodated by the sources and sinks of the planet.

Clearly then the authors are not anti-growth and they clearly want us to differentiate between types of growth.

So why does this criticism arise and why has it persisted?

Just as relatively few in the general public understand the concept of ‘overshoot’ few in the general public understand the concept of decoupling economic from physical growth. Few people have learnt that economic growth and physical growth are two different things because historically economic and physical growth have grown ‘lock step’ with the industrial revolution. Hence when the authors of Limits to Growth talk about the need to reduce physical growth – through recycling, resource efficiency etc – many will assume that this has to also negatively affect economic growth.

Political parties, businesses and workers associate economic growth with many positive outcomes such as high employment rates, good job security and reduced business investment risks. Many people want more economic growth. Hence one of the most important tasks of those who care about the future of this planet, and the almost 6.7 billion people who live on it, is to clearly explain the difference between economic growth and growth of physical throughput (which is often associated

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with environmental degradation). Economic growth is acceleration in the production of economic value. Physical growth of the economy means the economy’s physical stocks and flows spread over more area or has a larger material and energy throughput, or has a larger stock of physical products or buildings or infrastructure.

The attentive reader of the three *Limits to Growth* books will find a differentiation near the start, but because the authors have not defined these terms clearly right at the front of each book, those who do not read ‘cover to cover’ could be left with the perception that economic growth and physical growth are being presented as one and the same. This is compounded by the fact that the authors used the term ‘growth’ to refer to the pollution, population, and physical throughput of the economy; in other words mainly the negative aspects of the economy. When defining growth in this way anyone would agree that of course over time this needs to be slowed down, stopped or even reduced. However, without this clarification it is clear why the authors of *Limits to Growth* have been labelled ‘anti-economic growth’.

Defining these terms key terms - economic growth, physical throughput growth and decoupling of economic growth from physical throughput growth - still more clearly at the start of these books perhaps would have saved the authors much undeserved criticism and some of their readers much confusion. This clarification would be easy to make in future work. Dennis Meadows concurred in his reading of this review that, ‘surely the goal is to decouple GDP growth from the growth of physical throughput growth’.

A final key step to remove confusion would be, having defined these terms, to then use them – ‘economic growth’, ‘physical throughput growth’ and ‘decoupling of economic growth from physical growth’ - consistently through the text to ensure the reader is clear which type of ‘growth’ is being discussed.

Another reason why such changes would make a big difference to perceptions about the *Limits to Growth* books is the fact that the three *Limits to Growth* books were published during a time when the benefits of economic growth were being seriously disputed by many academics who, partly

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1651 The first book to have an impact that really questioned the value of economic growth was Mishan, E.J. (1967) *The Costs of Economic Growth*, Staples Press, London. It had an impact largely because Mishan was an economist and reader from the London School of Economics. This gave him credibility. Other influential publications include:
- Daly, H.E. (1996) *Beyond Growth: The Economics of Sustainable Development*, Beacon Pres, Boston, MA.
inspired by *Limits to Growth*, then wrote many books arguing that economic growth literally is bad. Thus in this context of real debate over whether economic growth is good or bad it would have been wise for the *Limits to Growth* team to acknowledge this lack of definition and in their sequels clearly address this literature. It would also have been wise to more clearly define what conditions are needed for economic growth to be socially and environmentally sustainable.

Anyone writing on ‘growth’ should be clear that there is enormous confusion over definitions of the word to different audiences. When businesses and governments talk about growth they generally mean economic growth. They mean (assuming the expenditure model of measuring GDP) the amount of economic value and monetary transactions as measured by the GDP. When environmentalists talk about growth they mean physical growth. Environmentalists dislike physical growth because it correlates with environmental damage and resource depletion.

Alan AtKisson, a colleague to the authors, concurs with this need to clarify economic and physical growth (though he does not frame it as a criticism of *Limits to Growth*). He writes,

> The trick is in separating out two kinds of growth: the so-called ‘economic growth,’ on the one hand, from growth in the amount of stuff we use and discard on the other (physical growth). These are two very different phenomena, and they have been falsely - and dangerously - confused for too long. Economic growth, remember, is nothing more than an increase in the flow of money. That’s what we’re measuring when we look at the Gross Domestic Product, which economists use as the key indicator of whether a country’s economy is ‘growing’ or not.

The GDP is a famously successful indicator of economic activity, and a notoriously bad way to measure progress. The GDP measures every dollar or yen or euro that changes hands, without bothering to ask whether that money went to purchase computer chips or to clean up oil spills. Because GDP growth has all too often been correlated with the destruction of Nature, it’s a measurement environmentalists love to hate, and with good reason. Yet contrary to what many environmentalists believe, there’s nothing inherently ‘unsustainable’ about economic growth - as long as it gets decoupled from the flow of stuff. Money flow (value) can increase, even as material flow (resource use and waste) decreases.

In fact, indicators suggest this decoupling is already starting to happen. Even the U.S. economy, for example, has begun to increase GDP without a similar increase in energy consumption. The ‘materials intensity’ of many industrial economies is getting more efficient, generating more money per unit of stuff every year.

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These are trends we should be celebrating - and accelerating - if we want to pass a worthy and beautiful world on to the next generation. There is every incentive to make the conversion to sustainability, and not just for environmental reasons (critical though they are). All materials are costs, all energy is a cost, all waste is a cost. Reducing such costs raises profits, and not incidentally lightens the load on Mother Earth, and improves life for humans. Everybody wins. That’s sustainability. That’s also the great challenge of the 21st Century.

In framing the growth debate in this way AtKisson outlines the challenge to decouple economic growth from negative physical growth and environmental pressure. Books inspired by the *Limits to Growth* team - for example the international bestsellers *Factor Four* and *Natural Capitalism* - show that significant decoupling of economic growth from physical growth is now possible over time. In Chapter 11 of *Factor Four*, the authors demonstrate literally through using the *Limits to Growth* model that they only needed to assume modest increases in the *Limits to Growth* team’s assumptions about the rate of resource efficiency gains in the economy (plus strategic substitution) to avoid the limits to physical growth.

This is where the debate is today. Alan AtKisson in his book *Believing Cassandra*\(^ {1653}\) writes,

> Paradoxically, by re-inventing the world so that it no longer runs on Growth [which Alan has clearly defined as physical, population, and pollution growth], we can increase that strange phenomenon we call ‘economic growth’... Sustainability is fundamentally a matter of decoupling money from material consumption, so that the value within the economy can steadily increase, even as humanity’s throughput gets drastically reduced.

**Finding New Audiences – Opportunities for Further Exploration of Topic**

Those developing subsequent work in line with the *Limits to Growth* series may also find new audiences if it uses the sorts of frameworks discussed above. For example, decoupling of economic growth from negative environmental pressure would be a framework of broad appeal, given the significant and growing interest in how to achieve decoupling. This potential is demonstrated by the second of five objectives adopted in 2001 by OECD Environment Ministers for the *OECD Environmental Strategy for the First Decade of the 21st Century* being, ‘Decoupling Environmental Pressures from Economic Growth’.\(^ {1654}\) It is also a stated goal of the European Union.

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Increasing the use of economic frameworks, studies & language:

We believe this is the main challenge and opportunity for those now building on from the Limits to Growth - to increase the use of rigorous economic frameworks, studies and language to support the overall thesis.

We believe the authors missed an opportunity to communicate with economists in this latest publication. Economics has increasingly become the study of market failure, so using the economic frameworks of market failure could help the authors communicate their message more effectively with economists. For example, using the model of decoupling economic growth from negative environmental pressure, the authors could have incorporated recent research which is now showing that a transition to a sustainable economy, if focused on improving resource productivity, will lead to at least strong economic growth (and possibly even higher than business as usual), while at the same time reducing pressures on the environment and enhancing employment. This economic modelling has been shown in Europe by ex-Wuppertal Institute member Joachim Spangenberg working with neo-classical economists, on a project called ‘Labour and Environment’. Spangenberg is currently working in a team to demonstrate this theory with global economic scenario models used in several EU funded projects, including one called Modelling Opportunities and Limits for Restructuring Europe towards Sustainability (MOSUS).

Increasing the focus on job creation and improved business competitiveness:

The Limits to Growth authors have dared to ask the ‘big questions’. For instance, they ask why it is that an idea like ‘Free Trade’, which shares even more uncertainties than sustainability and leads to more job losses than sustainability, has gone to the top of the political agenda? They ask why in thirty years did ‘Free Trade’ succeed to get to the top of the political agenda when sustainability is lucky to be even mentioned by our world’s leaders and politicians?

The solution, it is suggested, for the sustainability movement to follow Donnella Meadow’s example and work together to improve both our theory and practice. We can all improve how we communicate sustainability ideas to relate to the central concerns of business, government and citizens. I believe it is vital that sustainability books are clear on how a transition to sustainability will affect people, their lives, their families and their aspirations.

I believe that communication of sustainability ideas must be related to and explain how it is possible to assist economic growth while decoupling physical throughput. This is important because at the heart of lack of progress on sustainability is the mainstream belief that major trade-offs between sustainable development and economic growth are inevitable. The result is that other agendas like ‘Free Trade’ that promise to help economic growth get the attention. The result of this belief is that governments, research and development institutions and firms have not been encouraged to explore economically feasible and desirable paths to an ecologically sustainable economy. If sustainability is going to be as
high on the political agenda as free trade, sustainability publications need to address key issues of job creation, business competitiveness, productivity and economic growth. These are the central concerns of decision makers. This is what The Natural Edge Project is doing in its publications such as *The Natural Advantage of Nations, Factor 5 an update of Factor Four: Doubling Wealth, Halving Resource Usage*, and TNEP’s major publication on the “growth” debates - *Cents and Sustainability*.

**Conclusion**

The authors of *Limits to Growth - The Thirty Year Update* are to be commended for their daring and innovative work over the last thirty years. It is easy to criticise in hindsight. We hope that our comments are received as constructive suggestions on how the work could be made even better.

It is important to recognise that a full review of the Limits to Growth books would also review the history of global dynamical modelling itself and discuss developments in global dynamic modelling since the 1960s. Global dynamical modelling has advanced a long way since the 1960s and 1970s (originally pioneered by the Limits to Growth team). The work of the International Panel of Climate Change and the UN Millennium Ecosystem Assessment is testament to these advances in dynamical computer modelling. Such a full review of the history of dynamical modelling however is beyond the scope of this short review.

In conclusion, *Limits to Growth: The Thirty Year Update* would be a beneficial read for anyone interested in creating a better world. For those new to sustainability, it is a great introduction. For those experienced in the field, the latest *Limits to Growth* update will ensure that you are ‘up to date’. The original book was world-changing, inspiring a generation to develop ways to stay within the ecological limits, while the 20 year and in particular the 30 year update provide further clarification and expansion on the key issues outlined in the original *Limits to Growth* publication. Indeed, we recommend that all three seminal publications are read – in full.

**Limits to Growth - Further Reading and Online Resources**

Limits to Growth: The Thirty Year Update


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Important Online Reviews Of The Limits to Growth Books


Dynamical Systems Modelling – Online Resources


Appendix 7.1: Australian Studies Investigating Potential for Significant GHG emissions reductions by 2020


Appendix 7.2 Studies Investigating Potential for Significant GHG emissions reductions in the order of 60-100 percent by 2050

**Australian Studies**


**Sample of Canadian, UK and USA Studies**


Appendix 7.3 Learning from the Leaders: Examples of Global Climate Change Policy Leadership.

Australia is currently a long way behind many other ‘competitor nations’ on per capita climate change performance, having lost a decade for concerted action. The reality is that Australia’s emissions are currently still rising at 1.5 percent per annum, and current trends predict, under existing policy settings, that Australia’s emissions will be 20 percent above 1990 levels by 2020.1657 Most telling are the statistics that Australia’s per capita emissions and per capita oil use are among the highest in the world.1658 With regard to industry, a respected international study has found that Australia's power sector is the world's highest emitter of greenhouse gases on a per capita basis.1659

However on the upside, Australia can learn from the policy experience of many other OECD nations who have already implemented climate change policy reform. The following pages briefly highlight a range of climate change policy areas where Australia can learn much from the example of nations leading on climate change policy reform.

Climate Neutral Nations:

Four nations – Iceland, New Zealand, Norway, and Costa Rica have now committed to becoming net climate neutral by 2050 if not before.1660 They are leading a new UNEP climate neutral global network.1661 Norway, a significant OECD economy, has committed to becoming net climate neutral by 2030. Costa Rica aims to be climate neutral by 2021 when it celebrates 200 years of independence.1662 Other countries are moving towards similar levels of commitment such as the USA, with California committing to achieving 80 percent cuts in emissions by 2050.1663 The Climate Institute’s 2007 report on the economic impacts of Australia addressing emission reduction targets,
shows that Australia becoming carbon neutral by 2050 is consistent with strong economic growth, and that Australia would benefit if it were to take a leadership position on targets.\textsuperscript{1664}

**GHG Reductions – Regional Targets:**

The EU has committed to a minimum 20 percent reduction in greenhouse gas emissions (from 1990 levels) by 2020 and is pushing in international meetings for a global agreement of 30 percent reductions by 2020. If the world will agree to the 30 percent target by 2020 then the EU will adopt this stronger target.\textsuperscript{1665}

**Energy Efficiency Targets:**

In the UK the biggest 10,000 energy using companies have to, by law, sign up to and achieve energy efficiency targets to receive an 80 percent exception from the UK carbon tax.\textsuperscript{1666} Most of the 10,000 UK companies have exceeded their energy efficiency targets ahead of time and overall saved £650 million in the process. The European Union plans to increase energy efficiency sufficiently to reduce energy use by 13 percent by 2020 as part of its 2006 Energy Efficiency Action Plan, saving Euro$164 billion in the process, even though their economy is already much more energy efficient than Australia's.\textsuperscript{1667} In contrast, Australia does not yet have a national energy efficiency target. Although Australia's 250 biggest energy-using companies are required to publicly report their energy efficiency opportunities with a return on investment of less than four years, to date there is no legal requirement to invest in such opportunities - even those with a one year or less return on investment.

**Residential Buildings with Improved Energy Performance:**

The USA, Europe, China and Japan have all gone down the path of better regulation to improve building standards.\textsuperscript{1668} In the UK, all new homes are required to be ‘climate neutral’ by 2016. The

\textsuperscript{1664} Hatfield-Dodds, S., Jackson, EK., Adams, PD., and Gerardi, W. (2007) Leader, Follower or Free Rider? The economic impacts of different Australian emission targets, The Climate Institute, Sydney, Australia.


UK Government's 'Code for Sustainable Homes' legislates binding regulations for energy reduction with staggered targets; 25 percent more efficient by 2010, 44 percent by 2013, and 100 percent, or zero emissions by 2016. Now passed into law, the code sets minimum standards for both energy and water efficiency. In addition, the UK government has agreed that any home achieving a Level 6 sustainability rating will be exempt from stamp duty. In France, the government has committed to ensuring that all new buildings should ‘produce more energy than they consume’ by 2020. In the Netherlands, which experiences very cold winters, the standard design for a new home would qualify for an Australian star rating of 8-10.

In contrast, Australian buildings still fall short of overseas minimum building regulations for equivalent climate zones, with energy use in Australian new homes continuing to rise. Some states have begun to address this, following the Australian Building Code Board’s introduction of minimum energy performance requirements into the Building Code of Australia (BCA) in January 2003. In Victoria from July 2004, every new house and apartment in Victoria was required to meet a 5-Star Energy Efficiency standard. During 2006, requirements for 5-star energy ratings were introduced in South Australia, Western Australia and the Australian Capital Territory. New South Wales operates its own Building Sustainability Index, which includes a certification process for new dwellings with respect to mandatory targets for greenhouse gas emissions. However, Tasmania, Queensland and the Northern Territory have still not adopted 5-star requirements for new homes. In addition, the Insulation Council of Australia and New Zealand cautions that even with 5-Star energy efficiency regulations across the country, Australian buildings would still fall far short of overseas minimum building regulations for equivalent climate zones, noting that Australia still has a long way to go from having the least energy efficient buildings of OECD countries to anything approaching international minimum standards.

Energy Efficient Products and Services:

The energy demand in households accounts for 25 percent of the final energy needs in the EU, with electricity used for domestic appliances in households showing the sharpest increase. The EU is responding to this issue by requiring energy labelling of household appliances and to demand minimum efficiency requirements.\textsuperscript{1676} The Japanese government has set strict new energy-saving targets, focusing on 18 types of consumer and business electronics. Home and office air-conditioners, for instance, must be redesigned to use 63 percent less power by 2008. The targets have sparked a frenzy among electronics makers, who are producing record numbers of energy-saving consumer products.\textsuperscript{1677}

Although not yet as strict as Japan standards or as progressed as the EU, Australia is contributing a leadership role in this area, through mandatory approved energy labels, and minimum energy performance standards (MEPS). The Department of Resources, Energy and Tourism is delivering a world-leading Energy Efficiency Opportunities (EEO) Program which aims to improve the competitiveness, productivity and business investment in energy efficient technologies. The program requires involvement by an estimated 250 mining, manufacturing, transport, resource processing and commercial businesses that are responsible for about 40 percent of all energy used in Australia,\textsuperscript{1678} to help reduce growth in greenhouse gas emissions and demands on energy infrastructure.

Improving Freight Transport:

In 2007 France committed to invest heavily in rail infrastructure to take freight transport off the roads and onto rail as part of France’s ‘Green Revolution’.\textsuperscript{1679} In Australia greenhouse emissions from trucking freight continues to rise. In 2004, freight related emissions represented 36 percent of transport emissions and approximately 6 percent of Australia’s overall greenhouse gas emissions and in 2005 road transport contributed 84 percent of the total freight emissions despite carrying out only 38 percent of the domestic freight task.\textsuperscript{1680}


Reducing Traffic Congestion and Encouraging Modal Shifts:

Over 15 cities in OECD countries have successfully implemented a congestion tax. London is still a stand-out example, using revenue from its congestion tax to spend AUD$500 million in improving and building safe bike paths and cycle lanes. Mayor Ken Livingstone in February 2008 announced changes in the capital's ‘congestion charge’ road-pricing policy, increasing the congestion tax for powerful cars and certain pickup trucks with high carbon emissions to a £25 (AUD $54) daily charge, up from £8 ($17). Hybrid cars have also been made exempt from the congestion tax.

Reducing Oil Dependence:

A number of countries have committed to significantly reducing their nation’s oil dependency. Sweden, which was badly hit by the oil price rises in the 1970s, has committed to getting off oil by 2020. The country relies on fossil fuels mainly for transport, with only 32 percent of the energy coming from oil in 2003, down from 77 percent in 1970. Almost all of the country’s heating was converted in the past decade to schemes which distribute steam or hot water generated by geothermal energy or waste heat. Iceland hopes by 2050 to power all its cars and boats with hydrogen made from electricity drawn from renewable resources. Brazil intends to power 80 percent of its transport fleet with ethanol derived mainly from sugar cane within five years. Japan, the world's second-largest economy with no domestic sources of fossil fuel has kept its oil consumption steady since 1975 - while world consumption has risen steadily - by dramatically diversifying its power sources over the years, becoming far less dependent on oil and cultivating a culture of conservation.

These plans are a part of broader sustainability plans like Hawaii’s 2050 Sustainability project, which has created a citizen-driven blueprint for the state's next half-century. The Hawaii 2050 strategy documents outline how the state will handle a tourist economy, a swelling population, friction between cultures and a changing climate and environment. Australia has not yet developed a similar ‘off-oil’ plan.

Increasing the Role of Renewable Energy:

Renewable electricity generation capacity reached an estimated 240 gigawatts (GW) worldwide in 2007, a 50 percent rise over 2004, however, renewable energy represents only 3.4 percent of global power generation. By setting bold targets for the amount of the country’s electricity that will be sourced by renewable sources, national governments around the world are signalling to the market that innovation in renewable energy will be rewarded. For example, the UK renewable energy target is 40 percent by 2020, New Zealand is 90 percent by 2025, Costa Rica’s is 90 percent by 2030. The European Union has boosted the region’s renewable energy target to 21 percent by 2010. Where countries and regions may not have bold targets, states and cities are signalling their support and leadership at a global level. California has set a target of 20 percent renewable energy by 2010 and 33 percent by 2020. In contrast, Australia’s goal is currently 20 percent by 2020. Polling by The Climate Institute shows that 86 percent of Australians will readily accept an immediate shift to a target of 25 percent of Australia’s electricity generation to come from renewable energy sources by 2020. As yet, no Australian states or cities have targets that exceed the federal target.

Increasing the Use of Feed-In Tariffs (FITs):

FITs place a legal obligation on utilities to purchase electricity from renewable energy installations, whereby the tariff rate is guaranteed (in the best examples for a long period up to 20 years), and is determined for each technology to ensure profitable operation of the installation. In the EU, FITs are the norm, with Germany, Denmark, and Spain considered model countries achieving significant results. For Germany, where FITs have been in place and supported politically since 1990, their law has made them a world leader in renewable energy, generated billions of dollars a year in exports, created in the region of a quarter of a million jobs, saved nearly 100 million tons of carbon dioxide annually in recent years, and set records for installed capacity across many technologies, all at the cost of around US$1.80 per household, per month.

Roll-Out of Electricity Metering – Smart Meters:

Several OECD countries have already undertaken national rollouts of smart meters. In Italy, the energy utility Enel SpA undertook a roll-out of smart meters to 27 million customers, completing it

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Appendix 7.4: Existing Australian Policies and Programs to Build Upon

It is important as a first step to affirm that the new Federal Government has many existing government policies and R&D programs upon which it can rapidly build, some of which have already been alluded to above. Key initiatives are briefly highlighted below:

Establishing the world’s first ‘Solar Cities’ program.\(^{1698}\) This program will provide the new Federal Government with a wealth of information over the next five years to better develop and implement policy to reduce Australia’s peak load electricity demand.

Working with the states through the Council of Australian Governments (COAG) to establish and facilitate:

- The National Framework for Energy Efficiency,\(^{1699}\) a COAG initiative to add AUD$1 billion to Australia’s GDP through energy efficiency. What is needed is a solid energy efficiency target for both 2015 and 2020.

- The Australian Minimum Energy Performance Standards (MEPS)\(^{1700}\) for appliances, which have encouraged the refrigeration industry to achieve more than 50 percent energy efficiency improvements in the last 20 years. These are positive steps upon which Australia can build a sustainable energy future.

- Involving 250 of the biggest energy consuming companies in Australia in the Department of Resources, Energy and Tourism’s Energy Efficiency Opportunities program.\(^{1701}\) Further to previous comments above, this program involves companies that represent 60 percent of energy usage by business in Australia. However, currently the businesses that have signed up are only required to publicly report their energy efficiency opportunities of four years or less. In Victoria, the Government requires business to publicly report and implement any energy efficiency opportunity of three years or less. There is an opportunity for the Federal Government to apply the Victorian model nationally and thus align national regulation in this area.

- Phasing out inefficient lighting by 2012.\(^{1702}\) The European Union and California have committed to doing the same. This will have significant flow-on effects by driving a change


among manufacturers in China to focus on more energy efficient products. The same concept could be applied to other everyday household appliances and office and industry equipment. Why should we in Australia be allowing into our market the least energy efficient products? If it is right to ban the most inefficient types of lighting why not apply this concept to other products on the market? If Australia did phase out the least energy efficient products, home appliances and office and industry equipment it could lead to the EU and California following suit. This would provide clear incentives to domestic and international manufacturers to change. This would also help to give local manufacturers a competitive advantage by enabling them to be first to market with.

- Supporting and initiating numerous other innovations in energy efficiency.\footnote{Supporting and initiating numerous other innovations in energy efficiency.\textsuperscript{1703} This is a tradition that deserves to be highlighted and built on by the new Federal Government by setting up specific energy efficiency innovation research and development (R&D) projects. The Federal government has enormous R&D expertise in Australia such as the CSIRO Energy Transformed Flagship program. This program is tasked with researching how Australia can achieve 60 percent reductions in greenhouse gas emissions by 2050. It would be timely for CSIRO to now also be tasked with researching the following questions:

- How best can Australia best achieve 25-40 percent greenhouse gas reductions by 2020?

- Can Australia become climate neutral and if so, 1) by what date? 2) how much would it cost? and 3) what would the effect on jobs be?

- What is a safe emissions reduction target for the world?

- Providing higher rebates for solar photovoltaic energy\footnote{Providing higher rebates for solar photovoltaic energy and hot water systems.\textsuperscript{1704} South Australia has initiated a feed-in tariff providing further incentives for families to save energy and invest in solar energy. There is a significant opportunity for the Federal Government to work with the state governments to adopt the South Australian model nationally.} and hot water systems.\footnote{Ibid. South Australia has initiated a feed-in tariff providing further incentives for families to save energy and invest in solar energy. There is a significant opportunity for the Federal Government to work with the state governments to adopt the South Australian model nationally.} South Australia has initiated a feed-in tariff providing further incentives for families to save energy and invest in solar energy. There is a significant opportunity for the Federal Government to work with the state governments to adopt the South Australian model nationally.

- Supporting world-leading renewable energy research at Universities, such as ANU and UNSW. With its ready availability of land relative to population, sunny climate, winds, long coastline and existence of underground ‘hot rock’ geothermal resources, Australia would seem to have a natural advantage in developing renewable technologies. There is significant need to still improve the levels of investment in renewable energy in Australia. At the moment, with

\footnote{Pears, A. (2005) \textit{Innovation and Energy Efficiency}, Sustainable Solutions and RMIT. Available at \url{http://www.naturaledgeproject.net/NAON_ch17.aspx#PapersPears}. Accessed 13 March 2008.}


the government’s decision to put off a carbon trading framework until 2012, Australia has no such price signal, with the result that some companies have moved offshore. Australian company Solar Heat and Power, for example, has relocated to California, where venture capital for renewable energy is abundant, further to incentives provided by Governor Arnold Schwarzenegger’s administration. We are heartened to read Garnaut stating that, in his opinion, the emissions trading scheme should start earlier than 2012.

- Committing to a 20 percent renewable energy target by 2020. In addition to this Federal target other current state government initiatives to encourage reduced greenhouse gas emissions include:
  
  • A mandatory gas energy target in Queensland.
  
  • Feed-in tariffs in South Australia, Victoria and coming into the ACT and Queensland.
  
  • Minimum building efficiency schemes in each state.
  
  • Energy savings and demand management incentive programs in Victoria, South Australia New South Wales and Queensland.

Subsidies and Incentives

It has recently been estimated that Australia currently spends AUD$6.5 billion annually on perverse subsidies, i.e. subsidies which lead to more greenhouse gas pollution. This is far more than what is currently being spent by government to reduce greenhouse gas emissions. The Forum recommends a ‘whole of government’ approach is needed to realign economic incentives and subsidies to ensure all government departments grants and incentives focus on reducing greenhouse gas emissions. According to Riedy and Diesendorf, these current subsidies include:

- electricity price subsidies to aluminium smelting;
- tax benefits for salary packaging motor vehicles;
- Greenhouse Gas Abatement Programs (which go mostly to fossil fuels);
- fuel excise reduction;
- fuel sales grants scheme;
- automotive industry support;
- land for roads and car parking;
- reduced import duty on 4WDs;
- inappropriate company tax concessions; and
- R&D support for fossil fuels.

Simple policy changes need to be made to remove disincentives to do the right thing, such as the following should be considered:

- Remove the fringe benefits tax incentive to drive company vehicles long distances. Create incentives for employers to provide free public transport for their employees.
- Remove favourable tariff treatment of four-wheel-drive vehicles by increasing their import tariff from 5 percent to 10 percent, to bring it into line with regular vehicles, making exceptions for primary producers.
- Remove the GST from public transport.
- Remove GST from the sale of biofuels and indefinitely extend the biofuel-excise holiday.

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Ibid
- Remove GST from the sale of fuel efficient cars (7litres per 100 km or less), hybrids and new electric cars.

- Remove GST from the sale of 5-star energy efficient appliances

Since climate change is considered the most significant market failure of all, the following incentives and subsidies are recommended as justifiable for governments to apply, to address this market failure, removing perverse subsidies (AUD $6.5 billion annually) that encourage greenhouse gas pollution, and applying subsidies instead to the following climate change mitigation strategies (in addition to revenue raised from the permits for a national emissions trading scheme of between AUD$5-12 billion):

- Extend government subsidies for energy audits for small businesses and households. Introduce government subsidies for the purchase of energy-efficient equipment by small businesses and households as part of the follow-up to energy audits. This would help overcome upfront investment costs of energy efficiency for retrofitting homes, buildings and industry. Introduce financial incentives for new energy efficient equipment.

- Fund demand management infrastructure such as the national rollout of smart meters.

- Introduce tax incentives or subsidies for installation of co-generation and local energy-storage equipment.

- Subsidise renewable energy. Establish a government-sponsored venture capital fund to complement the Sun Fund, to help developers of renewable-energy and energy-efficient technology to get their new products to market. Initiate cooperation between the federal government and the finance industry in developing new forms of energy related venture capital funds.

- Increase tax incentives for private research and development of new energy-efficient and renewable-energy equipment.

- Fund major national sustainable transport infrastructure such as very fast trains and an upgrade of the national freight rail network.

- Compensate the poor for the likely higher electricity and fuel prices under an emissions trading scheme by funding the retrofitting of public housing, rental markets and low cost flats/housing with insulation, energy efficient lighting and appliances.

**Policy Options to Address Barriers to Energy Efficiency**

International experience suggests that the following policies and targets are needed to compliment both the Australian national emissions trading scheme and to provide economic incentives to ensure

- Set a national energy efficiency target for 2015, 2020 and 2030.

- Introduce and subsidize mandatory energy audits of all medium to large energy users, with compulsory implementation of energy saving opportunities that have a payback period of one year or less, coupled with public reporting of all energy-saving opportunities that have a payback period of up to four years.

- Increase national mandatory minimum energy performance standards to match best global practice.

- Implement national mandatory minimum energy and greenhouse performance standards for all appliances and equipment with the capacity to use more than 50 Watts of electricity or 5 megajoules per hour (MJ/hour) of natural gas.

- Legislate to ensure that all new homes and buildings have solar hot water systems and support this by maintaining the current rebate systems at the Federal and State government levels.

- For all homes mandate energy and greenhouse gas ratings and require that these ratings be published in all advertisements and contracts for the sale or rental of the homes.

- For all commercial buildings mandate minimum energy and greenhouse performance standards based on appropriate The minimum performance standards should initially include a 5-star requirement for new buildings including fit-out, and a requirement for existing commercial buildings to be progressively improved to achieve 4-star rating.

- Increase funding for the Cities for Climate Protection (CCP) program for local governments. Ensure that at least part of this funding is used to upgrade the energy efficiency of public street lighting. Require each local government to report annually on the use of the funding.

- Award one-off grants to manufacturers of energy consuming appliances and equipment, thus enabling them to retool in order to meet the mandatory energy performance standards.
Policies to Improve Demand Management

Restructure electricity tariffs to provide financial incentives for saving electricity

Australia’s electricity system is the main cause of our excessive greenhouse emissions but there is no consideration of this, or the cost of greenhouse emissions to the economy, in the design of the market. The rules of the National Electricity Market (NEM) are inappropriately focused on the supply of coal-fired electricity at the expense of energy savings and renewable energy technologies. The failure to harness an adequate level of demand management is such a fundamental flaw of the NEM that broad-scale changes to the rules are urgently required. Unnecessary pressures to build expensive new infrastructure inflate costs - decrease the efficiency and reliability of networks, destroy options for cost-effective demand management and unnecessarily raise prices for consumers. These outcomes are in conflict with the long term interests of consumers. The Total Environment Centre has published a range of publications providing detailed and clear recommendations for change to regulations and policies to encourage rather than discourage demand management.\textsuperscript{1710}

Policies to Encourage Renewable Energy\textsuperscript{1711}

Policies to help ensure a smooth transition to a low carbon electricity sector:

- Include a greenhouse trigger in the Environment Protection and Biodiversity Conservation Act that ensures federal oversight of developments that will have greenhouse emissions greater than 100,000 tons of CO$_2$-e each year.\textsuperscript{1712}

- Increase Australia’s Mandatory Renewable Energy Target (MRET) to ensure at least 15 percent of national electricity demand is met from renewable sources by 2015, and 25 percent is met from renewable sources by 2020.\textsuperscript{1713} Introduce annual auditing of national progress towards the target.

- Introduce “feed-in tariff” laws for renewable energy that guarantee minimum prices for renewably generated electricity for set periods, to give it a commercial foothold.

Policies to help the uptake of solar energy opportunities:

- Mandate that a solar, heat pump or solar compatible natural gas hot water system with low standby losses be installed in every proposal for a new or substantially renovated residential building.


Where natural gas and sunshine are both available, mandate that the only system that may be installed is gas boosted solar.

- Local governments must implement rules protecting solar access of all existing and new buildings.
- Local governments must remove planning requirements on the installation of solar hot water and photovoltaic modules on residential buildings
- Strengthen the development of Australia’s manufacturing base by committing to making Australia a world leader in solar photovoltaic and solar thermal technology. This can be achieved by keeping locally researched solar technology in the country through appropriate use of government subsidies, tax incentives, venture capital funds and research funding.

Policies to help the uptake of wind power opportunities:

- With wide public consultation, develop and implement consistent planning guidelines across all levels of government for the establishment of wind farms nationally.
- Develop grid management policies that allow for the inclusion of wind farm output forecasting data. The use of such data will allow for the greater penetration of wind energy and optimised cost and/or emissions reductions.
- Extend State and federal incentives for small renewable energy generation systems, such as solar thermal and solar photovoltaic rebates, to include small wind turbines of less than 100 kW capacity that service a similar need and market.

Create a more holistic and integrated approach to Research and Development (R&D) Funding for Renewable Energy in Australia, by:

- Over the past decade, the previous Federal Government systematically cut funds to Australia’s renewable-energy focussed research and development programs. Programs cut over the past decade include the Energy R&D Corporation, the Australian Cooperative Research Centre for Renewable Energy, and the Renewable Energy Commercialisation Program of the Australian Greenhouse Office.

After a decade of stop-start management of R&D support there remains a critical funding gap (see between early stage research and support at the point of commercialisation).\textsuperscript{1714} Furthermore, the Low Emissions Technology Development Fund, (the Government’s flagship low emissions technology program) allocation has favoured fossil fuel projects over renewable energy projects by a ratio of more than four to one on a dollar basis (AUD$335 million so far to fossil fuel projects; AUD$75 million to

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renewable energy). Moreover this program is not available to support R&D. Other countries, like Germany, effectively plug this gap for renewables funding, through integrated programs of support which cover every aspect of the renewable energy industry — research, development, demonstration, commercialisation and market support. Critical mass is built via the availability of large-scale and stable R&D funding in, for example, the Fraunhofer Institute for Solar Energy Systems, which has a budget of E$47 million per year. The Fraunhofer Institute is just one of many such large European solar research institutes. This type of integrated support for renewable energy research is not available in Australia.
Appendix 7.6: Initial List of leading International and Australian Businesses, Local Government and organisations committed to becoming Climate Neutral.

UNEP has created the new UNEP Climate Neutral Network to catalyse a transition to a low carbon world. Four countries, four cities and five corporations have joined together in a new initiative to address climate change and the urgent need to de-carbonize the global economy. Four countries so far have committed to becoming net climate neutral – New Zealand, Iceland, Norway and Costa Rica. Norway aims to become climate neutral by 2030. Four cities, who have committed to becoming climate neutral, have signed up, they are Arendal, Norway; Rizhao, China; Vancouver, Canada and Växjö, Sweden. Five companies have become the first to join the CN Net. They are Co-Operative Financial Services, UK; Interface Inc, United States; Natura, Brazil; Nedbank, South Africa and Senoko Power, Singapore. The Network, a web-based project, is seeking to federate the small but growing wave of nations, local authorities and companies who are pledging to significantly reduce emissions en route to zero emission economies, communities and businesses. The aim is a global information exchange network open to all sectors of society.

Internationally there is a major shift occurring in the business community. Consider the UK where numerous companies are committing to becoming climate neutral, including, Barclays Bank, Marks & Spencer and BSkyB. SkyB, for example, has cut greenhouse-gas emissions from its sites by 47 percent, buys all its electricity from renewable sources and has announced its intention to go carbon neutral. Australia has numerous businesses and local governments which have committed to becoming climate neutral. They also could join this new UNEP network.

Australian Business’s and Local Government’s Committing to become Climate Neutral rapidly.

Numerous corporate organisations have now committed to becoming climate neutral including high profile organisations like the News Limited, Australian Football League (AFL), Price Waterhouse Coopers, Westpac, Insurance Australia Group, Swiss Re, Bunnings Warehouse, KPMG Australia, and Channel Seven’s Sunrise Breakfast TV Program. Virgin Airlines, Qantas and Jetstar in Australia has

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launched a carbon offset option through which customers can choose to offset their emissions. Europcar Australia has partnered with Greenfleet to offset the carbon emissions of every new vehicle that is added to its fleet. Companies like BP, ACTEW/AGL, Origin Energy, and Virgin Airlines have already got low carbon/climate neutral products accredited with the AGO’s ‘Greenhouse Friendly’ accreditation scheme. Fuji Xerox Australia recently announced that it will soon run its company sites on 100 percent green power from renewable energy sources. Over the next four years the company will be increasing its use of renewable energy-based power by 25 percent annually, aiming to purchase 100 percent green electricity by the year 2010. Westpac has already reduced emissions by 45 percent.

With the increased severity of drought, likely due to climate change, organisations across the water services sector, which are directly affected, are also examining climate neutrality. Melbourne’s water authorities are leading the way by all working towards becoming climate neutral. City West Water announced on 27 March, 2007 that it will become the first carbon-neutral water authority in Australia by June 2007. Other water authorities such as Melbourne Water, Yarra Valley Water and South East Water are also working towards it but are yet to set a target. A recent survey by Yarra Valley Water showed 74 per cent of its customers supported efforts to go carbon neutral, even if it meant water bills would cost more.

In government, climate leaders in Australia include: Newcastle City Council - which has already reduced emissions by over 50 percent throughout its operations since the mid 1990s; and the City of Melbourne - which is working hard to achieve its goal of being climate neutral by 2020. Other local governments to commit to becoming climate neutral include Moreland City Council, Maribyrnong City Council and the Yarra Ranges Shire Council. Councils such as Townsville City Council are focused on practical programs such as the national Solar Cities program to assist constituents to reduce energy demand and shift to renewable options.

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