Unearthing the Sun

Making sense of the proposed coal developments in the Galilee Basin

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This thesis is my own original work except where due acknowledgement is made.

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Abstract

The Galilee Basin is a major coal basin in central-west Queensland on the brink of being ‘opened up’ for the first time. However, almost every component of the proposed developments has been clouded by controversy, with the prospect of substantial negative consequences at local, regional and global levels. In particular, the proposed coal developments in the Galilee Basin appear woefully out of step with the imperative to limit the production and consumption of fossil fuels in the face of global warming. This thesis examines the plans and controversies in the Galilee Basin as an example of human society’s coal conundrum; coal is central to the development and functioning of modern industrial society, yet a continuing reliance on coal will severely challenge the safe operating space for humans on planet Earth. It is a situation that demands engagement with the complex social and environmental dimensions of humanity’s continuing dependence on fossil fuels. I identify and explore some of the systemic factors driving coal development in the Galilee Basin by locating current events in a broad historical view. Guided by the fields of human ecology and environmental history, I consider a number of key nested historical contexts that help to explain the impetus behind Australian coal development, as well as the often uncomfortable coexistence of coal-based development with other industries and values. Current dilemmas in the Galilee Basin are situated in the context of the region itself, as well as in the longer story of coal in Queensland, Australia, early industrial Britain, and the planetary scale picture of carbon and fossil fuels. Coal is found to be inextricably entwined in the technological, economic, political, and cultural fabric of modern society. While there are broadly similar patterns across the industrialised world, there are distinctive features about the biophysical and sociocultural history of Australia that have enabled an especially prominent role for coal. From a broad historical perspective it is evident that there are multilayered, historically charged, forces propelling coal mining in the Galilee Basin. But also, the proposed developments come at a time when the costs of coal are starting to overwhelm its long perceived benefits. The Galilee Basin is thus at a unique crossroads in time. How events play out in the region will, to a large extent, reflect the complex global struggle to forge a future beyond fossil fuels. The discussion and findings from this research are also relevant to discussions about the multi-dimensional aspects of energy more generally, and how humanity might think about energy choices in the decades to come.
To my friends in central-west Queensland — forever at the frontier
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I would particularly like to acknowledge and thank those people who agreed to be interviewed for my research. I am very appreciative of their interest and generosity of time. This thesis would be poorer, and far less grounded, without their contribution. I also benefitted from talking with local historian Isabel Hoch, without whom the written record of central-west Queensland would be scant indeed.

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Preface

In August 2003, on the eve of major land clearing reform in Queensland, the then Premier Peter Beattie visited the Bimblebox Nature Refuge in the state’s central-west. The visit, organised by conservation groups, was aimed at demonstrating to the Premier that it was possible to graze cattle while preserving biodiversity. It was a crucial objective at the time, given that Queensland’s land clearing rates were amongst the highest in the world and mostly carried out in the pursuit of pasture for sheep and cattle.

Bimblebox comprises nearly 8,000 hectares of remnant vegetation and has been recognised particularly for its floral diversity. Nonetheless, a clearing permit had been attached to the title of the land when it came up for sale in 2000. A small group of people, concerned about the ecological havoc caused by land clearing in Queensland, decided to pool their money and purchase Bimblebox to prevent it from being cleared. The Commonwealth Government contributed around $300,000 in recognition of the property’s high conservation values. In 2002, a perpetual conservation covenant was signed with the Queensland Government stipulating how the landholders must care for the nature refuge. Bimblebox also became part of the National Reserve System of Protected Areas — one of very few in the Desert Uplands bioregion.

However, a decade after being protected from clearing and being held up as a positive example to the State Premier, Bimblebox now faces the threat of large scale coal mining. The Bimblebox owners were opposed to the twenty exploration holes that were drilled, beginning in 2008, but there was no legal means to stop this happening — in most cases landholders in Australia do not have the power to say no to mineral exploration and mining. In 2009, the high-profile businessman (and later politician), Clive Palmer, bought out Waratah Coal — the small coal company that had exploration rights on Bimblebox. In 2011, the company announced its plans to develop one the biggest coal mines in Australia that would involve open-cut mining just over half of Bimblebox, and underground mining the remainder of the property.

This predicament facing Bimblebox roused my interest in coal dilemmas. For several years, between 2003 and 2007, I helped in the daily running of Bimblebox as a conservation-oriented cattle property. I underwent an informal but intense education in hard work and careful observation, and grew to love the understated beauty of the Desert Uplands environment. A philosophy of minimising negative impacts on the natural world underpinned our activities. The underlying principle in all tasks was to limit the use of fossil fuels, the wear on machinery, and disturbance to the tracks, soil and vegetation. We strove for Bimblebox to serve as an
exemplar of thoughtful, sustainable living; for Bimblebox to be turned into an enormous coal mine would be the cruellest of ironies.

Back in my home town of Canberra, much of my spare time went into helping my friends at Bimblebox mount a grass-roots campaign to oppose the proposed mine. We assumed that things would change once the general public and our elected leaders learned of the injustice of the situation. Surely, a declared nature refuge under meticulous care could not be dug up to produce yet more climate-changing coal? However, after a couple of years of writing letters to politicians and newspapers, initiating petitions, designing campaign postcards, updating web blogs and other well-meaning efforts to draw attention to the issue, it became obvious the interests of coal companies and the state government to ‘open up’ the new coal province of the Galilee Basin was likely to overwhelm all our best intentions and carefully formed arguments.

By late 2009 my curiosity and concern about coal was firmly piqued. The opportunity to pursue a PhD and explore some of the deeper roots to coal’s tenacious significance in human society was too good to pass up. I hope that this doctoral thesis is just the beginning of my long-term engagement with the topic of humanity’s coal conundrum, and a helpful contribution to current coal dilemmas in Australia.

While state and federal governments have approved Waratah Coal’s Galilee Coal Project, work to develop the mine on the ground has not yet begun. And owing to a persistent lull in international coal prices, Bimblebox appears to be safe for the time being. But it is a fickle security for Paola Cassoni and Ian Hoch who have given over their lives to caring for and protecting a special patch of bush in outback Queensland, and who have become an unwitting part of the much bigger and long-unfolding story of coal in human society. That is the story I tell.
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Acronyms

AAC Australian Agricultural Company
ABC Australian Broadcasting Corporation
AIGN Australian Industry Greenhouse Network
BCE Before Common Era (that is, prior to year 0)
BHP Broken Hill Proprietary Company Ltd
BMR Bureau of Mineral Resources, Geology and Geophysics
CAQ Coast and Country Association of Queensland
CE Common Era (that is, after year 0)
$\text{CO}_2$ Carbon dioxide
CQEA Central Queensland Employers Association
CSG Coal Seam Gas
CSIRO Commonwealth Scientific and Industrial Research Organisation
Cth Commonwealth (of Australia)
DIDO Drive-in drive-out
EDO Environmental Defenders Office
EIS Environmental Impact Statement
FIFO Fly-in fly-out
GAB Great Artesian Basin
GBR Great Barrier Reef
GGE Great Oxidation Event
ICAC Independent Commission Against Corruption
IEA International Energy Agency
IESC Independent Scientific Committee on Coal Seam Gas and Large Coal Mining
ILUA Indigenous Land Use Agreement
IPCC International Panel on Climate Change
LNP Liberal National Party (Queensland conservative political party)
LULUCF Land use, land use change and forestry
MCA Minerals Council of Australia
NSW New South Wales (a state of Australia)
OECD Organisation for Economic Co-operation and Development
OMS Output per manshift worked
OPEC Organisation of Petroleum Exporting Countries
Qld Queensland (a state of Australia)
QRC Queensland Resources Council
SDA State Development Area
UN United Nations
WWF World Wildlife Fund
Chapter 1

OUR COAL CONUNDRUM

In a sense, climate change can now be considered another weapon of mass destruction, perhaps even the world’s most fearsome weapon of mass destruction (John Kerry, US Secretary of State, February 2014).¹

There is no doubt that the science [of climate change] is a clarion call for the rapid transformation of the coal industry (Christiana Figueres, Executive Secretary UNFCCC, November 2013).²

The government I lead is determined to create the conditions for the continued expansion of the coal industry (Tony Abbott, Australian Prime Minister, October 2014).³

The Galilee Basin is a major coal basin in central-west Queensland on the brink of being ‘opened up’ for the first time. If plans go ahead as anticipated, up to twelve massive mines and associated rail and port infrastructure will be established, leading to the annual export of around 300 million tonnes of thermal coal to foreign markets — a volume that would roughly double Australia’s black coal exports, and equal nearly one third of current world trade in thermal coal (see Figure 1.1 for map of Australian coal resources). The proponents as well as the Queensland and federal governments are eager for the projects to proceed. However, almost every component of the proposed developments has been clouded by controversy, with the prospect of substantial negative consequences at local, regional and global levels. In particular, the proposed coal developments in the Galilee Basin appear woefully out of step with the imperative to limit fossil fuel production and consumption in the face of global warming. On the face of it, the proposed opening of the Galilee Basin simply does not make sense.

² Christiana Figueres, ‘Keynote Address’ (presented at the World Coal Association International Coal & Climate Summit, Warsaw, Poland, 2013).
Figure 1.1 Map of Australian Coal Resources
Source: Map modified from Geoscience Australia^4

The plans and controversies in the Galilee Basin are not isolated phenomena. Rather, they represent a fundamental global struggle whereby increasing production and consumption of carbon based energy defies the crucial challenge to reverse the growth of anthropogenic greenhouse gas emissions and realign human society towards a more sustainable future. This dilemma demands engagement with the complex social and environmental dimensions of humanity’s continuing dependence on fossil fuels.

Over the past two hundred years carbon fuels have underpinned industrial development and economic growth, and have dramatically re-shaped human lives. However, current trajectories cannot continue unchecked due to the strongly-supported scientific proposition that there remain sufficient deposits of coal, oil and gas around the world, which if combusted, would push Earth’s climate system beyond the point of habitability for most humans and numerous other species. In effect, we are witnessing a slow-motion, high-impact, collision between the dominant mode of development and natural planetary systems. Coal is by far the most voluminous of all the remaining fossil fuels, and so radically re-shaping human’s relationship with coal emerges as a pressing priority. In light of this larger perspective, issues in the Galilee Basin have far-reaching resonance.

To date, the plans and controversies in the Galilee Basin have attracted surprisingly little in-depth critical analysis, despite it having become an increasingly high profile site of contestation. Commentary has mostly been restricted to press releases, media articles and environmental campaigns. This research seeks to help redress the analytical gap, by identifying and examining some of the key systemic factors driving the momentum towards coal development in the region. In this thesis I purposely look beyond the proximate causes of coal development, such as coal prices and market demands, to locate the plans and controversies in the Galilee Basin in a broader historical context.

The important place of coal in human society has long been observed. By the time the industrial revolution was in full swing there was little doubt in the minds of contemporary observers that coal played a pivotal role in the transformation of society and in the daily experience of countless people. The great nineteenth century British economist Stanley Jevons warned of the potential exhaustion of a finite commodity so central to British prosperity, writing in 1865:

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Day by day it becomes more evident that the Coal we happily possess in excellent quality and abundance is the mainspring of modern material civilisation.⁶

And further:

Coal in truth stands not beside but entirely above all other commodities. It is the material of the country — the universal aid — the factor in everything we do. With coal almost any feat is possible or easy; without it we are thrown back into the laborious poverty of early times.⁷

In 1860, American intellectual Ralph Waldo Emerson similarly eulogised the virtues of coal in terms that have a haunting resonance in the twenty-first century:

We may well call it black diamonds; every basket is power and civilization. For coal is a portable climate. It carries the heat of the tropics to Labrador and the polar circle; and it is the means of transporting itself whithersoever it is wanted.⁸

Nor were the broad transformative effects of coal lost on Australians in the nineteenth century. For instance, in January 1848 the Sydney Morning Herald reported that:

...manufactures, commerce, civilization, justice, happiness, and Christianity — home and home enjoyments — are all more or less bound up with the existence and availableness of coal.⁹

Half a century later in the United States (US), an abstract and grandiose representation of coal’s broad sweeping influence appeared in a mural consisting of a sequence of pictures commissioned by Kentucky land speculator John C. C. Mayo:

In the first picture, a giant anthropomorphic figure was chained beneath the ground by a stratum of coal. In the next, the figure awoke, freed by the mining of coal, and in the third picture, the figure trod the land “with transforming power”.¹⁰

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⁷ Jevons, p. 2.
The same basic sentiment was less dramatically espoused by Frederick Danvers Power, the author of the first Australian book devoted to the “glorification” of coal, published in 1912.\(^1\) Power referred to the competitive advantage coal-bearing economies had over others:

> Coal is a most important substance in the welfare of a country, as on it depends so many industries; consequently, other things being equal, that country which has the best coal supply has an immense advantage over her neighbours...\(^2\)

Coal may well have lost some of its magical lustre over the course of the twentieth century, but as a cheap and abundant source of energy its benefits are still undeniable. Oil and gas displaced the predominance of coal over the twentieth century to some extent, but coal has remained the backbone of economic development in much of the world. Coal has been the fastest growing fossil fuel since the beginning of the twenty-first century, providing 41% of the world’s electricity supply in 2011.\(^3\) The International Energy Agency (IEA) forecasts a continued growth in global coal demand of 0.7% per year out to 2035 if existing global commitments to address climate change are taken into account. However, the IEA also points out that coal use would need to fall by one third between 2011 and 2035 for a “50% chance of limiting the long-term increase in average global temperature to 2 degrees Celsius (°C)”;\(^4\) temperature increases beyond this are commonly regarded as posing unacceptable risks for humans and other life on Earth.\(^5\)

As argued in this thesis, the persistent and numerous grounds for opposition to the mining, transport and burning of coal over the past seven centuries have largely been overwhelmed by the conclusion that the benefits of coal far outweigh its costs. Only in very recent decades with better scientific understanding of the threat of global climate change, have there been calls to challenge fundamentally the position of coal in human affairs. Climate change arguments have bolstered substantial long-running concerns about other impacts of coal, such as the effect of mining on agricultural lands, water resources and communities, and the toll of coal combustion on human health. Nonetheless, for the time being at least, little headway has been made to stem the growth of global coal production and consumption.

Changing the function and status of such an important and deeply entrenched commodity as coal does not come quickly or easily. Christiana Figueres, Executive Secretary of the United Nations Framework Convention on Climate Change, has stated that coal use would need to fall by one third between 2011 and 2035 for a “50% chance of limiting the long-term increase in average global temperature to 2 degrees Celsius (°C)”; temperature increases beyond this are commonly regarded as posing unacceptable risks for humans and other life on Earth.

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\(^2\) Power, p. 1.


Nations Framework Convention on Climate Change, has likened the necessary transformation of the coal industry to the challenge undertaken by John F. Kennedy to put a man on the moon within a decade, at a time when the knowledge and technology did not exist to do so. Speaking to a meeting of the World Coal Association, Figueres implored: “we must transform coal with the same determination, the same perseverance, the same will.” Arguably though, “transforming coal” is in fact a process of far greater complexity and difficulty than putting Earthlings on the moon, given the degree of coal’s embeddedness in existing energy infrastructure, technological, economic, institutional and political systems, and the vested interests that work to maintain the status quo.

This research begins from the position that the current role of coal in human society is problematic for environmental, social, political and economic reasons, and that there is a need for fundamental change. However, this research does not simplistically call for humanity to deal with its dependence on coal by simply switching energy sources. In this thesis I work from the proposition that alternative energy initiatives are a crucial, but on their own, inadequate response to our collective coal conundrum. Implicit throughout this thesis is the argument that there is a need for a more concerted effort to interrogate coal in all its dimensions. Coal is a source of carbon and energy, but it is also much more. Coal is inextricably part the fabric of modern society. Thus, working towards the goal of ‘doing something’ about coal requires an appreciation of what it is we are dealing with in the fullest sense possible. Historian Tony Wrigley eloquently captures the core idea: “We cannot choose but to be the inheritors of the industrial revolution; we can choose to know our inheritance better than we do”.

There are a number of notable works that admirably account for the rich and complex milieu in which coal is situated, and how it helps to explain various events, situations or phenomena. The US has produced a relative abundance of popular and academic literature in this field. For instance Barbara Freese’s Coal: A Human History provides a highly readable summary of coal in human history, leading up to the battle for air pollution control in the US. Christopher Jones’ work highlights the important role of canals in ushering in a coal centred industrialisation in the eastern mid-Atlantic. Thomas Andrews’ Killing for Coal develops a sophisticated and powerful analysis of a 1914 Colorado coal-field massacre and its myriad environmental and

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16 Figueres.
CHAPTER 1: OUR COAL CONUNDRUM

human components and causes.\textsuperscript{20} Conflict in the Appalachians is the focus of a number of books, such as Chad Montrie’s detailed history of twentieth-century opposition to surface mining in \textit{To Save The Land and The People};\textsuperscript{21} a theme continued in Michael Shnayerson’s \textit{Coal River} that covers the ongoing twenty-first century struggle.\textsuperscript{22} Rebecca Scott’s \textit{Removing Mountains} and John Goventa’s classic \textit{Power and Powerlessness} deal with the highly fraught social and political dimensions of environmental and labour conflict in the area.\textsuperscript{23} There are undoubtedly many more US texts that could be mentioned.

While not specifically focussed on coal, Astrid Kander, Paolo Malanima and Paul Warde’s recently published book \textit{Power to the People} provides a comprehensive and in-depth study of energy in Europe over the past five centuries, drawing possible lessons for current and future challenges.\textsuperscript{24} John McNeill also integrates the important role of fossil fuels in his environmental history of the twentieth century, \textit{Something New Under the Sun}.\textsuperscript{25} Countless other articles and books deal specifically with the role of coal in the development of specific technologies, the industrial revolution, and the transformation of human energy systems at different national and continental scales. Rolf Peter Sieferle’s \textit{The Subterranean Forest};\textsuperscript{26} Tony Wrigley’s \textit{Energy and the English Industrial Revolution};\textsuperscript{27} and the multi volume \textit{The History of the British Coal Industry}\textsuperscript{28} have informed this research.

Australian literature on coal is less extensive than overseas counterparts, although taken together it spans a rich spectrum of topics. There are a number of histories of the coal industry written in the twentieth century, several of which are written from either predominantly labour or industry perspectives, and which mostly have an either New South Wales or

\begin{footnotesize}
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\item Chad Montrie, \textit{To Save the Land and People: A History of Opposition to Surface Coal Mining in Appalachia} (Chapel Hill: University of North Carolina Press, 2003).
\end{enumerate}
\end{footnotesize}
Queensland focus. Besides these, Chris Fisher’s book *Coal and the State* is a particularly important political economy contribution that appears to have been under-utilised to date. Hugh Saddler gives an invaluable overview of the role of coal in Australia as part of his analysis of the energy industry. Meredith Fletcher provides a compelling social history in *Digging up People for Coal*, looking at a company town that was created and destroyed for coal. A similar story is also told by Diane Menghetti in *Blair Athol: The Life and Death of a Town*. Marion Diamond has written one of the few summaries of the history of coal in Australia, in a chapter of a publication written from an industry perspective. Guy Pearse’s research on the political power and influence of the coal industry is perhaps the most prominent contribution in the past decade. Since the early 2000s, the conflict between the coal and coal seam gas (CSG) industries, and landholders and communities has also started to appear more frequently in academic journals (particularly in the disciplines of geography and anthropology) and in


33 Diane Menghetti, *Blair Athol: The Life and Death of a Town* (Clermont, Qld.: Blair Athol Coal Project, 1995).


popular books such as Sharyn Munro’s *Rich Land, Wasteland* and Paul Cleary’s *Mine-field*. Luke Keogh and I appear to have been the only researchers to have focussed specifically on coal and CSG from an environmental history perspective in the Australian context in recent years.

This inquiry draws on many of the works mentioned above, but is original in its focus on the Galilee Basin and by placing a longer and broader history at the centre of current concerns.

The main research question is:

> Why are there serious plans to open up the vast reserves of thermal coal in the Galilee Basin despite increasing concerns over the impacts of mining on land and water in Australia, and when there is a need to phase out the use of fossil fuels to curb catastrophic global warming?

This question leads to an interest in the Galilee Basin area itself, as well as the constituent coal reserves and how they are connected to multiple layers of planetary and human history. The research is guided by the complementary interdisciplinary academic fields of environmental history and human ecology, but draws on numerous other disciplines and fields of inquiry. It takes the risk of covering a broad range of topics, information sources and time periods in the effort to unveil blatant and subtle causes and consequences of coal’s embeddedness.

The large scope of this thesis makes it both appropriate and necessary for it to be predominantly a synthesis of secondary source literature. Nonetheless, the views and perspectives of twelve interviewees — predominantly residents of the Galilee Basin — help to ground and enrich the inquiry. For the more recent historical periods, useful sources have included newspaper articles, media releases, websites, and documents from governments, corporations and non-government organisations. I also draw on my own experience in the Galilee Basin area and connection with the environmental activist movement, as described in the Preface. So as to not interrupt the flow of the narrative, a more extensive discussion of the research approach has been included as an Appendix (see Appendix 1).

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CHAPTER 1: OUR COAL CONUNDRUM

The structure of this investigation takes the form of a series of nested historical contexts that emerge out of research sub-questions, and which match the chapters of this thesis:

- What is the nature of plans and controversies in the Galilee Basin? (Chapter Two)
- What is the context of the proposed Galilee Basin coal developments from a view of the region itself? (Chapter Three)
- How can we think about coal on a planetary scale over geological time? (Chapter Four)
- What are the historical forces that drive twenty-first century coal development?
  - What are the historical roots of coal’s importance in human society in general? (Chapter Five)
  - What is the background of coal development specifically in Australia and Queensland? (Chapters Six and Seven)
- How can we understand twenty-first century opposition to coal development in a historical context?
  - What have been the human and environmental implications of coal use through time and how does this inform current dilemmas with coal? (Chapter Eight)

Following this introduction, Chapter Two provides a snapshot of the plans and controversies in the Galilee Basin, thereby fleshing out the current context for the research. Chapter Three takes a closer look at the Galilee Basin area by considering the physical landscape and layers of human history and meaning in the region. I then turn to consider coal in more depth, firstly by placing coal in the carbon cycle and geological history of Earth in Chapter Four, and then in Chapter Five by investigating the emergence of coal in human society, most notably as part of the industrial revolution and from the view of energy regime transitions. Chapters Six and Seven respectively deal with coal in the history of Australia and Queensland. Chapter Eight documents coal contestations and controversies that continue in the Galilee Basin across at least seven centuries of struggle. Chapter Nine provides conclusions, drawing insights from across the research and outlining some implications for the future.

Altogether, the picture that emerges is one in which coal has been pivotal in delivering modern industrial society as we know it. Coal was the first energy source to free humans from the bounds of the ‘organic’ economy. Cheap and abundant coal led to an extraordinarily high level of energy dependence. It shaped technologies, infrastructure, economies, institutions and politics. While there are broadly similar patterns across the industrialised world, there are distinctive features about the biophysical and sociocultural history of Australia that have enabled an especially prominent role for coal. From a broad historical perspective it is evident that there are multilayered, historically charged, forces propelling coal mining in the Galilee
Basin. This finding invites the question as to whether it is possible to approach coal dilemmas without also attending to the multiple human systems in which coal is embedded, and to what extent more fundamental change is necessary and/or possible.

As a final note to this introduction, it is important to acknowledge that the Galilee Basin (and twenty-first century global coal dynamics more generally) is a very live and therefore slippery topic to handle. There is speculation in the latter half of 2014 that on-going depressed coal prices and the struggling financial situation of key proponents may result in the much-hyped Galilee Basin projects not proceeding.39 Some have even ventured to suggest that coal is now in structural decline globally40 — a notion that seemed extremely remote even just a few years ago at the outset of this research. While such remarkable shifts could render small sections of this thesis obsolete, the majority of the research is still highly pertinent to the more general question of how, as a global society, we might understand and deal with the deeper forces that lie behind the momentum towards fossil fuel development. Even in the optimistic case that production and consumption of fossil fuels are wound back in accordance with an objective to limit global warming to 2°C, there will still be need for a thorough understanding of the complex dynamics of energy in human society when imagining and designing more appropriate energy futures. And in this sense, there could hardly be a better opportunity than to learn all available lessons from human society’s long relationship with coal.


Chapter 2

THE GALILEE BASIN BATTLEGROUND

The Galilee Basin offers a twenty-first century example of how the benefits of coal exist alongside substantial costs associated with its mining, processing, transport and combustion. Many of these costs are represented by conflict and controversy of various kinds. The scale of developments planned for the Galilee Basin are such that regional and global consequences are equally, if not more, prominent than local concerns. The various concerns are increasingly ‘bundled’, bringing together novel coalitions of groups and issues, much to the ire of governments and industry pushing for swift progress. As such, the Galilee Basin has become a battleground for local, regional, national and global tensions around coal development, played out through formal and informal avenues. This chapter presents a snapshot of these dynamics. The majority of the chapter explores the plans and controversies in the Galilee Basin through the lens of the Alpha court case. Connections are drawn between the Galilee Basin and the broader territory of debate and discussion around coal development in Queensland, elsewhere in Australia and on the global level. This chapter also presents some of the voices of local residents — often overshadowed in high profile coverage of the Galilee Basin.

Scoping the territory

After a two decade hiatus in exploration activities, coal in the Galilee Basin received renewed interest from 2004, on the back of a hike in international coal prices.\(^1\) All of a sudden it was considered economically viable to develop the vast, but remote, reserves of thermal coal. With seemingly insatiable Asian markets ready to absorb Galilee Basin coal, new mines, rail lines and expanded port facilities appeared on government and company drawing boards.

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There are up to twelve mines currently proposed in the Galilee Basin, all of which line up along the eastern margin of the basin where the coal seams lie close to the land surface (see Table 2.1 and Figure 2.1). Also proposed are at least two new rail lines connecting the southern and central Galilee Basin mines to the export facilities on the coast, and an expanded port at Abbot Point. The likely and potential consequences from opening up the Galilee Basin have drawn a spectrum of opinions and perspectives, some of which are encapsulated in the following quotes:

... I think just the powerbrokers, or the faceless people, or whatever you want to call them — I think they are willing to sacrifice a small part of the world. I mean we are out of sight, out of mind. We are only a very small part of the world, or part of the country. Very small voice... (Alpha resident, 2012).¹

I'm just dying for [the mines] to come ... some people are against it, but that's their prerogative (Alpha resident 2013).²

It's reassuring to see the Anzac spirit is still alive in bush people – it's just a pity the battle is now raging in our home country between mining magnates and primary producers (Janeice Anderson, landholder in the vicinity of the proposed Galilee Basin mines, 2013).³

The Galilee Basin coal boom is not just one of the greatest ever environmental threats to Australia, its climate implications are global (Greenpeace, 2012).⁴

[Prime Minister Tony Abbott] asked me what the blockers were for my government and I said without any hesitation the need to see the massive Galilee Basin coal projects approved as soon as possible (Campbell Newman, Queensland State Premier, 2013).⁵

The Galilee Basin project perfectly fits GVK's global aspirations to be one of the most reliable coal suppliers in the world. Following the best practices in operations and environmental sustainability for the integrated 'pit to port project', comprising mining, rail and port, we will create jobs, contribute to the economic development of the region

¹ Interview data, 2012, interviewee #6.
These statements demonstrate the high hopes and strong sentiments on all sides of the ‘battle’ of the Galilee Basin. Discussion, debate and protest play out within the region as well as on city streets and in the halls of parliament. Courts of law are another venue where the costs and benefits of particular projects have been closely scrutinised.

### Table 2.1 Proposed coal mines in the Galilee Basin

<table>
<thead>
<tr>
<th>Company</th>
<th>Project name</th>
<th>Anticipated annual production of saleable coal (million tonnes)</th>
<th>Status (as of 2nd Dec 2014)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adani Mining</td>
<td>Carmichael</td>
<td>60</td>
<td>Approved (Qld &amp; Cth)</td>
</tr>
<tr>
<td>GVK Hancock</td>
<td>Alpha Coal Project</td>
<td>32</td>
<td>Approved (Qld &amp; Cth)</td>
</tr>
<tr>
<td></td>
<td>Kevin’s Corner</td>
<td>30</td>
<td>Approved (Qld &amp; Cth)</td>
</tr>
<tr>
<td></td>
<td>Alpha West</td>
<td>24</td>
<td>EIS Active</td>
</tr>
<tr>
<td>Waratah Coal</td>
<td>Galilee Coal Project</td>
<td>40</td>
<td>Approved (Qld &amp; Cth)</td>
</tr>
<tr>
<td></td>
<td>Alpha North</td>
<td>40</td>
<td>Pre-EIS</td>
</tr>
<tr>
<td></td>
<td>Alpha West</td>
<td>Not available</td>
<td>Pre-EIS</td>
</tr>
<tr>
<td></td>
<td>Carmichael East</td>
<td>9</td>
<td>Pre-EIS</td>
</tr>
<tr>
<td>AMCI &amp; Bandanna</td>
<td>South Galilee</td>
<td>17</td>
<td>Approved (Qld)</td>
</tr>
<tr>
<td>Macmines Austasia</td>
<td>China Stone</td>
<td>45</td>
<td>EIS Active</td>
</tr>
<tr>
<td>Vale</td>
<td>Degulla Mine</td>
<td>30</td>
<td>Pre-EIS, for sale</td>
</tr>
<tr>
<td>Resolve</td>
<td>Hyde Park</td>
<td>10</td>
<td>Pre-EIS</td>
</tr>
</tbody>
</table>

*Source: company and Queensland government websites, and IEEFA*

*Note: ‘EIS’ stands for Environmental Impact Statement*

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6 GVK Hancock Coal, ‘Described as the Jewel in the Crown of the Galilee’, *GVK Hancock Coal Pty Ltd* [http://gvkhancockcoal.com/](http://gvkhancockcoal.com/) [accessed 7 July 2013]. GVK Hancock was the first company in the Galilee Basin to receive State and Federal approval for its proposed Alpha Coal and Kevin’s Corner mines.

Figure 2.1 Map of proposed Galilee Basin coal projects

Source: Map modified from Queensland Government and the Coordinator-General.

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Alpha in court

Conflicts on the legal battleground came to ahead on 25th October 2013, when final oral submissions for the case of Hancock Coal Pty Ltd v Kathryn Kelly and others were heard in the Land Court of Queensland. The case related to the proposed Alpha Coal Project, the first Galilee Basin mine to receive both state and federal approval. Six parties lodged objections to the approval of the company’s Mining Lease and Environmental Authority, with all but one of these choosing the highest level of objection, leading them to participate in the court process. They included three local landholders, one Queensland based environment group and one concerned citizen from interstate. The environment group, the Coast and Country Association of Queensland (CCAQ), engaged the legal services of the Environmental Defenders Office (EDO), while all the other objectors stood for themselves due to the inhibitive costs of legal representation. A legal team, which included a Queen’s Counsel, represented Hancock Coal, and a lawyer represented the Queensland Government.

Following months of preparation, the main hearings had taken place between 16th September and 2nd October 2013 in the Brisbane court. For the final hearing the three objecting landholders were spared the 1,000 kilometre trip to the state’s capital, but video-conferenced from the Emerald Court House in Queensland’s Central Highlands, with three other landholders and three reporters watching on. Those in Emerald could hear but not see the Brisbane proceedings due to faulty equipment, but their presentations were projected onto a large screen in the Land Court where all other parties had gathered, along with a number of journalists and members of the public interested in the case.
Together, the objectors’ concerns encompassed some of the core complaints against coal development in the Galilee Basin, and against coal development more generally. They focussed on issues of groundwater, biodiversity, climate change and economics. Outside the Land Court process, these issues have appeared alongside others complaints, most prominently those related to the proposed rail and port development. The broad array of concerns, opinions and public debate has surfaced through formal submissions, media articles, environmental campaigns, as well as statements and reports from the mining companies and all levels of government. Less conspicuous issues were also raised during interviews for this research.

**Groundwater**

In the Alpha court case the landholders focussed on the impact mining would have on groundwater. For cattle graziers in the semi-arid Desert Uplands bioregion, bore water is vital to the functioning of businesses and the maintenance of livelihoods. It is graziers’ “most precious asset”, as one of the landholder objectors explained on national television:

> You can’t run a cattle business without water. So if we didn’t have the ground water supply we would be rendered unviable.

Landholder fears related to the individual impact of the Alpha mine as well as the cumulative effect of the four mines proposed in their direct vicinity. As part of mining operations, groundwater would be extracted for dust suppression and coal washing, but more significant quantities ‘dewatered’ from local aquifers to enable the mining of coal seams, in both the open-cut and underground mines proposed for the area. About 100 billion litres could be extracted over the life of the mine for the Alpha Coal Project alone, and over 500 billion litres for the four mines in the Alpha region. By comparison, water extraction for cattle watering in the same district would use less than a third of this amount over the same period. A report commissioned by protest group Lock the Gate reported that as much as 1,350 billion litres

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16 Janeice Anderson, ‘The fight to defend a home’.
18 Tom Crothers, *Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin* (Queensland: Lock The Gate, 2013), p. 36. This includes South Galilee, Galilee Coal Project, Alpha and Kevin’s Corner mines; the other proposed Galilee Basin mines are further north and outside what is identified as the Alpha district. Note, ‘billion litres’ equals 1x10^9 litres.
19 Calculated using figures from Crothers, *Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin*, pp. 36, 48. Assumes that the average life of mine is 30 years, that cattle drink on average 50 litres a day, and that there are between 180,000 to 240,000 head of cattle in the former Alpha-Jericho Shire and that all or most of the water for these cattle is drawn from bores. This is therefore likely to be an overestimate given that, dependent on the season and the locality, there are large surface water reserves used for cattle watering in a significant portion of the district.
could be extracted over the life of the proposed mines in the Galilee Basin if the nine currently proposed go ahead — a volume equal to 2.5 Sydney Harbours worth of water.  

The latest modelling for the Alpha mine has forecast a drop in groundwater depth of up to five metres within a radius of up to ten kilometres from the mine. This was concern enough for the local landholders in court, but an even greater worry is the potential cumulative impacts from the multiple planned mines. Waratah Coal’s modelling of the effect on groundwater from just three of the proposed mines indicates that an “elongated cone of depression” is likely to result, stretching about 100 kilometres long and 30 kilometres wide. Water tables levels may never fully recover. The South Galilee Coal Project assessment predicted drawdown to be as deep as 100 metres where the cumulative impact of four mines coincide, and that groundwater in the affected footprint of the mine would not recover beyond 10-20 metres below pre-mining levels.

As reported in the Coordinator-General’s report on the Alpha mine, GVK Hancock committed to ‘make good’ affected groundwater supplies. The agreements signed with landholders would oblige the company to provide alternative water sources should existing supplies be negatively impacted by mining operations. Drilling deeper bores or trucking in water are two examples of the possible options. In the Alpha mine case, the main concern for two of the landholders, Janeice Anderson and Bruce Currie, was that they had not been able to settle on acceptable make-good agreements with the mining company. They commented:

We haven’t been able to get documentation that guarantees our water supply.

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20 Crothers, Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin, pp. 5, 36.
21 URS, Groundwater Modelling Report - Alpha Coal Project, Alpha Coal Project Supplementary Environmental Report 2012 (Brisbane: Hancock Coal Pty Ltd, March 2012), p. 127; Observer at final submissions hearing, pers. comm.; also see Crothers, Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin, p. 35.
22 Includes GVK Hancock’s Alpha and Kevin’s Corner mines and Waratah Coal’s Galilee Coal Project
24 Merrick and Alkhatib, pp. 4038–4039.
For grazing families, ‘business’ is often inseparable from life. It is not surprising then that the landholders’ sentiments in these matters represent more than a threat to financial viability. In court, Anderson described the personal toll of potentially losing groundwater:

We are between a rock and a hard place... How the loss of ground supplies will be made good or compensated for is a devastating and ever increasing concern for us and our children’s future... Once the aquifers are dewatered and depressurised, there will be no remediating.29

Anderson further emphasised her concern for future generations in an article for a special feature of *Queensland Country Life*:

The permanent and irreversible impact mine dewatering has on local groundwater aquifers will not only affect us, but the generations to come...

The challenges of understanding legal procedures has opened a surprise window of blessing — camaraderie with other landholders, who too are simply fighting for the future of their business and for future generations who will be dependent on groundwater supplies.

She also reflected on her appreciation of her family’s country life and the qualities of country people, which she posed in contrast to the culture of mining companies and the inequalities inherent in dealings with mining companies:

The costs involved with regards to employing legal representation highlight the unfair playing field between the average primary producer and the mining companies. Representing our family in Land Court was definitely not something I would have chosen to do, but was simply a necessity given the drought conditions at home. The experience of objecting in Land Court and spending a few days in the city has made me extremely appreciative of my country upbringing and the life I live...
Dealing with the deceptive tactics of mining corporations has been in stark contrast to the genuine and sincere nature of most bush people. It’s made me appreciate that until what we hold dear is endangered, we tend to take it for granted.  

Filmed by ABC’s Four Corners and speaking through tears, Janette Currie — wife of Bruce Currie — also spoke of the totality of the mining threat and implored consideration of the cost to local families:

If we lose our water, what is Clive Palmer gonna do? If someone said to his wife, possibly in two years time when that mine kicks in down the road from you, you’re gonna lose your house, you’re gonna lose your family structure, you’re gonna lose your passion, and you’re gonna lose your viability, how would she feel? And how would her family feel?

While the security of personal and family livelihood did not motivate CCAQ’s involvement in the Land Court, groundwater was nonetheless one basis of its objection. With the backing of evidence from expert witnesses, it argued that there were contradictions between Hancock’s conceptualisation of the groundwater system and the available data, and as such the resulting modelling was unreliable and its impact assessment flawed. Technical concerns had also been expressed by the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC), a body established by the Federal Government in 2012 in response to “community concerns about coal seam gas and coal mining”. In its report on the Alpha mine, the IESC made a number of observations and recommendations, including the need for a cumulative assessment of groundwater impacts and more careful consideration of potential damage to aquifers that make up the Great Artesian Basin.

Groundwater impacts have also played out in the public arena to some degree. For instance, Lock the Gate commissioned a former senior Queensland Government water planner to assess the cumulative impact of nine proposed mines, in a report called ‘Draining the Lifeblood’.

30 Janeice Anderson.
31 Proponent of the Galilee Coal Project, formerly known as China First, and elected Member of Federal Parliament in the Queensland seat of Fairfax since October 2013.
32 Wilkinson and Jolley.
33 Environmental Defenders Office Queensland.
February 2014 the author Tom Crothers contributed an opinion piece in the Brisbane based 
*Courier Mail* entitled ‘Boring deeply into the impact of the Galilee Basin coal mines on water 
resources’. This article provoked a response from Queensland’s Deputy Premier, Jeff Seeney 
published several days later entitled ‘Strict conditions and monitoring will protect water and 
lands in the Galilee Basin from miners’.

Further west in the Galilee Basin where exploration for CSG has occurred over the last several 
years, the potential risk to the waters of the Great Artesian Basin has also been an issue of 
contention. Development of CSG appears to be a more remote prospect compared to the 
coal mines proposed in the east of the Galilee Basin, but it has nonetheless been a been a 
strong concern for at least some of the potentially affected landholders. For instance, in 2011 a 
sheep grazer in the Barcaldine area was motivated to form a group — the Galilee Basin 
Alliance — in an attempt to fight back against the resource companies. There have also been 
a number of public forums and information sessions about CSG and groundwater in the Galilee 
Basin, designed to facilitate discussion and pass information from the resource companies and 
government to the community.

The proposed Galilee Basin mines would also affect surface water. Creek diversions and 
alterations to catchment flows in the mining area have been questioned. Far to the east of 
the Galilee Basin there are other issues. For instance, to service the proposed new coal mines 
and coal mine expansions in the Bowen and Galilee Basins, a controversial 374,000 million litre 
dam was proposed on the Connors River, half way between Emerald and Mackay and about

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38 Seeney. 
Hydrogeological Investigations* (Brisbane, 2012); Galilee Basin Operators Forum, ‘Galilee Basin Operators 
40 Simon Green, ‘New Landholder Fighter’, *Central Queensland News*, 2011 
2012]]. 
41 See for instance Desert Channels Queensland, ‘Coal Seam Gas’ (presented at the Coal Seam Gas 
for Galilee Basin CSG’, *Queensland Country Life*, 25 June 2013 
basin-csg/2660015.aspx>]. 
42 Waratah Coal, *Supplementary EIS, Vol 1, Part C, Section 4 - Submissions Responses: Water Resources* 
(Brisbane: Waratah Coal, 2013); GVK Hancock Coal, *Supplementary EIS, Vol 1, Section 4 - Comments and Responses: Coal Mine*, 2011.
300 kilometres from Alpha. That project was put on hold in July 2012 whereupon attention turned to the Burdekin and Fairbairn Dams. Representatives from irrigated agricultural industries in those districts raised concerns about the reduced availability of water for cropping, and with further flow-on effects to the local economy.

Biodiversity

The third objecting landholder in the Land Court was Paola Cassoni, part owner of Bimblebox Nature Refuge (where I have worked, as described in the preface). Bimblebox is located around ten kilometres south of the proposed Alpha Coal Project, and is directly threatened by Waratah Coal’s Galilee Coal Project which gained state and federal approval in the latter half of 2013. Like the other landholders in the case, Cassoni was concerned about the lack of cumulative impact studies and the inadequacy of security offered by Hancock’s make-good agreement, but her additional objection concerned the potential negative effect that groundwater drawdown could have on groundwater-dependent vegetation on the nature refuge.

Outside of the court process, the grassroots campaign to save Bimblebox from mining has had surprising reach and helped to bring the coal development plans in the Galilee Basin to a large audience. Widespread support for the campaign can probably be attributed at least partly to its amalgam of grazier and environmental concerns, and to the perceived unfairness of the state government’s apparent retraction of a signed conservation agreement. The mining threat to Bimblebox also easily fits into a portrayal of a David versus Goliath struggle — with hard working landholders facing off against none other than Clive Palmer — a larger than life businessman turned politician. Cassoni’s sponsorship of a documentary called ‘Bimblebox’, about the impacts of coal development in eastern Australia, has also provided an opportunity for screenings and public appearances around the country.

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46 Land Court of Queensland, Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4) [2014] QLC 12, 2014, pp. 13–15; Observer at final submissions hearing, pers. comm.
Kathryn Kelly, the concerned citizen objector from Canberra in the case, also focussed on negative impacts to biodiversity from the proposed Alpha mine. She pointed to the direct biodiversity losses that would result from the Alpha Coal Project, including the direct clearing of around 20,000 hectares of native vegetation and the creation of a permanent 24 kilometre-long open pit, which would form an impenetrable barrier for wildlife and gene flow. She also argued that the biodiversity offsets proposed to compensate for the loss of biodiversity were inadequate, and that the logic of using existing high quality habitat for biodiversity offsets was fundamentally flawed.47

Some of Kelly’s concerns were closely echoed by an interviewee professionally involved with the Galilee Basin. They described the potential biodiversity disturbance from the Galilee Basin mines in a stretch up to 270 kilometres on the boundary between Desert Uplands and Brigalow Belt bioregions (see Figure 2.1):48

Well, the biggest impact is at a landscape level, it’s a massive division between two bioregions, one of which is intact, and in really excellent condition, and one that is already fragmented and degraded. And there are probably many species that are at the extreme distribution in the Desert Uplands that are connected to the core populations somehow across this area and that big mining shaft will stop the movement of many, many different populations of species... In ways that we don’t even know. We don’t even understand how those populations evolve to be there or how the distribution is maintained in disjunct locations. But we are severing that linkage forever.49

They also expressed concern about the likely surface water flow interruption between the Great Dividing Range and Belyando River, and water drawdown impact on the nationally important Doongabulla mound springs from Adani’s proposed Carmichael mine.50 They further disclosed that, in their opinion, there would be no positive outcomes from the proposed mines in the region, and that on top of the ecological impacts, the impacts on families and communities far outweighed any benefits in countries receiving the coal.

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47 Land Court of Queensland, Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4) [2014] QLC 12, pp. 11–12; Observer at final submissions hearing, pers. comm.
48 Figure from Crothers, Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin, p. 5.
49 Interview data, 2012, interviewee #3.
The Queensland Government has attempted to avoid the kinds of ecological losses that occurred in the neighbouring Bowen Basin through undertaking a bioregional assessment of the Galilee Basin area prior to development. Its *Galilee Basin Offset Strategy* aims to “provide spatial resources that guide proponents to locate offset sites in identified strategic conservation hubs and corridors” and assist decision-makers making assessments under relevant Acts. But while this kind of advanced planning for ecological connectivity and integrity is commendable, there is little to no evidence that the mining developments will not lead to a net loss of biodiversity across the region.

The government’s offset strategy document estimates that the total ‘impact area’ associated with the Galilee Basin coal developments could be up to 50,000 hectares across ten proposed mines and the proposed railway. However, this is likely to be a gross underestimate of the total area affected, given that Adani’s Carmichael development alone would cover approximately 45,400 hectares, and with other estimates of the total project areas covering close to 490,000 hectares. There are also serious doubts by independent ecologists that the ‘no net loss’ objective can be achieved and that the Federal Environmental Offsets Policy requirements will be met by the projects proposed in the Galilee Basin.

More generally the issue of environmental offsets has gained both political and public attention in recent years. A Senate Inquiry conducted between March and June 2014 used the examples of Waratah Coal’s Galilee Coal Project and Abbot Point Coal Terminal as two of five nominated Australia-wide case studies.

In the broader media, the plight of one species — the endangered black throated finch (*Poephila cincta cincta*) — has been most strongly associated with biodiversity impacts of the proposed development of the Galilee Basin. The sighting of the species on Bimblebox Nature Refuge in 2011, as well as several other locales in the region, has provided a formal hook for

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53 Adani, *EIS, Section 2: Description of the Project*, 2013, p. 3.
54 Crothers, *Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin*, p. 11.
55 See for instance Megan Evans, *Submission to Senate Inquiry into Environmental Offsets - Submission #26* (Canberra, Australia: Senate Environment and Communications References Committee, 4 April 2014).
concerned individuals and groups to appeal to government legislation aimed at protecting threatened species.\(^\text{58}\) In early 2014, Greenpeace attempted to hold Adani to account for exploratory seismic surveys that could damage habitat for the finch.\(^\text{59}\)

Concurrently in New South Wales, opposition to Whitehaven Coal’s proposed Maules Creek coal mine near Boggabri has centred on biodiversity issues, with close to 1,700 hectares of forest and woodland within the Leard State Forest marked to be cleared, including endangered white box grassy woodland.\(^\text{60}\) The connections and possible synergies between the Maules Creek and Galilee Basin campaigns have not been lost on at least some of the active protest groups, with recognition that Maules Creek is something of a training ground for the bigger battle in the Galilee Basin. Statements have been expressed in public meetings along the lines of “if the movement behind Maules Creek works, then we will be ready for the Galilee Basin”. In terms of strategies, landholders and activists opposed to the new mine feel that the government has failed them and that they have run out of options but for “mass direct action”.\(^\text{61}\) Journalist Paddy Manning has noted the trend:

> Non-violent protest against coal is not going away, and the miners cannot win, no matter how much money they spend pushing doubt and reaction or how many newspapers are on their side. In fact, every victory they notch up — defeating the mining and carbon taxes, securing vast new coal mine approvals — only ups the ante and ensures a stronger retaliation down the track.\

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\(^\text{61}\) Views expressed in a public meeting about Maules Creek, 6.3.14, Canberra and on an anti-coal activist email list.
Jonathan Moylan, a 24 year old activist from Newcastle was thrust into the public spotlight in early 2013 after releasing a prank media statement from Australian and New Zealand Banking Group (ANZ). The statement claimed that the bank had decided to withdraw $1.2 billion from the Maules Creek mine on the grounds of its Corporate Responsibility policy that refused investment in projects that “cause significant dislocation of farmers, unacceptable damage to the environment, or social conflict”. The release led to a temporary $314 million fall in the value of the Whitehaven’s shares. Moylan was charged with an offense under the Australian Corporations Act (2001) by the Australian Securities and Investments Commission, and faced a maximum penalty of up to ten years jail and fines of up to $765,000, although was in the end sentenced to one year and eight months in jail from which he was immediately released on a $1,000 good behaviour bond in July 2014.

The strong reaction by authorities in Moylan’s case was matched by those defending what they saw as worthy intentions to highlight a wrong, and the appropriate use of tactics within the well-established tradition of civil disobedience. Notable figures such as former Greens Party leader Bob Brown and economist and public intellectual Clive Hamilton were among Jonathan’s immediate and unabashed supporters, and a public discussion erupted around the issue. A solidarity campaign — Stand With Jono — was also established. Meanwhile, ANZ released a short and simple statement describing Moylan’s media release as “fraudulent” and reiterating that it remained “fully supportive” of Whitehaven Coal. Stephen Galilee, Chief

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Executive of the New South Wales Mineral Council, was more forthright in his criticisms. He named Jonathon Moylan among others in a scathing commentary article in which he described full-time activists as moving “like locusts from protest to protest” and with political objectives of blocking “anything that resemble economic progress”, which he argued warranted tougher penalties.67

Climate Change

The globally significant coal stocks in the Galilee Basin has mobilised climate activists in Australia and abroad, and it is probably the biggest driving force behind opposition to the coal developments outside the region itself. In 2014 Geoscience Australia conservatively estimated that there was around 23 billion tonnes of coal resources in the Galilee Basin.68

If 23 billion tonnes of Galilee Basin coal were to be burnt without any form of carbon capture and storage, it is likely to result in the release of between 35 and 39 billion tonnes of carbon dioxide (CO₂) to the global atmosphere.69 That is equivalent to about 50% of the anticipated CO₂ emissions from the controversial Alberta ‘tar sand’ development in Canada, which has an associated climate warming potential of up to 0.05°C.70 The six projects that have been approved or are currently being assessed in the Galilee Basin represent around 12 billion tonnes of coal resources and have a projected output of over 230 million tonnes of coal per

68 Department of Industry, Geoscience Australia and Bureau of Resources and Energy Economics, Australian Energy Resource Assessment, 2nd Edition (Canberra: Geoscience Australia, 2014), p. 139; includes the categories of Recoverable Economic Demonstrated Resource, Sub-economic Resource and Inferred Resource. This is highly likely to be an underestimate of the total accessible resource due to a relatively light exploration effort in the area compared to other coal basins in Australia to date, as well as Geoscience Australia’s cautious approach to reporting such figures. Nonetheless, it serves as a useful indication of possible quantities that could be extracted.
69 Calculations assume a coal wash yield of 71%. The lower range figure is based on the Greenpeace conversion figure, and the upper range figure is based on emission factors provided in Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, National Greenhouse Account (NGA) Factors (Canberra, Australia: Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, July 2013). The difference comes about because the measured carbon content of Galilee Basin coal has been taken into account by Greenpeace (Greenpeace Staff, pers. comm. 2012).
70 Calculated using figures from Swart and Weaver; and David Biello, ‘How Much Will Tar Sands Oil Add to Global Warming?’, Scientific American, 23 January 2013 <http://www.scientificamerican.com/article/tar-sands-and-keystone-xl-pipeline-impact-on-global-warming/> [accessed 21 March 2014]; note that this tar sands figure refers only to that which is ‘recoverable with today’s technology’. The total quantity of tar sands is believed to be around ten times this amount; for an explanation on the naming of ‘tar’, ‘oil’, or ‘bituminous’ sand, see Jeff Gailus, Little Black Lies: Corporate & Political Spin in the Global War for Oil (Victoria B.C.: Rocky Mountain Books, 2012), pp. 1–16.
annum.\textsuperscript{71} When burnt, this annual amount would result in at least 490 million tonnes of CO\textsubscript{2}, equivalent to 88\% of Australia’s total domestic emissions in 2012. When the Galilee Basin projects that are not yet being actively assessed are also included, the total annual production could be as high as 330 million tonnes, equivalent to over 700 million tonnes of CO\textsubscript{2}, or 125\% of Australia’s total annual emissions in 2012.\textsuperscript{72}

If all the Galilee Basin’s known coal reserves were combusted it would also equate to 6–7\% of the world’s remaining ‘carbon budget’ for restricting warming to below 2°C.\textsuperscript{73} The concept and quantification of a global carbon emissions budget was discussed in Germany from at least 2003.\textsuperscript{74} The concept appeared more publically in April 2009, in two consecutive letters published in \textit{Nature}. The letters reported on research that quantified the limits on cumulative greenhouse gas emissions that would be needed to restrict warming to various levels, and within various degrees of certainty.\textsuperscript{75} The approach has since been adopted by the International Panel on Climate Change (IPCC) and the International Energy Agency (IEA), as well as numerous scientists and activists.\textsuperscript{76} Subsequent IPCC calculations suggest that for a 66\% chance of limiting warming to 2°C, only 275 billion tonnes of carbon, equivalent to around 1,010 billion tonnes of CO\textsubscript{2}, can still be emitted from all sources.\textsuperscript{77} Aiming for a higher level of

\textsuperscript{71} As of early December 2014 the Alpha Coal (GVK Hancock), Kevin’s Corner (GVK Hancock), Galilee Coal Project (Northern Export Facility/China First) (Waratah) and Carmichael Coal Mine (Adani) have received both State and Federal government approval. The South Galilee project (AMCI) has received Queensland approval, and China Stone (Macmines) is still going through the assessment process.

\textsuperscript{72} Based on figures in Greenpeace Australia Pacific, \textit{Cooking the Climate, Wrecking the Reef: The Global Impact of Coal Exports from Australia’s Galilee Basin}, p. 8; and Australian national emissions of 558.8 Mt (including LULUCF) as reported in Commonwealth of Australia, \textit{National Inventory Report 2012 Volume 1}, 2014, p. 2; note that these emission estimates for the Galilee Basin are lower than if using the standard Australian Government emission factors.


\textsuperscript{74} H. Grassl and others, \textit{Climate Protection Strategies for the 21st Century: Kyoto and beyond} (Berlin: German Advisory Council on Global Change, 2003); also see H.-J. Schellnhuber and others, \textit{Solving the Climate Dilemma: The Budget Approach} (Berlin: German Advisory Council on Global Change, 2009).


certainty, the Potsdam Institute calculated that for an 80% chance of limiting warming to 2°C, only 154 billion tonnes of carbon, or 565 billion tonnes of CO₂, remain in the world’s carbon budget. A consistent finding is that there are far greater proven reserves of fossil fuels on Earth than can be burnt to keep within the carbon budget. Various estimates translate this as representing between 66% and 80% of known fossil fuel reserves, the majority of which is made up of coal.

Climate change was a major point of objection for both Kelly and CCAQ in the Alpha case. Notably, the burning of product coal accounts for around 98% of the carbon emissions across a coal project’s lifecycle, yet these ‘Scope 3’ emissions are not considered in current Australian assessment processes. Kelly argued that the decision before the court was whether or not to allow a currently intact carbon stock to be destroyed, which would inevitably lead to “serious widespread and near-irreversible harm”. The lawyer standing for CCAQ emphasised that proper application of the Environmental Protection Act 1994 (Qld) would necessitate Scope 3 emissions be considered by the court.

The Alpha case is not the first time that climate change consequences of proposed coal developments in Australia have been tested in a court of law. While there have been wins in individual cases there has not been significant incorporation of the precedents into government legislation. Nevertheless, at least one legal commentator has predicted that “Australian coal mines can expect the regulation of their direct and indirect emissions to escalate rapidly in the future”.

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82 Observer at final submissions hearing, pers. comm.
The contribution of Australia’s coal exports to global carbon emissions has been in the public consciousness to some degree since at least 2005 when two separate legal cases in the jurisdictions of New South Wales and the Commonwealth challenged the development of new mines on the ground of climate change impacts.\(^8\) However, the climate change implications of Australian coal exports have become more prominent since around 2010. Guy Pearse, an observer and commentator of coal politics in Australia, ventured to chastise Australia’s “big brand” environment groups for overlooking the issue at public events in 2010 and 2011.\(^5\) It is also likely that the public’s attention was piqued at this time by international discussions and events such as the United Nations conference in Copenhagen at the end of 2009.\(^6\) Since then, coal and coal exports have become better integrated into public narratives\(^7\) about Australia’s contribution to climate change, and the Galilee Basin is often mentioned as a prime case in point.\(^8\) Well-recognised activist groups such as Greenpeace, Friends of the Earth, 350.org and Australian Youth Climate Coalition have all fixed their attention on the Galilee Basin as a “ticking carbon time-bomb”.\(^9\) Bill McKibben, US founder of 350.org, while touring Australia in

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\(^8\) These cases were the ‘Anvil Hill case’ in New South Wales and the ‘Bowen Basin case’ at the Federal level, see Ruddock; Farrier; for an example of some of the activist commentary around the Anvil Hill case see Steve Phillips, ‘The Fight to Save Anvil Hill’, Green Left Weekly, 4 May 2006 <https://www.greenleft.org.au/node/34240>.


mid-2013 made frequent mention of the Galilee Basin during talks and in opinion pieces, urging Australians to take responsibility for our “massive deposits of hydrocarbons”, which he described as a “menace to the planet”.90

Besides raising awareness of the emissions that would result from the Galilee Basin coal, there has also been an effort to undermine investor confidence in the mines. This has come on the back of a number of international studies and reports highlighting associated financial risk of carbon investments in fossil fuels. Carbon Tracker’s report *Unburnable Carbon*, with an explicit message about the need to move away from fossil fuels, was followed by a number of others that included more conventional, established commentators on resource markets.91 A follow-up report which focussed on the Australian situation, highlighted the financial risk to the Queensland state government if the global ‘carbon bubble’ were to prevent the Galilee Basin mines from going ahead, recommending policymakers “to minimise exposure by diversifying their tax base” and limiting public investment in coal-related infrastructure.92

More specific economic risk from the development of the Galilee Basin has also been investigated and promoted, such as reports focussed on the Alpha and Carmichael mines commissioned by Greenpeace.93 These reports paint investment in the projects as a dangerous proposition, for instance:

Building Australia’s largest black thermal coal mine in the untapped Galilee Basin would challenge experienced operators, but the combination of an inexperienced developer, slack demand globally for thermal coal and a deteriorating cost of production scenario in

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Australia moves the project beyond speculative... GVK’s Alpha project appears likely to remain “stranded in the valley of death”.94

Other activist groups have also identified finance as an Achilles’ heel in the development of coal and gas projects in Australia and targeted campaigns at divestment,95 tapping into a global movement that Archbishop Desmond Tutu has likened to the worldwide campaign against apartheid in South Africa. Tutu has stated publically that “People of conscience need to break their ties with corporations financing the injustice of climate change”.96 Drawing on arguments of morality, multi-faith groups in Australia and North America have even lobbied Pope Francis to back divestment initiatives.97 The environmental and religious activist campaigns for divestment also dovetail with the main-stream Asset Owners Disclosure Project, chaired by former Australian Liberal (conservative) Party leader John Hewson, which is aimed at protecting members’ retirement savings from climate change risks.98 Al Gore has also lent his voice to divestment from fossil fuels, noting sound financial reasons for doing so in light of a growth in the renewable sector, tighter environmental regulations, and a rising discontent over carbon emissions.99

Economic analysis

The other major objection presented to the court in the Alpha case concerned the economic analysis that had been used to justify approval of the mine. CCAQ posited that the “input-output” model used by the applicant ignored the negative ramifications and overestimated the benefits of the project. As such, it argued that decision-makers did not have adequate evidence at hand to decide whether or not the project should be approved.100 In its final

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100 Environmental Defenders Office Queensland; note, input-output models are commonly used in mining project assessment in Australia, but empirical research concurs with CCAQ’s position that it has limited value in accurately predicting employment impacts, see David A. Fleming and Thomas G.
submission, the lawyer acting for CCAQ reasoned that bottom-up consideration of evidence was more substantial than what was in effect top-down consideration, whereby the great benefit and support for coal development is assumed and any counter evidence was rendered marginal.101

Failings of economic analysis was also argued in a report by Economists at Large, commissioned by the Bimblebox Nature Refuge landholders for submission to the environmental impact statement process for Waratah Coal’s proposed mine. A key finding in this report was that:

... there are few unambiguous benefits to this project. The impacts of the project, as identified in the assessment, relate to trade-offs between industries and regions, rather than clear benefits.102

The solution offered was cost-benefit analysis, an argument that was also central in the 2012/13 appeal to the approved extension of the Warkworth mine in New South Wales, in which the New South Wales Land and Environment Court found that the economic benefits cited by the mining company had indeed been overstated.103 In the Warkworth case, the court overturned the approval of the mine on the basis of “significant, adverse, biological diversity, noise and dust, and social impacts of the Project”. Notably, as part of the finding, the judge stated that the “ultimate decision involves an intuitive synthesis of the various matters”, and outlined what he saw as the limitations to any kind of economic analysis in determining a balanced decision.104 The New South Wales Supreme Court upheld the decision after an appeal by the proponent and the state government.105 As will be seen in later chapters, the weighing up of costs and benefits of coal development — whether by quantitative or intuitive analysis, and whether expressed explicitly or implicitly — has been a significant theme for at least four

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101 Observer at final submissions hearing, pers. comm.
104 NSW Land and Environment Court, see paragraphs 14 and 41.
centuries. It is also likely to be a major factor in the fate of humans' relationship with coal in the coming years and decades.

**Rail lines**

Getting Galilee Basin coal to the coast for export will require the construction of new rail infrastructure, an aspect of the developments which has met heated opposition from some of the landholders within the proposed rail corridors. Up to six rail lines were at one stage proposed to span the 500 kilometre distance between the Galilee Basin and Abbot Point coal terminal. In 2011 a landholder group, the Corridor to Coast Network, was formed to lobby for the protection of graziers' interests. The affected landholders have argued that the new rail lines would potentially divide up their paddocks and create levee banks on the floodplains, which would make the risk of damaging floods much greater. While the Newman government in Queensland reduced the number of rail options after it gained office in 2012, the landholder concerns over impact of floodwaters remained:

> They've put it on the low flat country as you can see it's very flat, makes it easy to build a railway line, it also makes it easy for water to spread and create massive damage when it does happen.

> Of all the corridors that could've been approved the Hancock/GVK one is actually the worst. It follows the flood plain and the most sensitive part of the flood plain for its longest distance.

> Culverts are not going to be the total solution because they will have debris on them and that will block the water flowing, and the potential for erosion will be great... Paddocks are going to have to be re-jigged and more watering points put in because cattle can't access them across a railway line... Both Federal and State Governments are doing

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106 Interview data, 2012, interviewee #3, Wilkinson and Jolley.


108 They reduced it to two rail corridors, but the approval of Waratah Coal's project also included a rail line, so it is unclear what actual outcome might be.


110 Agforce State Councillor Peter Anderson quoted in Hendry, 'Landowners Concerned about Mining Rail Corridor'.
everything in their power to help the mining community; they're not listening to landholders.111

A State Development Area (SDA) covering the proposed rail corridors was declared by the Queensland Government in June 2014. The government claims that the SDA will “enable a coordinated approach to developing multi-user common rail corridors whilst minimising impacts on landholders and the environment”.112 The SDA is aimed at providing “high level certainty to proponents and their financiers”, and enables the government to “compulsorily acquire land for projects”.113 The SDA is one in a package of initiatives in the Queensland Government’s Galilee Basin Development Strategy which together are “designed to help significantly lower start-up costs and fast track development”.114 However, landholders view the SDA as formal favouritism of mining interests. They fear that the incentives to encourage the rapid beginning of mining development will further side-line their interests, and that properties covered by the SDA will be substantially devalued.115

As critical infrastructure for the opening of the Galilee Basin, the proposed rail lines have also been the focus of a number of activist groups working to stop the proposed coal developments. Groups such as Market Forces have attempted to damage investor and shareholder confidence by targeting (the former government railway) Aurizon, which is considering acquiring a majority interest in the in the southern Galilee Basin rail project.116

More radically, the ‘Over Our Dead Bodies’ campaign is pursuing direct action and civil disobedience strategies, its rationale stated on its website:

The largest coal mining complex in the world is very close to being developed in the Galilee Basin, in Queensland, Australia. It is the biggest threat to the Great Barrier Reef and a key project leading us to runaway climate change. There are many companies involved, each waiting to get their greedy hands all dirty in the Galilee. But only one that is crucial, that can stop this environmental catastrophe before it starts. It used to be called QR National but is now known as Aurizon....

... Aurizon have thus far ignored pleas and representations from national and international environment organisations to stop this insanity. As they prepare to sign on the dotted line, it is time for us to act, to make demands.\(^\text{117}\)

The proposed rail lines have also been a point of contention between the state government and mining companies. It has even been argued that the government’s lack of favour for Clive Palmer’s rail and port proposals led to the public fall out between Palmer and the Queensland Liberal National Party (LNP), and provided an impetus for the launch of the Palmer United Party, which gained several parliamentary seats in the 2013 national election and which has held the balance of power in the federal senate from mid-2014.\(^\text{118}\)

**Port**

Coal port terminals are critical for the success of current plans in the Galilee Basin given that coal extraction is almost exclusively intended for export. Coal ports currently exist on the coast adjacent to the Galilee Basin — near Mackay, Gladstone and at Abbot Point near Bowen. These existing ports handle the coal from the Bowen Basin coal mines, but there is not sufficient capacity to take the projected output from the Galilee Basin.

One of the first proposals for port development to handle Galilee Basin coal output in recent years was slated for Shoalwater Bay near Rockhampton. A military training area since 1965, the area is also recognised for its population of dugong and sea grass habitat and other rich

\(^\text{117}\) Over Our Dead Bodies, ‘Over Our Dead Bodies Will This Madness Continue’ <http://overourdeadbodies.net/> [accessed 12 March 2014].

biodiversity at the southern end of the Great Barrier Marine Park.\textsuperscript{119} Waratah Coal proposed the rail and port development in April 2008 to receive coal from its Galilee Coal Project,\textsuperscript{120} a plan that was met by vigorous campaigning efforts from local environment groups.\textsuperscript{121} In September 2008 the plan was rejected by then Federal Environment Minister Peter Garret, on the grounds unacceptable ecological impacts to Commonwealth land and Ramsar listed wetlands.\textsuperscript{122} With Shoalwater Bay ruled out, Hancock Coal nominated Abbot Point and Dudgeon Point as possible port sites in its initial proposal document later in September 2008.\textsuperscript{123}

Since that time, the main focus of export facilities for Galilee Basin coal has become fixed on Abbot Point, 25 kilometres north of Bowen, where a coal terminal has been in operation since 1984.\textsuperscript{124} Mundra Port, part of the Adani group, signed a 99 year lease on the main terminal at Abbot Point in 2011.\textsuperscript{125} Under the Bligh Labor Government, a ‘Multi cargo Facility’ was planned at Abbot Point to provide twelve berths for coal and other cargo ships.\textsuperscript{126} This plan was scrapped by the in-coming Newman LNP Government in mid-2012, and replaced by a plan for


\textsuperscript{125} North Queensland Bulk Ports Corporation, ‘Abbot Point Port’.

a more incremental, and more rapid, expansion of the port.\textsuperscript{127} It is commonly said that the resulting capacity at Abbot Point will make it the largest coal port in the world.\textsuperscript{128}

To date, campaigns against the Abbot Point port expansion have been the most prominent of any connected to the proposed Galilee Basin coal developments.\textsuperscript{129} National groups such as Greenpeace, GetUp!, 350.org, World Wildlife Fund (WWF) and the Australian Marine Conservation Society have organised alongside regional conservation organisations to focus public attention on the threat posed to the World Heritage listed Great Barrier Reef (GBR) from the port expansion and coal shipping. Internationally, there have also been actions targeting banks that might consider providing funds of the Abbot Point expansion.\textsuperscript{130} In particular, the required dredging and dumping of three million cubic metres of spoil has consumed campaign attention. The activist groups have taken advantage of all opportunities to raise public awareness and put pressure on both state and federal governments, such as during UNESCO's revised assessment of the GBR's World Heritage Listing in 2012, and during various stages of the environmental assessment process.\textsuperscript{131}

Voices opposing specific aspects or the totality of the planned dredging activities have also included those outside of the environment movement, such as groups representing tourist and boating interests, commercial and recreational fishers, as well as some marine scientists and other researchers.\textsuperscript{132} Responding to the various criticisms, those supporting the port


\textsuperscript{129} See for instance Hill.


development have argued the threats have been grossly exaggerated in these public campaigns.\(^{133}\) One scientist has also pointed out that the continuing focus on dredging threatens “to undermine efforts at tackling the more serious issues facing the reef,” such as Crown-of-Thorns Starfish and agricultural runoff.\(^{134}\) Another has warned that the significant climate change consequences for the reef from continuing coal exports are being overlooked.\(^{135}\) Meanwhile, Federal Environment Minister Greg Hunt insisted in 2013 that the environmental conditions put on the dredging of Abbot Point will lead to a net benefit for water quality in the long term.\(^{136}\)

With a headline claiming that controversy over dredging at Abbot Point was a “Trojan seahorse in the war on coal” in early 2014, conservative commentator Nick Cater correctly identified at least part of the impetus behind the reef campaign. Referring to stated concerns about climate change related to coal exported through Abbot Point he asserted that “The aim is not to stop the Abbot Point expansion; it is to shut the whole damn thing down.”\(^{137}\) It was not an entirely novel insight given that the GBR was identified as one of the “key opportunities and strategic points of intervention” in an anti-coal activist funding proposal report entitled *Stopping the Coal Export Boom* that was leaked in early 2012. In the leaked report it was recognised that concerns for the GBR “can help to mobilize a powerful constituency to protect the Reef from the impacts of the coal boom.”\(^{138}\) It is also unlikely that activist groups would back away from Cater’s accusation given their explicit twinning of the GBR and climate change in their public campaigns. For instance, in 2012, Greenpeace released a report entitled *Cooking the Climate*,

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Wrecking the Reef: The global impact of coal exports from Australia’s Galilee Basin. Statements such as one from a GetUp! email campaign are also common:

As well as the huge damage the dredging will do to the delicate Great Barrier Reef ecosystem, Abbot Point’s expansion would dismantle the progress we’re making on reducing emissions - facilitating the export of the equivalent of 130% of Australia’s total current annual Co2 [sic] emissions.139

Cater was no doubt attempting to disparage the reef campaign by revealing there were mixed motives behind it. But there is a good chance that his readers were already familiar with the multiple concerns embodied in prominent coal controversies.

Battlelines drawn

The bundling of multiple concerns by multiple individuals and groups opposing coal is a key feature of the current debate in regards to the Galilee Basin and coal and CSG development in Australia more generally. Impacts on land, water, communities, human health and other industries from coal development are not infrequently woven into single narratives and analysis.140 Criticism has been levelled at the authors of the leaked Stopping the Coal Export Boom document that they have subversively orchestrated the movement in this direction.141 However, it is more likely that the broad-coalition-of-concerns character of Australia’s anti-coal movement has emerged on the basis of shared interests, with extra funding and organisation support making more effective what was occurring anyway. Long-time conservationist Drew Hutton’s efforts to support landholders’ opposition to CSG and his initiation of the Lock the Gate movement is a case in point,142 as are earlier examples of organised opposition to coal mines in Western Australia from the early 1990s and New South

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Wales from at least 2006 (further discussed in Chapter Eight). The coming together of wide variety of interests has been particularly well documented at Maules Creek. In any case, the strategy has drawn serious responses from industry and government, with an unidentified “coal veteran” quoted in the *Australian Financial Review* as saying:

> We have always worried all these groups would find enough common ground to pull things together under one hat... That is why this will be greeted with serious fear and loathing.  

Directly following the publicity of the leaked document, industry, unions, federal and state governments spoke out in unison against the anti-coal campaign, labelling it irrational and irresponsible. Pointed criticism of the movement has also continued since that time, with an effort to paint the activists involved as extremists. An indication of the degree of poor relations between activists and coal proponents came with revelation that company-funded spies had infiltrated the protest camp at Maules Creek. More significantly, there are indications that legislation has been planned and enacted in retaliation for the perceived malevolent attack by environmentalists on coal interests. In a media statement advertising two discussion papers for legislative reform in March 2014, Andrew Cripps, the Queensland Minister for Natural Resources and Mines, stated:

> The proposed reforms will allow us to hear from those who are directly impacted by the development rather than extreme green groups in Melbourne or California whose life goal is to create a road block for economic development.

> These individuals or groups have little or no interest in our state and submit vexatious objections to tie up economically beneficial projects.

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143 See for instance Janis Bailey; Connor, Freeman and Higginbotham; McManus and Connor.


A press release from the Queensland Resources Council (QRC) on the same day hints that there was a direct motive to stop objections similar to that of Kelly’s in the Alpha case:

> These reforms should bring to an end the spectacle of a Canberra-based environmentalist using the Queensland Land Court to object to a Queensland mining project in western Queensland on the grounds of alleged impacts on global climate change.150

And again, the QRC press release referred to the leaked 2012 document and allegations that the anti-coal movement was operating in a pre-mediated, orchestrated fashion:

> The stalling of projects through litigation was a strategy exposed in the anti-coal movement’s funding document Stopping the Australian Coal Export Boom that came to light in early 2012.

> The same organisations have also been going out of their way to spread fear and loathing in local communities.

The reforms under consideration in Queensland included a “streamlining” of notification requirements, limitations on who has objection rights, and “refining the range of matters” considered by the Queensland Land Court.151 In September 2014, the **Mining and Energy Resources (Common Provisions) Bill** was passed by the Queensland Government, with the effect of substantially restricting public objection rights.152 Unsurprisingly, the reforms have

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been met with concern by groups including the EDO,\textsuperscript{153} which suffered an immediate withdrawal of all government funding at the end of 2013.\textsuperscript{154}

The animosity and polarisation that already characterises the debate over coal and CSG in Australia is potentially going to increase as formal and legal avenues for complaint and objection are closed off. It is likely that extra-legal strategies and antics by activists will increase, and will be met with well-funded offensive and defensive strategies from the coal industry. There is already evidence that this is occurring. For instance, the Minerals Council of Australia (MCA) launched a new website ‘Australians for Coal’ in mid-April 2014, which is reportedly part of a multi-million dollar broader campaign aimed at re-gaining ground that has been lost to environmental campaigners.\textsuperscript{155} On the same day, the head of the New South Wales Minerals Council argued in \textit{The Australian} that anti-coal activists are “economic vandals” who also risk public safety, and that tough legal repercussions should be applied.\textsuperscript{156} It has also been reported that the MCA hired a consultancy company to distribute pro-coal information to 500 leaders in Australia’s investment community, seemingly in reaction to heightened efforts by fossil fuel divestment campaigners and a visit from the lead author of \textit{Stranded Down Under}, Ben Caldecott, in March-April 2014.\textsuperscript{157}

At a global level, the efforts of the anti-coal movement have also been met with a formal counter campaigns crafted and funded by pro-coal interests. One is called ‘Advanced Energy for Life’, funded by Peabody Energy, which seeks to reorient public and political discourse by painting energy poverty as the “world’s number one human and environmental crisis” that can


\textsuperscript{156} Galilee.

be addressed by policies and actions that “increase access to reliable, low-cost power — particularly today’s advanced coal technologies”. The campaign imitates the appearance and style of anti-coal and climate change activist strategies, replete with multiple social media platforms. Images on the campaign’s website portray the hopes of impoverished youth in Asia and Africa and are accompanied by statements that reinforce the message that coal is essential to their countries’ development, such as:

Energy is essential... like food and water. It’s the key to a better life for half the world’s population, improving health, education and longevity. The world’s strongest economies continue to turn to coal as the sustainable go-to fuel and the catalyst that enables people to live longer and better.

Australia is one of the three main national foci of the campaign, alongside China and the US, and it builds on a narrative that has been expressed more concertedly over the past several years. However, Peabody’s campaign has been strongly rebuked by a number of commentators and groups, including WWF, which launched legal proceedings in a Belgian court in April 2014 accusing the company of failing to meet standards of publicity that are “decent, honest and veracious”. In a separate investigation, the United Kingdom’s (UK) Advertising Standards Authority upheld one of three complaints made by WWF, relating to Peabody’s misleading use of the phrase “clean coal”.

The escalating tensions around coal come at a time when mining industries around the world have increasingly recognised the need to engage better with the challenge of more informed and better connected ‘stakeholders’. For example, Ernst & Young’s 2013-2014 report Business

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**At the coal face**

Less visible in national campaigns, legislative debates, and media mudslinging matches, are the majority of residents and landholders in and around the small towns of Alpha and Jericho, the towns closest to several of the mines proposed in the Galilee Basin. Following off-and-on talk about coal in the region over the course of decades, these outback railway towns experienced a flurry of activity since the late 2000s. The following comments from a long-term Alpha resident capture something of the experience for locals beginning around 2008:

> ... my first recollection was that I would go past the pub and you'd look in the door... and there would be a roomful of fellas in yellow and orange ... there was a big mix, I think there was a few Indians, there was a few Brazilians... There was — I don't know if they were Malaysians or some kind of Asian fellas... And of course there were a few South Africans. It was a bit of a league of Nations actually. There would have been, there must have been 40 or 50 of them... I think that might have been the initial stages for Waratah...

> I think everybody was a little bit, a little bit — I wouldn't say they were excited, they were inquisitive to figure out what was going on and why all these people were in town that we don't know. And yeah, they were inquisitive I would say — or I was definitely inquisitive.\(^\text{164}\)

However, for one older resident there was a sense of **déjà vu**:

> Oh well... there’s a mob called Bridge Oil. It would have been 30 years ago I suppose. Same thing was happening here, people were running around buying land. Land you couldn’t give away suddenly become valuable... this Bridge Oil was going to start coal mining out here. Whatever happened, I don't know. It never eventuated. It just suddenly died.\(^\text{165}\)

Opinion about the current plans for coal development on the ground is mixed. During interviews in April-May 2012, there were estimates that between one third and over a half of


\(^{164}\) Interview data, 2012, interviewee #6.

\(^{165}\) Interview data, 2012, interviewee #5.
the population of Alpha residents did not want to see mining go ahead. Concerns expressed by people in the broader Galilee Basin area varied, although an increase in housing prices was commonly mentioned. The neighbouring Bowen Basin was frequently brought up, and occasionally other coal mining regions, in reference to examples of environmental degradation, increased costs and social dysfunction that they did not want to see occur in their area, for instance:

... I saw the Bowen Basin go berserk. My uncle lost the whole of his property over there [to the mines], the whole lot of it...  

If they mine it down in Alpha, they reckon the next one after that is Jericho — they reckon there is more coal there at Jericho than there is at Alpha... so... It will look like, you know, like the Moranbahs and the Dysarts, and the Blackwaters and the Emeralds. You know, all look like that country.

Oh, just the same thing you know, like, I think it's what's been happening down the Surat Basin, coal seam gas... they just go on to properties putting these things all over the place. You know, and some of them.... Some leaked and that... Caught on fire...

[I am worried about] the population increasing, there would be more activity and a lot more, could be more crimes around here — things like that, you know. You get a lot of people... Break in and entry, it would be like Emerald — it's bad.

Well, initial thoughts think "you beauty, jobs for our kids and all that sort of stuff". But then you start looking at the history of other big entities — the fly-in fly-out and all that stuff, the depression, the domestic violence, the sexual violence and all that that happens in camps... young kids necking themselves because we are not built to do 24-hour shifts and things like that. So you know, it's only making a few very rich. Young kids think that, you know, course they want the big money, and they're on the gravy train. You might be rich in the bank but you're not rich in the mind. So it drains them and things like that. So that's a worry.

There were also issues raised in regard to the lack of local jobs being created by the exploration, anticipation that they would not eventuate in the mining phase either, and the potential impact on the character of region. The landscape and environmental impacts of

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166 Interview data, 2012, interviewees #6 & 7.  
167 Interview data, 2012, interviewee #2.  
168 Interview data, 2012, interviewee #7.  
169 Interview data, 2012, interviewee #7.  
170 Interview data, 2012, interviewee #10.  
mining were also commonly mentioned, even by dominantly town-based residents, for instance:

I reckon [open-cut mining] just spoils the country, you know. Like, they try and fix it up. But you know... I'm saying that's just the landscape sort of thing, country and that which I care about, you know, that's number one for me.¹⁷²

...And that will never ever be returned to its natural state. It will be just one big massive quarry with mountains of soil and great lakes of black coal dust in the bottom.¹⁷³

There was also some dissatisfaction expressed about procedural issues. One interviewee was particularly dissatisfied with the mandatory consultation processes:

...I've been going to these public meetings, and to be honest I'm a bit over it because they are just peddling their own wares, and they are not really there to listen to you at all. ... They took us all for fools as far as I'm concerned.¹⁷⁴

The shire Mayor, while supportive of the proposed developments, has also publically expressed frustration over a lack of infrastructural support from state and federal governments for such a potentially large undertaking in the region. Without that support, he and others fear that it could result in a total reliance on a fly-in fly-out workforce, with the consequence of a lack of local investment benefits.¹⁷⁵

One of the interviewees reflected on the unique role that Alpha has played in the lives of numerous low-income earning families needing a new start — a door that they thought would be shut if the proposed coal developments go ahead:

Alpha in years gone by... I'm sure a lot of people here, they'd probably just turn up in their car with a family and looking for work... Some would move on some would stay. Some are still here. And it was a good place for those sort of people to be able to make a new start. Because it wasn’t expensive ... Yeah, it's a safe place... Very good for children. And they always managed to find work. Like I said before, there is not an abundance of work — there is an abundance of work relative to the population. You know, it wouldn't show up on the Centrelink database but certainly there's a lot of work going around... ¹⁷⁶

¹⁷² Interview data, 2012, interviewee #7.
¹⁷³ Interview data, 2012, interviewee #2.
¹⁷⁴ Interview data, 2012, interviewee #6.
¹⁷⁶ Interview data, 2012, interviewee #6.
Some of the regional-based interviewees for this research could see no benefits of coal development in the Galilee Basin, but others could see some possible, or definite, positive outcomes. There were comments such as that Alpha was “dying”. Coal development could provide much needed boost to the district. Around town, there was a common feeling that mining development would increase the chances of Alpha’s hospital staying open, and getting a permanent doctor. One of the district’s landholders commented in a regional newspaper:

Look, it isn’t going to be smooth sailing, and I’m one of the major four landholders who will be affected... But you have to look at the big picture - the infrastructure like hospitals and schools out here and the opportunities for not only our local area but the state and the country as a whole.

GVK Hancock has so far been the most active in putting money into local community organisations and events. A perhaps unexpected form has been the funding a ‘Christmas Lights’ competition, whereby townspeople in Alpha and Jericho decorate their house in the lead up to Christmas. Gina Rinehart (Chairperson and Director of Hancock Coal and BRW declared world’s richest woman in 2012) visits the towns to judge the best performers, with the winner receiving a $15,000 holiday to Singapore, and prizes worth a total of close to $30,000 awarded down to eighth runner-up.

One interviewee active in community sport commented that local organisations “just barely keep our head above water” and recognised the benefits of resource company sponsorship of local clubs and teams. However, another was more sceptical, describing such sponsorship as “tokens” and imagined a more meaningful contribution:

Sure the t-shirts for the swimming club, they were great. But I mean, big fat deal, you know. You know, it would be different if they built another wing on to the hospital... Or set up a dentist surgery or something like that — something substantial, or built a Queensland ambulance service here, or something like that. That would be substantial. But even then it is still the “shut up” money.

177 Interview data, 2012, interviewee #5.
178 Sean Dillon quoted in Stanley.
180 Interview data, 2012, interviewee #7.
Understandably, some of the interviewees’ sentiments were ambiguous, with a sense of feeling torn between the costs and benefits, or recognising that outcomes will be contingent on how changes occur, such as:

I don’t know. The jury is still out with me. Because now I see my own greed coming in. Like I want to make things better for my children. So I want to start up a business and get a contract on the mine. And make a shit-load of money myself. So it’s just sort of at that point in time, you know... But the gain... the big warning sign comes up for me, for instance you know like, Northern cattle trade, live cattle trade into Indonesia. Diversify your business. How many of were just solely reliant on that live export? And when that stopped the banks foreclosed on them. So yeah, being solely reliant, solely reliant on one industry [is risky]...182

Like for me myself — if the mines did come here in a big way, as a businessperson, that could be an opportunity or threat — depending on how big and how fast it happens.183

If someone could convince me that the way they do it wouldn’t affect the Great Artesian Basin, I’d be okay with it [in regard to CSG development].184

The passage of time and shifting contextual circumstances can alter perceptions. For instance, in March 2014 — roughly two years after initial interviews were conducted — one of the Alpha residents explained that there had been a sense of economic depression in the region in recent months. Mine closures in the neighbouring Bowen Basin and a severe dry period had resulted in local job losses, with numerous families moving away, student numbers declining at the school and the prospect that the local hospital would close. It was commented that “All that stacked up will push locals to pro mining” and observed that “the worse things get” the more “greenies... are used as scapegoats” for delays in mining development.185

Some attempt has been made to understand and address local concerns about coal development in the Galilee Basin through mandatory social impact assessments for individual mines and through the ‘Galilee Basin economic and social impact study’, a joint-initiative between the state government and regional bodies. The issues raised during focus groups within the study are summarised below (see Table 2.2). However, the independence and scope of such studies are limited given that they are undertaken in the context of a general pro-development narrative, so that positive impacts (“potential opportunities”) are highlighted and negative impacts (“potential issues”) considered in terms of how they can be managed.

182 Interview data, 2012, interviewee #9.
183 Interview data, 2012, interviewee #6.
184 Interview data, 2012, interviewee #7.
185 Extension to original interview, March 2014, interviewee #6.
Table 2.2 Summary of findings from Galilee Basin Economic and Social Impact Study

<table>
<thead>
<tr>
<th>Opportunities</th>
<th>Issues</th>
</tr>
</thead>
<tbody>
<tr>
<td>Training</td>
<td>Impact on current lifestyle</td>
</tr>
<tr>
<td>Better work opportunities</td>
<td>Negative business impacts/labour shortages</td>
</tr>
<tr>
<td>Better business opportunities</td>
<td>Need for planned development</td>
</tr>
<tr>
<td>Better infrastructure</td>
<td>Funding of infrastructure/having adequate infrastructure and services</td>
</tr>
<tr>
<td>Financial contributions to the community</td>
<td>Fair compensation for graziers/impacts on grazing land/land access agreements</td>
</tr>
<tr>
<td>Introduction of new cultures</td>
<td>Water/environment</td>
</tr>
<tr>
<td>Improved lifestyles</td>
<td>Localised inflation/impact on rates/speculation</td>
</tr>
<tr>
<td>Environmental enhancement</td>
<td>Increased crime</td>
</tr>
<tr>
<td>Increased population retention</td>
<td>Good communication at all levels</td>
</tr>
<tr>
<td></td>
<td>Legacy issues (after coal resources are exhausted)</td>
</tr>
</tbody>
</table>

Source: Economic Associates

Despite the local, pressing, and immediate concerns about mining, people interviewed for this doctoral research in 2012 were able to reflect on the future for the region and beyond. For instance, one interviewee was critical that long-term opportunities were not being factored into the planning stage of the mines and related infrastructure. They imagined an alternative approach whereby mining development could potentially increase the future productive capacity of the region. The placement of rail infrastructure for agricultural market access, and the design and treatment of mining voids to provide safe irrigation water, were two examples. Another was in regards to rehabilitation, with “giant mullock heaps” envisioned as “a very good source of future vine thickets”, and potentially “more useful than what the cleared grazing land was to begin with”.

Other interviewees commented on more fundamental issues. A farmer from the Bowen Basin saw a core dilemma as being related to modern society’s dependence on finite resources and wasteful practices. In response to questions about climate change and whether or not Australians have a duty to provide energy to poorer nations they commented:

... I think the argument is we’re wasting our resources, and teaching next-generations to throw things away. Whether it’s changing climate or not — is not the argument. Is it wasting our resources? Yes. Is there a better way to do it? Yes. If the added benefit is we stop climate being so variable, isn’t that a benefit for everyone? I think [climate change] is an add-on argument, not the main argument.

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187 Interview data, 2012, interviewee #1.
... the minerals aren’t going away. And just rushing to take them out faster because you think it’s our duty, I think is more reason to go slower and more carefully. This isn’t the last generation on the planet, I don’t think.\textsuperscript{188}

In conversation, one grazier in the Alpha district expressed a similar sentiment by questioning why there was such a rush towards coal development, and outlined what to them would seem a far more sensible approach, whereby all information — about energy demand, energy provision options, environmental damage considerations, the state’s economic situation, and so on — was all laid out on the table in a transparent manner for discussion. In their opinion, only from that basis could informed decisions be made.

**Conclusion: A moment in time**

The Land Court of Queensland announced its decision on the Alpha case on 8\textsuperscript{th} April 2014. The verdict was unusual, with a recommendation that the Queensland Government either reject the Mining Licence Application and Environmental Authority on the basis of potential groundwater impacts in light of the precautionary principle, or approve them subject to stricter conditions.\textsuperscript{189} In legalese the decision was made ‘in the alternative’. Both the company and the objectors initially claimed the outcome as a victory.\textsuperscript{190} All the other matters raised in the case were addressed in the Court’s 149 page decision. As discussed above, a more clear-cut decision was announced the previous day by the Supreme Court of New South Wales, in a finding that upheld the New South Wales Land and Environment Court’s rejection of the proposed expansion of the Warkworth mine on the basis that the economic benefits did not outweigh social and environmental costs.

These two twenty-first century Australian legal examples which advise coal mining operations be constrained because of negative impacts are noteworthy in the longer history of coal contestations (discussed further in Chapter Eight). However, the response from the Queensland and New South Wales’ governments highlights the political unpalatability of such findings. Queensland’s Deputy Premier publically refuted the Land Court’s recommendations,

\textsuperscript{188} Interview data, 2012, interviewee #4.

\textsuperscript{189} Land Court of Queensland, *Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4) [2014] QLC 12.*

and the government has proceeded to grant an Environmental Authority for the Alpha mine prior to make-good agreement having been signed with the effected landholders.\footnote{Deputy Premier Jeff Seeney speaking on ‘Acting Premier Jeff Seeney Supports Land Court’, \textit{QLD Country Hour} (ABC Rural, 2014) <http://www.abc.net.au/news/2014-04-08/alpha-coal-project/5378528> [accessed 17 November 2014]; GVK Hancock Coal, ‘Media Release: GVK Hancock Secures An Environmental Authority For It’s [sic] Alpha Coal Project’, 2014; landholder Bruce Currie and GVK Hancock corporate affairs manager Josh Euler speaking on ABC Radio, ‘GVK Hancock Granted Environmental Authority’ (ABC Western Queensland, 2014) <https://soundcloud.com/abc-western-queensland/gvk-hancock-granted-environmental-authority> [accessed 17 November 2014].} In New South Wales, the state government responded to the Warkworth case by introducing legislation that gives greater weight to the economic significance of mining proposals. Finalised in November 2013, the changes were announced within a heroic framing of the importance of mining to the state’s economy:

Mining is a $23 billion industry in New South Wales directly employing more than 35,000 and supporting a further 90,000... It’s important that these benefits are recognised as part of a balanced and rigorous assessment process to ensure a vibrant and prosperous mining industry that continues to deliver jobs and investment to rural and regional NSW, whilst ensuring the protection of our valuable agricultural land and water resources.\footnote{Chris Hartcher, Minister for Resources and Energy quoted in NSW Government, ‘Media Release: Benefits of Mining an Important Part of Planning Assessment Process’, 2013 <http://planspolicies.planning.nsw.gov.au/index.pl?action=view_job&job_id=6065> [accessed 24 March 2014].}


The Court’s findings in the Alpha case highlight the complex mix of costs and benefit from coal development in the Galilee Basin. It acknowledges the fact that development of the Alpha mine with its supporting infrastructure would “enable the development of additional coal mines” in the region.\footnote{Land Court of Queensland, \textit{Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4)} [2014] QLC 12, p. 6.} It highlights the many “direct economic benefits” that would result from the Alpha mine going ahead; an estimated 1,500 jobs would be created during construction and 800 jobs during the operation of the mine, and around $204 million royalties would be paid annually to the Queensland Government and $2.9 billion would be raised in annual export revenue.\footnote{Land Court of Queensland, \textit{Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4)} [2014] QLC 12, p. 104.}
On the other side of the ledger, the Court’s Orders on groundwater strongly validates the landholders’ concerns. On other matters too, there were notable concessions made to the objectors’ arguments. For instance, it was found that the amount of CO₂ that would result from the product coal from the proposed Alpha mine “cannot be dismissed as negligible”, even though it was determined that consideration of Scope 3 emissions was not within the Court’s jurisdiction.¹⁹⁶ Arguably, this demonstrates the incapacity of current legislation and institutions to handle the complexity, scale and urgency of the issue.

From a wide-angle view, the first court case related to coal development in the Galilee Basin is just one part of the very big, long-playing, story of humans’ relationship with coal. In reality, a question mark remains poised over the future of the Galilee Basin area as a result of the culmination of numerous historical threads. Its fate will be determined by factors that are largely remote to the region itself — for instance, international coal prices,¹⁹⁷ energy policies in China and India, state politics, international pressure for action on climate change, industry lobbying efforts, and the effectiveness of campaigns run by anti-coal activists. A similar set of factors will determine coal development in other parts of Australia and around the world. Some of these big picture themes are taken up in later chapters. But first, I take a closer look at the Galilee Basin area itself.

¹⁹⁶ Land Court of Queensland, Hancock Coal Pty Ltd v Kelly & Ors and Department of Environment and Heritage Protection (No. 4) [2014] QLC 12, pp. 91, 94.
Chapter 3

LAYERS IN THE LANDSCAPE

The coal in the Galilee Basin, deposited 250–300 million years ago, has been the focus of intense interest and speculation in recent years. However, the mapped extent of the Galilee Basin as a geological layer has little to no relationship with the current surface landscape. Nor do people living in the 248,000 square kilometre area, an area roughly equal to that of the United Kingdom, identify the ‘Galilee Basin’ as the region where they live.¹ Rather, the Galilee Basin underlies numerous other recognised and mapped boundaries in the landscape. It coincides with broad regions such as ‘Capricornia’, ‘The West’ and ‘Central West’. The patterns of soil, water and vegetation, the gullies, slopes and hills, the Great Dividing Range, the rivers, water catchments and bioregions, the pastoral property boundaries, shire boundaries, the roads, rail lines and the scattered townships: these are more relatable features in the area.

This chapter seeks to identify and understand some of the key biophysical, sociocultural and historical layers in the landscape, named here as the Galilee Basin area, that overlie the geological strata in question (which is discussed further in Chapter Four). This ground level view establishes the local context for of the proposed Galilee Basin coal developments, and highlights some persistent themes in the region. This chapter first considers the period of white settlement in central-west Queensland from the mid-nineteenth century, before exploring the region’s Indigenous heritage and frontier conflict. The remainder of the chapter concentrates on more recent social and environmental trends leading up to the present time.

There is slight inconsistency in where the boundary of the Galilee Basin is drawn between different maps which has the consequence that marginal locations are either judged to be just inside or outside the area — the most notable example being the town of Alpha.² In any case, several towns, localities and geographical features that lie beyond the mapped margins of the Galilee Basin are incorporated into this discussion because they are integral to the story of the region which in reality is not sharply bounded. The towns of Alpha and Jericho and the

² For instance, Evans and others (2014) put Alpha just outside the boundary, whereas RPS (2012) include Alpha. See Evans and others, p. 21; RPS, pp. 2, 135.
surrounding country are particularly represented here due to their proximity to several proposed coal developments.

**A train ride back to a new era**

While barely registering in geological time, 'Galilee' does ring a biblical-aged bell on a human time scale. Local stories have it that a creek situated near the Tropic of Capricorn — on the western side of the Great Dividing Range and five hundred kilometres from the east coast — was named after an early white settler, Harry Jordan.\(^3\) In 1879 a town was planned on the banks of Jordan Creek to service the Central Railway as it was pushed further west from the coast.\(^4\) Willouby Hannam, Engineer in Charge of Surveys for the new rail line, named the town-to-be 'Jericho'.\(^5\) It is difficult to gauge whether he chose the name out of religious fervour, a sense of historical gravity, or a larrikin sense of humour, but it was consistent with the name given to a large lake situated north of Jericho — Lake Galilee. The relative location of the creek, town and lake in central-west Queensland is almost identical to its namesake configuration of the city of Jericho, the Jordan River and the Sea of Galilee in today’s north-east Israel.

Great ambitions surrounded the creation of the Central Railway, laid down by teams of workers between 1865 and 1892. The rail line was built at the insistence of Rockhampton community leaders who were keen to ensure the budding town would not lose out on the trade of minerals and pastoral produce too often being directed on southern routes due to the poor state of roads connecting Rockhampton to its hinterland.\(^6\) More generally, Queensland had only officially separated from New South Wales in 1859, and the young self-governing British colony was eager to profit from what it saw as unexplored and untapped above- and below-ground riches.\(^7\) Reliable transport infrastructure was vital to ensure the westerly flow of basic supplies to people living in remote areas, and the easterly flow of rural produce to coastal markets and ports.

The Governor of Queensland, Sir George Ferguson Bowen was in Rockhampton to launch the construction of the new westward-reaching rail line in September 1865. With a silver spade, Bowen lifted the first sod into an ornate cedar wheelbarrow. He finished his reply speech to


\(^4\) Originally called the 'Queensland Northern Railway', it was changed to 'Central Railway' in 1878 which was a more apt description of its location and because another railway further north was underway and it was given the name of 'Northern Railway' (see Hoch 1992 pp. 27-28).


\(^6\) Hoch, *To the Setting Sun*, p. 9.

local dignitaries by articulating the spirit of the times, trusting that “the important public work now commenced will realise all the hopes of its promoters... to become a source of permanent and ever-increasing prosperity”.\(^8\) It is a refrain that echoes in the words of politicians and business people nearly 150 years later when promoting proposed new rail lines to transport coal from the Galilee Basin to northern ports. However, Bowen’s pride in enabling agricultural expansion was explicitly ideological as well as economic, in extending “the margins of Christianity and Civilization” to Aboriginal land.\(^9\)

Searing heat, prolonged droughts and engulfing floods tormented the men who undertook the manual labour, engineering and planning for the Central Railway. Although men outnumbered women, some families kept together, shifting their tents and shanties as the rail development carried them forever west. Death and disease were not uncommon, and a tough culture of drinking, gambling and fighting soon became entrenched.\(^10\) A number of towns and sidings were built along the way, many of which still exist today; the towns of Jericho and Barcaldine fall within the Galilee Basin area, and the town of Alpha is variously included or just outside the eastern margin on different maps.\(^11\)

In February 1892, twenty-six and a half years after construction had begun at Rockhampton, the Central Railway line terminated at the young town of Longreach, on the ‘long reach’ of the Thomson River.\(^12\) The upgraded Central Railway is still in use, although these days it mostly carries coal trains from several Bowen Basin mines to the port at Gladstone, as well as tourists and locals on Queensland Rail’s ‘Spirit of the Outback’ — connecting towns from Longreach to Rockhampton, and onward from Rockhampton to Brisbane.

Two other major east-west Queensland rail lines transect the Galilee Basin area. Through the northern tip of the area, the Great Northern Railway has connected the towns of Torrens Creek, Hughenden and Richmond to Townsville on the coast since the mid-1880s. At the southern end of the Galilee Basin area a rail line has connected Charleville to the state’s capital, Brisbane, since 1888. In the latter half of the 1890s a rail line running south-west from Hughenden was built to join Winton, enabling a transition from cattle to sheep grazing for wool production in the west of the state (see Figure 3.1 for town locations).\(^13\)

\(^8\) Quoted in Hoch, *To the Setting Sun*, p. 11.
\(^10\) Hoch, *To the Setting Sun*, pp. 10–11. This is mentioned in various places throughout her book.
\(^11\) For instance, Evans and others (2014) put Alpha just outside the boundary, whereas RPS (2012) include Alpha. See Evans and others, p. 21; RPS, pp. 2, 135.
\(^12\) Hoch, *To the Setting Sun*, p. 51.
CHAPTER 3: LAYERS IN THE LANDSCAPE

Early days of colonial occupation

At the outset of the official formation of the new colony in 1859, it was clear that Queensland's development would be largely dependent on the profits of pastoralism. There were 3.5 million sheep and half a million cattle in just one quarter of Queensland's land area, and these provided 70% of revenue and the vast majority of exports. Of the exports in 1859, 79% of value came from wool, 11% from livestock, and 8% from tallow and hides. The remaining 2.5% of export value was made up chiefly of timber, coal, gold and fruit.

The early Land Acts in Queensland were designed to ensure that the country was settled by white pastoralists. The 1860 Act for Regulating the Occupation of Unoccupied Crown Lands in the Unsettled Districts stipulated that "if any person shall be desirous of obtaining a Run he shall be at liberty to apply" — to the district's land commissioner for a one year licence. This provided the opportunity for squatters to lease an unlimited number of runs between 25 to 100 square miles (65 to 260 square kilometres) in size, "of a rectangular form in which the external lines shall run east and west and north and south and the length shall be as nearly as may be equal to the width", for an occupation fee of 10 shillings per square mile. Within a period of nine months the occupier could apply for a fourteen year lease on the condition that the land had been stocked to one quarter of its assumed carrying capacity. An annual rent payment was also required to be paid to the government at the rate of between 10 and 56 shillings per square mile (2.5 square kilometres).

However, managing land settlement effectively was a significant challenge for the early governments of Queensland. In the first fifty years, the new colony and state would see over fifty principal and amending Acts, and thirty-seven lost or defeated Parliamentary Bills related to land legislation. The legislator's task was one of juggling the divergent on-ground and political demands of graziers and selectors, along with their respective town-based supporters, with the interests of government and new settlers, against the back-drop of fluctuating markets, climatic cycles and other challenges, including conflicts with Aboriginal people. The challenge was much the same in the other Australian colonies. Senior officials were often in the uncomfortable position of juggling unclear directives from London on how colonisation

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14 Ross Fitzgerald, p. 133.
18 Svensen, p. 9.
should proceed, and the interests of the new, extremely powerful, pastoralists. Meanwhile, graziers' land management decisions was at times determined by the pecuniary demands of English financiers on the other side of the world to a greater degree than local environmental conditions.

The land area of Queensland was divided up into pastoral districts and filled with sheep and cattle in a "series of quick incursions". Squatters with their livestock had started arriving in south-eastern Queensland in the 1840s, and spread into the central, western and northern parts of the colony from the early 1860s. In many parts of Queensland, the first influx of squatters was quick to move on, selling the leases to later arrivals.

The waves of white settlement in Queensland generally followed close on the heels of the first white explorers. The country that overlies the Galilee Basin incorporated the journeys of well-known white explorers, including Sir Thomas Mitchell, Frederick Walker, Augustus Gregory, Edmund Kennedy, William Landsborough and Nat Buchanan. Ludwig Leichhardt's 1844–1845 expedition from Moreton Bay to Port Essington crossed the north-eastern corner of the Desert Uplands, within the vicinity of the Galilee Basin area. There is also evidence, in the form of trees marked with the letter 'L', that Leichhardt's final expedition in 1848 crossed through the southern part of the Galilee Basin area before the party disappeared without a trace. Explorers' accounts of the land they passed through often included assessment of the suitability of country for livestock. Indeed, many of their exploratory journeys were explicitly designed for that purpose. Enthusiastic appraisal of tall grass on wide plains drew the

22 Ross Fitzgerald, p. 133.
23 Ross Fitzgerald, pp. 133, 135.
24 Svensen, p. 233.
28 For instance see Gwen Trundle, 'Landsborough, William (1825–1886)', in Australian Dictionary of Biography (Canberra: National Centre of Biography, Australian National University, 1974), v.
attention of land-hungry men characterised as generally being both restless and reckless in their ventures to occupy the country.  

The early favourable assessments of grazing land were often the result of journeys made after ’good’ years of rain. The contrast between the extremes of Australian climate is legendary, and involves cycles that 150 year old primary industries continue to grapple with today. Travelling in the south of the Galilee Basin area in 1846, through country surrounding the Barcoo River, Mitchell described it as the “El Dorado” of Australia, and the “the finest and most extensive pastoral region” that he had seen. The same area twelve years later was described by brothers Augustus and Francis Gregory in the following way:

... nothing could well be more desolate than the unbounded level of these vast plains, which, destitute of vegetation, extended to the horizon. Our horses were reduced to feeding on decayed weeds, and even these were so scarce that they eagerly devoured the thatch of some old native huts.

Over time, the elements of the country — the soils, vegetation, animals and water — and how these responded to different seasons, was slowly recognised and better understood by the white newcomers. However, few of the early white explorers and squatters were tuned-in to Australian ecological conditions and were mostly ignorant of the important function that Aboriginal land management played in maintaining the areas that they had assessed as being suitable for grazing European livestock.

Colonial government policy in Queensland sought to encourage ‘closer settlement’ from the first decade of separation. Successive legislation attempted to facilitate the widely popular vision of an agrarian society. Large pastoral properties were to be divided, to enable the creation of family farms that would supply agricultural staples and underpin a socially conservative, economically viable and stable social order. However, persistent environmental, technical and economic challenges meant that the pastoral-agricultural agrarian dream was never realised to the extent originally imagined. There were limited successes in the south-east of the colony in the first two decades, but it took the passage of the Land Act 1884 for changes to be felt in the Galilee Basin area. In the eastern portion of the region, sub-division

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29 Ross Fitzgerald, p. 134.
31 Quoted in Thomis, p. 2.
was limited. By the 1930s, on the back of drought, many of the smaller holdings were reintegrated with the larger runs.34 Further west, around Longreach, a larger proportion of the selectors who flocked to the area in the late nineteenth century appear to have been more successful in holding onto their blocks.35

Lines on maps

The boundaries of Queensland's pastoral districts were established in the early years of the colony of Queensland. They were chiefly used for administrative purposes; districts were described as being 'opened up', or even 'thrown open' for pastoral settlement. In most cases they were either named after the white explorers who had travelled through the respective areas or given long-standing Aboriginal names from local languages. The Galilee Basin is largely overlaid by the Mitchell pastoral district, but also includes parts of Burke, Gregory North, Warrego (meaning 'river of sand' in Bidjara language),36 South Kennedy and Leichhardt districts.37 Six of the total fifteen pastoral districts in Queensland are included in the Galilee Basin area.38

As the white population in Queensland grew in the latter half of the nineteenth century, there was consideration of using the pastoral districts as the basis of local government areas. However, this idea was surpassed in 1879 when it was decided that the Queensland colonial government would create the local government divisions in rural areas, roughly based on census districts. Divisions across Queensland were hastily created, to be re-fashioned as shires in the early twentieth century. In 2008 the Beattie Labor Government in Queensland slashed the number of councils from 157 to 73, leading to fierce complaints across the state, including in the Galilee Basin area where there were a number of amalgamations. For instance, the Jericho and Aramac Shires merged with the Shire of Barcaldine; Blackall and Tambo Shires amalgamated; as did Longreach, Isisford and Ilfracombe.39 According to this latest

configuration, the Galilee Basin area overlaps a total of fifteen local government areas, although several of these areas are only very marginally included. Altogether they include the shires of Diamantina, Winton, McKinlay, Richmond, Flinders, Charters Towers, Longreach, Barcaldine, Isaac, Barcoo, Quilpie, Blackall-Tambo, Central Highlands, Murweh and Paroo (see Figure 3.1).40

Proposed Changes’, *ABC Queensland Local Radio*, 2007

40 Evans and others, p. 24.
Figure 3.1 Local government areas and towns in the Galilee Basin area

Source: Slightly modified map from Evans and others\textsuperscript{41}

\textsuperscript{41} Evans and others, p. 24.
The current electoral districts intersecting the Galilee Basin area reveal the predominant conservative political leanings of the constituents. At the time of writing, the Queensland electorates of Mount Isa and Dalrymple are held by Katter’s Australian Party, and Gregory and Warrego are held by the Liberal National Party.42 The Federal electorates of Kennedy and Maranoa cross the Galilee Basin area to a large extent and are safely held by Katter’s Australian Party and The Nationals respectively. Flynn and Capricornia coincide with the Galilee Basin area to a smaller extent and are both held by the Nationals, although are more politically marginal.43

In the latter half of the twentieth century, the concepts of ‘bioregion’ and ‘catchment’ have offered new lines on maps and help to describe the biophysical elements within a landscape. There have been 89 bioregions and 419 subregions across Australia identified as part of the Commonwealth’s National Reserve System programme, which aims to ensure adequate representation of ecosystems in Australia’s network of protected areas. Each bioregion is classified on the basis of common geology, soils, landform, climate, and characteristics of native flora and fauna.44 The Galilee Basin area overlaps with large sections of the Mitchell Grass Downs and Desert Uplands bioregions, and smaller areas of the Gulf Plains, Einasleigh Uplands, Brigalow Belt North, Brigalow Belt South, Mulga Lands and Channel Country bioregions (see Figure 3.2). All these bioregions are considered ‘underrepresented’ in Australia’s network of protected areas.45

45 Environmental Resources Information Network, ‘National Reserve System IBRA Regions with Less than 10% Protection’ (Canberra, Australia: Commonwealth of Australia, 2013).
Figure 3.2 Bioregions in the Galilee Basin area

Source: Based on bioregions map from the Environmental Resource Information Network

There is significant diversity in the bioregions in the Galilee Basin area. The Mitchell Grass Downs bioregion, dominating the western section of the Galilee Basin area, mostly consists of treeless plains covered by Mitchell tussock grasslands, and with only occasional ridges, rivers and gorges. The Desert Uplands bioregion, directly east of the Mitchell Grass Downs and taking up the north-eastern section of the Galilee Basin area, straddles the modest rise of the Great Dividing Range. The ‘upland’ features include sandstone ranges and sand plains. Floristically, the Desert Uplands is dominated by thickly vegetated eucalypt woodlands and spinifex understorey, as well as acacia woodlands.\textsuperscript{47} To the north of the Desert Uplands is the Einasleigh Uplands, also dominated by eucalypt woodlands and with a landform featuring a series of rugged hills and ranges, dissected plateaus, sand and alluvial plains. To the south-east of the Desert Uplands is the Brigalow Belt South, which consists of mixed landscapes, including undulating hills with low ridges and deep valleys. Again, eucalypt woodlands are common, but there are also areas of brigalow scrub and open Mitchell grasslands. The Mulga Lands bioregion in the far south of the Galilee Basin area is characterised by flat to undulating plans with strips of low hills, with mulga and eucalypt woodlands. And a small section on the far south west ‘nose’ of the Galilee Basin area includes the Channel Country bioregion, covered by large braided, flood and alluvial plains, surrounded by gibber or gravel plains, low ranges and dune fields, with Mitchell grass, gidgee and spinifex as the dominant vegetation.\textsuperscript{48}

Another way of dividing up the Galilee Basin area is according to how water flows. Surface water in the area flows into a number of major water catchments. In the west are the Cooper Creek-Bulloo and Diamantina River basins, making up 46% and 17% respectively of the Galilee Basin area, and terminating at Kati Thanda–Lake Eyre in central Australia. Remarkably, Kati Thanda lies 15.2 metres below sea level. It is the lowest point on the Australian continent, and the collection point of one of the largest internal drainage system in the world — covering around one-sixth of the Australian continent.\textsuperscript{49} The Flinders River basin is in the north of the Galilee Basin area, representing 12% of the area, and flows towards the Gulf of Carpentaria. In the east are the Burdekin and Fitzroy River basins, which make up 8% and 3% of the area, which ultimately lead to the Pacific Ocean on Queensland’s east coast. And 12% of the area is

\textsuperscript{47} For a narrative description of a biological survey of the northern Desert Uplands see Geordie Torr, ‘White Mountains’, \textit{Australian Geographic}, 2001, 60.  
taken up by the Warrego River basin in the south, which forms part of the larger and nationally significant Murray Darling Basin.\textsuperscript{50} The local catchments to lakes Buchanan, Dunn, Galilee and Huffer also fall within the Galilee Basin area (see Figure 3.3).\textsuperscript{51}

In addition to the surface water catchments, the Galilee Basin area includes seven groundwater systems.\textsuperscript{52} It also contains a number of subterranean formations that make up the Great Artesian Basin (GAB) and recharge area, including the Clematis Group, Warang Sandstone, Rewan Group and aquifers in the overlying Eromanga Basin.\textsuperscript{53} The GAB is one of the world's largest known underground water reservoirs, and lies beneath around 22\% of the Australian land surface.\textsuperscript{54} Only a narrow strip on the far eastern edge of the Galilee Basin area is outside of the GAB or GAB recharge zone.\textsuperscript{55} It is an incredibly important resource for outback towns and livestock operations in Queensland, New South Wales, South Australia and the Northern Territory.

There are many more lines that could be drawn across the Galilee Basin area, representing various geomorphological, biophysical, social, economic, political and cultural features and boundaries. Those described here give some impression of the many layers of meaning that occur in this one defined space in the Australian landscape. However, a closer examination of particular events is required to relate more of a nuanced history and experience of people living in the area.

\textsuperscript{50} Evans and others, pp. 89–103.
\textsuperscript{51} Evans and others, p. 132.
\textsuperscript{52} Evans and others, pp. 60–64.
\textsuperscript{53} Evans and others, p. 85; also see Crothers, \textit{Draining the Lifeblood: Groundwater Impacts of Coal Mining in the Galilee Basin}, pp. 32–34; RPS.
\textsuperscript{55} RPS, p. 2.
Figure 3.3 Water catchments in the Galilee Basin area

Source: Slightly modified map from Evans and others\textsuperscript{56}

\textsuperscript{56} Evans and others, p. 10.
Political unrest

Across the 248,000 square kilometres of the Galilee Basin area, wool production dominated the country in the early years of white occupation. Not only did this displace the original people of the area, but within the industry itself there was complex, often highly unequal and at times explosive, set of dynamics between pastoral workers, landholders, and governments.

The land was leased, and the sheep were owned, by a relatively small number of landholders. These were generally either wealthy pastoralists from South Australia or Victoria, or less-wealthy people who had borrowed money from British lending institutions, in which the wealthier pastoralists often had shares. As was the case in the other Australian colonies, local magistrates were generally current or former pastoralists, and the colonial government was made up of men with predominantly pastoral interests.57

It is not unsurprising in this context that it took over thirteen years from the establishment of Queensland as an independent colony to amend an administrative error, based on the older New South Wales Constitution Act, whereby only men who paid a minimum ten pound annual land rent were qualified to vote. This meant that around one third of the adult male population was unable to vote until 1st January 1873 when the laws were finally changed.58 Voting rights were not given to Queensland women in state elections until 1905, following South Australia in 1895, Western Australia in 1899, New South Wales in 1902 and Tasmania in 1903.59 Only in 1965 did Queensland enable Indigenous people to vote in state elections, the last of all Australian jurisdictions to do so.60

The grip of the wealthy landed elite on Queensland politics was challenged at various times on a number of fronts. From at least the early 1880s, working white men from across Queensland began organising. They posed a serious third force alongside the rural-conservative hub and the town-based “liberal petit-bourgeois ethos”. Republican, socialist and ultra-democratic ideals began bubbling up into public discourse, and in 1886 trade unionism was legalised in Queensland.61 Unionist activities in this era advocated political and industrial direct action, departing from the more cautionary and reformist approach taken by earlier craft unions. The

58 Ross Fitzgerald, Lyndon Megarrity and David Symons, Made in Queensland: A New History (St Lucia, Qld: University of Queensland Press, 2009), p. 17; Raymond Evans, A History of Queensland, p. 80.
61 Raymond Evans, A History of Queensland, pp. 117–118.
new culture was an affront to both the landed pastoralists as well as liberal town-based business owners.62

Some of Queensland’s most notable expressions of political and class-based ferment during the 1880s and 1890s occurred within the Galilee Basin area. Pastoral workers joined together in unions to confront the power of the government-backed pastoralists. Specifically, they aimed to set standard rates of pay, to improve working conditions, and to abolish ‘coloured’ workers who generally undercut the pay and conditions of white working men. Chinese workers were the main target, but ‘South Sea Islanders’, and ‘Kaffirs’ also faced discrimination.63 In Barcaldine, wool carriers launched a union in 1887.64 Shearers had attempted to form unions in the 1870s, but they found themselves quashed by repressive laws. The shearers’ efforts to unionise were however reinvigorated when some pastoralists tried to cut the shearing rate in 1886, and in 1887 the Queensland Shearers’ Union was formed in Blackall. In 1888 the Queensland Labourer’s Union formed to represent woolshed labourers.65

In response to the organisation of workers, pastoralists formed their own unions — the first and most powerful was the Central Queensland Employers Association (CQEA, later renamed Queensland Pastoral Employers Association), formed in Barcaldine in 1889.66 Apparently controlling the CQEA was the Melbourne-based Fairbairn family, who owned 40% of the Queensland wool clip.67 In 1890 the CQEA tried to impose a cut to labourer’s wages.68 Tensions only increased with the first meeting of the Australian Labor Federation, held in the town of Blackall.69 The Federation linked the bush unions to other major unions, including maritime unions, which vastly increased their power to threaten major industrial action.70

In 1891, with Australian and New Zealand maritime and associated unions engaged in massive industrial action, George Fairbairn took a definitive stand against the bush unions in Queensland.71 Many of the pastoral employers abhorred the prospect that the freedom of contract — the right of employers to negotiate individual employment contracts — was under

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62 Raymond Evans, *A History of Queensland*, p. 120.
65 Svensen, p. 235.
66 Svensen, p. 235.
68 Svensen, p. 235.
70 Svensen, p. 235.
71 Svensen, p. 236.
threat.\textsuperscript{72} By introducing new working agreements on top of the wage cut from the previous year, Fairbairn provoked the unions to strike, and so began the 1891 Shearers’ Strike, also known as the Shearers’ Dispute or Shearers’ War.\textsuperscript{73}

The ‘front’ of this war almost entirely encompassed the Galilee Basin area, but was particularly concentrated around Barcaldine, where it is believed around 4,500 people had gathered. The battle lasted for more than four months.\textsuperscript{74} It directly involved around 10,000 striking bush workers who congregated in about 40 camps around western Queensland, some with significant stores of arms. The strikers enjoyed substantial local support.\textsuperscript{75} At least some of them also envisioned that their struggle could lead them to taking control of Brisbane, the colony’s capital in the south east.\textsuperscript{76}

Arguing the need to maintain law and order, the government came to the aid of the pastoralists by deploying over 3,000 special constables, soldiers and police, whose main role was to guard non-unionised labour being transported to the woolsheds across the district.\textsuperscript{77} It was the first time since the Eureka stockade in Victoria in 1854 that the colonial endeavours in Australia faced a serious prospect of civil war.\textsuperscript{78} Strikers set fire to pasture and five large wool sheds, and there were attempts to derail trains carrying ‘scab’ labour. There were a series of clashes between strikers and police, although remarkably, only one violent death as a result of the dispute was reported.\textsuperscript{79}

In surprise raids, a number of the key strike leaders were arrested, some charged with conspiracy. Non-unionised workers eventually made it through to many wool sheds, and heavy rains made camp life difficult and miserable. Eventually the strike broke and many of the men returned to work.\textsuperscript{80} In total, 255 strikers were imprisoned and more than a dozen union leaders sent to the island penitentiary of St Helena — located several kilometres off the mouth of the Brisbane River — for three years.\textsuperscript{81}

\textsuperscript{73} Svensen, p. 236.
\textsuperscript{74} Svensen, p. 4; Hoch, \textit{Barcaldine 1846-1986}, p. 21.
\textsuperscript{75} Svensen, p. 239.
\textsuperscript{76} See for instance Raymond Evans, \textit{A History of Queensland}, p. 122.
\textsuperscript{77} Svensen, p. 4.
\textsuperscript{78} Raymond Evans, \textit{A History of Queensland}, p. 122.
\textsuperscript{80} Hoch, \textit{Barcaldine 1846-1986}, pp. 21, 23.
\textsuperscript{81} Raymond Evans, \textit{A History of Queensland}, p. 123.
The causes and fallout from the dispute were multi-faceted and variously interpreted. Some commentators point to the surplus workforce in the central-west caused by workers displaced by the new rail line.\textsuperscript{82} Others mention the pressure on pastoralists from drought and falling markets.\textsuperscript{83} Undoubtable though were the numerous structural forces pitted against the labour movement: the state’s military, transport and legal forces were deployed against the strikers for the benefit of inter-colonial and overseas’ capital; around a third of parliamentarians in Queensland at the time held pastoral leases;\textsuperscript{84} workers consistently received harsher sentences than their pastoral counterparts; and the press consistently reported in favour of the government and financiers — in the case of the *Brisbane Courier*’s Barcaldine correspondent at least, reports appear to have heavily censored by sub-editors.\textsuperscript{85}

**Marked memories**

While the details and fuller context of the 1891 Shearers’ Strike are invariably overlooked, one of the most common accounts is that it gave birth to the Australian Labor Party, beneath the wise limbs of a single *Eucalyptus papuana* growing in front of the Barcaldine railway station. The Tree of Knowledge has become a potent historic symbol in Queensland’s central-west, and is listed on the national heritage database. The tree’s death in 2006 spurred the construction of an enormous artistic monument around the tree which dominates the main street of Barcaldine today.\textsuperscript{86}

In 1891, Henry Lawson wrote the stirring poem ‘Freedom on the Wallaby’ in support of the shearsers’ cause that had been centred around Barcaldine.\textsuperscript{87} The final stanza conveys the defiant energy of the times:

\begin{quote}
So we must fly a rebel flag,  
As others did before us,  
And we must sing a rebel song  
And join in rebel chorus.

We’ll make the tyrants feel the sting  
O’ those that they would throttle;
\end{quote}

\textsuperscript{82} Hoch, *Barcaldine 1846-1986*, p. 18.  
\textsuperscript{83} Svensen, p. 5.  
\textsuperscript{84} Raymond Evans, *A History of Queensland*, p. 123.  
\textsuperscript{87} Hoch, *Barcaldine 1846-1986*, p. 25.
Further west, between the towns of Winton and Kyuna, an incident in 1894 is believed to have provided the spark for Australia's pseudo national anthem 'Waltzing Matilda', written by Lawson's contemporary rival poet, Banjo Paterson. At the height of the 1894 Shearers' Strike, at a billabong named 'Four Mile', a shearer named Samuel Frenchy Hoffmeister mysteriously died by a gun shot in the mouth. His death followed an arson attack on the nearby Dagworth Station woolshed, in which many shots were fired and 150 lambs were burnt to death. The cause of the shearer's death was recorded as suicide. But there is ongoing uncertainty as to who may have pulled the trigger; Hoffmeister's striking unionist comrades, the Dagworth Station manager, and a local police trooper have all been suspected. In any event, there is a compelling case that in Waltzing Matilda, Paterson penned a multilayered set of lyrics that communicates the heat and complexity of the region's political situation at the time, embodied in the unfolding moments beside an unremarkable billabong. The Queensland version of the song was certainly local, being an interpretation of an old Scottish song attributed to Christina MacPherson, sister of the Dagworth Station manager, friend of Paterson's then fiancé, and suspected secret sweetheart of Paterson himself.

Another Australian icon was born in the Galilee Basin area when in 1921 the Winton Club hosted the first board meeting of the newly registered Queensland and Northern Territory Air Service (QANTAS). The headquarters for the fledgling airline soon moved to nearby Longreach, where it was convenient to the Central Railway railhead. The founding of the airline emerged from the confluence of two returned World War I pilots with an ambition to start an airline, and the support of wealthy and well-connected landholders who knew too well the travails of traversing the distances of the west and central-west. There were regular flights between Charleville and Cloncurry from 1922 and the airline became an important passenger and mail carrier between Queensland's western railheads. Pilots also delivered food stores and luxury items to remote stations in Queensland and Northern Territory. The QANTAS headquarters moved to Brisbane in 1931 and the flying kangaroo logo first appeared in 1944.

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Besides its remarkable political history, Barcaldine is also remembered as the site where, in December 1887, deep water from the Great Artesian Basin started flowing freely for the first time in Queensland. That original government-funded bore was measured as producing some 664,000 litres per day, and within a few years there were hundreds of flowing bores in western Queensland, helping to secure pastoralism in the district. While the volume of water unleashed in Barcaldine was unprecedented in outback Queensland, it was not the first town to tap into the artesian depths. Two years earlier the state government had directed the government geologist and hydraulic engineer to search for artesian water in the southern part of the Galilee Basin area, in the vicinity of Tambo, Blackall and Aramac. Blackall was perceived as having the greatest need, and a bore was developed there in 1885. When artesian water was tapped in Charleville in 1889, the immense pressure of the flow projected fossilised ferns into the air and it took up to a dozen men to cap the hole.

There are intriguing parallels between Queensland’s artesian water in the late nineteenth and early twentieth centuries, and coal resources in the late twentieth and early twenty-first centuries. Artesian water was crucial for the pastoral development of the outback. And with pastoralism the main pillar of Queensland’s economy, the colonial authorities played a major role in financing the exploration and establishment of artesian bores, similar to how mineral exploration and development has been supported and encouraged from the second half of the twentieth century. By 1894 some 228,700 square kilometres, roughly one third of the land surface of Queensland, had been tested for artesian water. Ownership rights according to English common law were overturned for water as they were for minerals, whereby the state’s interests in minimising waste and raising revenue trumped the concerns of landholders.

The pastoral history in the Galilee Basin area has also provided specialist heroes, such as the shearer Jack Howe who on Alice Downs Station, north of Blackall, shore 321 sheep with blades in a single day in 1892. It was only with mechanical shears, 58 years later, that Howe’s record was broken.

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92 Thomis, p. 16.
94 See O. C. Powell, ‘Song of the Artesian Water: Aridity, Drought and Disputation along Queensland’s Pastoral Frontier in Australia’, *The Rangeland Journal*, 34 (2012), 305–17 (pp. 310–311). Mining rights are further discussed in Chapter Eight. For an account of the value of pastoralism to Queensland’s economy over the period described, see Thorpe, pp. 115–132.
95 Thomis, p. 85.
There is generally a sense of celebration and pride when Australians remember these various events and the enduring spirit of the early white pioneers in face of the odds. The nation’s pastoral heritage and outback culture is often portrayed as representing the heart of Australia, despite the fact that 70% of Australians lived in urban areas by 1891, and the significant contribution of minerals and manufacturing to colonial economies as early as the mid-nineteenth century. Looking back at the history of western Queensland (Wilmot) Hudson Fysh, a pilot and managing director of QANTAS, praised the achievements of the early white western Queensland settlers in laying the foundations for later generations:

The race of western Queensland pioneers is wellnigh extinct, and already the present generation but dimly realize their battle against the primitive wilderness, peopled by a wild and uncivilized race, or their grim fortitude in struggling against drought and flood, that the wild lands might be tamed.

There is a sharp distinction between Fysh’s memory of the brave, stoic pioneers and his dismissive and unflattering description of the original people who had lived in the area. Such characterisations are common. In stark contrast to the well-documented and eulogised moments in Queensland’s central-west over the span of white history, memories and events related to the region’s first people have gone largely unrepresented in both the local and national memory.

The First People

The Indigenous people whose territories overlapped, or were encompassed by, the Galilee Basin area possibly had tens of thousands of years of accumulated knowledge and cultural life in the region. What would they have made of the notion that in less than 170 years of first seeing white men on horseback, their country would be fenced off into discrete paddocks,

98 J. M. Powell, *An Historical Geography of Modern Australia*, p. 15.
100 Hudson Fysh, *Taming the North: The Story of Alexander Kennedy and Other Queensland Pathfinders* (Sydney: Angus And Robertson, 1933), pp. vii–viii.
much of it cleared of its original vegetation, taken over by sheep and cattle, roads and rail, drill rigs and draglines, and that only a handful of their kin would remain in the district?

The Galilee Basin area was home to people who identified as Maiawali, Guwa, Wunumara, Yirandali, Yilba, Miyan, Iningai, Yagalingu, Kuungkari, Dharawala, Bidjara, Gunggari and Wangan. Some of these groups have very few or no known living descendants. As such, trying to convey a sense of their lives and history in the region is extremely limited and mostly restricted to sites of remaining physical heritage. The surviving accounts from the outsider, often unsympathetic, white men who invaded their country provide sketchy details fleshed out by more recent work of white historians, whose primary focus is the pastoral heritage of the region.

When explorer Thomas Mitchell travelled through a significant portion of the of the Galilee Basin area in 1846, he found much evidence of Aboriginal occupation of the area, and had several encounters with the local people. In his diary entry on 10th August Mitchell describes an encounter with men (presumably Yagalingu) over six feet tall, each of them armed with several missile clubs, at a river which he understood from them was called ‘Belyando’, and which has retained that name till today.

A couple of months later, and further west near the Alice River, Mitchell came across “large permanent huts”, plainly the “the home of a numerous tribe” near a lagoon where a large group of (presumably Iningai) people were gathered “amusing themselves in the water during the noon-day heat, which was excessive”, some digging for worms and searching for freshwater mussels. In the west, Landsborough described a group of “fine, tall, powerful fellows” (Iningai).

There are accounts of people near Aramac (presumably Iningai) who would commonly travel with possum-skin rugs, grass-woven dilly-bags, fire sticks, yam sticks and weapons. The weapons included boomerangs and long slender hardwood spears made of Gidgee or

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102 This is indicative only, as it is based on super-imposing an outline of the Galilee Basin (based on Evans and others, 2014, p.24) on top of the Aboriginal Australia Map, which itself does not claim to be definitive, see David Horton, ‘Aboriginal Australia Map’ (Canberra: AIATSIS, 1996); AIATSIS, ‘Aboriginal Australia Map’, Australian Institute of Aboriginal and Torres Strait Islander Studies <http://www.aiatsis.gov.au/asp/map.html> [accessed 15 August 2014]. Note that Wangan territory, which lies to the east of Yagalingu country, does not appear within the boundaries of the Galilee Basin from this simple mapping exercise. However, Wangan and Yagalingu jointly applied for native title in 2004, including land where Adani proposes its Carmichael mine. Some Wangan representatives have become prominent in opposition campaigns against the mine, see for instance ‘Wangan & Jagalingou Family Council’ <http://wanganjagalingou.com.au/> [accessed 8 July 2015]. For slightly different descriptions of Aboriginal territory in the region, also see Evans and others, pp. 28–29; Rolfe, Blamey and Bennett, p. 9.

103 T. L. Mitchell, p. 269. (10th August)

104 T. L. Mitchell, pp. 324–325. (25th September)

105 Moffat, p. 13.
Brigalow, some of them barbed, hardwood nulla-nullas, and softwood shields that usually bore tribal markings or other designs.106

Many places in the Galilee Basin area contain physical remnants of the region’s first people. Numerous stone tools and weapons lie scattered around the paddocks of pastoral properties, many of which have been picked up by the intervening generations of graziers, and kept in private family collections, some along with wooden boomerangs and spears.107 Near Tambo, an area of some twenty hectares was gazetted as a ‘Reserve for Scientific Purposes’ in 1933. Locally the site has been known as ‘The Blacks Place’,108 or ‘Blacks Palace’,109 although on the Register of the National Estate it is given the name ‘Indigenous Place’.110 Overhanging sandstone cliffs host extensive galleries of rock paintings, etching and stencil work from the region’s first people, believed to be the largest site of its kind in Australia and possibly the largest in the world. Around 9,500 motifs are spread between more than forty clusters of art work. The site was also a burial place, where bodies of the dead were placed in bark cylinder coffins after being prepared on large racks.111

Less well known are rock carvings covering over 100 metres in the Gracevale Caves on the Aramac Range, believed to be in the order of 10,000 years old and open to tourists only since 1996.112 There is also rock art in the northern part of the Desert Uplands, in the White Mountains region.113 Smaller cultural sites known as bora, or ceremonial rings, have also been noted in the region. Many have been accidently or deliberately destroyed, although one with significance to Yagalingu and Wangan people is known to be on the Wendouree Station, and was described in the Alpha Coal Project environmental impact statement.114

Such sites and accounts can be rich and captivating, but they are only tiny fragments of the societies, families and cultures they represent. The work of anthropologists and linguists provide further glimpses. Aboriginal words and languages intimately described country and life

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107 Interview data 2012, interviewee # 9. I have also been told about these private collections during conversations with local graziers.


109 Cooper, *Crossing the Divide*, p. 8; Rolfe, Blamey and Bennett, p. 9.


111 Cooper, *Crossing the Divide*, p. 8; Hoch, *Alpha Jericho*, p. 67; Rolfe, Blamey and Bennett, p. 9.


113 Rolfe, Blamey and Bennett, p. 9.

114 Hancock Coal, ‘EIS, V2 Section 18: Indigenous Cultural Heritage’, 2010, p. 6; this could be the same one referred to by Hoch, *Alpha Jericho*, p. 67.
in the Galilee Basin area for countless generations up until 100–150 years ago. Some of these languages appear to be entirely lost, and only survive in the form of documented language ‘salvage studies’.115

Compared to traditional cultural artefacts, until recently Aboriginal people’s management of their environment has been a less recognised, although extremely potent, legacy right across the Australian continent. Beginning in the late 1960s, researchers such as Rhys Jones and Sylvia Hallam began to recognise and describe Aboriginal people’s use of fire as a form of active land management that changed assemblages of plants and animals.116 More recently, Bill Gammage has brought awareness of the topic to a much wider audience, and extends the argument to suggest that the entire landscape of Australia can be thought of as a carefully created and managed ‘estate’.117 These Australia-wide interactions between Aboriginal people and their land were evident in the Galilee Basin area. Fire is still an important management tool by the white graziers in the district today.118 However, the loss of knowledge about the skilful and appropriate use of fire generated over millennia was probably one aspect considered by a local grazier, who expressed during a conversation that the absence of Aboriginal people, along with their knowledge, language, customs and culture, is a “loud silence and emptiness” that remains in the landscape today.

Perhaps more profoundly foreign to the region’s first people than the animals and artefacts of white society that started appearing on their country, were the fundamental underlying tenets of the invading culture and economy that shaped its relations between class, gender, race, and with the country and resources it drew upon. A rare and valuable account of the fraught intersection of Aboriginal and white worlds in western Queensland in the early twentieth century is given by Alice Duncan-Kemp — a white woman born in 1901, who grew up on a cattle station in the Channel Country just outside the margins of the Galilee Basin area. Under the respectful management of Alice’s father, Moonaberrie Station became a refuge for Aboriginal people in the region, and Alice grew up absorbed in the culture and country of the ‘Diamantina blacks’. She describes the ‘finesse’ with which her Aboriginal friends negotiated

115 Gavan Breen, Salvage Studies of Western Queensland Aboriginal Languages (Canberra: Dept. of Linguistics, Research School of Pacific Studies, Australian National University, 1990).
117 Gammage.
118 Fensham and Fairfax, Talking Fire, pp. 7–8; Rolfe, Blamey and Bennett, p. 10.
the cross-cultural space they found themselves in, in the decades before the destructive wave of influenza in 1918–19, and their removal to a remote mission in the early 1930s.¹¹⁹

In the north of the Galilee Basin area near Hughenden, the pastoralist Robert Christison is remembered as being unusually sympathetic to the people on whose land he lived and grazed sheep. After first abducting and chaining up a “fine looking fellow” to his verandah post, Christison befriended the Dalleburra man and explained to him “Country belonging to you: sheep belonging to me”.¹²⁰ This pronouncement by Christison was extremely generous relative to the dominant attitude at the time, but it speaks volumes of the arrogance and blindness of the invading society and the destructive impact its activities would have on the region’s first people.

Worlds colliding

Queensland’s history of frontier violence is commonly regarded as the grimmest of all the Australian colonies. There are numerous chilling accounts written by white men — both supportive and horrified — of what they heard and saw around them as their society rapidly pushed its way into Aboriginal lands.¹²¹ Settlers were anxious to be unfettered in their various enterprises, and the Queensland government was only too keen to assist their pursuits, including condoning the killing of Aboriginal people.¹²² Queensland was colonised in a relatively short space of time and circumstances were different to other Australian colonies, as explained by historian Raymond Evans:

It was the only colony where pastoral, mining, maritime, and plantation frontiers were advancing simultaneously; and all this occurred as Western racist theories, grouped


around polygenism and Social Darwinism, were peaking in their certitude and influence.\(^{123}\)

The Imperial Government deemed itself effectively powerless in these matters since Queensland had been granted self-government, as expressed by a British Colonial Office officer in 1866:

> I believe it to be by no means easy to exaggerate the recklessness with which blacks have been destroyed (in some cases by strychnine like foxes) in Queensland. But the Home Government can but hold up its hands. There is no effectual power to interfere in their cause.\(^{124}\)

Violence had been escalating on the northern frontier since the 1840s. Whites invaded Aboriginal lands with little regard for the effect of removing Aboriginal means of livelihood.\(^{125}\) It was common for leaseholders to build their homesteads on the best permanent waterholes, and stock routes were also determined by available water.\(^{126}\) And while the white newcomers were outraged by theft or attacks on livestock and property, they themselves regularly transgressed strictly coded Aboriginal law relating to important and sacred places, and sexual relations with Aboriginal women.\(^{127}\)

White settlers were probably responsible for killing the largest number of Aboriginal people in Queensland. However the Native Mounted Police, which operated for over sixty years, has been described as “the singularly most destructive institution”.\(^{128}\) The Native Police force was initiated in the Middle District of New South Wales in 1848, following earlier examples in the Port Phillip district of New South Wales from 1837.\(^{129}\) In 1849, Frederick Walker, who was in charge of the Middle District force, led his band of Native Troopers into the newly settled northern districts in what would later become Queensland. The Force was formally adopted in Queensland from the outset of the formation of the colony in 1859.\(^{130}\) However, far from a

\(^{123}\) Raymond Evans, “‘Plenty Shoot “Em”: The Destruction of Aboriginal Societies along the Queensland Frontier’, p. 164.
\(^{124}\) J. Rogers, Colonial Official Minute, 15 January 1866, Public Records Office (UK), Co 234/13, 57283, 422, quoted in Raymond Evans, “‘Plenty Shoot “Em”: The Destruction of Aboriginal Societies along the Queensland Frontier’, p. 158.
\(^{125}\) Reid, A Nest of Hornets, p. 5.
\(^{126}\) Cooper, Crossing the Divide, p. 10.
\(^{127}\) Reid, A Nest of Hornets, p. 5; Larissa Behrendt, Indigenous Australia for Dummies (Milton, Queensland: John Wiley & Sons, 2012), p. 103.
\(^{128}\) Raymond Evans, “‘Plenty Shoot “Em”: The Destruction of Aboriginal Societies along the Queensland Frontier’, p. 166.
\(^{129}\) Reid, A Nest of Hornets, p. 4; Marie Hansen Fels, Good Men and True: The Aboriginal Police of the Port Phillip District 1837-1853 (Carlton, Vic: Melbourne University Press, 1988).
regular accountable police force, they were given free rein to squash black resistance. Historian Gordon Reid describes them as:

... a paramilitary force which acted as an army in the field, operating at will against a definable enemy of the government and the society which they served. As such, they clearly facilitated the settlement, and also the conquest, of north-eastern Australia.131

Native Police could move more expertly through the Australian environment than the white newcomers, and inter-tribal rivalries could be brutally exploited in their activities of ‘dispersing’ — a common euphemism for shooting — Aboriginal groups that were problematic for the white settlers.132 From the 1870s Native Police were armed with Sniper Carbines, and Martini-Henries from the 1880s. They were aided by industrial-age technologies such as the telegraph, steamboats and railways, and had the advantage of horse-back mobility.133

Queensland’s Indigenous people often mounted resistance and retaliation in face of the white invasion. For instance, in the Galilee Basin area it is said that the first white manager on the Belyando River, Karl Aumuller, was forced to temporarily withdraw, due to Aboriginal attacks on sheep and shepherds.134 However, overall the casualties on either side of the frontier wars were grossly uneven. It is thought that around 1,500 non-Indigenous people were killed by Aboriginal people in Queensland frontier violence between 1824 and 1900. Over the same period there were at least 10,000, and possibly up to 65,000, Aboriginal people who died in frontier conflict.135 Aboriginal communities were further hollowed out by the combined effects of disease, starvation and a falling birth rate.136

In the 1850s and 1860s, central Queensland saw some of the most notorious points of conflict in the colony. White men, women and children made up the forty or so killed in a number of attacks by local Aboriginal people between Rockhampton and the Dawson Valley south of

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131 Reid, A Nest of Hornets, p. 185.
133 Raymond Evans, “‘Plenty Shoot ’Em’: The Destruction of Aboriginal Societies along the Queensland Frontier”, p. 165.
134 Hoch, Alpha Jericho, p. 10.
135 Raymond Evans, “‘Plenty Shoot ’Em’: The Destruction of Aboriginal Societies along the Queensland Frontier”, p. 167; Evans and Ørsted-Jensen.
136 Raymond Evans, “‘Plenty Shoot ’Em’: The Destruction of Aboriginal Societies along the Queensland Frontier”, p. 164.
Emerald. Estimates of over 500 Aboriginal people were killed in swift and brutal reprisal, carried out by ‘white vigilantes’ and native police.\textsuperscript{137}

At Hornet Bank Station eight members of the Fraser family and three of their employees were murdered in a planned attack by local Jiman in their home on the Dawson River in October 1857. The assault was led by an Aboriginal man who is believed to have been involved in a number of attacks on pastoral stations over the previous decade. The Jiman were also advantaged by having at least two ex-Native Troopers living with them, who were familiar with firearms and police tactics.\textsuperscript{138} In October 1861 at Cullin-la-Ringo on the Nogoa River, around 260 kilometres north-west of Hornet Bank, nineteen white people were massacred in another planned attack.\textsuperscript{139} Among the attackers were men who had also been involved with the Hornet Bank killings.\textsuperscript{140} Popular accounts of the massacres rarely acknowledge the context in which they happened, which in both cases included prolonged frontier tension and atrocities against the local Aboriginal people by white settlers and native police.\textsuperscript{141}

The disproportionate revenge killings of Aboriginal people after the incidents at Hornet Bank and Cullin-la-Ringo were committed with impunity, and spilled over into the Belyando valley.\textsuperscript{142} The Cullin-la-Ringo massacre in particular loomed large in the minds of the white newcomers at a considerable radius of the actual event, including in the north and west of the Galilee Basin area.\textsuperscript{143} The implications for Aboriginal people only accentuated the prevailing process of dispossession. For instance, writing about her father’s experiences at Lammermoor station near Hughenden, Mary Bennett says:

\begin{quote}
After the Will’s massacre [at Cullin-la-Ringo] it had become the practice not to allow blacks near the homestead, and as the homestead was generally built on the best water, there was always the probability that the settlers would only keep the blacks away by using fire-arms. The Will’s tragedy no white man would forget; it’s cause none troubled at.\textsuperscript{144}
\end{quote}

By the mid-1860s two Native Police Barracks had been established on the Belyando River. Details of the extent and particularities of conflict in the area have been mostly left

\textsuperscript{137} Raymond Evans, “‘Plenty Shoot “Em”: The Destruction of Aboriginal Societies along the Queensland Frontier’, pp. 155–156.

\textsuperscript{138} Reid, A Nest of Hornets, pp. ix, 60.

\textsuperscript{139} Reid, A Nest of Hornets, pp. 123–140.


\textsuperscript{141} Reid, A Nest of Hornets, pp. ix–x.

\textsuperscript{142} Reid, A Nest of Hornets, p. 140; Hoch, Alpha Jericho, p. 8.

\textsuperscript{143} See Bennett, p. 56; Porter, p. 53.

\textsuperscript{144} Bennett, p. 56.
uncovered. However, in 1864 “some large mobs” were reported to have been ‘driven back’ and ‘dispersed’ from a property on the river. There are also records of a station owner along the Belyando who “was in the habit of hunting the Gins [women] of the Blacks” with the aid of a “Blackfellow” who he kept for that purpose. Events only got more sordid when the station owner murdered his Aboriginal helper and another man when they tried to escape from his service, as well as firing upon and stabbing two other Aboriginal men. The station owner called in the Native Police for protection, whom he offered monetary reward if they successfully brought him a woman for his exploitation. Later records report that Native Troopers similarly exploited local women (presumably Yagalingu) in the same manner themselves.

In the Alpha region, oral history recalls twenty-one Yagalingu people killed at Rifle Creek in reprisal for the death of white shepherds. In the early 1870s Native Troopers paroled Beaufort Station, also remembered for the rifle loopholes built into the homestead walls. Further west, in 1866, Native Police were requested to assist in dealing with the “very troublesome and hostile spirit of the Native Blacks on the Barcoo, Alice and Thomson Rivers”. Around the same time, it was reported that a group of leaseholders had cornered a group of about forty Aboriginal people in a cave, shooting the leaders and young men in retaliation for the killing of a worker from Aramac Station. This is possibly the same incident that Aboriginal people speak of today, although they report that there were sixty Aboriginal men, women and children rounded up and killed at Mailman’s Gorge, east of Aramac, in retribution for the spearing murder of a station owner.

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145 Hoch, Alpha Jericho, p. 8.
146 Cooper, Crossing the Divide, p. 10.
148 Hoch, Alpha Jericho, p. 8.
149 Cooper, Crossing the Divide, p. 11; Hoch, Alpha Jericho, p. 11.
150 Colonial Secretary’s office correspondence, 1866, ID846811, Qld State Archives quoted in Cooper, Crossing the Divide, pp. 10–11.
151 Cooper, Crossing the Divide, pp. 10–11.
152 Interview data, 2012, interviewees #7 & 9. There are additional accounts of a massacre in the area, although further research would be required to understand if they all refer to the same incident. One interviewee mentioned reading about a massacre in a rare book that has since been misplaced, but which corroborated local oral history. Presumably, it is the same massacre that is reported in a 1938 article on the history of Aramac, which describes the spearing death of Lacey — an owner, or relative of an owner — of Aramac Station. On finding Lacey’s body a man named “Long” Gordon retaliated. He tracked a group of ‘blacks’ to Mailman’s Gorge. The article describes that Gordon “found them at Raven’s Bath at Greyrock”. On seeing Gordon, the camp of Aboriginal people ran into a cave, at which point “Gordon stood at the mouth of the cave and shot every one of them”; Anon, ‘Aramac: Tales of the Years Gone by and Now’, The Longreach Leader (Qld., 7 December 1938), p. 22. It is also worth noting that an article from 1930 mentions a “great slaughter” at Greyrock on Aramac Station “during the early portions of Mr. Gordon’s career at Aramac Station”, and describes “the skeletons of the dead natives” that can still be seen. However this article attributes the mass-killings to “tribal war between the abo’s”;
The Native Police were gradually phased out of the Alpha region after the late 1870s, following public outcry about the atrocities, and presumably too because of the reduced ‘trouble’ faced by the leaseholders. Across Queensland, the number of Native Police detachments fell dramatically from the mid-1880s. However, the force was never officially wound up, and there remained active stations in Cape York Peninsula right up until the outbreak of World War I, in 1914.

Within just a couple of decades of initial pastoral expansion, the Indigenous people of the Galilee Basin area had been much reduced in numbers, pride and purpose. At Blackall in the 1890s and early 1900s, the small number of remaining Aboriginal people were regarded more of a nuisance than a threat, as they were chased away from locating their camp near the town’s water reserve. With the passage of time they were “remembered locally with a certain nostalgia as colourful, peaceful characters, who were indulged rather than persecuted”.

There are no records of violent clashes after 1880 in the Alpha-Jericho area. By the mid-1880s it is reported in a local history that “Aborigines had ceased to be a problem for the white settlers”, with survivors camping on stations and the town fringes and becoming useful as a “source of cheap labour”. Between 1890 and 1920 Aboriginal people were sometimes employed for their tracking skills in local searches, although their numbers further diminished in this period when, in compliance with the *Aboriginal Protection and Restriction of the Sales of Opium Act (1897)*, many were taken to live on missions. Most were taken to Barambah, later renamed Cherbourg, but others possibly went to Taroom, Woorabinda and Palm Island — all of which were at least several hundred kilometres away from Alpha. Those who remained working on stations, and those who returned when permission was granted for them to do so, were able to maintain a certain degree of connection with their traditional country. However, overall there was a bleak emptying out of the region. In 1890, thirty Aboriginal people turned up to receive government-issued blankets at the Alpha Court House. But by the 1930s local historian Isabel Hoch describes:

*The Belyando natives... had almost died out. Three survivors, Jacky, Yorkey and Jungo, lived in a humpy on the creek bank with several dogs for company. The final chapter for*
these old men is sad and ironic for Jacky was found to be the carrier of diphtheria, a
disease which had flared up repeatedly among children of the district.  

In the intervening years, the challenges faced by the Yagalingu people around Alpha reflected
the broader experience of Aboriginal people in the region. The severe drought between
1899 and 1902 made it difficult for them to remain living on stations, and many drifted into
towns “where most of them lived in degradation and disease and addicted to opium”. Opium, and commonly the ashes of opium, was widely used. The effect on those addicted
was “too awful for description” according to the Protector of Aborigines who travelled through
the district in 1902.

Most of the opium in central-west Queensland was supplied by Chinese immigrants. Chinese
labour had been actively pursued in the Moreton Bay Area from 1848 as way to fill the labour
shortage. Within a decade it is thought that over 2,000 Chinese people had arrived as part of
the ‘coolie’ trade. By 1891 there were 8,574 in Chinese in Queensland, 1,200 of which were
living on ‘the front’, although fewer than 100 in the whole colony were registered as pastoral
workers. Chinese people had come into the Alpha region as storekeepers and gardeners
after the Central Railway was built, with some also working as cooks and gardeners on
stations. There is also oral history of ‘Kanakas’ (Pacific Islanders) working on stations in the
early years of white settlement. Chinese gardeners also provided vegetables to the town of
Blackall, and worked in woolsheds across the district, the cause of much discontent amongst
white shearers in the period during and leading up until the 1890s shearer strikes. Many
Chinese living around Alpha and Jericho returned to China in the early twentieth century,
although there were several who remained in the district until after the Second World War.

Humans were not the only ones to suffer on the pastoral frontier of colonial expansion in the
Galilee Basin area. Attitudes to wildlife, dramatic changes in the ecological balance of species,
and desperate economic times, particularly in the early twentieth century, led to widespread

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164 Hoch, *Alpha Jericho*, pp. 27, 35–36, 51; also see Andrew Gillett, *Opium and Race Relations in
Queensland* (Brisbane: State Library of Queensland, 2010).
165 Quoted in Hoch, *Alpha Jericho*, pp. 41–42.
167 Evans, Saunders and Cronin, *Race Relations in Colonial Queensland*, p. 239.
168 Svensen, p. 65.
169 Hoch, *Alpha Jericho*, p. 27; Cooper, *Sufficient for Living*, p. 17; Anon, ‘Aramac: Tales of the Years Gone
by and Now’.
170 Thomis, p. 4.
slaughter of kangaroos, possums and koalas. Possums and koalas are now rare in the region.\footnote{172} The central-west was far from the only district engaged in such activities. The \textit{Marsupial Destruction Act (1877)} was designed to “facilitate and encourage” the destruction of “pest” species across Queensland by offering a bounty on scalps, until it was withdrawn in 1930. It is estimated that around 28 million animals were killed in total, 96% of which were wallabies, pademelons, kangaroos, wallaroos and other small marsupials, and the remainder being dingoes and foxes.\footnote{173} Around Australia there were similar patterns, with the Tasmanian tiger \textit{(Thylacinus cynocephalus)}, being hunted to extinction during the same period.\footnote{174}

The recent and current landscape and people of the Galilee Basin area

The community across the Galilee Basin area today is mostly made up of the descendants of the first wave of pastoralists, rail and other workers, as well as many subsequent arrivals. It is estimated that less than 20,000 people live in the region, 75% of whom are in towns. With 3,561 residents, Charleville is the largest town. According to the 2011 census, agriculture is the main industry in the region, employing around one third of the population. The next largest employer is ‘public administration and safety’ at 11.4% and ‘health care and social assistance’ at 8.4%. Mining is the thirteenth largest industry, employing just 1.3% of workers.\footnote{175}

Community activity is focussed around the main towns in the area, such as Alpha, Jericho, Barcaldine, Aramac, Tambo, Blackall, Charleville, Augathella, Hughenden and Richmond. The towns function as service centres for the surrounding pastoral properties. Most of the towns have schools, and various levels of health services, entertainment and tourist attractions. Some children on remote properties are enrolled in the Longreach School of Distance Education, which describes itself as “a classroom more than twice the size of Victoria, where the playground is as vast as the outback and the partnership between home and school is legendary”, and with the motto “Effort Conquers Distance”.\footnote{176}

Sport plays a big role in the region’s social life. There is a history of the nationally common sports of football, golf, tennis, netball and cricket.\footnote{177} Rugby League played a particularly

\footnote{175} Evans and others, pp. 21–26.
important role in Barcaldine, where the Aboriginal ‘All-Blacks’ played the ‘All-Whites’ for charity in the early 1960s. The game became a regular annual match for over twenty years, drawing players from around Queensland and the rest of Australia, and preceding the national Indigenous All-Stars teams in the codes of rugby league and Australian Football League. The Black-White games in Barcaldine have been credited for helping to build the remarkably racially harmonious relations in the town.178

Characteristic of outback Australia, horse-based sports that highlight the skills of pastoral work have also long been popular in the Galilee Basin area. Horseracing, camp-drafting, rodeos, gymkhana, pony clubs and equestrian events are some examples.179 Goat racing was also a much loved sport up until at least the mid-1900s.180 Free roaming goats however caused no end of mischief. For instance, one elderly Alpha resident recalls:

Blooming goats all right! There was no stopping them. In the old days the cars had the ragtop wouldn’t you know, and they used to park underneath the trees. And of course the goats would get up on top of the bonnet and up on the hood and go through the roof... Yeah, they weren’t too pleased with that.181

Hoch recounts the effect of reticulated water on the town animals of Alpha in the early 1960s, and the ultimate control that was placed over them a decade later:

With water available for gardens, the old love-hate relationship for animals that roamed the streets became bitter. Everyone loved his own goats, horses and cows and hated his neighbours. Fences were jumped, gates pushed open, even public taps turned on by some clever animals. In the dry years of the sixties, every bit of greenery became more precious and every creature more cunning and determined. Letters of complaint appeared regularly on the council table until in the early seventies the town commons were fenced off and animals banned at last from the streets.182

Besides the roaming animals, local stories from Alpha’s past commonly refer to not infrequent grog-fuelled fights and ineffective policing.183 The picture painted, at times at least, is one of a wild outback town well into the second half of the twentieth century.


179 Cooper, Crossing the Divide, pp. 157–165; Hoch, Alpha Jericho, pp. 77–78.


181 Interview data, 2012, interviewee #10.

182 Hoch, Alpha Jericho, p. 76.

183 For instance, interview data, 2012, interviewee #5.
Compared to the bigger population centres in Australia, the towns in the Galilee Basin area were relatively late to be provided with modern services. Alpha and Jericho received small power plants from the State Electricity Commission in 1952, but the power supply was limited. Restrictions on electrical appliances were only lifted in these towns when they were connected by transmission line to Barcaldine’s recently built gas-fired power station in the late 1960s. Households in Jericho and Alpha were connected to reticulated water in 1958 and 1962 respectively, and television reception finally arrived in Alpha in 1974 and Jericho in 1980. Of major significance was the ceremonial opening of the bitumen road that connected the central-west with the state’s more populous east coast in 1984.

Outside of the towns, the livestock industries continued to strongly shape the landscape and ecology of the Galilee Basin area in the post-World War II period. The presence of the deadly native Poison Heartleaf bush (Gastrolobium grandiflorum) in the Desert Uplands region had constrained grazing to some extent, but landholders limited its effect by fencing off patches where it grew thickly, and where is was less dense, cleared and re-cleared it after fire and rain.

Sheep had formerly been the predominant livestock grazed on the western side of the Great Dividing Range, protected by the Dingo Barrier Fence, whereas cattle grazing predominated on the eastern side. However, dingo numbers, the cost of maintaining the dingo fence — especially after major floods — the problem of grass seed in the wool of sheep, and falling wool prices all influenced a widespread transition to cattle in the eastern and central parts of the Galilee Basin area during the 1950s, 60s and 70s. A drop in wool prices following a period of drought particularly affected the western part of the region, so that numbers of cattle relative to sheep increased there as well during the late 1960s and 70s. By 1985 most properties ran at least some cattle. In 2011, there were close to 1.7 million cattle in the central-west region, representing 18% of the state’s total herd. Sheep are also still numerous in the central-west, with close to 1.44 million head in 2011, or 39% of Queensland’s total sheep numbers.

The most dramatic and visible change in the landscape of the Galilee Basin area has been the broad scale clearing of vegetation in the central and eastern regions, beginning in the late

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185 Cooper, *Crossing the Divide*, p. 94.
186 Cooper, *Crossing the Divide*, pp. 185–186.
188 Regional Development Australia: Fitzroy and Central West Inc., *An Overview of Food and Fibre Industries in Central Queensland* (Queensland: Regional Development Australia, 2013), p. 16 note, the Central West region is made up of the local government areas of Barcaldine, Barcoo, Blackall-Tambo, Diamantina, Longreach and Winton.
1950s and continuing through to the early 2000s. Tree clearing by ring barking had begun on a smaller scale during the first half of the twentieth century. The chief aim was to increase pasture cover and thus carrying capacity, but there were questionable benefits of the method in the ‘desert country’.189 There was also the additional problem of increases in woody biomass, known as ‘vegetation thickening’, and especially after 1950. The causes of vegetation thickening are not fully understood, but one explanation is that that protracted drought periods in the first half of the twentieth century led to particularly open-structured woodlands that were then susceptible to woody plant establishment following good rain in the 1950s.190

Another possible secondary effect relates to the fact pastoralism has interrupted the original fire regime in the area. The original Aboriginal population is likely to have managed with small frequent fires, especially in in autumn and winter, and more intense wild fires could also have cleared out forests and woodlands of young woody undergrowth.191

Mechanical clearing in the late 1950s was encouraged by tax deduction and was at first experimental. Single bulldozers were eventually replaced by two such machines dragging a large heavy chain between them — a technique devised in the neighbouring Brigalow Belt by peanut farmer Joh Bjelke-Petersen, who later became the Premier of Queensland.192 The fallen timber would be mechanically raked into piles and allowed to dry before being burnt; the persistent re-growth knocked back by stick-rakes and fire, and in some instances roots would be cut by the horizontal blade of a blade-plough, offering a permanent ‘solution’ to woody vegetation.193 A new effective poison, tordon, also became available to help kill unwanted trees.194 Besides increasing the land productivity, cleared paddocks made the job of mustering

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livestock easier, particularly the introduced Brahman breeds that had been introduced for their greater resistance to ticks.\footnote{Hoch,\textit{ Alpha Jericho}, p. 79.}

The cumulative impact of individual land management decisions became significant. In the first half of the 1990s, Jericho Shire had the highest clearing rate in Queensland,\footnote{Cooper,\textit{ Sufficient for Living}, p. 193.} a period in which Queensland had the highest rate of clearing in Australia,\footnote{Productivity Commission,\textit{ Impacts of Native Vegetation and Biodiversity Regulations} (Melbourne: Productivity Commission, 2004), p. xxvii.} and when Australia was ranked the sixth largest land-clearer in the world, and the only 'developed' nation among the top twenty countries on that list.\footnote{David Lindenmayer and Mark Burgman,\textit{ Practical Conservation Biology} (Melbourne: CSIRO Publishing, 2005), p. 230.}

Once cleared, the open expanses were then sown with exotic pasture grasses, most commonly buffel grass (\textit{Pennisetum ciliare}, formerly \textit{Cenchrus ciliaris}). Buffel grass is native to northern Africa, the Middle East, India and Indonesia. It is thought that the species was originally introduced to the north-west and central Australia in the 1870s by Afghani cameleers who intentionally threw the seed around as they travelled, and who also unintentionally spread the grass when they discarded the buffel-stuffing from their worn harness and saddle packs.\footnote{M. Friedel and others,\textit{ Buffel Grass: Both Friend and Foe. An Evaluation of the Advantages and Disadvantages of Buffel Grass Use, and Recommendations for Future Research} (Alice Springs, Australia: Desert Knowledge Cooperative Research Centre, 2006), p. 4.}

Trials and deliberate efforts in establishing the grass began at several locations around Australian in the first half of the twentieth century, including in the Galilee Basin area around Blackall.\footnote{L.R. Humphreys, ‘Buffel Grass (\textit{Cenchrus Ciliaris}) in Australia’, \textit{Tropical Grasslands}, 1 (1967), 123–34 (p. 123); also see Libby Robin, \textit{How a Continent Created a Nation} (UNSW Press, 2007).} It has since become a dominant grass in the region.

Overall, buffel grass has proved to be an enormous boon for the pastoral industry in Queensland and across central Australia where it has boosted livestock production and economic viability. It is still widely promoted by organisations such as the agricultural arm of the Queensland government.\footnote{See for instance Department of Agriculture, Fisheries and Forestry, ‘Buffel Grass in South Queensland’, \textit{Department of Agriculture, Fisheries and Forestry}, 2013 <http://www.daff.qld.gov.au/plants/field-crops-and-pastures/pastures/buffel-grass> [accessed 21 August 2014].}

However, its spread has been a bane for conservationists. Buffel grass aggressively out-competes local grass species and is associated with more intense and more frequent fire that can wreak havoc for larger shrubs and woody vegetation.\footnote{Friedel and others, pp. 6–12; Peter J. Clarke, Peter K. Latz and David E. Albrecht, ‘Long-Term Changes in Semi-Arid Vegetation: Invasion of an Exotic Perennial Grass Has Larger Effects than Rainfall Variability’, \textit{Journal of Vegetation Science}, 16 (2005), 237–48 <http://dx.doi.org/10.1111/j.1654-1103.2005.tb02361.x>.} As such, the species has significantly degraded native plant communities and is an ongoing threat.
to flora and fauna biodiversity. There are efforts to eradicate buffel grass in small areas, but the work is incredibly labour intensive and requires many years of careful follow-up weeding.203

Despite the widespread negative ecological impacts of buffel grass and other introduced pasture species, it has been broad scale land clearing that has been most controversial. From the mid-1990s, successive legislation was developed in Queensland to curtail the unchecked clearing of remnant vegetation, first on leasehold and then on freehold land. Queensland lagged behind the southern states in developing such policy.204 Nonetheless, the changes were stridently protested by many individuals and groups with agricultural interests, and the debate was keenly watched at the national level as well as in rural Queensland.205 In anticipation of the regulations, a burst of ‘panic clearing’ took place in the late 1990s and early 2000s, with a peak of 758,000 hectares cleared in 1999-2000 — an area more than three times the size of the Australian Capital Territory.206 Yet tougher legislative reforms took effect in 2004 and broad scale land clearing of remnant vegetation was finally phased out by the end of 2006, with anticipated benefits for conservation values in Queensland and a reduction in the nation’s carbon emissions.207 Divisions between ‘greenies’ and graziers over land clearing had been fierce. There are also ongoing tensions related to the management of regrowth.208 The more recent alliance between conservation and farming groups when fighting coal and CSG in parts


of Queensland has therefore been both surprising and cautious (discussed further in Chapter Eight).

Apart from grazing properties there is a scattering of conservation areas that make up a tiny fraction of the total land surface in the Galilee Basin area. National Parks include White Mountains, Salvator Rosa, and Porcupine Gorge National Park in the north-east, Ka Ka Mundi Carnarvon Gorge National Park in the south-east, the Diamantina National Park in the west, among a number of others. There are also several private protected areas, such as the Bimblebox Nature Refuge.

A small parcel of land on the Alice River near Barcaldine, estimated to be around twenty hectares, was bought through the Indigenous Land Council for use by the local Aboriginal community. Native title claims cover a large portion of the Galilee Basin area, and a number of Indigenous Land Use Agreements (ILUA) has been signed, representing negotiated agreements between native title claimants and other land users about the management and use of land and water. ILUAs have been developed with the Yirendali People in the north, and the Maiawali and Karuwali peoples in the north-west of the Galilee Basin area. ILUAs that extend into the area also include those with the Wangan, Yagalingu and Bidjara peoples in the east and Mardigan people in the south-west.

Among the attractions in the region are the four semi-permanent to permanent lakes — Buchanan, Dunn, Galilee and Huffer. In the mid-nineteenth century, Lake Dunn was a paperbark swamp. It became a permanent water body after grazing and tree clearing, and is now a popular recreational lake. Lake Galilee and Lake Buchanan are particularly renowned for their birdlife, being important wetlands for southern birds that fly north over winter. Lake Galilee is considered an Important Bird Area by Birdlife Australia, and is also listed on the Australian Directory of Important Wetlands. During annual aerial surveys between 1983 and 2008, the average bird count on Lake Galilee was 116,883, and has included significant numbers of Freckled Duck and Grey Teal. Wet seasons can see a huge influx of bird numbers,

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209 Evans and others, pp. 27–28.
210 Interview data, 2012, interviewee #7.
211 Evans and others, pp. 28–29.
212 Evans and others, p. 143.
213 Interview data, 2012, interviewee #1; Barcaldine Regional Council, ‘Aramac’, 2013
214 Interview data, 2012, interviewee #1.
for instance over one million ducks and up to a quarter million black swans have been counted in individual years. An admirer of the lake and its birdlife contributed the following poem to a regional newspaper in 1941:

LAKE GALILEE
Far beyond the fold on fold of tumbling purple range,
Past, vale on vale of shadowed timbered land,
Where wave on wave of haze skims the far skyline,
Lake Galilee lies, shimmering and grand.
I see it there, like some great mirror of the earth,
Reflecting herons in their placid flight,
so far it is, I hear no lapping of the waves
Or wild duck stirring on the wing at night.
But beholding it so shining. I sense, I almost see
The scurry of the sandpipers at play,
Hear plovers calling there along its scalloped edge,
Their yellow legs all hurry on their way.

A steady stream of ‘grey nomad’ travellers and other tourists now visit the Galilee Basin area every year, drawn by the natural attractions and ‘outback’ culture heritage. These are celebrated in grand displays such as the Stockman’s Hall of Fame at Longreach, more modestly at centres like the Australian Workers Heritage Centre at Barcaldine, and in local works such as the murals of bush life painted on buildings in Alpha and Jericho.

Some reports have emphasised the economically marginal existence of the dominant grazing industry in the Desert Uplands portion of the Galilee Basin area, where properties were historically used as drought reserves for graziers of the richer pastures to the west. However, others who know and love the area have emphasised other qualities, for instance:

See marginal — everyone talks about it being marginal. A lot of people have raised a lot of families out there, marginally, for a long time. So, you know, I’m a bit dubious when

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220 See for instance Rolfe, Blamey and Bennett, p. 11; GVK Hancock Coal, EIS, Vol 1, Section 6 - Land Use and Tenure, 2010, p. 58; Fensham and Fairfax, Talking Fire, p. 9.
they say it’s marginal. Marginal is all relative. Yeah — I wouldn’t call it marginal, personally.221

I mean, a lot of people think that that way of life is... pretty Third World-ish as it is, but it actually has very high qualities as well... you know, you don’t get anywhere else.222

Now in the twenty-first century, it is these lifestyles and communities in the Galilee Basin area that face yet another wave of transformation in the form of massive mining developments.

**Surfacing the underground**

Evidently named after Lake Galilee, the name ‘Galilee Basin’ was first used by Frederick William Whitehouse in 1954.223 The name appeared in a Queensland Government commissioned report on the Queensland portion of the Great Artesian Basin “with particular reference to the problem of diminishing supply” [of water].224 At the time Whitehouse was an Associate Professor at the University of Queensland225 and he authored an appendix to the report, in which a figure entitled ‘The Mesozoic Plan of Queensland and Associated Structures’ lists the ‘Galilee Basin’ as one of the Mesozoic margins.226 Whitehouse’s geological investigations were greatly expanded on in the following decades. By 1965, a better understanding of the extent and nature of the downwarped Late Carboniferous-Triassic basin had been gained, and the name ‘Galilee Basin’ was re-applied to the larger area.227

As described above, the first underground wealth to be discovered, utilised and valued in the Galilee Basin area was water from the Great Artesian Basin, sometimes described as ‘liquid gold’.228 At Longreach, just outside the margins of the western side of the Galilee Basin, drilling for water in September 1924 produced a burst of gas and a black substance, later found to be oil. There was some excitement over the apparently good quality of the oil, but it was determined that extraction would be too difficult and the quantity of the reserve not large

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221 Interview data, 2012, interviewee #4.
222 Interview data, 2012, interviewee #3.
223 Vine, R.R. 1976,
228 Hoch, *To the Setting Sun*, p. 29.
enough to warrant full scale exploration at the time. This however did not stop future exploration efforts around Longreach in 1930, the 1950s and in 1980.229

The position of the Galilee Basin next to the similarly aged oil and gas provinces of the Bowen and Cooper Basins made it an attractive exploration target. During the 1940s and 1950s, petroleum exploration in the southern Galilee Basin revealed much of the underlying stratigraphy. In the 1960s, mapping of the region was undertaken jointly by the Bureau of Mineral Resources and the Geological Survey of Queensland at the same time that private petroleum exploration companies started exploratory activities.230

Commercial petroleum exploration in the Northern Galilee Basin occurred in two phases, between 1959–74 and 1980–88. The break in 1974 was primarily due to the Federal government’s 1973 decision to withdraw income tax concession for explorers and the 1974 termination of the Federal petroleum search subsidy scheme. During the intervening period, in 1972–77, the Geological Survey of Queensland’s petroleum section initiated deep stratigraphic core drilling which included the northern Galilee Basin and two drill holes alongside the railway between Alpha and Jericho. Two further deep stratigraphic bores were drilled by the Department of Resource Industries in 1989 and 1990.231 Esso Australia Ltd.’s activities dominated petroleum exploration in the region when it commenced in 1981. However, theirs and other company searches turned up no ‘economic hydrocarbons’ and in 1988 company seismic and drilling activity came to an end.232

Even though no great oil and gas reserves were found in the Galilee Basin as hoped, the petroleum exploration wells did reveal a widespread occurrence of coal seams in the area.233 It followed reports of coal in the Alpha district, including in government journals, from at least 1928.234 Coal had also been formally documented in 1918 and 1947 north of the Northern Railway. Consequently, the Galilee Basin was considered for inclusion in the Queensland government’s geological drilling program. Initially, field traverses in the north and south Galilee Basin were conducted, but these found no outcropping of the relevant strata. However, the Minister for Mines approved shallow drilling in the southern part of the basin as part of the departmental drilling program which commenced at Wendouree Station in July

229 Moffat, pp. 244–245.
230 P.R. Evans, p. 299.
232 Hawkins and Green, p. 282.
233 P.R. Evans, p. 300.
1971, around 55 kilometres north of the town of Alpha. Over the following few years, holes were drilled at a number of other stations: Degulla, Laglan, Lambton Meadows, Moray Downs, Mirtna, View Hill, Longton, and between Pentland and Milray.\(^2\) A summary of the government’s drilling program from the 1970s states:

As a result of the drilling along the subcrop of the Late Permian coal seams in the Galilee Basin, it was concluded that the area extending from a few kilometres north of the Central Railway to a few kilometres south of Pentland was the most prospective for large scale mining of coal.

This drilling proved that very large inferred resources of sub-bituminous coal, which would be suitable for electric power generation, are present in the Galilee Basin.\(^3\)

It was not only the government and exploration companies that had discovered coal in the region. In the act of sinking bores for water, local people since the early twentieth century came to know of the coal seam layers that made up the sequence of dirt and rock beneath the ground.\(^7\) Some understood the significance of their finds and purposely kept the news quiet, for instance one long-term resident told me:

Well, to be truthful my dad and I found this coal on the family property ... when I was six years old. That would be 61 years ago. He swore me to secrecy because he said ‘we don’t want any coalmines in this area’, he said ‘you saw what happened at Blair Athol, near Clermont.’ So we kept it quiet. But ultimately they found it. And since then they have developed the exploration all through that area, to a point where I am led to believe it’s an 85 kilometres long by 65 kilometres wide lease, or leases.\(^8\)

Others however viewed the prospects of coal development favourably. For instance, recalling the mood in Alpha in the early 1980s, Hoch describes:

Spirit in the town was high because mineral exploration continued. Hancock and Wright, Bridge Oil and Robertson Research (for Mobil) prospected north of Alpha while Greenvale and Esperance Companies were reported to be examining a rich shale oil deposit to the south. State Government investment in main roads of the area seemed to indicate an expanding future...\(^9\)

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\(^3\) Hawthorne, p. 94.

\(^7\) Moffat, p. 244; Andrew Fraser, ‘India Dictates Return to Galilee’, *The Australian: Business, Mining and Energy*, 11 April 2011, p. 24; Hill and Denmead.

\(^8\) Interview data, 2012, interviewee #2.

\(^9\) Hoch, *Alpha Jericho*, p. 84.
Such diversity in opinions about coal development in the region persist to the current time, as was discussed in Chapter Two.

Fossil fuel dreams: ‘Opening up the Galilee Basin’

In the first week of 1979, Lang Hancock visited the small town of Alpha in Queensland’s central-west. Hancock Prospecting Pty Ltd and Wright Prospecting Pty Ltd had been granted authority to drill for coal on a tenement north-west of Alpha in December 1978. Following the second oil shock of the 1970s, steaming coal became attractive as a fuel and source of energy (see Chapter 7 for more discussion). With the rise in price of steaming coal, the known resources near Alpha looked promising, but the lack of transport infrastructure was an impediment. Hancock’s proposed solution was to build a $300 million plant to suspend the coal in methyl-alcohol and pump it to the coast for export. On his visit to the region in April 1979, Hancock was accompanied by the Queensland Premier Joh Bjelke-Petersen and a group of Swedish businessmen. At that time Sweden was planning a mandatory 25% addition of methanol, derived from methacoal, to motor fuel.

Nearly a decade later, in 1988, Hancock was supported by Premier Joh Bjelke-Petersen and Prime Minister Bob Hawke when he entered a ‘barter deal’ to sell coal and iron ore to Romanian dictator Nicolae Ceausescu. Plans were afoot to develop a rail line across northern Australia, connecting up Western Australia’s iron ore and Queensland’s coal resources. But these plans apparently disintegrated when Ceausescu and his wife were executed, in December 1989.

Lang Hancock died in 1992, before he could activate his plans for the Galilee Basin. However, with Hancock’s daughter Gina Rinehart at the helm, Hancock Prospecting Ltd mined and exported the first coal from the Galilee Basin in 2011, as part of its Alpha Coal Project test-pit operations. The sample coal was trucked to Blackwater where it was washed before being exported through the port at Gladstone on Australia’s east coast. In September 2011 an Indian

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241 Isabel Hoch, ‘Mining Chief Starts Search Here for Coal’, The Courier-Mail (Brisbane, Qld., 23 January 1979), p. 3; Hoch, Alpha Jericho, p. 84.


company, GVK Coal Developers, acquired a 79% interest in the Alpha and Alpha West coal mine and a 100% interest in the proposed Kevin’s Corner mine and rail component.244

On 29th May 2012 the Queensland Coordinator-General, Barry Broe, released his report on the Alpha Coal Project. He found that the project could proceed “subject to the conditions and recommendations of his report and the proponent gaining all statutory State approvals and meeting its commitments listed in the report”.245 In effect, his report gave the first in a series of approvals required before the 30 million tonne per annum thermal coal mine and 495 kilometre railway to the port of Abbot Point can be constructed.246

In the western portions of the Galilee Basin, where the coal seams dip deeper underground, CSG exploration has also been underway since at least 2008.247 However, whether or not the Galilee Basin’s fossil fuels will be developed as anticipated will be largely determined by forces far away from the region itself. The next several years will be critical one way or another.

Conclusion: Echoes through time

This encounter with the Galilee Basin area has revealed a layered biophysical, sociocultural and historical landscape, but one with consistent threads and re-occurring themes. The potential large scale changes in the region associated with coal development in the twenty-first century follow earlier social and ecological transformations.

The first major change in recent geological time came with the arrival of humans tens of thousands of years ago. Aboriginal people profoundly changed the environment, through their food-gathering, hunting and deliberate use of fire. The arrival of white settlers heralded another era and with them the pre-existing social-ecological order was dramatically, and often violently, overturned — aspects of this history still haunt the region today. The grazing of hard-hooved animals brought changes to soil and vegetation, which were further compounded by interruptions to traditional fire regimes, the building of fences and dams, the discovery and utilisation of artesian water, the broad scale clearing of vegetation and establishment of exotic pastures. Some of these processes are on-going.

Capturing energy from the landscape has long been of interest. Since the beginning of the colonial era to the present day it has involved alliances between governments and private interests. At first it was the solar energy captured in grass and plants, eaten by sheep and cattle, and exported as wool, meat and other products. In the process, the pastoral industry displaced the Indigenous people of the area within one generation in most cases. But where Australian governments once operated in favour of pastoral interests, the importance of mineral revenue to both the state and federal coffers now surpasses that of agriculture.248 Queensland Premier Campbell Newman has stated emphatically:

... We are in the coal business. If you want decent hospitals, schools and police on the beat we all need to understand that.249

With four massive coal projects now approved by state and federal governments, the momentum towards coal development in the Galilee Basin is convincing. Twenty-first century grazier landholders face a new form of invasion, as the condensed solar energy in coal-bearing strata beneath the soil has become a valued commodity on foreign export markets. If the mines go ahead, there will be another round of severe consequences for local people and environments. This time though, impacts will extend to regional and global levels as well. The associated opposition campaigns around the proposed coal developments are likely to involve various forms of direct action and civil disobedience. As history has shown, the Galilee Basin area has been host to notable precedents in this way as well.

Ultimately, establishing a more complete view of the coal plans for the Galilee Basin is a task that requires a larger perspective than just the region itself. It demands understanding interrelated features and threads that are ancient and futuristic, local and global, human and non-human, material and abstract, subterranean and atmospheric. In particular coal, and the role of coal in society becomes crucial, as the following chapters explore.

248 For instance, the value of mineral exports to the Queensland economy has been greater than ‘Food and Live Animals’ since 1982-83, and coal has contributed the majority of this, see Queensland Treasury, ‘Historical Tables, Economy, 1860-2008 (Q150 Release)’ (Queensland Government, 2009); and at the Federal level the value of resource sector exports has been greater than agricultural exports since 1981-82 ABARE, Minerals and Energy Commodities: Coal (excel Data), Australian Commodity Statistics 2009 (ABARE, 2009), p. 4 <http://www.abare.gov.au/interactive/09acs_dec/> [accessed 2 September 2010].
Chapter 4

A SHORT, BIG HISTORY OF COAL

Beneath a landscape of fenced paddocks, small towns, railway sidings, roads, and remnant patches of bush in the Galilee Basin area, are the remains of former worlds. Among the subterranean layers are seams of ancient plant life, deposited and buried in pre-human environments almost unimaginable today. These known carbon stocks have been the target of a mining exploration frenzy from the late 2000s, driven by industrial society’s growing demand for energy. Before exploring the emergence and importance of coal in human systems in the following chapters, it is important to first consider coal in its planetary context over geological time. The story of how and why carbon is concentrated in coal seams and the atmospheric dimensions of the global carbon cycle, takes us on a sojourn into the fields of planetary and climate science, paleobotany and geology. Overall, this big history of coal provides insight into an unavoidable biophysical dimension of what humans are actually dealing with in our dependence on fossil fuels, and the enormous gravity of our inadvertent transference of substantial quantities of geological carbon to the Earth’s atmosphere.

Global carbon cycle

The total stock of carbon that is part of Earth’s systems today was present 4.6 billion years ago at the formation of our solar system. Once planet Earth had formed out of a cloud of solid particles and gases, and before biological life first emerged some 600 to 800 million years later, it is believed that the primordial atmosphere was created by the degassing of the planet’s solid or molten interior. The major volatile elements and compounds that escaped from the Earth’s interior at that time were water, carbon, nitrogen, sulphur and chlorine. In time, these became the major components of Earth’s atmosphere, hydrosphere, biosphere, and sediments — collectively referred to as Earth’s “outer shell”.¹

CHAPTER 4: A SHORT, BIG HISTORY OF COAL

Over the span of Earth’s existence, there has been huge variation in the partitioning of carbon between the atmosphere and other biogeochemical reservoirs.\(^2\) In the long period before biological life first emerged on Earth, there were likely to have been distinct stages in the atmospheric-ocean system. Initially there was a hot atmosphere. Temperatures reached as high as 374°C and volatile elements occurred in gaseous forms. Later, the atmosphere cooled and water became liquid. Chlorine and sulphur dissolved in the water, leaving CO\(_2\) and nitrogen as the main constituents of the atmosphere, and with a portion of CO\(_2\) also dissolving in the hydrosphere and reacting with rocks.\(^3\)

Possibly as early as 3.9 billion years ago, carbon began to be allocated to living organisms, with the emergence of the first prokaryotes — organisms that lack cell nuclei.\(^4\) These anaerobic Archaea and Bacteria are thought to have flourished prior to free oxygen becoming an abundant portion of Earth’s surface chemistry at a significant turning point known as the ‘Great Oxidation Event’ (GOE). Occurring around 2.4 billion years ago, the GOE is associated with the rise of cyanobacteria, or blue-green algae, which, through photosynthesis, oxygenated Earth’s atmosphere and oceans.\(^5\) In photosynthesis, organisms take in light energy, CO\(_2\) and water to produce carbohydrates and oxygen.\(^6\) This availability of oxygen was fundamental to the evolution of fungi, multicellular plants, and animals.\(^7\)

**Reservoirs and cycling**

More than 90% of the Earth’s carbon could occur deep in the planet’s deep interior, although these deep reservoirs are far less understood than their planetary surface counterparts.\(^8\) The largest reservoir of carbon on Earth’s surface today is in sedimentary rocks. Primarily this is in carbonate rocks such as limestone and dolomite, but there is also a significant portion in sediments made up by undecomposed organic matter. The next biggest carbon reservoir is in the hydrosphere, dominated by dissolved inorganic carbon in the oceans. This is followed by methane hydrate in ocean sediments, then carbon that is in the reserves of coal, oil and gas.

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\(^2\) Mackenzie and Lerman, p. 21.
\(^3\) Mackenzie and Lerman, pp. 35–45.
\(^4\) Mackenzie and Lerman, pp. 49, 290.
The next most significant pool of carbon is in soils, and then land biomass and atmosphere holds roughly similar quantities. Ocean biota makes up the smallest pool of carbon.\(^9\)

Carbon is cycled between its various reservoirs through processes such as geological uplift and subduction, volcanism, weathering, erosion, gaseous exchange, settling and decay.\(^{10}\) The timescale for these processes can range from months to millennia.\(^{11}\) The relative partitioning of CO\(_2\) to the atmosphere strongly correlates with different global climate states over the Earth’s history, with higher concentrations of atmospheric CO\(_2\) associated with warmer periods.\(^{12}\) Together with other greenhouse gases, aerosols, land cover and solar radiation, changes in the concentration of CO\(_2\) alter Earth’s energy balance, known as ‘radiative forcing’.\(^{13}\)

At Earth’s surface, large amounts of carbon naturally cycle between the terrestrial biosphere, atmosphere and oceans as CO\(_2\) or methane (see Figure 4.1). Plants take up CO\(_2\) from the atmosphere via photosynthesis. Carbon then returns to the atmosphere as CO\(_2\) or methane through the respiration and decomposition of plants, soil and animals. Large variations can occur on annual time scales, such as the release of large amounts of carbon in the event of widespread bush fires. However, this is generally balanced out on decadal time scales when vegetation re-grows. There is a continual exchange of CO\(_2\) between the oceans and atmosphere. In the oceans, CO\(_2\) reacts with the water to become dissolved inorganic carbon, which circulates between different oceanic depths as well as back to the atmosphere from warm surface waters. Carbon is also taken up in the oceans by phytoplankton through photosynthesis, most of which is respired by bacteria, but some reaches deep ocean sediments. Altogether, these natural processes within the global carbon cycle maintained relatively stable concentration of atmospheric CO\(_2\) for the past ten thousand years, up until 1750.\(^{14}\)

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\(^9\) Mackenzie and Lerman, pp. 8–12.
\(^{10}\) Mackenzie and Lerman, p. 8.
Humans in the global carbon cycle

Human activity is a relatively recent, yet highly significant, addition to the 'unperturbed' processes of carbon cycling. The advent of permanent and shifting agriculture in various parts of the world between 5 and 12,000 years ago led to the clearance of previously forested lands, and is a trend that has continued up until the present time. Such changes in land use led to the transfer of around 114 billion tonnes of carbon from land-based carbon stocks to the atmosphere and oceans between 4000 BCE and 1850 CE, and 148 billion tonnes between 1850 and 1990.16

An even greater change in the balance of Earth's carbon cycle has come about as a result of modern society's dependence on carbon based energy, particularly over the last two and a half centuries. All fossil fuels predominantly originated from carbon-based life that was buried,

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heated and compressed to varying extents, and all have in common a molecular composition that includes carbon and hydrogen. The combustion of fossil fuels — and more traditional fuels such as turf, peat and wood — produces heat when carbon and hydrogen combine with oxygen. The harnessing of this energy has played a profoundly important role in the development of modern industrial society, as further discussed in the following chapters.

The fossil fuels that have been most important to human society to date are coal, oil and natural gas that occur in seams and rich deposits. Each has its own development story. For instance, coal is largely derived from terrestrial plant life (as described in more detail below), whereas most conventional oil and gas deposits originated in ancient oceans and lake environments, and were formed by the remains of prehistoric zooplankton and algae rich in lipids, proteins and carbohydrates. Conditions favourable for coal formation have been rare over the course of the Earth’s history, but the formation of petroleum has probably been forming continuously for around the last one billion years. Besides ‘conventional’ forms, there are also vast deposits of ‘unconventional’ fossil fuels, such as tar (or oil) sands, oil shales, heavy oil, coal seam gas, tight gas, shale gas and gas hydrates. On current trajectories these are likely to make up a significant portion of future energy sources.

By tapping into the stored carbon reserves in fossil fuels, humans effectively use up massive quantities of photosynthetic product that were formed over millions of years. For instance, it has been estimated that one litre of petrol is generated from around 24 tonnes of ancient carbon-based life; so that a modest 42 litre petrol tank, when full, represents one thousand tonnes of original organic material.

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17 There is speculation that some oil deposits may be ‘abiogenic’, thought to be carbon rich fluids generated by Earth’s mantle.
There are various estimates of the photosynthetic legacy in modern fossil fuel dependence on a global scale. Jeffrey Dukes calculates that world fossil fuel combustion in 1997 represented over 400 times current world net primary productivity — the amount of organic carbon fixed in plants by photosynthesis, less the amount respired.\(^{24}\) Rolf Peter Sieferle suggests that each year modern society burns through up to half a million years’ worth of photosynthetic accumulation.\(^{25}\)

Whichever way it is calculated, such large scale combustion of fossil fuels inevitably has profound implications for the global carbon cycle. Between 1750 and 2011 fossil fuel combustion and cement production led to around 375 billion tonnes of carbon, that was once stored as a long-term stock, being distributed between the oceans and atmosphere — nearly 1.5 times the total quantity from deforestation since the advent of agriculture.\(^{26}\) By mid-2013, the cumulative CO\(_2\) emissions from land clearing and fossil fuel combustion over the previous centuries led to the concentration of CO\(_2\) in the atmosphere reaching 400 parts per million. This is 140% higher than any time in the previous 800,000 years, a period in which concentrations stayed within the limits of around 180–280ppm.\(^{27}\)

Climate scientists have long understood the basic warming influence of increasing concentrations of CO\(_2\) and other greenhouse gases in the atmosphere, beginning with important breakthroughs in scientific understanding in the nineteenth century (described further in Chapter Eight). Nonetheless, the precise relationship between levels of CO\(_2\) and levels of warming — ‘climate sensitivity’ — is still under active discussion in the academic literature.\(^{28}\) The IPCC’s Fifth Assessment Report states that a doubling of atmospheric CO\(_2\) concentrations since pre-industrial times is likely to result in warming of between 1.5 and 4.5°C.\(^{29}\) The level of warming will obviously depend on humans’ future emissions path (see


\(^{25}\) Sieferle, p. 42.


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Figure 4.2), but in any case, the effect will be long lasting; modelling has suggested that the average lifetime of atmospheric CO₂ is 300 years, but the climate effects could potentially last for tens, if not hundreds of thousands of years into the future. This means that if all anthropogenic emissions were to abruptly end, temperatures on Earth would remain roughly constant for many centuries to come. Additional warming will depend on the sum of emissions from this point on. Considering humans’ strong influence on global carbon distribution, it is not surprising that many scientists advocate that the carbon cycle, climate, and humans be viewed as working together as a single system.

The substantial remaining quantities of the world’s fossil fuels, and the chance that they may yet be combusted, is alarming. The proven resources of oil, gas and coal embody potential CO₂ emissions of 2,795 billion tonnes. Coal is by far the most significant in this group, making up 65% of potential CO₂. Coal is thought to contain around 9.9 trillion tonnes (9.9 x 10¹² tonnes) of the 12.5 trillion tonnes (12.5 x 10¹² tonnes) of carbon that exists in the total resource base of the world’s fossil fuels, including estimates of resources that are not yet proven. Based on these figures, the associated CO₂ potential in coal alone represents a climate warming potential of close to 15°C. In the absence of policy committed to keeping these carbon stocks safely buried, or effective and widely deployed carbon capture and storage, coal emerges as a rock of immense global significance that requires closer scrutiny in all its biophysical and sociocultural aspects.

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34 Swart and Weaver, p. 135.
Figure 4.2 The International Energy Agency’s fossil fuel demand scenarios
Source: IEA, 2014

The solid lines represent projections for fossil fuel in the EIA’s ‘New Policies Scenario’. This takes into account “broad policy commitments and plans that have been announced by countries, including national pledges to reduce greenhouse-gas emissions and plans to phase out fossil-energy subsidies, even if the measures to implement these commitments have yet to be identified or announced”. The dashed lines represent projected demand in the ‘450 Scenario’. This “sets out an energy pathway consistent with the goal of limiting the global increase in temperature to 2°C by limiting concentration of greenhouse gases in the atmosphere to around 450 parts per million of CO₂”. ‘Mtoe’ stands for million tonnes of oil equivalent.

A closer look at coal

At first glance coal is an apparently inert and homogenous black rock, ranging only degrees of lustre. But in fact, coal is highly heterogeneous and reveals the remains of diverse life from up to hundreds of millions of years ago.

Fossilised life

In medieval Britain and Belgium, and up to as late as the early eighteenth century, coal was commonly considered to be a kind of plant that grew underground, and which could be encouraged by applying manure. It was thought to only be found at shallow depths and that it

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reproduced by special spores. A more modern understanding of coal's organic origins began with eighteenth century Scottish geologist James Hutton, often considered the founder of modern geology, who observed in 1795:

... from vegetable bodies produced upon the habitable earth, they are now become a mineral body, and the most perfect coal...

After cutting thin sections of the rock, Englishmen William Hutton and Henry Witham made the first microscopic investigations of coal in 1833, and were able to identify the vegetative components of coal. Around 1870, coal's origin from terrestrial plants was discovered when spores were identified under the microscope. Since then, much knowledge has been gained by drawing on combined methods from the fields of botany and coal petrology, illuminating the genesis of coal in terms of the character of the plant communities and the depositional environments of early coal formation.

The varied characteristics and properties of any particular coal facies is related to the wide range of variables influencing the original deposition of organic material. Such variables include whether the deposit was formed in situ or transported, whether the depositional environment was coastal or inland, the type of plant communities, the level of nutrient supply, the temperature of the original deposit, and the degree to which the deposit was aerobic or anaerobic. The coal that is mined today originated in tropical to subarctic zones, with tree trunks, branches, leaves, roots, grass, algae, and spores all contributing to the accumulation of organic matter.

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43 The concept of facies refers to the "sum of lithologic and paleontologic characteristics of a sedimentary rock from which its origin and the environment of its formation may be inferred", see Curt Teichert, 'Concepts of Facies', American Association of Petroleum Geologists Bulletin, 42 (1958), 2718–44.
44 Stach and others, pp. 18–19.
Dissecting coal

Coal consists mostly of plant remains, but also frequently contains smaller proportions of minerals, cations and moisture. The various types of coalified plant remains are called ‘macerals’, a term coined by Dr Marie Stopes in 1935 to describe the microscopically discernible constituents of coal. Macerals, analogous to the minerals that make up metamorphic and igneous rocks, result from various components of plants and are broadly categorised as vitrinite, liptinite and inertinite. The main origin of vitrinite is lignin and cellulose from plant cell walls, but also includes tannins that fill the cell lumens. The botanical origin of inertinite is mostly the same as for vitrinite, but differs from also having undergone some kind of charring, mouldering, fungal attack, biochemical gelification or oxidation relatively soon after deposition. Liptinite originates from plant parts that are more resistant to transformation, including hydrogen-rich plant organs, algal and bacterial substances, and products from decomposition. Each maceral group in coal has distinct characteristics and qualities that are suitable for different end uses.

Coal formation

The broad stages of coal formation begins with peat, which if subjected to sufficient amounts of heat and pressure, continues through the stages of brown coal (or ‘lignite’), to sub-bituminous coal, to bituminous coal and finally to anthracite. These stages are also regarded as ‘ranks’, with higher rank coals being those which are further along the development path. This process, termed ‘coalification’, results in a progression towards higher carbon and energy content and lower moisture content. For instance, brown may contain around 70% carbon, and anthracite as much as 95% carbon, measured on a dry ash-free basis. The differences in heating value between the different ranks of coal is notable, for instance, bituminous coal

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47 Given, p. 53.
48 Teichmüller, pp. 3–4.
49 Stach and others, pp. 271–272; Teichmüller, pp. 23–29.
50 Teichmüller, p. 16.
52 In Australia ‘black coal’ usually refers to sub-bituminous, bituminous and anthracite coals, whereas in Europe sub-bituminous coal is regarded as brown coal, see Geoscience Australia and ABARE, Australian Energy Resource Assessment (Canberra: Geoscience Australia, 2010).
54 Larry Thomas, Coal Geology, p. 109.
produces roughly twice that of lignite.55 If the maturation of anthracite continues then graphite if formed, through the process of ‘graphitisation’.56 Looking at the process of coal formation more closely, first we must start with peat.

**Peat**

There are a number of sites in the world today where peat is actively forming, and these help to shed light on the conditions and processes that generated the peat that is the origin of today’s coal.57 Worldwide peat today covers around 3 million square kilometres of land area, or 2% of Earth’s total land surface, with an estimated volume of 3,500–4,000 billion cubic metres.58

Peat has been described as a “combustible soft, porous or compressed, fossil sedimentary deposit of plant origin with high water content (up to 90% in the raw state), easily cut, of light to dark brown colour”.59 Peat is classified as an ‘intermediate fuel’, in a state of transition between vegetation and coal, given appropriate conditions, and as ‘renewable’ to a certain extent. Peat is sometimes categorised together with coal in reports of world energy statistics, and is a valued energy fuel in its own right.60 For instance, in 2007 it was reported that around 17 million tonnes of peat was used for energy generation worldwide, principally in Ireland and Europe (including Finland, Belarus, Russia, Sweden and Ukraine).61 Ireland exemplifies peat’s importance in modern times; peat supplied 54% of domestically sourced energy in 2013, equivalent to 9.5% of total energy consumed in the country that year.62

The key feature of organic depositions with a potential to become coal is the lack of decomposition. Mostly peat forms in ‘mires’, or non-saline wetlands, in which local plant productivity is greater than that of the respiration of organisms.63 This may be more the result of the relative inaction of microbes than the abundance of plant growth. Retardation of decomposers and detritivores can result from limited access to food, limiting mineral

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56 Taylor and others, p. 86.
57 Given, p. 3.
61 World Energy Council, p. 11.
elements, acidic environments and cold temperatures. But probably the most dominant cause of peat formation is low oxygen concentration, resulting from the continual presence of water. High rainfall is thus often critical for peat swamp formation, both in terms of plant growth and for creating the high water tables to preserve peat. Temperature is less of a critical determinant of peat formation although is important for plant growth at high latitudes.64

Ecological communities that are common in peat-forming conditions in modern times include forest-swamps hosting a variety of plant associations; in marshes of sedges and/or grasses, in swamps with mostly submerged or floating plants, or in raised bogs with mosses, shrubs or trees.65 Raised bogs, known as ombrogenous mires, and are fed by heavy rainfall. In contrast topogenous, or rheatrophic, mires are those caused by a high groundwater level — these are generally more nutrient rich and have a higher inorganic content.66 In earlier coal forming periods it is thought that the vegetation able to survive in water-logged and usually acid substrates of peat swamps were highly specialised and low in diversity compared to the surrounding better drained areas.67

Apart from sufficient rainfall, peat formation also requires conditions where groundwater can be consistent throughout the seasons, close to or above the ground surface, to prevent plant material from decomposing. Most commonly these conditions are found in flat coastal areas or around large inland lakes. Inland sites of peat formation are known as ‘limnic’ deposits, and those on the landward side of a coastal system are known as ‘paralic’ deposits. Around twenty different environments where such water-logged conditions are met have been described, fitting within the categories of braid plain, alluvial valley and upper delta plain, lower delta plain, barrier beach/strand plain system, and estuary.68 Today’s coal deposits are thought to have arisen through a combination of these conditions.69

In energy terms, peat formation is a sign that an “entire ecosystem is steadily increasing in its total energy reserves”.70 The proportion of plant productivity (net primary productivity) in peat forming environments that is preserved as peat has been estimated to be in a range between 4–39%.71 An equation to represent peat formation can be expressed as:

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65 Teichmüller, p. 35.
66 P.D. Moore, p. 89; Taylor and others, p. 7.
67 Teichmüller, p. 8; Balme, Kershaw and Webb, p. 41.
69 Taylor and others, p. 12.
70 P.D. Moore, p. 91.
71 See Given and Dickenson 1975 in Given, p. 3; Moore 1987 in Dukes, p. 33; Dukes, p. 33.
Gross primary productivity + imported organic material = change in ecosystem biomass + respiration of the entire ecosystem + exported organic material + growth of peat deposit.\textsuperscript{72}

Estimates of peat formation-rates have suggested annual growth of 0.1–0.8 millimetres in subarctic mires,\textsuperscript{73} 0.5–1.0 millimetres in temperate swamps, 1–2 millimetres in high-moor peats, 1–1.3 millimetres in subtropical reed swamps and delta plains, and up to 3–4 millimetres in tropical peats.\textsuperscript{74} So, depending on the depositional environment, it takes in the order of 250 to 10,000 years for one metre of peat to form.

The degree of compression that peat must undergo in the transition to brown, then black, coal is highly variable depending on the originating conditions. In general, forest peats undergo less compression than reed or other peats that start with a lot of water. A commonly used compaction ratio from peat to brown to bituminous coal is 6:3:1, but this can be as high as 20:1 from peat to coal in some instances.\textsuperscript{75} Overall, the formation of coal from plants has been estimated to be less than 10\% efficient, meaning that less than 10\% of the carbon remains after the process of ‘coalification’. By way of comparison, oil formation is less than 0.01\% efficient.\textsuperscript{76}

\textit{Coalification}

If all the above conditions for peat formation are met, the interplay of temperature, time and pressure will determine whether the peat will undergo transformation to coal. A rise in temperature results in chemical changes to coal — ‘chemical coalification’ — whereas pressure brings about other changes, known as ‘physico-structural coalification’.\textsuperscript{77}

A rise in temperature is critical for coal formation, and this can occur either from direct contact with igneous material or through deep burial, associated with tectonically controlled subsidence.\textsuperscript{78} The relationship between depth of burial and degree of coalification was described by German geologist Carl Hilt in 1873: “In a vertical sequence, at any one locality in a coalfield, the rank of coal seams rises with increasing depth”.\textsuperscript{79} Thus, coal deposits today are often found in ‘foredeeps’ and other ‘back arc’ basins near mountain ranges, areas associated with subduction at continental margins, and continental collision margins. This has been true

\textsuperscript{72} P.D. Moore, p. 89.
\textsuperscript{73} Taylor and others, p. 10.
\textsuperscript{74} Taylor and others, p. 25; Stach and others, p. 17.
\textsuperscript{75} Stach and others, pp. 17–18.
\textsuperscript{76} Dukes, pp. 34, 41.
\textsuperscript{77} Stach and others, p. 38; Larry Thomas, \textit{Coal Geology}, pp. 110–111.
\textsuperscript{78} Larry Thomas, \textit{Coal Geology}, pp. 110–111.
\textsuperscript{79} Larry Thomas, \textit{Coal Geology}, p. 110.
in Australia where many of the Permian coal deposits occur in ‘foreland’ (Sydney and Bowen) and ‘cratonic’ (Cooper and Galilee) basins.80

**Layers in geological time**

The world’s oldest discovered coal deposits, found in Michigan US, are thought to contain organic matter dating back to the Middle Huronian, around 2,300 million years ago, but these deposits are considered to be uncommon and impure.81 The formation of thick and extensive coal deposits that are mined today was only possible after the evolution of vascular plants and structured plant communities, which begin to appear in the geological sequence from the Middle Ordovician (460–472 million years ago), more from the Silurian (416–444 million years ago), and finally becoming abundant and widespread during the Middle Devonian, (approximately 385–398 million years ago).82 However, the coal that originated in these periods mostly does not have the economic value of later periods.

It was not until the Carboniferous Period (299–359 million years ago), and particularly the latter part of the period, that coal-bearing depositional systems prevailed to an extent that eventuated in the formation of major coal deposits.83 Coal deposits from this time are mostly found in the northern hemisphere, and it is thought that they originated in warm, humid climates, where tall forest swamps prevailed over reed and moss dominated environments.84 By the end of the Carboniferous, rich forest swamps hosted 30 metre *Sigillaria* and *Lepidodendron* trees, the latter interspersed with *Calamitean* reeds. While abundant in growth, these forests were far simpler in terms of species diversity than forests in later geological times. The coals from of that period in the Ruhr region of modern-day Germany reveal a floristic origin dominated by *Lyginopteris oldhamia* seed fern. Moving into the Permian, a period that spanned 251–299 million years ago, the Gymnosperm *Cordaites* became more prevalent, and predominate in the coal deposits of modern-day Russia.85

In modern-day Siberia and the southern hemisphere, the depositional story was quite different. The majority of coal deposits on the Gondwana land mass (parts of which have finished up in modern day Antarctica, Australia, India, South America and South Africa) originated in post-glacial, sub-arctic to cool climates during the Permian Period. The location of these lands was significantly different to their current placement. For instance, on the land-mass that would become Australia, most of the coal deposits were formed between 50° and

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80 Taylor and others, pp. 23–24.
81 Taylor and others, p. 7.
82 Taylor and others, p. 7; Balme, Kershaw and Webb, p. 41; Diessel, p. 34.
83 Taylor and others, p. 7; Diessel, p. 35.
84 Taylor and others, pp. 7, 10.
85 Taylor and others, p. 10.
70° south, latitudes currently occupied by Antarctica. The coal-bearing peats of that time were characterised by *Glossopteris* and *Gangamopteris* flora, with many herbaceous species, shrub-like trees and bushes, and deciduous trees that were better suited to the cold climates.

Coal deposits from the Late Carboniferous to Early Permian Periods represent the first of three major coal accumulation episodes through Earth's history. The second was during the Jurassic-Cretaceous Period (around 65–200 million years ago), and the third during the Tertiary Period (approximately 2–65 million years ago), in which the majority of the world's brown coal deposits were formed. While these three pulses of coal formation are notable, there are at least some coal deposits representing most of the time between the Carboniferous and the Quaternary.

Between the major coal deposition periods there were substantial evolutionary changes to plant species and vegetation communities. These changes manifested in coal that differs botanically, and sometimes chemically, from one depositional period to the next. For instance, gymnosperms (including *Gingkophyta*, *Cycadophyta* and conifers) were the dominant vegetation in the Jurassic and Early Cretaceous (around 100–200 million years ago), commonly found in the coals of Siberia and central Asia today. The development of flowering plants, angiosperms, during the Cretaceous Period led to a far greater diversity of plant species than was present during the Carboniferous Period, as is well represented in the late Cretaceous and Tertiary coal now in North America, Europe, and Australia among other countries.

There have also been evolutionary changes to detritivores over long periods of time that may have influenced the geological occurrence of coal. For instance, research published in 2012 suggests that the decline in organic accumulation at the end of the Carboniferous evolution correlates with the evolution of white rot fungi (Agaricomycetes), a fungi capable of decaying lignin.

With this broad overview of the carbon cycle and coal geology established, it is now appropriate to consider the coal resources of Australia and the Galilee Basin, and their significance in the twenty-first century.

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86 Balme, Kershaw and Webb, p. 41.
87 Taylor and others, p. 10; Teichmüller, p. 44.
88 Larry Thomas, *Coal Geology*, pp. 46–47.
89 Given, p. 4.
90 Taylor and others, p. 10.

Coal in Australia

The Australian continent contains significant quantities of the global coal resource. About 25% of the world’s brown coal is found in Australia, which is the largest share of any country. The continent’s reserves of recoverable black coal are the fifth largest in the world and make up around 7% of total global deposits. Coal deposits are located in all Australian states and the Northern Territory. Bituminous coal is mostly found in New South Wales, Queensland and Western Australia. Sub-bituminous and brown coal deposits are found in South Australia, Tasmania and Victoria. More than 95% of Australia’s brown coal is located in Victoria, with seam depths of up to 100 metres in parts of the Latrobe Valley. In total, it is thought that Australian coal stocks amount to around 130 billion tonnes of black coal and 195 billion tonnes of brown coal (see Figure 1.1 for map).

A closer look at the Galilee Basin’s ancient buried layers

A number of theories have been put forward to explain the geological mechanics of the formation of the relatively shallow Galilee Basin. But it is agreed that it is ‘intracratonic’, meaning that it formed within a continental interior, away from the margins of tectonic plates. The basin is divided into two sections by the Barcaldine Ridge that runs east-west just below the Tropic of Capricorn, and much of it is buried under the younger, 65–200 million year old, Eromanga Basin. At the vertically thickest section, the Galilee Basin measures at least 2,800 metres.

Sediments accumulated in the Galilee Basin from the Late Carboniferous to the Mid-Triassic Periods, during which time the landmass we now recognise as the Australian continent was

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94 Hutton.
96 Department of Industry, Geoscience Australia and Bureau of Resources and Energy Economics, p. 139 includes ‘economic’, ‘sub-economic’ and ‘inferred’ resources.
98 Hawkins and Green, p. 283.
100 P.R. Evans, p. 299.
101 Jonathan Allen and Christopher Fielding, ‘Sedimentology and Stratigraphic Architecture of the Late Permian Betts Creek Beds, Queensland, Australia’, Papers in the Earth and Atmospheric Sciences
part of Gondwanaland. As part of this larger landmass, Australia had wandered from high to low latitudes in the northern hemisphere in the Early Cambrian, straddled the equator during the Silurian, before heading to southern polar latitudes in the Late Carboniferous (around 306 million years ago). It was in this southerly cline that the Galilee Basin’s coal and other sedimentary deposits accumulated.

The earliest deposits in the Galilee Basin were made up of quartz-rich sand, mud and silt, deposited by fresh water lakes, streams and glaciers; the Galilee is unique amongst its Bowen and Cooper Basin neighbours in having significant quantity of deposits from this Late Carboniferous Period. By the Early Permian (around 270–300 million years ago), coal-forming peat swamps occurred in the region. However, unlike the common notion of the steamy Carboniferous peat bogs from the northern hemisphere, the coal-forming Gondwanian regions in the Early Permian were severely cold. The plants that survived there were generally low in diversity and consisted of small broad-leafed ferns, horsetails and mosses. Coal forming environments again occurred in the Galilee Basin in the Late Permian (250–260 million years ago), interspersed with times when further layers of sand, silt, mud, and volcanic material were deposited.

Terrestrial vertebrate animal life in Gondwanaland during the Permian was dominated by amphibians, although reptiles were on the way to becoming dominant. Elsewhere in the world at this time mammal-like reptiles had evolved, and insects were abundant everywhere. Life continued evolving in all its multiple forms over the following periods. In the north and west of the Galilee Basin area — around Hughenden, Richmond, Muttaburra and Winton — several famous dinosaur skeleton discoveries have been made, including the first find of a

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104 P. R. Evans, p. 299.


106 Allen and Fielding.

107 M. E. White, *The Nature of Hidden Worlds: Animals and Plants in Prehistoric Australia and New Zealand* (Balgowlah, N.S.W.: Reed, 1990), p. 120.
Muttaburrasaurus.\textsuperscript{108} Along with a relative abundance of petrified wood found around the town of Alpha, these finds provide a glimpse of some of the life in the area after the time when carbon deposits accumulated in the area.

There has been a 250 million year interval between the time when carbon sediments in the Galilee Basin were last deposited, and now — when the coal seams are valued as an abundant fuel supply for electricity generating furnaces. Humans evolved to our modern form in the last two-thousand-five-hundredths of this interval. And only in the last one-millionth of this time did the main era of coal-centred industrialisation begin. The geological history of coal is on a time scale that is difficult for people to comprehend. Nevertheless, it is a history that has been drilled and sampled on an increasingly regular basis since the price of thermal coal has determined that unearthing the Galilee Basin’s coal deposits is a viable proposition for the companies in the coal mining business. If the mines go ahead, there will be inevitable consequences for the balance of the carbon cycle in Australia and the world.

**Accounting for Australia’s carbon**

The carbon embodied in Australia’s fossil fuels has been accounted for in various ways. There are studies that focus on carbon fluxes as part of the global carbon cycle,\textsuperscript{109} and those that instead focus on carbon stocks and flows.\textsuperscript{110} Both of these approaches highlight the significant place of fossil fuels in general, and coal in particular, in Australia’s carbon accounts.

An account of Australia’s carbon fluxes, focussing on the period between 1990 and 2011, was constructed as part of a global initiative run by the Global Carbon Project, a collaborative international team of Earth scientists formed in 2001.\textsuperscript{111} The research found that fossil fuel


\textsuperscript{111} C. Le Quéré and others, ‘Global Carbon Budget 2014’, *Earth System Science Data Discussions*, 7 (2014), 521–610 <http://dx.doi.org/10.5194/essdd-7-521-2014>; Canadell and others. Note: There can be some confusion in terminology, because the carbon flux accounting described here is generally called a ‘carbon budget’, in the sense of “accounting of the balance of exchanges of carbon among the reservoirs” (see King and others ref at the end of this footnote). This is different to the common usage of
combustion was the single largest source of greenhouse gas emissions in Australia over the period studied. The burning of fossil fuels released an average of 95.1 million tonnes of carbon every year (equivalent to 349 million tonnes of CO₂), and over the twenty year interval these emissions grew by 30%, from 76 million tonnes of carbon in 1990, to 114 million tonnes of carbon in 2009–2010. The authors also noted that the export of fossil fuel carbon from Australia was on average 1.5 times greater than territorial emissions in the study period, but rose as high as 2.5 times territorial emissions by 2009–2010.112

Despite the significant contribution of carbon emissions from fossil fuel combustion as part of the total territorial carbon flux, it was exceeded by the inter-annual variability in net ecosystem productivity, which is largely a function of the variability in rainfall. Indeed, the researchers found that precipitation “is the single largest driver of variability in the Australian carbon cycle”.113 The research also reported on Australia’s net cumulative emissions from land use, land use change and forestry (LULUCF) — the other major source of anthropogenic carbon emissions after fossil fuel combustion. It found there was an average of 21.4 million tonnes of carbon emitted from LULUCF in the 1990s and 14.4 million tonnes of carbon in the 2000s, and that emissions dropped by 51% from 1990 to 1995, reflecting high rates of land clearing at the beginning of the period.114

Other researchers argue that there is a need to add carbon stock accounts to existing flow inventories to be consistent with the overarching objective to stabilise the stock of CO₂ in the atmosphere, and as commonly discussed in the frame of a global carbon emissions budget (described in Chapter Two).115 Looking at Australia’s carbon stocks, we find that the quantity of carbon in fossil fuel reserves is in the order of 240 billion tonnes. This compares to an estimated 31 billion tonnes of carbon in the nation’s total stock of biocarbon.116 In other...
words, the amount of carbon stored in Australia’s fossil fuels is an order of magnitude larger than the carbon found in biomass and soil profiles across the whole continent. The carbon in black coal and brown coal deposits together make up an estimated 65% of the carbon in all Australia’s fossil fuels and 57% of the carbon stored in fossil fuels and the biosphere. On a global level, Australia’s fossil fuels account for around 2% of the estimated carbon in conventional and unconventional fossil fuels.  

With a current estimated coal resource of 23 billion tonnes, the Galilee Basin makes up 18% of the total ‘economic’, ‘sub-economic’ and ‘inferred’ black coal resource in Australia — the third largest after the Sydney and Bowen Basins which have 21% and 24% of total resources respectively. In turn, the carbon stock in the Galilee Basin equals approximately 5% of carbon in all the continent’s fossil fuel and biosphere stocks.

**Conclusion: Essentially carbon**

Human life could not exist without carbon. Carbon makes up 18.5% of the human body, it is essential in all biological processes necessary for our existence, it has helped to create and maintain climatic conditions conducive for human civilisation, and has been the major energy source behind modern industrialised society. Crucially though, carbon is not just a function of human systems. Carbon has been moving between reservoirs in the Earth and atmosphere for 4.6 billion years. The history of fossil fuels helps to illustrate the way in which biological life evolved and became an important part of the global carbon story over geological time. Human activities are but one astonishingly recent influence on the carbon cycle.

Humans began redistributing land based and fossil fuel carbon stocks to the oceans and atmosphere thousands of years ago. The cumulative result is that the unique climatic conditions that have allowed humans to thrive are now under threat. The coal developments planned for the Galilee Basin cannot be separated from this bigger picture view of the planetary carbon cycle over geological time, and the consequences for the global climate. If the mines proceed, significant quantities of carbon that were initially buried some 250 million years would again enter the active carbon cycle of Earth’s atmosphere and land surface.

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117 Calculated based on the figure of 12.5 trillion tonnes of carbon in the world’s stock of fossil fuels, in Swart and Weaver, p. 135.
118 Department of Industry, Geoscience Australia and Bureau of Resources and Energy Economics, p. 139.
119 Assuming a Galilee Basin coal wash yield of 71% and carbon content of 66%, see Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education, p. 64.
121 Hazen, Hemley and Mangum, p. 17.
In trying to understand why humans continue with such an enormously high stake venture as fossil fuel dependency demands a closer look at the role of fossil fuels in human society. The entwined story of coal and human society is the focus of the following chapter.
Chapter 5

THE COAL REVOLUTION

This chapter considers how and why coal is central to industrial societies, predominantly from the perspective of energy transitions. Coal came to play a pivotal role in several ways: it was as an important source of heat, exchanged directly for wood and charcoal in the provision of warmth and as a cooking fuel; it provided energy and carbon in the manufacture of industrial products including metals and machines; and it fuelled the new industrial machines. Far from a simple substitution of one fuel for another, coal incorporated millions of years' worth of stored solar energy into human affairs. Its mass of available energy facilitated a new human ecological regime that has underpinned modern human societies up to the present time, and is projected to persist well into the future.

Energy and human ecology

All life, movement and change on Earth depends predominantly on the sun's energy — “the basic currency of the biosphere”. Earth's interior heat and gravitational forces play crucial but quantitatively less influential roles. The functioning of biological systems rests on the process of photosynthesis, whereby the sun's energy, together with carbon dioxide and water, is converted into carbohydrates and oxygen. The transformation of light energy to chemical energy provides energy not only to plants, but to the multitude of organisms that utilise plants. The biosphere as we know it — the evolution of species and the complex web of life, including human civilisations — could not have come about without the constant flow of energy from the sun, and the ability of plants to photosynthesise. From this view, the inventions and technologies that commonly characterise different forms of human society are perhaps not as important as the energy sources that underpin them. The changes in humans' relationship

4 Dovers, Sustainable Energy Systems, p. 3.
with energy feature in various human–ecological accounts of our biological and social history, as for instance in Stephen Boyden’s “four distinct ecological phases or modes” — hunter-gathering, early farming, early urban, modern high-energy.\(^5\)

A useful definition of energy is “the capacity of bodies to perform work”.\(^6\) For the bulk of human history it would have seemed absurd that such disparate things as wind, light, food and heat could be considered within the same category, or as having a common denominator in solar radiation.\(^7\) Better understanding of the functioning of energy came when conceptualisations were refined in the interplay of practical technological innovation and abstract scientific theorisation in the industrial era.\(^8\) Standard international units, such as joules and watts were defined, and enabled equivalences between different energy forms.\(^9\) Figure 5.1 and Figure 5.2 illustrates the change in energy consumption over time.

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\(^7\) Sieferle, pp. 19–20.


For all non-human animals and for most of human history it has only been *somatic* energy, the chemical energy ingested by an individual organism and metabolised into mechanical energy, that fuelled day-to-day functioning, movement and work. Early humans made a radical leap outside of this basic energy balance when they began using fire at least 400,000 years ago.\(^{12}\) It represented human’s first step on the *extra-somatic* energy path of harnessing energy outside their bodies.\(^{13}\) The warmth of fire allowed humans to expand their range into areas that would have been prohibitively cold without extensive evolutionary changes to their bodies to cope with such conditions. The use of fire and smoke to cook and preserve also considerably expanded the range of food which humans could keep and digest.\(^{14}\) These changes were significant in the course of *Homo sapiens* becoming a dominant species on the planet.

Through the use of fire and a range of tools, hunter-gatherer societies are able to tap powerfully and efficiently into energy flows in a way that strongly contrasts their ecological behaviour with that of other animals.\(^{15}\) Around 12,000 years ago, some human groups made a further radical leap in extra-somatic energy capture when, through agriculture, they began to actively control energy conversion for their own benefit.

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\(^{13}\) Boyd, p. 61; Dovers, *Sustainable Energy Systems*, pp. 2–3.


\(^{15}\) Sieferle, p. 8.
The agricultural energy regime

The Neolithic Revolution marked the next major socio-metabolic change in human societies with the introduction of agriculture. It is often described as a revolution, although like its industrial counterpart, is best understood as a complex process emerging from “many interdependent interactions”, rather than having any single cause. Archaeologist David Rindos advocates that animal domestication and agriculture can in fact be explained as a process of co-evolution between plants and humans.

From an energy perspective, agriculture is essentially “a solar energy system controlled by humans”, whereby plants are carefully selected, bred and cultivated, to photosynthetically store solar energy in a way that is advantageous to the people controlling the system. In most cases, other plants competing for light, water and nutrients are removed, as are other animal competing for the plants’ output. Ecologically, most agricultural systems mimic an early stage of succession where there is a high level of biomass production. When humans select for those parts of the plants which are desirable to them, they commit themselves to agricultural practices where the natural defences and genetic variability of plants can be replaced to some extent by human effort. Likewise, animals bred for desirable characteristics rely on human protection and care. Through harnessing the somatic power of other animals and more efficiently utilising plants, humans increased their control over the flows of biological energy.

Remarkably, agriculture as it is conventionally recognised appeared in at least seven locations around the world between 12,000–5,000 years ago, apparently quite independently of one another. A number of explanations have been offered for how the transition came about. Population growth and climatological influences are often cited as dominant factors for triggering the move away from hunting and gathering in some areas. The coincidence between a range of agricultural steps with the Holocene period is of particular interest; not only was agriculture more likely to develop and persist under the stable climate conditions of the Holocene, there is also on-going speculation that humans helped to create the stable climate conditions through the release of greenhouse gases caused by land clearing and irrigated agriculture. A systemic view recognises these biophysical forces, but also identifies the need for a convergence of factors across the technical and economic, socio-political and

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19 Sieferle, pp. 14–18.
cultural-ideological subsystems of any given society to allow such fundamental transformations to occur.  

Stephen Boyden’s imagined account of the transition to agriculture serves as a starting point: quite possibly, agriculture could have resulted from incremental responses to favourable post-glacial conditions in particular places, whereby relatively settled groups began casually experimenting with plant germination and animal domestication. If there was decreased mortality associated with these new conditions, an increase in the size of the population would entrench development further in the direction of higher yielding agriculture. It is possible to imagine that in certain circumstances, and over a period of time, there were parallel incremental changes in technology, politics and culture that supported the transition to an early agricultural society.

There was undoubtedly significant diversity in how early agricultural societies emerged in different environments. For instance, there is evidence that complex social arrangements, not dissimilar to those in agrarian societies, arose among certain hunter-gatherer groups in very productive terrestrial and coastal locations. It is thought that the social and technical skills required to harvest and store seasonal fluxes of abundance would have lead quite easily into early farming arrangements.

Whatever the exact and various causes, the initial transition from foraging to agriculture is likely to have had dubious benefits on a range of measures. The fact that the new practices were not universally adopted even within the same area is a possible indication of this. It is generally believed that hunter-gatherers on the whole enjoyed a less laborious means of acquiring food, better nutrition, a diet with greater variety, and lesser frequency of famine than their agrarian contemporaries. Some scholars go so far as to argue that the first stages of agrarianism led to worsened conditions for the majority of people. These issues are actively debated. In any case, motivation for the change is likely to have been influenced by non-food factors to at least some degree. For instance, a cropping regime is thought to have been associated with greater social contact, larger families, individual ownership and accumulation of property, and warfare.

Even if the initial impulse to agrarianism was stimulated by a range of factors, it is likely that the further development of agriculture was driven by energy imperatives. In short, the

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22 Sieferle, p. 12.
23 Boyden, pp. 88–89.
development of agriculture resulted in more food energy being available per unit of area and
time, providing food for an increasing numbers of people and allowing population density to
further rise significantly.\(^{29}\) It is estimated that, on average, permanent farming can support a
population one order of magnitude larger than a population dependent on shifting cropping
interspersed with long regeneration times, which in turn can feed a population one order of
magnitude larger than a population of settled foragers.\(^{30}\) In particularly fertile areas, it has
been calculated that up to 50,000 times as many people per unit area can be fed under a
regime of agriculture compared to that of hunter-gathering.\(^ {31}\) It then follows that once a new
higher yielding agricultural system emerges on which more people are dependent, reversion to
earlier forms of food gathering and/or cultivation would amount to significant losses in food
availability to large proportions of the population, so is thus unlikely. The ecological trade-off
with agriculture is that large areas of biological energy and ‘ecosystem services’ are channelled
towards human benefit and away from species and ecosystems that are not human controlled.

A whole host of technological, cultural and institutional forms and norms developed in
conjunction with early agricultural and urban beginnings. Hoes, yokes, wheels, levers, storage
vessels, formalised division of labour, property rights and social institutions are some examples
of the physical and sociocultural artefacts of settled agricultural societies.\(^ {32}\) In turn, these were
important prerequisites for the eventual emergence of yet more complex technologies and
societal arrangements which enabled ever more energy to be captured and utilised in
industries such as forestry, whaling and coal mining. Energy expert Vaclav Smil identifies
water, wind, biomass, as well as human and animal labour as providing the power for the
“preindustrial complexification” of human society.\(^ {33}\) Slavery and serfdom were particularly
widespread in societies lacking an abundance of draft animals, and are examples of how
controlling energy flows have extended to cruel and inhumane practices for extended periods
in human history.\(^ {34}\)

In sum, the advent of agriculture marked a profound shift in humans’ relationship with their
environments, following the use and control of fire as the first step on humans’ extra-somatic
energy pathway. As well as a revolutionary shift in human ecological dynamics, the advent of
agriculture also resulted in substantial changes in human relationships with each other. The

\(^{29}\) Sieferle, pp. 13–14; Paolo Malanima, ‘Pre-Industrial Economies’, in Power to the People: Energy in
Europe over the Last Five Centuries, ed. by Astrid Kander, Paolo Malanima, and Paul Warde (Princeton:

\(^{30}\) Smil, Energy in Nature and Society, p. 150; Malanima, p. 44.

\(^{31}\) Boyden, p. 96.

\(^{32}\) For some discussion, see Sieferle, pp. 27–34; Boyden, pp. 125–160.


\(^{34}\) J. R. McNeill, Something New under the Sun, p. 12; Manfred Weissenbacher, Sources of Power: How
understanding of energy that can be used to describe and explain these earlier shifts in human history is also crucial for the later transition involving fossil fuels.

Towards industrialisation

The long-playing story of energy transitions in human society cannot be told without consideration of the technological and material changes that accompanied increased energy use. Iron and steel have been key players in the development of industrialised society and are particularly relevant in the history of coal. There has been a mutually reinforcing relationship between coal and the ferrous metals since the early eighteenth century in Britain, and numerous centuries earlier in China. In modern times coal not only provides the bulk of energy and carbon required for the production of iron and steel, but iron and steel in turn provide the industrial machinery that depends on coal (and other fossil fuels) for its operation. And of course, iron and steel are significant to the architecture and infrastructure in modern times.

Iron and steel

The earliest evidence of human contact with iron dates back to the fourth millennium BCE. The high nickel content in the early objects identifies it as iron from meteors. Pieces of the extraterrestrial metal were knocked off large meteorites or picked up from the ground and worked into small objects; the relatively high nickel content provided it with some resistance against oxidation (rust). But like the intermittent use of coal prior to the sixteenth century, such instances of early iron use are dwarfed next to developments in the era before the turn of the first millennium BCE that ushered in the Iron Age. The development of iron facilitated a host of societal and technological changes, including more tools, deadlier weapons, and a further step away from agriculture towards industry in some parts of the world. Eventually it took its place as the “load-bearing skeleton of our material civilisation”.

The move from bronze to iron is thought to have resulted from ‘sea peoples’ invading the Near East and eastern Mediterranean basin, around 1,200 BCE. The massive disruption caused by the invasion is likely to have diminished trade access to tin, an essential ingredient in the production of bronze. With bronze in short supply, iron was increasingly sought, becoming common in the tenth century BCE. Iron had most likely not been the metal of choice prior to this time due to the high temperature — 1537°C — at which it melts, unattainable in the

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36 Raymond, p. 52.
furnaces of the Bronze Age. At a lower temperature only ‘bloom’, a spongy iron mixed with slag, could be produced. Bloomery iron required repeated hammering before it became wrought iron, but was softer, prone to rust, and could not maintain an edge as well as bronze.\textsuperscript{38}

Metallurgical breakthroughs eventually saw iron supersede bronze in strength and quality. Initially, the addition of carbon in the smelting process lead to the ‘steeling’ of iron; just 0.3% carbon gives iron the strength equal to, if not greater than, bronze. Later development of quenching and tempering techniques further improved its robustness. These basic techniques are thought to have been initially developed in the Near East, before being passed on to Chinese metal workers whose proficiency led to the early development of cast iron, 2,000 years earlier than it appeared in Europe.\textsuperscript{39} A greater control over the introduction of carbon to the metal was key to the production of iron wherever it developed. It was this, along with the need for a regular supply of fuel, which aligned the future of iron and steel with coal.

Prior to industrialisation, charcoal was the only source of carbon for metallurgical processing, and the relatively high melting temperature of iron meant that demand for charcoal rose when iron began to replace bronze.\textsuperscript{40} Even when coal started to be used at significant scales for other purposes, charcoal was the preferred source of heat and carbon in iron production because, unlike coal, it was free of impurities that contaminated the smelting process. As a result, iron, like its metallurgical predecessors, was “essentially a forest product”.\textsuperscript{41} It has been estimated that between around 1.2 to 10 hectares of woodland were required to produce the charcoal sufficient for one tonne of iron, depending on the efficiency of the metallurgical process and the productivity of woodlands. Charcoal used in forges further increased the embodied woodland in iron products.\textsuperscript{42}

When wood resources were in short supply for metal production people were forced to look to coal to fill the gap. However, impurities in coal meant that it could not be swapped for charcoal without an additional process. It is likely that a method for ridding coal of its impurities was first discovered in China, sometime before the fourth century CE, whereby coal was baked at high temperatures in anoxic conditions, resulting in coal’s carbon-hydrogen molecules breaking up, while also letting steam, gas and wood tar to escape.\textsuperscript{43}

\textsuperscript{38} Raymond, pp. 55–56.
\textsuperscript{39} Raymond, pp. 62–63, 73.
\textsuperscript{41} Freese, p. 65.
\textsuperscript{43} Theodore Wertime A.,\textit{ The Coming of the Ages of Steel} (Chicago: The University of Chicago Press, 1962), pp. 54–55; for description of coking process see Sieferle, p. 63; Smil,\textit{ Energy in Nature and
The result was what we now know as ‘coke’, and it was probably used in China specifically for iron production no later than the eleventh century, as discussed further below. However, the technique is more popularly credited to British brewers in the mid-seventeenth century, who used coke for roasting malt.44

Abraham Darby from Coalbrookdale is famous in the history of the industrial revolution for successfully using coke in the production of cast iron in 1709, the first time it was achieved in Britain. Seventy-five years later, in 1784, Henry Cort invented a puddling and rolling process which facilitated the production of malleable iron from coke.45 These breakthroughs were essential components of industrial transformation, and were the root of long-lasting production techniques. Today, nearly 70% of world steel is produced using coke, with about 600 kilograms of coke required to make one tonne of steel.46

Today’s level of steel production simply would not be possible if coke had not replaced charcoal. Sieferle estimates that if the quantity of iron produced in Britain in the early twentieth century relied on charcoal, it would have demanded close to 100 million hectares of sustainably managed woodland under pre-industrial conditions — an area approximately the size of Bolivia.47 Using this ratio where one tonne of iron requires just under ten hectares of forest for charcoal production, world steel production in 2013 would have required around 1.6 billion hectares of woodland to supply the charcoal — an area close to 10 times the size of the Russian Federation, or around one third the area of the Earth’s surface. Even if the far more conservative ratio of 1.2 hectares per tonne of steel is used, the land area required would be over 1.2 times the size of the Russian Federation.48

The importance of wood

Wood was the dominant precursor to coal in many traditional sectors, and it was often the challenges in managing and securing wood supply that provided a strong direct impetus to

47 Based on data in Sieferle, p. 122; The World Bank, ‘Land Area (sq. Km)’.
48 Note: these calculations are, at best, rough indications. They are based on 2013 steel production of 1.607 billion tonnes, see International Steel Statistic Bureau, ‘Global Steel Production’, 2014 <http://www.issb.co.Uk/global.html#CSP> [accessed 5 September 2014]. They also assume that the iron and steel would be roughly equivalent in their demand for charcoal, and they have not been adjusted for the difference between a long ton of 1016 kg (which is how the ratio is originally reported) and a metric tonne. This also does not account for like efficiency gains in production over time. The surface area of the Earth is taken to be 510 million square kilometres.
develop coal resources and coal dependent technologies. The following discussion is mostly focussed on Britain due to the later significant developments there as part of the industrial revolution, and because of the ample availability of literature in English on the topic. However, transitions from wood to coal similarly occurred in Europe and China, and so examples from these regions are also included.

Despite substantial reductions in the spatial extent of forests and woodlands since the advent of agriculture, industrialisation, and modern logging techniques in recent decades, forests have represented around half the global share of net primary productivity, and have accounted for more than 50% of global terrestrial carbon. It is therefore not surprising that wood played a critical role in the energy metabolism of human societies prior to the large scale development of fossil fuels.

Wood had been used as a fuel since the discovery of fire by early humans, but its uses were expanded and refined as societies learned to harness the multiple values of timber. Wood has been described as no less than the “foundation upon which early societies were built” and as “the raw material that permitted early modern life”. In strikingly similar tones to later exaltations on the crucial role of coal in society, a leading seventeenth century German agronomist reflected:

Were we not to have wood, then we would have no fire, then would we have to eat all meals raw and freeze in winter, we would have no houses, would also have no lime or bricks, no glass, no metal, we would have neither table nor doors, neither stools or other furnishings.

Observing English society in the seventeenth century, John Evelyn famously noted that his homeland would be better off “without gold than without timber”.

In its raw form, wood could be crafted into ships, houses, furniture, mills and machines. In Britain in the latter part of the 1600s, the majority of harvested wood, measured by monetary

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51 Malhi, Meir and Brown, p. 1572.
55 Quoted in Perlin, p. 31.
value, was put to these uses.\textsuperscript{56} When burnt in domestic hearths and stoves, wood provided thermal energy for cooking and heating. It could also be burnt directly to provide the heat for industrial uses. Importantly, wood could also be transformed into almost pure carbon in the form of charcoal, which was required for smelting and processing metals, and which was a more concentrated and smokeless form of energy favoured in a range of circumstances.\textsuperscript{57} It is thus no exaggeration to say that the functioning of society and daily life prior to industrialisation in many parts of the world would have been impossible without secure access to wood.

Considering the importance of wood, it is unsurprising that forests were contested sites on the pre-industrial landscape in early modern Europe and Britain. Besides wood fuel and construction timber, forests provided pasture for animals, bark for tanning, and sap for resin-based products. Humus from the forest floor was also harvested for use as stall litter. The various groups and individuals drawing on forest resources would frequently clash when their interests in the form and function of the woodland did not coincide. Localised and general increases in population put further pressure on the already strained resources and relationships in woodlands.\textsuperscript{58}

Karl Marx and several other nineteenth century German observers and commentators were among those concerned that different social groups had very different levels of access to forest resources. They witnessed and reported on the social problems that arose from changes to forest management practice and governance. In particular, customary laws that had formerly given working class, non-property holders’ rights to gather wood from forests had been overturned. While these issues received much attention in the 1840s in Germany, in reality they were part of a longer term struggle between forest users and efforts to reform forest management. And while there were different tangible interests manifest in the woodlands, there was also a growing problem of genuine scarcity of the wood resource. This was by no means just a problem in Germany, but throughout Europe and Britain.\textsuperscript{59} In Britain, the timber shortage provided an impetus towards developing the coal resource.

**Wood scarcity and the rise of coal**

The crucial role of wood in providing structural materials and thermal energy for domestic and industrial uses in pre-industrial societies meant that there was significant angst whenever and

\textsuperscript{56} Hatcher, i, p. 31.
\textsuperscript{57} Sieferle, p. 63; Smil, *Energy in Nature and Society*, p. 188.
\textsuperscript{58} Warde, ‘Fear of Wood Shortage and the Reality of the Woodland in Europe, c.1450–1850’, pp. 35–36, 41, 47.
wherever the security of wood supply was threatened by overdraw, usually signalled by increased prices. Medieval and early modern Europe and Britain were not the only places where diminished wood supplies resulted in a shift to coal. Evidence of earlier coal use in Roman Britain, and further back in Palaeolithic times, has also been associated with periods of diminished wood resources.60 A transition to coal in China more than half a millennium prior to the main thrust of industrial development in Britain suggests that where it was available, coal proved a vital fuel for societies that had a greater demand for wood than what could be sustained. Remarkably, the expansion of the coal, metallic and non-metallic industries in China during the Northern Sung Dynasty (960-1126 CE) has been compared to the early modern industrialisation of England six hundred years later.61

**The case of China**

China was the only site of ancient civilisation that had an abundant local geological coal resource. There is evidence that coal was handled in north-east China as far back as 4000 BCE, when black lignite was carved into ornaments. Coal had been used as a fuel for both domestic and industrial purposes in China by around 200 CE at the latest, and possibly much earlier. Coal use was increasingly common in China between the fourth to tenth centuries CE, before production “underwent explosive growth” in the eleventh century, particularly in the northern provinces of Shansi, Shensi, Honan and Kiangsu.62 It has even been suggested that Chinese per capita use of coal in the eleventh century was not matched again until the twentieth century.63

Demand on woodlands associated with urbanisation, industry and military strategy during the eleventh century in northern China is believed to have led to a severe wood fuel shortage, triggering the broad scale transition to coal. Coal became cheaper than wood for both domestic and industrial purposes by 1050 and began to be used extensively for all heat requirements in the region, despite wood and bamboo being the preferred fuel.64 Over the

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following seventy five years coal is likely to have become the most important source of heat for both domestic and industrial purposes in the area.65

Coal was initially used for domestic heating and for non-metallic industries in this period, which freed up wood resources to produce charcoal, required by the expanding iron industry. Eventually though, coal became an important fuel for iron production itself. There are a number of ways that coal could have been incorporated into the iron production process, including the possibility that it was used to produce coke and then used in the smelting of the ore itself — a technique only discovered in Europe in the eighteenth century.66 There is evidence that anthracite had been used for smelting iron in crucibles as early as the Han dynasty (that is, before ~ 200 CE), suggesting that coal was used in the production of iron long before it became a widespread domestic fuel in China — the opposite sequence to what occurred in Western Europe many centuries later.67

It is likely that iron was first produced and had become an important part of local Chinese economies in the first millennium BCE.68 By the third century BCE techniques for producing high quality cast iron and steel had been discovered, enabling significant quantities of iron products to be manufactured from the easily accessible rich iron ore deposits, at affordable prices. Again, this was in contrast to later experience in Western Europe which was initially dependent on labour intensive and relatively expensive wrought iron. The significance of iron in this period is further indicated in the Han government’s attempt, in 117 BCE, to establish a monopoly over the iron industry along with salt production — a precedent of government intervention in mining activities that was to be oft repeated over the following 2000 years.69 However, it seems though that the most dramatic rise in Chinese iron production occurred, along with coal, in the eleventh century, stimulated by demand for coins, agricultural tools, salt pans, nails, anchors, weapons and armour.70 While currency, agriculture and the military are likely to have been the largest sources of demand, the cumulative requirements of the

69 Golas, pp. 168–171.
expanding salt, construction, shipbuilding and artistic industries could have been equally or more significant.71

There is disagreement among historians over the quantities of iron that were produced in Sung China, and the extent of the industry in the following centuries up to the modern period. Robert Hartwell contends that iron production was higher during the Sung dynasty than any time up until the nineteenth century.72 Other scholars suggest that it is more likely that iron production continued to grow following the Sung, right up until the eighteenth century. In either case, there is no doubt though that China was notable amongst contemporary societies in its level of iron production from very early times.73

Questions as to why eleventh century industrial growth in Northern China based on coal and iron did not go on to resemble the full catalogue and scale of change that occurred during the industrial revolution might be best answered by pointing to the confluence of the many factors that were important for industrialisation in Britain in later centuries. China's commercial and agricultural centres were mostly not in proximity to its coal deposits, whereas the geography of Britain allowed for relatively cheap and easy transport of coal on waterways, including from the north-east coalfields down the coast to London.74 In China, fuel was very expensive compared to labour, while the high price of labour and low cost of coal energy in pre-industrial Britain served as a particular incentive to base productivity on innovations based on coal energy rather than human labour.75 Historian Kenneth Pomeranz neatly summarises the situation:

... while overall skill, resource, and economic conditions in “China,” taken as an abstract whole, may not have been much less conducive to a coal/steam revolution than those in “Europe” as a whole, the distribution of those endowments made the chances of such a revolution much dimmer.76

73 Golas, p. 170.
Pomeranz also makes that point that China excelled in techniques and technologies that emphasised efficiency, which have been largely obscured by the celebrated technologies dependent on extravagant quantities of energy.77

In Britain, patterns of urbanisation, particularities of technology, culture and demographics, fortunate geographical and biophysical features, are just some of the other factors that came together in unique alignment to make the industrial revolution possible.78 When taken altogether, these variables were unlikely to have occurred at any other place and time in the same way. Nonetheless, the example from eleventh century China is significant for representing what is probably the world’s only precedent of a high level of dependency on coal prior to Britain’s industrial revolution.

*The case of Britain*

Evidence for the earliest use of coal in Britain is in South Wales, where the fossil fuel has been linked to a Bronze Age cremation. Later evidence indicates systematic use of coal in parts of Roman Britain (43-410 CE) across the varied domains of civil, military, urban, rural, domestic and industrial life. Coal use apparently waned with the Roman retreat from Britain, and its use is thought to have been negligible up until the thirteenth century.79 Throughout this early period coal was probably gathered from natural washouts from coal deposits, or dug from shallow pits, as there is no evidence for underground mining until the modern period.80

Britain’s population increased as much as threefold between 1066 and 1300. With more mouths to feed, more land was brought under cultivation — a process that resulted in a loss of forests, woodlands, moorlands, heath and marshland. By the mid-thirteenth century, wood shortages were experienced for the first time in a number of areas, resulting in conflicts over wood resources as well as efforts to conserve and renew forests. Following on from earlier times, peat and turves helped meet the fuel needs of people in many parts of Britain, but altogether there was a trend of increasing demand and diminishing reserves of the main fuel types. London and other large towns experienced severe shortages, and significant increases in the price of fuel. London began dealing with the dearth of wood by importing coal from the country’s north-east coalfields via transport on sailing ships as early as the first half of the 1200s.81

77 Pomeranz, pp. 46–47.
79 Hatcher, i, pp. 16–17.
80 Sieferle, p. 79.
81 Hatcher, i, pp. 19–25.
So, it was a growing population and diminishing wood resources in the Middle Ages in Britain that largely set the context for significantly increased coal production after 1250, a time when temperatures dropped with the Little Ice Age. Most mines were small-scale operations during this period, and the bulk of the product consumed within the local vicinity. There was however some commercial mining and a trade in coal. The most significant use of coal at this time was probably in lime burning and iron working industries. Lime burning was the bigger of the two main industrial uses, providing mortar and plaster to a number of large castles as well as countless smaller building projects. As discussed further in Chapter Eight, coal-fuelled lime burning in London during the thirteenth century led to some of the earliest documented disputes related to coal smoke. Coal was generally preferred over charcoal in iron forging due its characteristics of burning slowly at relatively low temperatures. However where there was not a local source, coal would have been prohibitively expensive for most smiths.

Wood and charcoal were still the dominant domestic and industrial fuels during the thirteenth and fourteenth centuries in Britain, but there was a tangible increase in the importance of coal. People in many parts of the country had access to small quantities of coal, though those in port towns and cities on route from the Tyne coalfields had access to larger quantities. Coal was also exported from Newcastle to Holland, France, Flanders, Zeeland and the Baltic, from at least the latter years of the fourteenth century. In those parts of the country which were close to coal deposits, and in which there was also a scarcity wood resource — notably in the north east — coal use was more widespread, and more likely to be used for cooking and heating as well as industrial purposes.

The expansion of the British coal industry in the fourteenth century was interrupted by the arrival of the Black Death plague in 1348, and the subsequent dramatic reduction in Britain’s population over the following 150 years. It is thought that more than three million people, or 50–60% of the British population, perished from the bacterial pandemic. The reduced numbers of people lead to a retraction of cultivated land and a renewal of pastures and woodlands, to the extent that quantities of wood fuel substantially recovered and restrictions on accessing wood resources were eased. The parallel contraction of the coal industry did not spell its demise, as some collieries maintained production throughout the period and demand was apparently secure in at least some parts of the country. And importantly, replenished wood availability was the result of decreased demand rather than a lasting improvement in supply, so woodlands were prone to the same population pressure when numbers grew again.

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82 Hatcher, i, pp. 21–23.
83 Hatcher, i, pp. 27–28.
84 Sieferle, p. 86; Hatcher, i, p. 28.
Following the Black Plague’s ravages, the population of Britain recovered strongly. Between the 1530s and 1650 the population is thought to have roughly doubled.\textsuperscript{86} Over the following two centuries, it grew more than threefold — reaching around 17 million by 1850.\textsuperscript{87} The increase in the numbers of people translated again into pressure on the country’s woodlands through direct demand for wood, as well in the expansion of land used for growing food and animals. In the order of hundreds of thousands of acres of woodland were lost to agriculture in this period.\textsuperscript{88}

The exact nature of the relationship between declining wood resources and the increase in coal use after 1550 has generated voluminous debate in the historical literature.\textsuperscript{89} Much of the argument revolves around the claims of John Ulric Nef, an American economic historian writing in the first half of the twentieth century. Nef contends that wood shortages in the sixteenth and seventeenth centuries can be accurately described as a ‘timber famine’, that this led directly to a large scale transition to coal between 1550 and 1700, which he describes as the first industrial revolution, and which in turn prepared Britain for its second industrial revolution, with world-changing consequences, at the end of the eighteenth century.\textsuperscript{90} This argument has been challenged, particularly on the extent and significance of wood shortages, and the evidence for high wood prices in this period.\textsuperscript{91} There has also been significant discussion around the impact of Britain’s maritime demand for timber on total wood supplies, including the need to account for forest management and other supply side factors, as well as the particularities of demand for certain timber characteristics.\textsuperscript{92}

Drawing on extensive empirical data, energy historian Paul Warde argues that it is unlikely that there was a general problem of wood scarcity across Europe and Britain prior to the mid-eighteenth century, and possibly not until 1820. That however, in no way discounts the occurrence of localised wood shortages much earlier than a general shortage was felt.\textsuperscript{93} The central factor in this differentiation was the price of transport in the pre-industrial\textsuperscript{94} era.

\textsuperscript{86} Hatcher, i, p. 31.
\textsuperscript{87} Wrigley, \textit{Energy and the English Industrial Revolution}, pp. 155, 165.
\textsuperscript{88} Hatcher, i, p. 31.
\textsuperscript{91} Hatcher, i, p. 32.
\textsuperscript{92} Warde, ‘Fear of Wood Shortage and the Reality of the Woodland in Europe, c.1450–1850’, pp. 32–33.
\textsuperscript{94} While I use the term ‘industry’ for convenience, it is incorrect to assume that there was no industry in ‘pre-industrial’ Britain. Agriculture was certainly dominant in the economy, but manufactured, processed and fashioned articles had been vital to the running of households and farms in agrarian times. See Hatcher, i, pp. 418–419.
Carting firewood just three miles (4.8 kilometres) in seventeenth century England had the effect of doubling its price. Urban centres as well as locations of fuel-demanding industries — such as those producing glass, metals, bricks, salt and ships — were thus prone to feeling the economic effects of a declining local wood supply. So the experience in England, as elsewhere, was not so much a problem in wood supply as “the great difficulty in transporting wood”.

Wherever wood was scarce and/or expensive, and coal accessible at a competitive price, a transition to the fossil fuel was seemingly inevitable. But even while coal was favourably substituted for wood and charcoal for lime burning and iron working at equal prices prior to 1550, wood and coal were not valued equally for other purposes. Impurities that could interfere with industrial uses and the foul smell from burning coal meant that the price of wood had to reach roughly twice that of coal before many would make the transition. Nonetheless, the transition was eventually made.

London, with a population that grew from around 55,000 in 1520 to more than 500,000 by 1700, had turned to coal to supply the majority of its heating needs before 1650. But London was not alone in becoming ever more reliant on coal. Warde estimates that by the mid-seventeenth century, coal contributed the largest share of all energy sources in England and Wales, supplying around one third of all energy consumed.

The significance of coal in England and Wales grew over the following centuries, supplying around 50% of total energy demand in the opening decade of the eighteenth century, 80% one hundred years later, and over 90% by the mid-nineteenth century. The quantity of energy from all sources grew over this period except from firewood, which declined after the 1750s. However, where total energy from human labour, draught animals, firewood, wind and water increased by around 2.5 times between the mid-sixteenth and mid-nineteenth centuries, the energy from coal expanded by nearly 250 times over the same period; on a per capita basis, the contribution of traditional energy sources retracted by more than half, while coal expanded by about 45 times. Total energy consumption expanded by around nearly 30 times

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96 Sieferle, p. 79.
97 Allen, p. 88.
98 Allen, p. 87.
100 Figures from Paul Warde, Energy Consumption in England and Wales, 1560-2004 (Naples: Consiglio Nazionale della Ricerche, 2007) also quoted in; Wrigley, Energy and the English Industrial Revolution, p. 94.
in this 300 year period and per capita energy consumption by about 5 times. The trend of increasing coal dependence and growing energy consumption in England and Wales is illustrated on the following page (Figure 5.3 and Figure 5.4), based on data from Paul Warde.

\[\text{Data from Warde, } \textit{Energy Consumption in England and Wales, 1560-2004} \text{ calculated as the average over a decade (1600-09, etc.), as presented in; Wrigley, } \textit{Energy and the English Industrial Revolution, p. 94.}\]
CHAPTER 5: THE COAL REVOLUTION

Figure 5.3 Energy consumption in England and Wales, 1560–1860
Source: Created with data from Warde

Figure 5.4 Per capita energy consumption in England and Wales, 1560–1860
Source: Created with data from Warde

102 Data from Warde, Energy Consumption in England and Wales, 1560-2004 calculated as the average over a decade (1600-09, etc.), as presented in; Wrigley, Energy and the English Industrial Revolution, p. 94.

103 Data from Warde, Energy Consumption in England and Wales, 1560-2004 calculated as the average over a decade (1600-09, etc.), as presented in; Wrigley, Energy and the English Industrial Revolution, p. 94.
Industrial Energy Regime

The gradual, and by the end large scale, incorporation of coal into England’s energy system between the sixteenth and nineteenth centuries launched an entirely novel human ecological regime, most commonly associated with the industrial revolution. Indeed, the delivery of unprecedented quantities of energy by coal has been described as a “necessary condition” of the industrial revolution.\(^{104}\) Some of the key innovations, which were largely dependent on coal for their manufacture and operation, strongly shaped subsequent development throughout the world, and remain cornerstone features of industrialised countries today. Even so, it is important to recognise that while the energy in coal was vital to the initial process of industrialisation, by itself it was not sufficient.\(^ {105} \)

The British Industrial Revolution

The industrial revolution is often described as occurring between the second half of the eighteenth and first half of the nineteenth centuries, beginning in Britain before spreading to Europe and US, and as being characterised by a transition to new manufacturing processes. The steam engine is an icon of the technological breakthroughs, and the period is also noted for its wide social effects, largely stemming from unprecedented economic growth which provided an escape from poverty for the majority of people. In more recent times, the industrial revolution is also frequently identified as marking the beginning of the era of human-induced increases in atmospheric CO\(_2\) concentrations.\(^ {106} \)

Outside these basic conceptions, a more detailed and nuanced framing of the multitude of causes, effects and spread of industrialised society can be found in the many books and articles on the topic. Overall, the industrial revolution defies strict definition, nor is there wide consensus on its origins, chronology or relationship to other contemporary changes.\(^ {107} \)

Discussion and re-framing is on-going. For instance, Astrid Kander, Paolo Malanima and Paul Warde’s recent contribution contends that there have been three industrial revolutions over the past five centuries in Europe; the first concentrated around changes in the eighteenth and nineteenth centuries, the second associated with the emergence and spread of oil and electricity particularly in the period following World War II, and the third related to the

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\(^{104}\) Kander, Malanima and Warde, pp. 11, 14.

\(^{105}\) Kander, Malanima and Warde, p. 11.

\(^{106}\) One this last point, see for instance NASA, ‘Causes’, Global Climate Change: Vital Signs of the Planet <http://climate.nasa.gov/causes>.

\(^{107}\) Wrigley, Energy and the English Industrial Revolution, pp. 3–4; Allen, pp. 3–14.
expanding use of electricity alongside information and communication technology since the 1970s.\textsuperscript{108}

For this research, the role of coal and energy in the (first) industrial revolution is the focus of discussion, although it is firmly acknowledged that social, cultural, demographic, political, scientific, legal and institutional changes were vital and, in many cases inseparable from, the material and energy transformations.\textsuperscript{109} Even within a relatively limited focus on coal and energy, there are numerous interacting factors that are variously weighted and emphasised by different scholars.

The phrase ‘Industrial Revolution’ appeared sporadically in England from around the middle of the nineteenth century. It had probably been adopted by early English socialist writers from the French \textit{revolution industrielle}, which had been in use from at least the 1820s.\textsuperscript{110} The term is however generally credited to British economic historian and social reformer Arnold Toynbee following the publication in 1884 of his \textit{Lectures on the Industrial Revolution in England}.\textsuperscript{111} In any case, it was only in the nineteenth century that the profound changes that had occurred over the previous centuries were generally acknowledged to represent a markedly new era.\textsuperscript{112} Even the renowned eighteenth century economist, Adam Smith was apparently unaware of the significance of the changes that were occurring during his lifetime.\textsuperscript{113}

\textbf{Processes of transformation}

Historians generally resist interpretations of the industrial revolution that characterise it as a clean break from previous times. In this sense, ‘revolution’ may be a misnomer. However, the rate and scale of economic growth and technological change between around 1750 and 1850, and its profound large scale consequences, is generally regarded as warranting an identifying label. The British economic growth rate during this period was “historically unique and internationally remarkable”.\textsuperscript{114} With the benefit of hindsight we can see more clearly how the major breakthrough innovations and smaller iterative refinement of processes and products

\begin{flushleft}
\textsuperscript{108} See Kander, Malanima and Warde, pp. 14–15.  
\textsuperscript{113} Wrigley, \textit{Energy and the English Industrial Revolution}, p. 11.  
\textsuperscript{114} O’Brien, pp. 1–3.
\end{flushleft}
had the cumulative result of being revolutionary, including ultimately, in the nature of humanity’s basic ecology.

*From an organic to industrial economy — an outline*

Adam Smith and the other classical economists provided an essentially ecological explanation of the pre-industrial economy, in the sense that they described the interactions and feedbacks of key components that were constrained by natural productivity. They saw that material production was a function of the dynamics of labour, capital and land. Labour and capital could expand in certain circumstances, but ultimately sustained growth was impossible because the supply of land was fixed. Theirs was an accurate description of the ‘organic’ economy, in which the vast majority of food, materials and fuel was generated from agricultural or forestry production, but which was ultimately bounded by the photosynthetic capacity of the land area. Wrigley effectively summarises the view of the classical economists:

> Each type of production was in competition with every other for access to the products of the land. Such pressure in turn must mean either taking land of inferior fertility into agricultural use, or working existing farmland more intensively, or, more probably, both simultaneously. The result must be a tendency for the return to both labour and capital to fall. Growth must slow and eventually come to a halt. Improvements in production techniques and institutional change might for a time offset the problems springing from the fixed supply of land. This might delay but could not indefinitely postpone the inevitable. In short, the very fact of growth, because of the nature of material production in an organic economy, must ensure that growth would grind to a halt. This impasse was reached not because of human deficiencies, or of failure in political, social, or economic structures but for an ineluctable physical reason, the fixed supply of land.

For Wrigley, the vital question is not how or why economic growth accelerated during the industrial revolution, but why it didn’t stop as it would have previously. In essence, the answer centres on the expanded role coal came to play in the British economy. The profound break from the constraints from the organic economy came when coal — which represents countless millennia worth of accumulated photosynthetic energy — began to be harnessed. No longer did the “annual round of plant photosynthesis” define the limits of economic activity. Importantly, it was not so much the case that the industrial revolution was based on entirely novel industries stimulated by coal. In many instances it was the continued growth of

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traditional industries, such as textiles, that was made possible by utilising the energy in coal.\textsuperscript{118} The pre-existing organic economy would simply have been unable to supply the growing energy demands of the new industrial economy.

Coal was not the only biophysical factor that allowed Britain to free itself of the limits of its pre-industrial organic economy. Enormous benefits flowed to Britain and other north-western European countries from their various international exploits, as persuasively argued by Pomeranz.\textsuperscript{119} In part it was a process of obtaining the minerals and resources of territories outside their own, in effect, increasing the land available from which to draw economic growth. It was a process of acquiring colonial “ghost acres”\textsuperscript{120} as a means to “abolish the land constraint” at home.\textsuperscript{121} The labour for agricultural production in these colonised areas was largely provided by African slaves, which through tragically inhumane means, also removed the cost of wages.\textsuperscript{122}

The combined savings to British land-based production from both coal and its imported ‘ghost acres’ was substantial. By the first quarter of the nineteenth century it is estimated that between 6 and 8.5 million hectares of cultivated land would have been needed to grow the timber equivalent of the energy derived from coal in Britain.\textsuperscript{123} At around the same time, Britain benefitted from around 11 million hectares of colonised land producing wool, cotton, sugar and timber.\textsuperscript{124}

There were also at least two other important contributions to British and western European growth from exploiting land and resources elsewhere. The incorporation of the potato and other New World species into Old World farming practices provided harvests of higher energy value than traditional European crops. There were also significant advances in ecological understanding gained, in large part, from the acquired experience in colonised lands, and particularly in forestry.\textsuperscript{125} But of the various ways that Britain was able to get ahead during the industrial revolution, the technological breakthroughs have been the most celebrated.

**Innovations**

Warde emphasises that there were two significant developments in regards to energy that underpinned the industrial revolution. Firstly, there was the enormous expansion in the total

\textsuperscript{120} Pomeranz, p. 275; Wrigley, *Energy and the English Industrial Revolution*, p. 87.
\textsuperscript{121} Pomeranz, pp. 264–297.
\textsuperscript{122} See Pomeranz, pp. 264–169.
\textsuperscript{123} Wrigley, *Continuity, Chance and Change*, p. 55; Pomeranz, p. 276.
\textsuperscript{124} Pomeranz, p. 276.
\textsuperscript{125} Pomeranz, p. 57.
amount of energy that became available in the harvesting of coal, described as a *quantitative* change; through the sheer increase in energy availability many of the traditional strictures of the organic economy were removed. The second, and perhaps more revolutionary development, was the set of discoveries that allowed the thermal energy in coal to be converted to kinetic energy to drive machines, described as a *qualitative* change. This had the effect of removing the mechanical energy bottleneck and was the clinching means by which fossil fuels “broke the bonds of the organic economy”.

**Coal for heat**

The large scale transition to coal was only possible because of a wide range of innovations that allowed the effective use of the new fuel. For some of the main energy demands it was not “simply a question of chucking one fuel rather than the other onto the fire”, technical design solutions had to be found to accommodate the particular properties of coal. Even domestic heating, the dominant use of coal around 1700, was dependent on innovation. Open and hooded hearths had to be replaced with enclosed fire places, grates and chimneys, which in turn significantly changed the design of houses. Interestingly, designs for new ‘coal-burning houses’ were most easily accomplished in London where a high density of builders could learn from each other’s experimentations.

There were a number of industries that had adopted coal with little difficulty in the Middle Ages, and these provided the largest source of industrial demand in the sixteenth and seventeenth centuries. They included salt boiling, lime burning, iron working, brewing and dyeing. When coal became a more economically attractive alternative to wood and charcoal, its use spread more widely again. The potential saving that could be made by switching to coal motivated improvement and invention in the manufacture of glass, bricks, tiles and pottery. By the end of the seventeenth century coal was also being used for smelting lead, tin and copper. The major breakthroughs in using coal for iron smelting came in the eighteenth century with truly revolutionary consequences, as discussed below. By 1700, it is believed that coal supplied over half of Britain’s fuel needs.

The increasing importance of coal meant a greater demand for productive coal mines. Miners dug ever deeper into the Earth, with shafts extending 100 metres by the early 1700s, 200

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128 Allen, p. 90.
130 Allen, p. 95.
131 Allen, pp. 90–95; Hatcher, i, pp. 409–418.
132 Hatcher, i, p. 54.
133 Hatcher, i, p. 55.
metres by 1765, and 300 metres by the 1830s. Deeper mines led to increasing battles with groundwater. Removing water proved difficult and expensive. Gravity was the preferred method where the topographic location of a mine allowed for it. ‘Soughs’ or ‘adits’ were narrow sloping tunnels cut between a mine pit and a drainage point in the outside landscape, and were used up until the nineteenth century in some areas, and at least one persisted in draining a colliery near Lancashire from the eighteenth century through to 1970.

However, conditions did not allow for gravity drainage in large areas of Britain, and water had to be removed from mine pits by the more energy intensive, and thus often more expensive, means of mechanically lifting it out. In the early eighteenth century, pulley systems with a single or multiple buckets, or else chain and rag pumps were common. Such devices were powered in some cases by water or wind, but most commonly by horses. With horse-energy providing an essential component of mine operation, coal was still tied to the limits of the organic economy.

**Coal for motion**

The challenges posed by water infiltration in coal mines spurred experimentation and invention. Designs for new devices could draw on recent scientific discoveries of the physics of air pressure and vacuums, largely made in Italy and Germany in the seventeenth century. A significant step was made in 1675, when Frenchman Denis Papin was the first to condense steam to create a vacuum and drive a piston. Over two decades later in Britain, in 1698, a patent was granted to gentleman Thomas Savery for a steam driven pump, the title of which describes the purpose:

> ... for raising water and occasioning motion to all sorts of mill-works, by the impellent force of fire, which will be of great use for draining mines, serving towns with water, and for the working of all sorts of mills, when they have not the benefit of water nor constant winds.

From this, and a pamphlet printed in 1702 describing Savery’s invention entitled *The Miner’s Friend…*, it is clear that the uses to which steam powered energy came to be applied was anticipated at the turn of the eighteenth century. Savery’s pump however was not widely

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137 Allen, p. 157.
140 Thurston, p. 36.
used; it is only known to have been used for mine drainage at one colliery. Rather, it was Thomas Newcomen who is commonly credited as the inventor of the first steam engine. Newcomen worked as a tool supplier to the mining industry and so could well appreciate the usefulness of an engine that could drain mines. Some historians contend that after spending a decade experimenting with the design, he built an engine in Cornwall in 1710, two years before the more widely renowned machine in Dudley in 1712.

The first Newcomen steam engines were incredibly energy inefficient, to the extent that only 0.5% of coal energy was converted into useful motion. However, given the initial primary use was at the mouth of collieries, there was an ample supply of waste coal that could be used to fuel the engines, thereby making them economic. Over time and with improvements in efficiency, great savings were made in switching to coal-fuelled engines from horse powered gins. In one example from 1744, it was claimed that the annual operation costs of a Newcomen engine (including fuel, maintenance and labour) was £150, just one sixth of the £900 operation costs of maintaining the previous work of fifty horses in feed and labour each year. By 1733, when the expiry on the patent for Newcomen’s invention expired, a total of 78 pumping engines had been installed at coal mines across Britain. This number climbed considerably in the following 40 years when the annual rental payment of up to £350 was removed, and a total of 321 engines were recorded at coal mines between 1734 and 1775. By 1770 it is likely that steam pumps would have been found at all but the smallest collieries across Britain.

The next big leap in the design of steam engines came when Scottish engineer James Watt figured out how to substantially improve the operational efficiency by adding a separate condenser, which ensured that heat would not be wasted in the continual heating, cooling and reheating of the cylinder. James Watt and Matthew Boulton together took out a patent on the design in 1769. The engine became more widespread when their patent expired in 1800, again because of the removal of rental payments. Numerous adaptations were made by experimenting engineers and tradesmen both before and after the patent expired. By the

141 Flinn, II, p. 115.
143 Allen, pp. 158–161. The first use of a Newcomen engine prior to 1712 is however in dispute, for instance Flinn II, p. 119. claims the evidence for it to be “exiguous in the extreme”.
145 Sieferle, p. 130.
146 See for instance Allen, pp. 164–166.
mid-1830s, the average steam engine burnt less than 5% of the coal required by the first Newcomen engines of the previous century.\textsuperscript{152}

The incremental efficiency gains made by innovations in steam engine technology meant that in the first quarter of the nineteenth century it became economical to use coal-fuelled steam engines in most industries where power was required.\textsuperscript{153} And crucially, because of breakthroughs made in the late 1770s and 1780s, it was also possible for steam engines to generate rotative power that could drive industrial machinery, as well as to pump water from mines. Matthew Wasborough and James Pickard took out patents for engines that could directly drive machinery in 1779 and 1780 respectively. But once again, it was James Watt in the 1780s who found solutions to some of the key problems with rotative power. Watt also had the advantage of being able to connect the newly designed rotary capability to his patented efficient steam engine.\textsuperscript{154}

The spread and growth of steam power was already significantly greater than that of water and wind between 1760 and 1830, but in the following decades the number of coal-fuelled stationary power sources jumped ahead much further, increasing by an order of three magnitudes. It is estimated that in 1830 there were equal numbers of steam power and water sources of stationary power, around 160,000 of each, in Britain. But where water derived energy sources grew by less than 50% by 1870, steam power grew by nearly 13,000 times to an estimated 2,060,000 stationary power sources. This increased again to 9,659,000 sources by 1907.\textsuperscript{155} By the latter third of the nineteenth century steam technology was also making a decisive presence in Western Europe and North America.\textsuperscript{156} By 1830, coal was also being used in almost all the same ways that it is today, apart from in the generation of electricity.\textsuperscript{157}

Ecology of transport

The development and improvement of transport infrastructure was a vital aspect of the industrial revolution. It was not long after the development of the high-pressure steam engine in the early 1800s that locomotives and steamships began to appear, drawing on breakthroughs in the production of kinetic energy. Steam powered rail and shipping transport spread industrialisation to places other than those in proximity to coalfields, and eventually resulted in a more intensive extractive global trade network.\textsuperscript{158}

\footnotesize\textsuperscript{152} Allen, pp. 165, 168.
\footnotesize\textsuperscript{153} Allen, p. 169.
\footnotesize\textsuperscript{154} Warde, 'The First Industrial Revolution', p. 168; Allen, pp. 170–172.
\footnotesize\textsuperscript{155} Allen, p. 173.
\footnotesize\textsuperscript{156} Allen, p. 179.
\footnotesize\textsuperscript{157} Flinn, II, p. 2.
\footnotesize\textsuperscript{158} Warde, 'The First Industrial Revolution', pp. 192–193.
The impetus and significant repercussions of these new transport facilities can be described using the concepts of ‘areal’ and ‘punctiform’ energy sources. Economies that rely on the harvest of short term photosynthetic energy flows — for instance cereals and wood — are by nature widespread across geographical space, because of the diffuse way in which solar energy is captured in the landscape. In pre-industrial Britain, the road network that serviced such ‘areal’ economies was often extensive and poorly maintained, making wheeled journeys difficult, and further adding to transport costs. Inescapably, a sustainable system for transporting products in an agrarian economy could only occur when the energy required for transport (namely the hay and grain fed to horses) was not greater than the energy contained in the load being carried. The result was a tendency towards decentralised patterns of occupation and use of landscapes. Overall, difficulties of inland road transport were a significant factor in constraining many aspects of pre-industrial economic activity and growth.

Collieries were ‘punctiform’ in comparison with their agrarian and forestry counterparts. For instance, calculations have shown that around one cord of wood could be sustainably harvested annually from around 4,000 square metres of land in Britain. This quantity of wood supplied the same amount of energy as around 1.3 tonnes of coal, which could be harvested from a much smaller area. So rather than utilising an extensive network of roads, there was often a more limited number of routes between collieries and places of demand. This provided greater incentive to invest in transport infrastructure, such as canals and turnpikes.

The large scale development of railways was soon to follow. The first wagon ways in Britain were established to alleviate the substantial costs of transporting coal on often degraded roads. Following Europe’s lead from the previous century, in the early 1600s wooden ways appeared in Britain, on which horses could pull a load of coal with substantially less friction than on dirt roads; on a wagon way, one horse could carry as much as the combined effort of two horses and two oxen on a road. The later iron plated railways gave way to cast iron rails beginning in 1767. When carriages pulled by steam powered engines appeared in 1825,

159 See Wrigley, Energy and the English Industrial Revolution, pp. 101–103.
161 Wrigley, Energy and the English Industrial Revolution, p. 102.
163 Wrigley, Energy and the English Industrial Revolution, p. 102.
164 One cord of wood equals a properly stacked woodpile with the dimensions of 4x4x8 feet, see Ministry of Forests and Range, ‘Glossary of Forestry Terms in British Columbia’, 2008, p. 17.
165 Allen, p. 96.
166 Wrigley, Energy and the English Industrial Revolution, p. 103.
167 Flinn, II, pp. 147–148; Wrigley, Energy and the English Industrial Revolution, p. 103.
169 Flinn, II, p. 149.
coal was the primary cargo. Interestingly, significant landholder opposition to railways being routed through their properties in the 1800s resulted in their objections being heard in parliament and causing costly delays for the new industry. It is a theme that resonates with many Australian landholders and townspeople who live in the path between mines and ports in the twenty-first century.

In the second half of the nineteenth century the world’s oceans were increasingly spanned by steam in place of sailing ships. By the mid-1850s trade between Britain and the Low Countries and France was powered by steam, but journeys further afield depended on later gains in engine efficiency. These advances were eventually made so that by the 1880s trade with Asia was taken over by steam ships, after Mediterranean and Atlantic routes were traversed by the vessels in the intervening period. Coal powered steam ships were only supplanted by diesel powered shipping in the first quarter of the twentieth century.

**Inter-dependency in the industrial revolution**

As a central technology of the industrial revolution, it might be asked whether the development and operation of the steam engine could have occurred without coal. In addressing this question, Warde points to the “complementarity of coal and steam power” and concludes that “it seems very unlikely that the steam engine would have been developed” in the absence of coal. In essence, the early model steam engines were so inefficient that it is unlikely that any other fuel would have been used besides the abundant quantities of coal available at collieries. During the nineteenth century, more efficient models were fuelled by wood when coal was not available, but such a substitution would have been economically unfeasible in the early stages of development. It is therefore unlikely that the necessary iterative improvements leading to a widely applicable steam engine would have occurred in any other situation. There was also the strong mutual dependence; if it had not been for steam powered mine drainage, it is unlikely that there would have been a cheap and plentiful supply of coal to fuel the engines. Steam engines took the place of both hydraulics and horses, and although the initial transition was prompted through favourable economics of engines over

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171 Pollins, p. 21.
173 Allen, p. 178.
174 Weissenbacher, p. 381.
traditional methods, as the coal mines reached deeper, the steam powered pumps were essential in the task of raising coal.\textsuperscript{176}

Iron constituted the third major force in the energy-innovation nexus of the industrial revolution. Following the discovery of how coke could be made from coal, the large scale production of cheap iron was dependent on coal in the smelting process, and the mass production of steam engines was dependent on cheap iron.\textsuperscript{177} After 1800, steam engines were also increasingly used in the iron smelting process itself, by powering bellows in blast furnaces.\textsuperscript{178} Barbara Freese neatly describes the dynamic between coal, steam and iron in her popular book on the history of coal:

\begin{quote}
Steam increased the demand for both coal and iron, and also made coal and iron easier and cheaper to produce. Cheaper coal and iron made steam engines cheaper to build and to run, which in turn, attracted more people to steam power, further increasing the demand for coal and iron, and so on.\textsuperscript{179}
\end{quote}

After the basic core innovations were made, further refinement and their extension to a wide variety of uses stimulated demand, reinforcing the new fossil fuel economy. The basic interdependencies and the associated developments were well understood by the mid-nineteenth century at least. For instance, in 1865 Jevons wrote:

\begin{quote}
And it cannot escape the attention of any observant person that our inventions and works do multiply in variety and scale of application. Each success assists the development of previous successes, and the achievement of new ones. None of our inventions stand alone — all are bound together in mutual dependence. The iron manufacture depends on the use of the steam-engine, and the steam-engine on the iron manufacture. Coal and iron are essential either in the supply of light or water, and both these are needed in the development of our factory system. The advance of the mechanical arts gives us vast steam-hammers and mechanical tools, and these again enable us to undertake works of magnitude and difficulty before deemed insuperable.\textsuperscript{180}
\end{quote}

Within the first half of the nineteenth century, power for Britain’s manufacturing industries was dominated by coal-generated steam.\textsuperscript{181} By around 1855 coal supplied around 92% of all energy in England and Wales, up from less than 11% three hundred years earlier.\textsuperscript{182} These

\begin{flushleft}
\textsuperscript{176} Warde, ‘The First Industrial Revolution’, pp. 164–166; Flinn, ii, p. 114.
\textsuperscript{177} For summaries, see Flinn, ii, pp. 2–3; Warde, ‘The First Industrial Revolution’, pp. 168–179.
\textsuperscript{178} Sieferle, p. 131.
\textsuperscript{179} Freese, p. 66.
\textsuperscript{180} Jevons, p. 152; also partly quoted in Warde, ‘The First Industrial Revolution’, p. 159.
\textsuperscript{181} Wrigley, \textit{Energy and the English Industrial Revolution}, p. 100.
\end{flushleft}
figures illustrate the remarkable degree to which British society became dependent on a fossilised store of photosynthetic energy over the course of the industrial revolution, in large part as a result of the many interdependent innovations centred on coal.

A broader array of interactions

The complex web of dependent interacting components and relationships operating to create the industrial revolution can be expanded beyond those aspects just related to energy, technology and scientific discovery. Feedback mechanisms were also linked with geological and geographical characteristics, agricultural productivity, demographic change, pre-industrial transport, urban growth, culture, social structures, and so on — some of which have been mentioned above. Many of these were aligned in such a way as to create the conditions necessary for industrial take-off in the first instance. As with the subset of energy related factors, it is perhaps less instructive to pinpoint the degree of importance of any one thing, than to examine “the nature of the feedback between the components of change”. It would be impossible to give a comprehensive account of all the variables and dynamics in the lead up and during the course of the industrial revolution here. But still, it is useful to consider at least some of the forces at play to better appreciate the complex context in which coal was integrated into British society, and eventually throughout the world.

Somewhat counterintuitively, an increase in agricultural productivity played a central role in enabling the British industrial revolution, and has often been considered a prerequisite for industrialisation more generally. In very simple terms, the agriculture sector usually contributes the largest share of wealth in pre-industrial economies, and unless there is a level of productivity above self-sufficiency, then excess product, labour and capital cannot be invested into other kinds of economic activity. However, changes in agriculture do not operate alone, but are hitched to a number of other variables. For instance, economic historian Robert Allen contends that “the city drove the countryside — not the reverse”. He argues that wage rates, levels of urbanisation and proto-industry acted in conjunction to raise agricultural productivity in Britain, and that growth was mutually reinforcing across these four variables. He also emphasises the importance of international trade and the commercial revolution as shaping early modern British history and as forming the background context for

185 Allen, p. 58.
the other changes associated with the industrial revolution.\textsuperscript{186} The case of London is exemplary for looking closer at these patterns and feedbacks.

\textit{The case of London}

One of the main origins of wealth in London was the growth of the English wool-based textile industry in the sixteenth and seventeenth centuries, and the cloth that was exported through the city's ports. This too was connected to earlier events, in that the growth in wool based trade was influenced at least in part by the dramatic loss of population from the Black Death plague in the fourteenth century, whereby the decreased pressure on productive lands for crops led to an increase in wool quality as sheep were given better pastures.\textsuperscript{187}

The rapid growth of London during the early modern period translated in a huge increase in demand for reliable supply of agricultural products. Many other urban centres grew too, so that by 1800, 24\% of the English population lived in towns with at least 10,000 inhabitants, compared to around 6\% in 1600.\textsuperscript{188} Urban growth and the parallel increase in relatively predictable markets provided an incentive for farmers to invest and improve their farms and production methods, including a move to regional specialisation.\textsuperscript{189} Besides agricultural productivity and urbanisation, improved transport infrastructure was necessary to facilitate regional trade relationships that could respond quickly to price signals. Thus, urban growth, agricultural productivity and transport infrastructure had to work together in lock-step to at least some degree.\textsuperscript{190}

The increases in agricultural productivity in the early modern period were remarkable. Between 1600 and 1800, the total English population grew from 4.2 to 8.7 million people, and agriculture was able to keep pace, with total cereal grain production over the same period believed to have almost tripled.\textsuperscript{191} What is more, this was achieved with only modest increases in the area of land under production and the number of agricultural workers employed.\textsuperscript{192} By 1850, agricultural productivity in Britain was significantly higher than comparable European countries.\textsuperscript{193}

\begin{itemize}
\item \textsuperscript{186} Allen, pp. 108–109, 111.
\item \textsuperscript{187} Allen, pp. 109–110.
\item \textsuperscript{188} Wrigley, \textit{Energy and the English Industrial Revolution}, pp. 59, 64–65.
\item \textsuperscript{189} Wrigley, \textit{Energy and the English Industrial Revolution}, pp. 78, 81; Allen, p. 65.
\item \textsuperscript{190} Wrigley, \textit{Energy and the English Industrial Revolution}, pp. 64–65.
\item \textsuperscript{191} Wrigley, \textit{Energy and the English Industrial Revolution}, pp. 78, 81; Allen, p. 65.
\item \textsuperscript{192} Wrigley, \textit{Energy and the English Industrial Revolution}, p. 90; Allen, p. 63.
\end{itemize}
Improved farming practices and urban growth led directly to higher wages in north-western Europe. In Britain, the coincidence of high wages and cheap energy from coal meant that where possible, it was economically preferable to invest in coal-fuelled mechanised production over that which was dependent on human labour. When coal could replace wood fuel in towns and cities, formerly wooded areas could be turned over to agriculture, thereby further enabling urbanisation. The growing urban populations became increasingly literate, and willing and able to make lifestyle changes. A budding consumer culture prompted further economic growth and a rise in secondary and tertiary employment.

An appreciation of the many features, relationships, and variables leading to the large scale uptake of coal during the industrial revolution is further enriched by looked beyond Britain.

**The case of the Netherlands**

An observer at the end of the seventeenth century could have been forgiven for predicting that it would be the Netherlands, and not Britain, that was poised to become the undisputable world leader during the course of the following century. The Netherlands was the first and leading example of a modern European economy during the Dutch Golden Age, between 1588 and 1702. The Golden Age is recognised as a period in which the Republic enjoyed sustained economic growth, a position on the leading edge of technological advancement, high labour productivity, domination of world shipping and trade, and the benefit of an enormous range of commodities. In light of the discussion in the preceding section, it is also relevant to note that urbanisation across the Netherlands reached 45% in 1675 before declining over the subsequent decades. Part of the increased wealth of urban merchants during the seventeenth century flowed back to rural districts and resulted in significant investment in agriculture.

Like the later transformation of the British economy, the flourishing Dutch economy over the seventeenth century cannot be attributed to any one thing, and a range of variables are emphasised by scholars. In terms of energy, the Netherlands had stepped outside the

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194 Allen, p. 114.
195 Allen.
196 Hatcher, I, p. 548.
197 Wrigley, *Energy and the English Industrial Revolution*, pp. 70–73, 88–89.
200 De Vries and van der Woude, p. 60.
201 For instance, authoritative accounts are given by De Vries and van der Woude; Israel.
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constraints of an organic economy by moving away from imported wood and charcoal and relying extensively on its abundant reserves of peat. The small scale production of peat grew in importance during the fifteenth and early sixteenth centuries. An increase in demand for the fuel spurred the invention of a new long-handled tool with a metal net basket on one end — the ‘baggerbeugel’ — which allowed peat to be cut below the water level and for more intensive extraction from around 1530. Production also increasingly went into the hands of merchants, investors and companies.

Peat was the main source of thermal energy for domestic and industrial uses during the Golden Age, providing an estimated \(1.2 \times 10^{12}\) kilocalories per annum, equivalent to around 5 petajoules, or 200,000 tonnes of black coal. The low-cost fuel heated homes as well as giving the Netherlands a competitive advantage in the processing and transforming of commodities, many of which had been imported from overseas. Brewing, sugar refining, alcohol distillation, and tobacco drying are some of the industries that benefitted from the availability of peat.

Like coal mining in Britain and elsewhere, peat digging in the Netherlands led to a range of environmental and regulatory challenges and responses. Since 1600, around 275,000 hectares of land has been stripped of peat in the Netherlands — an area roughly the size of Luxemburg. Jan De Vries and Ad Der Woude summarise some of the consequences during the Golden Age:

> Peat digging became both a major pillar of the economy and threat to the environment and the tax base as the exhausted bogs formed lakes that expanded to cover vast areas throughout central Holland and western Utrecht.

In this way, peat extraction was implicated in the nexus of three important domains of change during the period — cheap energy, land reclamation and the development of a widespread canal transport network.

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203 John F. Richards, p. 54.
206 Calculated on the basis that there is an average of 25 kilojoules per tonne of coal, converted from a quoted average of 6000 kcal/kg, see World Coal Association, ‘Coal Conversion Statistics’, *World Coal Association* <http://www.worldcoal.org/resources/coal-statistics/coal-conversion-statistics/> [accessed 17 September 2014].
207 Unger, p. 222; De Vries and van der Woude, p. 502.
208 De Vries and van der Woude, p. 37; The World Bank, ‘Land Area (sq. Km)’.
209 De Vries and van der Woude, p. 37.
210 De Vries and van der Woude, p. 37.
Besides tapping into the store of photosynthetic energy in its peat bogs, the Netherlands operated outside of the immediate organic constraints through its international shipping and trade operations, which facilitated substantial economic benefit to the Republic from drawing on the products of oceans and far-flung lands.\textsuperscript{211} While quantitatively less important than peat, the wind energy that powered the Dutch maritime fleet and its onshore windmills was also essential to the success of the Republic’s economy.\textsuperscript{212}

Coal also played a significant part in the Dutch Golden Age. There were only very limited domestic supplies of coal, but the Netherlands was able to import significant quantities from Liège, Germany, England and Scotland. Over the course of the seventeenth century it is thought that imported coal, used mostly by industry, contributed around two-fifths of the energy supplied by domestic peat.\textsuperscript{213} By 1660, total per capita energy use in the Netherlands from peat and coal is likely to have been two to three times what it was a century earlier, and greater than it would be for the subsequent century.\textsuperscript{214} By the end of the 1800s, nearly a century after the end of the Golden Age, energy from coal became dominant, contributing more than double the energy that was drawn from peat, and roughly the same as what peat had supplied during the seventeenth century.\textsuperscript{215}

While it is generally acknowledged that peat played an important role in the success of the Netherlands in its Golden Age, the Republic’s economic stagnation over the eighteenth century should not be overly attributed to a reduced supply of the fossil fuel alone. De Vries and Der Woude point out that Dutch peat reserves were far from exhausted in the eighteenth century, and also that English coal could be bought in the main Dutch ports at prices comparable to those in England. They argue that the economic slow-down was more a product of “economic circumstances that limited demand” rather than because of the “supply constraints of inelastic energy sources”.\textsuperscript{216} However, others maintain that the Netherlands was energetically disadvantaged: by way that the supply of cheap peat “choked off” the potential of drawing extensively on the vast Ruhr coal deposits, and thus precluding a continental industrial revolution;\textsuperscript{217} that their growing dependence on coal imports made them subject to the “commercial policies of other states”, and in particular, to the restrictive shipping regulations and the increased taxes on coal imports from Britain;\textsuperscript{218} and that with an energy concentration

\textsuperscript{211} see De Vries and van der Woude, pp. 235–269, 350–502.
\textsuperscript{212} see Unger, pp. 228–231 for calculations on wind energy.
\textsuperscript{213} Unger, pp. 222, 245–246.
\textsuperscript{214} De Vries and van der Woude, p. 710.
\textsuperscript{215} Unger, p. 246.
\textsuperscript{216} De Vries and van der Woude, pp. 719–720.
\textsuperscript{217} Allen, pp. 98–104.
\textsuperscript{218} Unger, pp. 246–248.
of just 60% of that of coal,\textsuperscript{219} peat offered a quantitatively inferior supply of energy that would last only a fraction of the time that coal offered elsewhere.\textsuperscript{220}

Overall, the case of the Netherlands in the seventeenth century helps to reinforce some of the important but complex roles of energy resources in modern and industrialised economies. The Netherlands’ rise to prominence prior to the industrial revolution highlights that the many features of a ‘modern’ state were not synonymous with industrialisation, but that operating outside the bounds of a local regenerating economy was an important factor. The dramatic landscape effects of the Dutch reliance on peat also suggests that the various energy resources might be considered to exist on a spectrum ranging from ‘areal’ in the case of agriculture and forestry, to ‘punctiform’ coal deposits, with peat extraction placed somewhere in the middle. And ultimately, in the Netherlands as in Britain and elsewhere, the story of energy and energy resource can only be meaningfully understood when considered in relationship to the contemporary and historical assumptions, structures and processes that it is shaped by and which it enables.

**Conclusion: Industrious coal**

The proposed developments in the Galilee Basin are remote in space and time from coal’s initial emergence and eventual embeddedness in industrial society, yet a search for the systemic causes of coal expansion in the twenty-first century cannot ignore the background to how and why coal came to inhabit such a pivotal place in human affairs. The early history of coal in human society set the conditions for later patterns and phenomena. Some of the key proximate causes of the proposed opening up of the Galilee Basin, such as market demand for coal in China and India, are directly related to the emergence of industrial society in Europe several centuries ago.

The long history of coal reveals the essential role of energy in all human societies, and how energy dynamics can be used to differentiate various socio-ecological arrangements. This bigger view highlights the truly revolutionary transformation that coal helped to deliver human society in ‘breaking the bonds’ of a traditional organic economy. Once coal had been integrated into human systems as it was during the industrial revolution, there were no incentives to revert to older energy regimes. The expanded role of carbon-based fuels since the eighteenth century has only reinforced the basic established pattern, and this has continued up until the present day. It suggests that the upward trajectory of fossil fuel extraction and consumption is inevitable until there is a way to break human society’s current

\textsuperscript{219} Malanima, p. 61.
\textsuperscript{220} Wrigley, *Energy and the English Industrial Revolution*, p. 23.
high level of energy dependency, and/or alternative sources of energy and carbon can replace the massive stored reserves of ancient ‘buried sunshine’ that industrial societies have come to rely on.

Besides the challenge of dealing with the quantitative aspects of energy supply, a longer and broader history of coal also illuminates the myriad sociocultural dimensions of how particular energy sources and associated technologies come to be dominant, as well as their wide ranging consequences. The following chapter further explores these issues by looking at the way in which the history of coal unfolded on the Australian continent.
Chapter 6

AUSTRALIA’S COAL-FIRED JOURNEY

Coal has played an important role in Australian society and economy since the early years of British colonisation. Coal was a convenient fuel that could be used for heating and cooking when wood supplies diminished, as it was in Britain in the preceding centuries. But coal also represented an enormous industrial potential for the new colony, as the condensed energy in coal enabled various forms of manufacturing and industry. As discussed in the previous chapter, the sheer quantity of energy available in coal together with innovation breakthroughs saw the humble black rock play a pivotal role in revolutionising British society and form a backbone for economic growth in the latter half of the eighteenth century. Against this backdrop, the fate of Australia’s vast coal deposits was secured with the arrival of the British in 1788; Australia’s ‘subterranean forest’ was eagerly exploited at the earliest opportunity by the white newcomers. But Australia’s journey with coal over the past two and a quarter centuries has reflected more than our British inheritance. The unique characteristics of Australia’s geology, geography, culture and history have all shaped the way in which Australia’s relationship with coal has unfolded. Far more than of mere historical interest, the early years of colonial coal history and significant events over the following one and half centuries established some of the enduring patterns that have played out until the current time.

A colonial project

The shadow of Britain’s industrial revolution fell decisively on Australia’s eastern seaboard in 1770, as Lieutenant James Cook navigated the Endeavour northward along one of the oldest inhabited continents on Earth. The coal that progressively enabled the full thrust of the British industrial revolution in the latter half of the eighteenth century had given rise to the maritime training of James Cook as a young man, apprenticed to a Quaker coal-shipper in the Baltic Sea trade in 1746.1 The Endeavour, built as the collier Earl of Pembroke was another product of the

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ever increasing demand and supply of coal in that era, before being bought, renamed, and refitted by the British navy.\(^2\)

As the ship and crew set sail for the southern seas in August 1768, Britain’s industrial revolution and its new demands on energy and technological innovation were well underway. Steam engines were found at all but the smallest collieries across Britain, draining water out of the deepening mines.\(^3\) And in the period between Cook’s voyage on the *Endeavour* and the journey of the First Fleet in 1787–1788, James Watt patented his more efficient steam engine, signalling a breakthrough in rotative power.\(^4\) As explained in the previous chapter, these quantitative and qualitative breakthroughs unleashed a high energy socio-metabolic regime of a scale and character that had never been seen before. In 1768, the year that Cook departed, coal provided around two thirds of all energy used in England and Wales. By the time the First Fleet landed in Australia twenty years later, energy use in England and Wales had grown by 20% and coal contributed close to 75% of that total.\(^5\) In the coal mines too, technological advances during the eighteenth and early nineteenth centuries meant that winning coal became more efficient and effective; developments in exploration, boring, sinking, working, cutting, hauling, winding, drainage, ventilation, lighting and transport all contributed to boosting the supply of coal on which British society was becoming ever more dependent.\(^6\)

The world from which the *Endeavour* and the First Fleet came was thus one where coal was becoming an ever-more vital part of the operation of society and economy. As such, Australia was delivered a “compressed, double revolution”\(^7\) of colonisation and coal-centred industrialisation at the very beginning of permanent white occupation. Nonetheless, it would be a number of years before the colony’s coal resources would be tapped to any meaningful extent. The abundance of timber and the labour of convicts delayed the need for coal for the purposes for which it was employed in Britain.\(^8\)

What’s in a name?

It is somewhat curious that Cook, who well understood the value and importance of coal, made no mention in his journal of seeing coal, especially as coal seams were reportedly visible

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\(^2\) Hugh Carrington, p. 51.
\(^3\) Flinn, pp. 121–122; Warde, ‘The First Industrial Revolution’, p. 165.
\(^6\) See Flinn, pp. 69–189.
\(^8\) Diamond, p. 24; Saddler, p. 40.
to later British seafarers travelling as far as two miles off the east coast.\(^9\) In places, the omission can be explained as a matter of distance. For example, on the 10\(^{th}\) May 1770, the Endeavour sailed past the current site of Newcastle, observing Nobbys Island two leagues (over ten kilometres) from land, and so presumably too distant to detect the coal seams visible in the local strata. Two weeks earlier, Cook had been in very close proximity to local outcrops when he attempted a landing with several others in a small boat near Bulli, just north of today’s Wollongong, and the site of a later coal export jetty. The landing had been prevented by the “great Surf”, and the white men were disappointed at losing a chance of “getting a near View” of four or five Aboriginal people who “took to the Woods” as the men approached the shore.\(^{10}\)

In retrospect it is tempting to imagine that the imposition of the name New South Wales to the eastern half of Australia was made in anticipation of the potential, and eventually realised, vast coal deposits in the new British colony. Was it hoped that the coal in New South Wales would match the coalfields of South Wales in importance to the British economy? While there is no direct evidence that South Wales and New South Wales were connected because of coal, the context of the times is suggestive.

Common accounts report that James Cook named New South Wales, previously known to Europeans as New Holland, when he claimed the eastern half of the continent in the name of King George III. However, in Cook’s daily Log of the events on Possession Island in August 1770, he does not give any new name to the continent. A copy of his journal apparently written on the voyage between Australia and Batavia shows the newly claimed land referred to as New Wales, and in two later copies apparently made between Batavia and England, New South Wales.\(^{11}\)

There are a number of theories about why these names were chosen, but there is no firm evidence of the reasoning documented anywhere. Historian George Wood comments that “Cook had a way of naming places without giving his reasons”.\(^{12}\) Yet other historians have argued that it was not Cook but the editor of his journals, Dr John Hawkesworth, who is more likely to have come up with the name.\(^{13}\) If that was the case, the popular assumption that Cook

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\(^{9}\) Marsden, p. 1; David F. Branagan, Geology and Coal Mining in the Hunter Valley 1791-1861, Newcastle History Monographs, no. 6 (Newcastle, N.S.W.: Newcastle Public Library, 1972).


\(^{12}\) Wood, p. 444.

\(^{13}\) See F.M. Bladen, Historical Records of New South Wales (Sydney: Govt Printer, 1893), i, pp. xxvi, 170 <http://archive.org/stream/historicalrecord00bladgoog#page/n614/mode/2up>; History of New South
bestowed the name out of resemblance with the coast of South Wales loses ground.
Considering that a 1770 world map featured New Britain, New England, New Scotland, New
Ireland, New North Wales, New Guernsey, New Denmark, New Holland, New Jersey, New
Zealand, New Hanover amongst others, it is plausible that New Wales and New South Wales
were the “best that was left”,14 and consistent with the colonial mindset of acquisition.
Specifically, Dampier’s earlier naming of New Britain to the north east could have provided a
convenient analogy,15 especially considering the relative positions, if not the disproportionate
sizes, of the two land masses.

To the various suggested reasons behind the naming of New South Wales, there is another one
added here. It is possible that whoever decided on the name had in mind the vessel that
carried the Englishmen to the southern seas — the collier originally known as the \textit{Earl of
Pembroke}. Notably the town of Pembroke in Pembrokeshire is located in South Wales, in the
old Cantref of Penfro — ‘Pen-fro’ meaning ‘Lands End’.16 To a European mind in the eighteenth
century, the Australian continent existed on the outer edges of the known globe, and with a
further link made through the \textit{Earl of Pembroke}, it could have seemed a neat fit. And given the
rich coalfields that existed in the district of Pembrokeshire, could the naming of the collier
been related to a likely port of call? If so, then perhaps there is after all a coal-connection in
the naming of New South Wales, albeit somewhat circuitous.

At the very least, there is serendipity in the fact that New South Wales, where coal has been an
important industry from the early stages of colonisation, is named after that part of Britain
with one of the longest and strongest associations with coal. The first evidence of coal use in
South Wales goes back to the Bronze Age,17 there were active pits in the Middle Ages, coal was
widely used in the early modern period, and it became a vital source of fuel during the
industrial revolution.18 But well before New South Wales became a colonial acquisition and
place of European occupation, coal was a resource for at least some of Australia’s first people.

\begin{footnotes}

14 \textit{Wales from the Records}, ed. by G. B. Barton (Sydney: Charles Potter, 1889). I would like to acknowledge
the NSW Geographical Names Board for supplying me with the file on the naming of NSW, where I
found these references.
15 Beaglehole, p. 249.
17 Hatcher, i, pp. 16–17.
18 Flinn, ii, pp. 10–12; Hatcher, i, pp. 135–141; George Edwards, ‘The Coal Industry in Pembrokeshire’,
\textit{Field Studies}, 1 (1963), 33–64.
\end{footnotes}
Indigenous coal

Indigenous people were the first to use and account for coal in Australia. The Awabakal people of the Lower Hunter region called the combustible black rock *nikkin*, and *nikkinba* referred to ‘a place of coals’;\(^{19}\) they would pick up coal from the ground, beaches, and cliff faces as a fuel for fires, to repel insects, and for waterproofing their canoes.\(^{20}\) An Awabakal dreaming story describes a time when a great frightening darkness emanated from a hole in a mountain and enveloped the world. A gathering of wise elders decided that to bring back light, the source of the darkness would need to be covered up. Men, women and children gathered sand, rocks and plants to cover the darkness where it broke through the land’s surface. Generations of people walking on the covered ground pressed the darkness together with eternal deep underground fires, making *nikkin*. The spirit of the ancient fire is released whenever that coal is burned.\(^{21}\)

Further inland, in the region now known as the Upper Hunter, is Burning Mountain — an underground burning coal seam which is one of only three in the world.\(^{22}\) To the local Wonnarua people, the area is known as *Wingen*, meaning fire. A large outcrop of sandstone is the immortalised Wingen Maid; she ignited the burning coal seam with her grief-stricken tears, shed for her husband killed in battle.\(^{23}\) Archaeological evidence suggests that Indigenous people in the area made tools from a glassy recrystallised material generated by the burning seam, and may have used the heat from the steaming vent to heat silcrete cobbles for easier working.\(^{24}\)

South Australia’s Leigh Creek coal deposits were also encompassed in Indigenous accounts of the landscape, as being the charcoal remains of trees burnt up by Yulu (Kingfisher Man), signalling his pursuit of Wild Turkey Man to Wilpena Pound.\(^{25}\)

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\(^{25}\) Martin and others, p. 192.
These few examples of Aboriginal people using and explaining the occurrence of coal in their landscapes are undoubtedly among many more that have either not made it into the written record of modern Australia, or have been lost in the process of colonisation. Whatever the case, human interaction with coal in Australia took on a quantitatively and qualitatively different character with the arrival of the British.

**First British discovery of coal in Australia**

The first white people known to have found coal in Australia were a group of convicts escaping the confines of the early penal settlement in March 1791, just three years after the First Fleet landed. William Bryant was a Cornish fisherman who had been transported for “having interrupted revenue officers in the execution of their duty”. While employed as the supervisor of the colony’s fishing fleet in Port Jackson, Bryant made plans and preparations to steal a small fishing boat that he would use to escape to Timor together with his wife Mary, their two children and seven other male convicts. The group ultimately reached Timor, but it was a stop they made just two days into their journey that is notable in the early colonial history of coal in Australia. Pulling their boat into a small creek in the vicinity of what is now known as the Hunter River — possibly at Glenrock Lagoon — the group found a quantity of coal lying on the shore, as recounted in William Bryant’s journal of the voyage:

> Walking along shore towards the entrance of the creek we found several large pieces of coal; seeing so many pieces we thought it was not unlikely to find a mine, and searching about a little, we found a place where we picked up with an axe as good coals as any in England, took some to the fire and they burned exceedingly well.

It was during their stay of two nights and one day that Mary Bryant has since been honoured the dubious title of the first white woman in Australia to cook with New South Wales’ coal.

News of the escaped convicts’ valuable find did not reach Sydney before coal was found and samples taken in the same area five years later, in 1796, by a group fishing in a “bay near Port

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Although perhaps overshadowing this latter coal find was the fact that two of the party had been severely wounded — one eventually died — by the local Indigenous people in response to the fishers “having conducted themselves improperly”.

Mid-way through the following year, in 1797, coal was found south of Sydney by survivors of the wrecked Sydney Cove. The ship was en route from Bengal to Port Jackson when it began to leak in the Bass Straight. In their lifeboat, the crew made it close to the Australian mainland, only to be wrecked again in the Gippsland Lakes area. After a long trek on foot, three of the original seventeen travellers, including supercargo William Clarke, found coal in the area now called Coalcliff, north of today’s Wollongong. They were able to have a warm night by a coal fire, before being found by fishermen two days later and taken to Sydney. Clarke’s account of finding coal roused the interest of Governor Hunter and spurred George Bass to travel in a whale-boat to verify the report. He took samples that were shipped to Joseph Banks in England for testing, and although the coal at Coalcliff was deemed not suitably located for mining and transport, Bass surmised that the seams could “extend a considerable way”, perhaps as far as the Blue Mountains.

Within months of the find of coal south of Sydney the existence of coal north of Sydney was officially verified by Lieutenant John Shortland. In early September 1797, Shortland was on a return journey to Sydney in the Governor’s longboat, after searching for convicts who had escaped in the prized Cumberland. Shortland sheltered from a gale between Nobbys Island and Signal Hill, prominent features on the coastline of today’s city of Newcastle, and reported “a considerable quantity of very good coal, and lying so near the waterside as to be conveniently shipped”, estimating that 60 to 250 tons (61 to 254 tonnes) might be easily loaded at the site. Shortland named the “very fine coal river” Hunter River after the colony’s governor, and predicted that “in a little time this river will be a great acquisition to this settlement”.

However, the more descriptive name of Coal River was commonly used for at least the following twenty years.

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31 Collins, 1; also see H.W.H. Huntington, ‘Affray with Newcastle Natives in 1796’, *Newcastle Morning Herald* (Newcastle, 1897).
33 Ellis, pp. 4–5.
34 Quoted in Ellis, pp. 5–6.
These stories of Australian coal finds in the closing decade of the eighteenth century relay something of the character of the young penal settlement; the response from British colonial officials on learning about the existence of coal in Australia reflect the importance of the mineral fuel to the growing British empire in that period, as can be seen a letter from Surgeon John Thomson to Captain John Schanck in 1799:

> We have also some hopes that coal with which the country abounds will be of much Colonial advantage. A ship lately returned to Bengal loaded with coals, and it gave no small satisfaction to every person interested in the prosperity of the colony to see this first export of it; and I am hopeful from these advantages that New South Wales, however contemptible it may at present appear in the list of our colonies, may yet become an acquisition of value to the mother country.36

As discussed above, coal was a crucial commodity for the rapidly industrialising British society in general. More specifically though, coal from New South Wales presented an opportunity to supply the significant demands for coal on the naval vessels and in the garrison forges of the recently won Cape Colony in southern Africa. On receiving Hunter’s notice about the New South Wales coal discoveries, the Duke of Portland in the role of Colonial Secretary instructed Hunter to despatch two ships loaded with coal to the Cape as soon as possible. Portland figured the shipment would save Britain between £5,000 and £6,000, and that New South Wales could receive a valuable load of livestock in return.37

Portland’s request for coal could not be fulfilled because one of the ships that he nominated for the role was being repaired, and the other had not yet left England. But apart from the immediate need for coal in Capetown, it was well understood that a coal export industry would serve the New South Wales colony and the British colonial budget well. A trade in coal would be invaluable for reducing the cost of freight to the colony by providing a return cargo for British ships. And all the while, coal mining would afford the young colony the “constant means of employing a considerable number of convicts in a manner equally advantageous to the settlement and to the interests of the community at large”.38 The mining of coal apparently presented a ‘win-win situation’, as far as the British officials could see. In reality, the dual aims of convict punishment and coal production were not as complementary as they hoped.

36 Mr. John Thomson to Captain Schanck, 1799, printed in ‘Mr. John Thomson to Captain Schanck, 8th September 1799’, in Historical Records of New South Wales, ed. by F.M. Bladen (C. Potter, Govt. Printer, 1895), iii, 716–18 <http://archive.org/stream/historicalrecor05walegoog#page/n12/mode/2up>; also quoted in Turner, Coal Mining in Newcastle, 1801-1900, p. 14.
37 Turner, Coal Mining in Newcastle, 1801-1900, p. 13; see also Ellis, p. 5.
38 Portland quoted in Turner, Coal Mining in Newcastle, 1801-1900, p. 13; see also Ellis, p. 5; Marsden, p. 9.
Stages of coal development in Australia

The following section looks at the first 150 years of the Australian coal industry in four stages. It begins in the convict era at the turn of the nineteenth century and ends in the mid-twentieth century, at which point there was a distinct break from established patterns of coal production and consumption, which is taken up in the following chapter. Each section begins with a graph that presents coal production over the relevant period. It is important to note that the units of production changes across these graphs, representing the growth of production over time — from tonnes in the first, thousands of tonnes in the second, and millions of tonnes in the last two. Similarly, production of brown coal is only represented in the last graph, because it is the period in which brown coal production got seriously underway. Where it is not indicated otherwise, the data refers to black coal.

Establishing Australia’s first coal settlement

For the first three decades of coal production in New South Wales, coal was mostly mined as part of the convict system and at a small scale; production barely exceeded 4,000 tonnes in any one year.

![Graph showing Australian coal production, 1805–1830](image)

**Figure 6.1** Australian coal production, 1805–1830

*Source: Created with data from Turner 1982*

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39 Throughout this chapter I have converted original volumes measured in tons, to metric tonnes (where 1 ton = 1.016 metric tonnes). Note, the data in this graph begins from 1805, so does not capture the first several years of coal production in Australia. The break in records for 1820 and 1821 is the gap between two data sources, the first is from the Board of Trade (roll 107, p. 300), the second is from NSW Blue Books; Turner, *Coal Mining in Newcastle*, 1801-1900, pp. 17, 25.
Within months of Shortland’s report of easily accessible coal at Hunter River, small private vessels began carrying the valued commodity to Sydney. Soon the first coal was exported from New South Wales, although there is some confusion in the historical records about exactly when this occurred and which ship it was carried on. It is possible the private ship the Hunter carried coal to Bengal as early as 1798, in between carrying raw spirits back to New South Wales. Others identify the Earl Cornwallis as more likely to have been the first, carrying upwards of 600 tonnes of coal to Bengal in 1801.

Active exploration for coal closer to Sydney began in late 1799 on the Hawkesbury River, without success. However, coal exploration in New South Wales had the enthusiastic support of Sir Joseph Banks, residing in England but with an ongoing interest in New South Wales since accompanying Cook on the Endeavour. On hearing of Bass’s suggestion that the southern seams be further examined, Banks lobbied the British Navy Board, which agreed to supply the mechanical parts necessary to conduct boring operations. These items were sent out on the same ship as Phillip Gidley King, who six months after arriving in New South Wales succeeded Hunter as Governor of the young colony in 1800.

King was renowned for his focus on commerce and industry, and believed that economic development was a core job of his governorship. Originally from the mining district of Cornwall in England, it is not surprising that King had a keen eye on establishing coal exploitation in New South Wales. King employed John Platt, the only convict miner he could identify in the colony, to explore for coal in the headwaters of the Georges River, south-west of Botany Bay. Hope that there might be a source of coal so convenient to Sydney resulted in an extended search at Georges River before attention was refocussed on the Hunter River. King sent an expedition to the Hunter led by William Paterson to further investigate the potential of establishing a settlement in the vicinity. Paterson reported not only on the suitability of coal mining as a primary industry, but also the potential for salt boiling, lime production, fish salting and grazing. And so in the latter half of 1801, ‘King’s Town’ — New South Wales’ first coal settlement — was established.

By the turn of the eighteenth century, there was a growing demand for coal within New South Wales as well as to supply the Navy in the East Indies and South Africa. Locally, the availability of coal created an opportunity to make iron grates and ranges for guardhouses, barracks and

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40 Ellis, p. 7.
41 Turner, Coal Mining in Newcastle, 1801-1900, p. 14; Ellis, p. 10.
42 Turner, Coal Mining in Newcastle, 1801-1900, p. 14.
43 Ellis, pp. 8–9; Turner, Coal Mining in Newcastle, 1801-1900, p. 14.
44 Ellis, p. 8.
45 Turner, Coal Mining in Newcastle, 1801-1900, pp. 14–15; Ellis, pp. 9–10.
46 Martin and others, p. 6.
so forth. With consumption on the rise, regulation and governance of coal production was soon to follow. At the beginning of July 1801 Governor King issued a General Order proclaiming “Coals and Timbers which are to be Procured at Hunter River to be the exclusive property of the Crown”. Vessels were forbidden to visit the Hunter area without a licence, and dues and fees were applied to coals taken. The Order not only instituted managed conduct, but also ensured that the colonial government would benefit financially from the budding coal industry.

However, the settlement at Hunter River was disbanded in early 1802, having existed for only six months. It was not the burden of the new taxes, or a lack of coal that aborted Australia’s first attempt at regulated coal production. Rather, the settlement was designed as a place of secondary punishment in the young colony, and the spirited and rebellious — mostly Irish — convicts that were sent there proved unmanageable for two successive overseers.

Exploration and mining continued in the area over the following two years in a less regulated form, before a settlement was again established.

The motivation for the second settlement was again to isolate Irish rebels. This time it followed the dramatic Rebellion at Castle Hill on 4th March 1804, which Governor King feared could have easily drawn in several hundred more of the colony’s convicts had it not been immediately quelled. Writing to Lord Hobart a week after the Rebellion, Governor King communicated that the ring leaders had been executed, and that fifty of the insurgents would be sent to the resurrected coal settlement:

I shall immediately send a small establishment to the Coal River, and shall act respecting those daring characters agreeable to your Lordship’s suggestion; and as measures are now taking for that purpose; by removing the most daring characters, I think every future inclination of the kind will be removed.

General Orders relating to the coal settlement were published on March 25th 1804. Replacing the pre-existing 1801 Orders, fourteen new regulations and a new set of fees and dues were

47 Ellis, pp. 8, 10, 13.
49 Turner, Coal Mining in Newcastle, 1801-1900, p. 15.
50 Turner, Coal Mining in Newcastle, 1801-1900, pp. 15–16.
52 Writing again on August 14th 1804, Governor King said that “About forty of the worst were sent to the coal-works at Newcastle...” H.R.A., ‘Governor King to Lord Hobart, 14th August 1804’, in Historical Records of Australia, 1 (The Library Committee of the Commonwealth Parliament, 1915), v, 1–18 (p. 1); J. W. Turner, Manufacturing in Newcastle, 1801-1900, Newcastle History Monographs No. 8 (Newcastle, N.S.W.: Newcastle Region Public Library, Council of the City of Newcastle, 1980), p. 10.
applied. The settlement was proclaimed ‘Newcastle’, and the surrounding area, the ‘County of 
Northumberland’. It was a direct analogy to Newcastle on Tyne in Northumberland County, 
England, located north of London and famous for being one of the most productive coal 
regions and important coal ports in Britain. The naming of the new coal settlement in such 
strident and colonial terms was further exclusionary of the place’s original people who knew 
the area as Mulubinba, place of edible fern; it was a sign that the invading colonists were 
digging their heels in and had a coal vision for New South Wales, one that was to some degree 
a “transplanted” industry from Britain.

The threat of a violent convict uprising at Newcastle lingered for several months, and was 
suppressed with the harshest corporal punishment. Until the early 1820s, the bulk of 
Newcastle’s population was made up of men and women serving sentences, with numbers 
swelling as Newcastle became favoured as a place of secondary punishment over Norfolk 
Island and Van Diemen’s Land. As late as 1820, 84% of Newcastle’s population were convicts, 
although after 1824 free settlers were also allowed to move to the area. Besides mining coal, 
convicts worked in the exploitation of timber, salt and lime, and in the town-gang. On the 
whole, convict workers in Newcastle received no pay and only meagre rations. Rations 
consisted of wheat and salted meat, until maize porridge was added to the menu around 1820. 
Female convicts received half the quantity of their male counterparts. The health of the 
convicts was compromised by the inadequate diet and the nature of the work, including the 
effect of coal dust on the lungs of the miners.

While there are varying accounts of the extent of harshness of life in Newcastle in this era, it 
was at the very least a life of “monotony and deprivation”, and considered to be an undoubted 
punishment for convicts in the colony. Captured escapees could expect a hundred lashes 
before a week in irons, and with just bread and water to eat. In these conditions, it was 

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54 Governor King, ‘General Orders, Vol.II, Number 56’ (Sydney Gazette And New South Wales Advertiser, 
1804); Ellis, p. 15.
56 Grothen, p. 9.
57 Turner, Coal Mining in Newcastle, 1801-1900, p. 129.
58 Ellis, p. 16.
59 J. W. Turner, Newcastle as a Convict Settlement: The Evidence Before J.T. Bigge in 1819-1821, 
Newcastle History Monographs No. 7 (Newcastle, N.S.W.: Newcastle Region Public Library, Council of 
60 Gollan, p. 9.
61 Turner, Manufacturing in Newcastle, 1801-1900, pp. 10–11.
64 see Turner, Newcastle as a Convict Settlement: The Evidence Before J.T. Bigge in 1819-1821, pp. 32– 
35; Gollan, p. 6.
65 Gollan, p. 7.
probably inevitable that Newcastle had a reputation for less than efficient coal production. Indeed, in the first two decades of operation, production from Newcastle’s coal mines rarely exceeded 1,500 tonnes per year, and contributed only about 90% of the revenue generated from the region’s timber.\textsuperscript{66}

There was at least some export of coal from Newcastle every year between 1801 and 1819, except for 1802. However, the amounts were generally small and exports ground to total halt in 1820 and 1821.\textsuperscript{67} Mostly the expansion in coal demand came from domestic uses. In 1815 the colony’s first steam engine was kicked over in Sydney, employed to grind wheat and saw wood. It was originally fuelled by wood, but soon ran on coal. In the same year, a coal depot was established on the docks in Sydney Cove, supplying a weekly allowance of the fuel to select civil and military personnel. In September 1815, coal replaced firewood as the fuel for official fires in the colony.\textsuperscript{68}

Coal at Newcastle was at first taken from exposed seams. The first shaft was completed in 1817, facilitating access to higher grade coal, although it was worked using relatively primitive mining methods. In the absence of horse-gins and steam engines, convict labour supplied the energy for all the required tasks for mining and loading coal, such as bailing water, hewing, carting coal underground in wheelbarrows, winding, and driving bullock carts of coal to the wharf.\textsuperscript{69}

At the end of 1818, Governor Macquarie issued new instructions to Newcastle’s commandant, Major Morisset, emphasising that restraint should be made in doling out punishment to convicts — that it was preferable “at all times rather to forego punishment than inflict it where the evidence of guilt is not perfectly clear and satisfactory”.\textsuperscript{70} Commissioner Bigge, who visited Newcastle in 1820 as part of his examination of the government of the Colony of New South Wales, interpreted Macquarie’s stance as a sign that things had turned around, and that “the exclusive supply [of coal and timber] to government was considered to be the principal object of the settlement, and the punishment of convicts sent thither, to be a subordinate one”.\textsuperscript{71}

\textsuperscript{66} Turner, Coal Mining in Newcastle, 1801-1900, pp. 17, 22.
\textsuperscript{67} Turner, Coal Mining in Newcastle, 1801-1900, p. 21.
\textsuperscript{70} Governor Macquarie, quoted in Turner, Newcastle as a Convict Settlement: The Evidence Before J.T. Bigge in 1819-1821, p. 33.
Bigge’s report helped to further shift the colonial government’s thinking about the operation and governance of Newcastle’s coal production. Bigge concurred with the view amongst some colonists that government control of coal and timber were hampering growth and export, and he recommended that coal mines be leased to private interests.\textsuperscript{72} The government retained control of the coal mines until end of the 1820s, but there was increasing pressure for change. There were decreasing supplies of wood fuel in Sydney and some persistently hoped for a coal export industry.\textsuperscript{73} Pressure also came in the form of ridicule, such as in William Wentworth’s young newspaper \textit{The Australian}:

\begin{quote}
... Five or six prisoners to a barrow is quite a common number of hands, and so often is the coal shifted from baskets to bullock carts to the wharf, from the wharf to the pier, from the pier to the lighter, and from the lighter to the ship, that, by the time it arrives in Sydney for sale, this fine coal is nothing but dust; and even this dust is difficult to be had, at any price, sometimes in the winter months. Such a waste of labour was never seen as at the government coal work at Newcastle, and sooner they get quit of them, the better for themselves and the Colony.\textsuperscript{74}
\end{quote}

It is difficult to gauge how much public sentiment pushed the authorities’ decisions in the matter, but privatisation was close at hand.

\textsuperscript{72} Turner, \textit{Coal Mining in Newcastle, 1801-1900}, pp. 22–23.
\textsuperscript{73} John Busby, quoted in Turner, \textit{Coal Mining in Newcastle, 1801-1900}, p. 23.
\textsuperscript{74} X.Y.Z., ‘Account Of a Trip to Hunter’s River’, \textit{The Australian} (Sydney, N.S.W., 31 January 1827), p. 2, also quoted in Marsden p. 12.
The New South Wales coal monopoly changes hands, 1831-1847

Production of coal in New South Wales gradually increased after 1830, as coal mining moved out of the control of colonial authorities. Coal output grew from 5,000 tonnes in 1831 to over 41,000 tonnes in 1847.

Figure 6.2 Australian coal production, 1831-1847
Source: Created with data from Mudd 201175

Coal in New South Wales first came under private control in the mid-1820s through an alleged deal between Governor Brisbane and a Hunter Valley settler and ship owner, Thomas Winder. Brisbane later denied having entered into the unwritten agreement, but in the meantime the incoming Governor Darling felt obliged to let Winder proceed in what turned out to be an exercise in monopolising and stockpiling — driving up the price of coal in Sydney by ten shillings per ton, and causing public outrage.76 The incident foreshadowed some of the controversy that would emerge in the lead up and during years of coal privatised in the hands of the Australian Agricultural Company (AAC) over the decades to follow.

The AAC expressed their strong interest in leasing the New South Wales coal mines from the colonial government as early as 1825. The company’s panel of directorship overlapped with that of the East India Company, and there was a perceived cost saving opportunity in supplanting coal from Newcastle, England, with that from Newcastle, New South Wales, to power the nascent traffic of steam ships in India and Batavia.77 The discovery of coal in the

75 Gavin. M. Mudd, Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future (Victoria, Australia: Department of Civil Engineering, Monash University and Minerals Policy Institute, 2011).
76 Ellis, pp. 22–23; Turner, Coal Mining in Newcastle, 1801-1900, pp. 26–27.
77 Turner, Coal Mining in Newcastle, 1801-1900, p. 27.
Ganges and the prospect of finding coal reserves in Western Australia somewhat dampened those particular export plans, yet the negotiations continued, with the Colonial Office in England very supportive of the privatisation.78 However, the following three years were rife with complex political and ideological contest and controversy both between and within the company and colonial government. Both parties fluctuated between enthusiasm and reluctance for the deal, and divisions within the AAC and the government were split between Australia and Britain.79

In the end, the AAC was granted 2,000 acres (810 hectares) of land and a virtual monopoly on coal raised in the colony for 31 years.80 Work began in 1829 and the Colonial Government was notified to relinquish control of the Newcastle works from the beginning of 1830. The AAC officially opened a new mine and began to sell coal at the end of 1831, working with the benefit of a steam engine, iron rails, and an inclined plane to a new wharf. The notorious over-handling of coal from the government controlled days was finally over.81

More advanced technology in mining operations facilitated an increase in coal production at the same time that demand for the fuel sharply increased. Production from the AAC mines grew from 7,000 to 40,000 tonnes in the first decade of operation, largely driven by the appearance of steam ships in Australian waters, beginning with the British built Sophia Jane in 1831.82 Plans were hatched for coal gas lighting in Sydney 1836 with the formation of the Australian Gas Light Company two decades after the first permanent installations of gas lighting in London.83 The technology involved roasting coal in an airtight cylindrical retort, so that gases were forced out of the coal and fed into a refining process, whereby tar and water soluble chemical compounds were removed.84 Gas lights were lit in Sydney in 1841 amongst much fanfare, and with some excitement that the millennia old light tradition of oil and candles would be done away with within the foreseeable future. Melbourne followed suit from

78 Turner, Coal Mining in Newcastle, 1801-1900, p. 32; Ellis, p. 24.
80 See Turner, Coal Mining in Newcastle, 1801-1900, pp. 26–33; Ellis, pp. 22–27.
81 Ellis, pp. 26–27; Turner, Newcastle as a Convict Settlement: The Evidence Before J.T. Bigge in 1819-1821, p. 32; Marsden, pp. 14–16.
82 Turner, Coal Mining in Newcastle, 1801-1900, pp. 33–35; Ellis, pp. 28–29.
the beginning of 1856, Hobart in 1857, Adelaide and Brisbane from 1865, and Perth in 1885.85 Stoves began to be fuelled by gas in Sydney from the early 1840s and the by-products from gas production also found ready markets — coke as an industrial and domestic fuel, and tar for paving hitherto muddy paths.86

Government and domestic consumption of coal also increased during the 1830s and the market for Newcastle coal further expanded with the growth of inter-colonial trade, with shipments to Van Diemen’s Land, Melbourne and Adelaide beginning during that decade. Steam shipping was established between Sydney and Melbourne in 1841, although was frustrated by unreliable coal supplies during the 1840s.87 Steam shipping across the Tasman Sea operated from the 1840s, and Newcastle coal was exported to New Zealand for bunkering. Newcastle coal also went further afield when used as ballast on sailing ships and as an export commodity to South America and Asia, although some of these markets were abandoned due to pricing disagreements. All the while, small amounts of British coal arrived in Australia as ballast and imported to places of settlement that were distant from Newcastle.88

Labour issues proved the bane of the AAC throughout its time in control of the coal mines. There was an immediate impasse between the company and free miners assigned by the government on the basis of low wages.89 The supply of convicts had been an important part in the AAC agreeing to take over the Newcastle coal mines, and until the early 1840s the majority of the mining workforce was made up with convict labour. In 1835 the AAC’s five immigrant miners worked alongside 64 convicts to produce over 12,000 tonnes of coal, but the company argued that it needed more convict labour to sustain that level of productivity. The colonial government assigned fewer and less-skilled convicts than they had promised, possibly a mark of disapproval within the New South Wales Legislative Council of the generous terms on which the AAC had been given to produce coal. It was also partly a reflection of the fact that few coal miners arrived in New South Wales as convicts; as waged employees in an expanding industry in Britain they were less likely to be drawn to the crimes leading to transportation. It is also possible that as skilled workers they were held back in Britain, and that some may have tried to hide their profession when in New South Wales, to escape the notorious Newcastle mines.90 Nonetheless coal mining was a particular skilled trade in itself. As argued by John Busby, a

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85 Keating, pp. 23, 50–64.
86 Broomham, pp. 9–10; Keating, pp. 11, 23, 36; Ellis, pp. 30–31.
87 Turner, Coal Mining in Newcastle, 1801-1900, p. 35.
88 Turner, Coal Mining in Newcastle, 1801-1900, pp. 36–37.
90 see Turner, Coal Mining in Newcastle, 1801-1900, p. 18.
colonial surveyor and engineer with a background in managing coal mines, it was one in which “... no man is capable of it who has not been accustomed to it from his boyhood”.91

An AAC experiment to increase the assigned convicts’ productivity in the mid-1830s involved paying the workers two shillings for every ton (1.016 tonnes) they produced above their quota, as well as providing more generous clothing allowances. The scheme worked a charm on the miners’ output. However, opposition from a local clergyman and magistrate, and ultimately Governor Burke, put an end to the short-lived boost to coal production. They asserted that convicts possessing money would lead to an increase in crime and drunkenness.92 In any case, the New South Wales coal mines were not supplied with any new convict labour from 1840,93 although convict transportation was only officially abolished in New South Wales in 1850.94 The AAC was thus compelled to seek immigrant miners for the coal works.

From 1840, miners from Wales, Cornwall, elsewhere in England, and Scotland arrived as indentured labourers. Many of the new miners arrived fresh from bitter relations between workers and proprietors in the British coalfields, and with the recently emerged Chartist movement giving direction to working class agitation. Soon after arriving, the miners successfully struck for better conditions. The subsequent years working under the AAC were marked with similar examples of militancy, and helped establish what would become more than a century of sustained industrial turmoil in the Australian coal industry.95

The demise of the AAC’s control of New South Wales coal came about through increased competition, combined with a reluctance of the New South Wales’ authorities to uphold some of the terms in the original agreement, and the pressure of economic recession during the 1840s. The growing market for coal and the spread of British settlement in Australia led to a number of people attempting, some successfully, to open coal mines at places such as Port Phillip, Illawarra, Lake Macquarie, Maitland, and Morton Bay. The most threatening competitor was James Brown who had opened a mine at East Maitland, secured the business of the Hunter River Steam Navigation Company, and forced down the sale price of coal. In 1845 a case was eventually heard before the full Supreme Court in which the AAC legally

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92 Turner, Coal Mining in Newcastle, 1801-1900, pp. 41–43.
93 Martin and others, p. 8.
95 Turner, Coal Mining in Newcastle, 1801-1900, pp. 41–43.
challenged Brown’s right to mine. The judgement ruled in favour of the company’s exclusive right to coal on crown land.96 However, this led to only a temporary celebration for the AAC, for in clarifying the details of the relevant Act, the case highlighted the unpopular restrictions on winning coal in the colony, as well as exposing ways to get around the restrictions, and demonstrating there were minimal penalties for those who flouted them.97

Influential colonists and members of New South Wales legislative bodies successfully pushed for an inquiry into the arrangements for coal exploitation in New South Wales. A Select Committee was charged with the following task in May 1847:

To inquire into the nature of the agreement made by the Government with the Australian Agricultural Company, respecting the working of coal; the expediency of taking measures for obtaining from the Company, for the benefit of the public, the advantage thereby conceded to them; and the terms of compensation, if any, which should be granted to them for relinquishing any right to which, under their agreement with the Government, they may be entitled.98

Before the Committee had released their findings, news had arrived from Her Majesty’s Government in England announcing that the agreement in which the AAC had been given “exclusive advantages in the working of coal” had been terminated, and with it, “all claims for compensation”.99 The company’s Commissioner, Phillip Parker King, son of the colony’s third Governor, had foreseen the inevitable imminent end to the AAC’s exclusive coal enterprise and had resigned himself to seeking the best terms of surrender, fourteen years before the monopoly was due to end.100

**Coal elsewhere**

The region around Newcastle dominated coal production in the first half century of colonisation, but coal was found and attempts made to established mines, with varying levels of success, in numerous other localities. However, the reporting of these early activities are often inconsistent between various historical descriptions. A summary is given here, although a closer inspection of original sources would be required to clarify the history.101

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97 Turner, *Coal Mining in Newcastle, 1801-1900*, p. 48.
99 Quoted in Murray and; Turner, *Coal Mining in Newcastle, 1801-1900*, p. 52; also see Ellis, pp. 37–38.
100 Ellis, p. 37; Turner, *Coal Mining in Newcastle, 1801-1900*, p. 52.
Coal was identified on the south coast of Tasmania in 1793 by the French naturalist Jacques Labillardière when looking for the La Perouse expedition.\textsuperscript{102} Local coal was used in Hobart as early as 1805, but the first recognised Tasmanian coal mine was established at Saltwater River near Port Arthur in 1834 and worked by convict labour until 1848.\textsuperscript{103} In Queensland, coal was found on the Brisbane River in 1825 by Edmond Lockyer, near Ipswich in 1827, and in Central Queensland in 1845 by Ludwig Leichhardt’s expedition.\textsuperscript{104} The English explorer William Hovell found coal at Cape Paterson, Victoria, in 1826, and there was a short-lived attempt at mining there ten years later. In South Australia, Colonel Light was instructed to select a site for Adelaide in proximity to a coal seam, although coal was not found in the colony until 1847, twelve years after the capital city’s establishment. Significant discoveries of coal in South Australia were only made towards the end of the 1800s, including at Leigh Creek, over 500 kilometres north of Adelaide. Coal was found in Western Australia in 1846 after the government announced a monetary reward for such a find five years earlier, although the working of the remote and low quality deposit north of Perth was short lived.\textsuperscript{105}

\textsuperscript{102} Martin and others, p. 2; John Mulvaney, 'The Axe Had Never Sounded': Place, People and Heritage of Recherche Bay, Tasmania (Canberra, Australia: ANU E-Press, 2007).

\textsuperscript{103} Martin and others, p. 3.


\textsuperscript{105} Martin and others, pp. 3, 192–193, 196–197.
Coal and industrialisation spread, 1848-1914

Coal production in Australia increased by orders of magnitude from the mid-nineteenth century to the start of World War I. From just over 46,000 tonnes in 1848, production reached 12.6 million tonnes by 1914.

Figure 6.3 Australian coal production, 1848–1914
Source: Created with data from Mudd 2011

The decades following the end of the AAC’s monopoly on coal in New South Wales were remarkable in Australia’s coal history. Economic and population growth went hand in hand with a rapid expansion in coal production and export. Notable developments included the opening of coalfields beyond Newcastle, the beginning of coal-powered rail transport and the formation of the first coal miners’ union, against a backdrop of intensified conflict between coal miners and mine owners.

Following the end of their monopoly in the late 1840s, the AAC remained in the coal business and dominated production into the 1880s, but others steadily joined the industry. Between 1848 and 1866, coal production in New South Wales increased more than seventeen fold — from 46,000 tonnes to 779,000 tonnes — the vast majority of which still came from the Newcastle area. Around two thirds of the coal produced in New South Wales between 1860 and 1914 was used within Australia. Steam shipping, gas production, industrial and domestic use reliably absorbed a large portion of the product coal, and rail transport added a

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106 Mudd, Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future.
107 Turner, Coal Mining in Newcastle, 1801–1900, p. 53; Gollan, pp. 10–11; Martin and others, pp. 11–42.
108 Gollan, p. 10.
109 Turner, Coal Mining in Newcastle, 1801–1900, p. 54.
considerable new market on top of these when it switched from being exclusively wood fired in 1861.\textsuperscript{110} The remaining third of coal from New South Wales was exported in this period. Coal was valuable as return cargo on ships that brought manufactured goods from Europe. Sailing eastward with the prevailing winds, Australian coal was frequently offloaded and replaced with grain from North America before the ships returned to Europe. Towards the end of the nineteenth century and into the twentieth century, the coal would be dropped in South America where nitrates could be loaded. Asia, New Zealand and Pacific Islands made up the remainder of the export coal market until World War I.\textsuperscript{111} But quantitative trade figures belie the tumultuous dynamics of coal production.

The first coal miners’ union

The news that gold had been discovered west of the Blue Mountains hit Newcastle in May 1851, prompting an exodus of men including coal miners.\textsuperscript{112} In the scarce labour market, the coal workers that remained were in a relatively powerful position to demand increased pay.\textsuperscript{113} The organisation amongst coal miners in these years preceded the more famous Eureka Stockade that took place in the Victoria goldfields in December 1854, and is recognised by some as the beginning of unionism in the coal industry.\textsuperscript{114} However, a meeting of miners from a number of different mines in Grove’s Paddock, Waratah, in 1860 marked the formal beginning of the first recognised union in Australia — the Hunter River Coalminers’ Mutual Protective Association.\textsuperscript{115} It was also the same year that the miner trade unionist Thomas Lewis won the seat of Northumberland (New South Wales).\textsuperscript{116}

Australian coal miners in this period focussed on local issues, but their views and attitudes were strongly influenced by the experience in Britain. Less than two decades before the formation of Australia’s first coal miners’ union, the \textit{Mines and Collieries Bill (1842)} was passed in Britain, following a report from the 1842 Royal Commission. The report detailed accounts of poor conditions in the nation’s mines and particularly inquired into “the Employment of the Children of the Poorer Classes in Mines and Collieries”. Both boys and girls worked in mines, some as young as four, as did women, some up until advanced stages of pregnancy.\textsuperscript{117} The

\begin{footnotesize}
\begin{enumerate}
  \item \textsuperscript{110} \textit{Turner, Coal Mining in Newcastle, 1801-1900}, p. 57; \textit{Gollan}, pp. 10–11; \textit{Whitmore, Coal in Queensland}, pp. 10–11.
  \item \textsuperscript{111} \textit{Gollan}, pp. 11–12.
  \item \textsuperscript{113} \textit{Gollan}, p. 29.
  \item \textsuperscript{114} \textit{Ross}; \textit{Ellis}, p. 72.
  \item \textsuperscript{115} \textit{Ross}, pp. 19–20; \textit{Gollan}, p. 33.
  \item \textsuperscript{116} \textit{Ross}, p. 19.
  \item \textsuperscript{117} \textit{Great Britain Parliamentary Papers, Report of the Commissioners on the Labour of Women and Children in Mines} (U.K., 1842); reproduced in \textit{English Historical Documents, 1833-1874}, ed. by David
\end{enumerate}
\end{footnotesize}
employment of women and children in the catacomb arteries of Britain’s coal mines is indicative of the lack of formal regulation that had been applied to the industry, but it is only one aspect of the culture and conditions that characterised the coal workers’ experience even into the twentieth century.  

Australian and British coal miners were not alone in their industrial struggles, as the structure of the industry and the nature of the work made cohesion between workers and disparity with mine owners and managers widespread internationally, and conflict somewhat inevitable. Coal mining was hard, dangerous work. Miners suffered chronic illnesses and there were not infrequent fatal accidents. Coal miners and their families mostly lived in tight-knit mining towns situated close to the mines; these communities in Australia were relatively isolated and often faced indifference, if not ostracism, from the broader community. In stark contrast, managers often lived further away from mine sites and only spent a small portion of their time underground. Owners were further removed again; some never actually visited the mines they owned. Owners and managers often had arrogant and authoritarian responses to workers’ requests to have more of a say in the conditions that affected their lives. Workers were legally bound to their employers and worked under conditions stipulated under the Servants and Masters Act (various dates). Although the Act was variously interpreted and applied, breaches of contract could result in miners being punished with gaol terms and hard labour. The result of all this could be explosive, as described by historian Robin Gollan:

More than in any other industry, employers and employees have faced each other as enemies, and fought each other with all the bitterness, the high hopes, the despair, and the suffering of the civil war.  

Energy expert Hugh Saddler similarly comments:

For the next hundred years [following the first major Australian coal miners’ strike in 1855] the relations between miners and mine owners were characterised by chronic

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119 Gollan, pp. 1–2; Shaw and Bruns, pp. 168–169; Saddler, pp. 43–44.  
121 Gollan, p. 1.
acrimony, which from time to time erupted into prolonged and bitter strikes and lockouts.\textsuperscript{122}

High rates of profit attracted investment from Britain as well as within Australia, and the consequent excess capacity dogged the industry up until World War II.\textsuperscript{123} Coal prices were ‘inelastic’. Coal demand was closely tied to the general performance of the economy, so that the industry would expand and profit in times of economic growth, but cut wages and employment when economic conditions turned around. Sackings and reduced wages commonly prompted industrial action.\textsuperscript{124} An accentuating force behind these industrial disputes was the “basic importance of coal” as the principal source of energy for Australia.\textsuperscript{125}

It was no coincidence that coal workers began to make effective claims in this era. Political scientist Timothy Mitchell makes the compelling argument that the increased importance of coal in the nineteenth century amounted to vulnerability in the socio-technical fabric of society, which in turn handed an unprecedented power to workers in the geographically concentrated coal supply chain. The empowerment of labour organisations in turn laid the foundations for twentieth century democracy.\textsuperscript{126} As an essential commodity for the functioning of industrial society, coal gave both workers and proprietors significant power and leverage.

Coal mine proprietors and managers on the whole considered the demands of the coal miners unreasonable and dangerous to the future of the industry. To them, concessions given to the miners would only fuel further demands for “increased pay and less work”, thereby threatening the profitability of operations.\textsuperscript{127} In 1861, just fourteen months after the establishment of the workers’ union, four of the major Newcastle colliery owners met in Sydney and devised a plan to cut wages and place restrictions on striking workers.\textsuperscript{128} While it was a mostly unsuccessful attempt to “check the unjust an exorbitant demands of the miners”,\textsuperscript{129} it was followed up in 1872 with the formation of the Northern Coal Sales Association, known as the ‘Vend’. This body presented a united front to the worker unions and was further strengthened through its agenda of limiting competition. It achieved this latter goal through setting a minimum sale price for coal and dividing the market between its members. Although breaking down on more than one occasion, various incarnations of the

\textsuperscript{122} Saddler, p. 43.
\textsuperscript{123} Gollan, p. 11.
\textsuperscript{124} Saddler, pp. 44–45.
\textsuperscript{125} Saddler, p. 44.
\textsuperscript{127} AAC half yearly report quoted in Ellis, p. 73, p. 81.
\textsuperscript{128} Ross, pp. 22–23; Gollan, p. 14; Ellis, pp. 75–76.
\textsuperscript{129} AAC papers, quoted in Gollan, p. 14.
Vend existed well into the twentieth century. It included collaboration with shipping companies and a division of roles between different branch organisations that could specialise in tasks such as opposing unions, engaging in arbitration (after 1901), and representing the proprietors’ interests in parliament. The Vend eventually faced prosecution and several of its members were fined in 1912 for engaging in monopolistic combination. However, the decision was eventually overturned on appeal, and the Vend only morphed into more effective monopolistic structures until World War II.130

Despite the turmoil, industrial development continued in Australia during the second half of the nineteenth century. The gold rush had brought enormous wealth to Victoria, which became a separate colony in 1851, followed by Queensland in 1859. Coastal routes were increasingly serviced by steam ships, and steam powered vessels helped to transform economies along Australia’s inland waterways, such as between Moreton Bay and Ipswich, and along the Murray and Darling Rivers. With the new transport facility, rural communities could more easily receive supplies and deliver their wool and other agricultural goods to ports. These ships were increasingly powered by coal, as wood supplies dwindled and as railways were able to deliver coal to inland shipping hubs, such as from Melbourne to Echuca.131

Wood fuelled New South Wales’ steam ships and trains until the 1860s when it became increasingly uneconomical. The Great Northern Line alone, connecting Newcastle with the Hunter Valley and eventually with Queensland, required over 4,000 tonnes of ironbark timber per year to operate. The local abundance of coal provided a clear incentive to swap fuels.132 Initial attempts by private companies to build rail lines in New South Wales around the middle of the nineteenth century had failed, but the government proved to be in a better position to negotiate problems of financing and land resumption.133

The history of Australian railway development is similar in chronology to that in Britain. The first Australian railways were built for coal trams in the Newcastle area and were initially drawn by horses.134 Horse-powered railways were also prominent in South Australia. Steam powered locomotives appeared first in Victoria in 1854 on a privately built line that connected Melbourne and Port Melbourne,135 and thereafter it did not take long for substantial distances

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130 Gollan, pp. 14–16.
132 Turner, Coal Mining in Newcastle, 1801-1900, p. 57.
133 Diamond, p. 33; Ellis, p. 45.
135 Robert Lee, ‘Linking a Nation’.
to be spanned by rail. By the end of the 1860s rail connected Melbourne with Geelong, Ballarat, Bendigo and Echuca, Brisbane with Toowoomba, Sydney with Goulburn and Lithgow, and Adelaide with Kapunda. Coal-fired engines were helping to connect town and country, and spread the reach of industrialisation across the Australian landscape.

**Interstate coal demand and production**

At the end of the first decade of the twentieth century the output of coal from New South Wales was more than six times the combined output of the other coal-producing states, making up 86% of Australia’s total production. In monetary value, coal led all other minerals in New South Wales, and was second only to gold at the Commonwealth level. Likewise, production and demand were picking up across all Australian states.

Discovery and development of coal resources beyond Newcastle accelerated from the middle of the nineteenth century. Coal mining near Wollongong began from the end of the 1840s and was well established by 1870. Production commenced at mines in the Lithgow area in the 1860s, where iron smelting also got underway the following decade, and Katoomba in the late 1870s. Englishman Tannatt William Edgeworth David, New South Wales' assistant geological surveyor, along with his assistant mapped the South Maitland coalfield in 1886 that proved to be a significant source for the railways' demand. It was one of David's many life achievements that were eventually honoured with a state funeral in 1934, at which he was praised for a life devoted to the geological study of his “adopted country” in which “he at once aided the industrial development of this land, and enriched the scientific knowledge of the world”.

There had been attempts to establish both black and brown coal mines in Victoria during the 1860s and 1870s, although by 1890 only 3% of Victoria’s black coal demand could be met by local coal. The dependence on New South Wales coal was of great concern to the Victorian authorities; the young colony’s industrial function and economic success was vulnerable while tied to New South Wales coal, the supply of which was not infrequently disrupted by industrial

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136 Gunn, p. 105; Robert Lee, ‘Linking a Nation’.
137 Power, p. 2.
138 Power, p. v.
139 Martin and others, pp. 8, 11.
140 Diamond, p. 36.
disputes on the New South Wales coalfields, wharves and ships.\textsuperscript{143} A protracted New South Wales strike in 1909 spurred Victorian authorities to rapidly develop a state coal mine at a recently proven black coal seam in the South Gippsland area. Within six months of commencement the mine’s output was 1,000 tons (1,016 tonnes) of coal per day, which ensured some independence for Victoria’s locomotives.\textsuperscript{144}

Coal was found at several locations in central Queensland in the 1860s, including at Blair Athol which in time would become famous for its vast deposits, covering around thirteen square kilometres and with one of its four seams famously averaging a depth of 100 feet (more than 29 metres).\textsuperscript{145} Tasmania’s productive North Eastern Coalfields were opened to exploitation with the building of a railway to St Marys in the 1880s.\textsuperscript{146} In 1887, Western Australia’s interest in gaining energy self-sufficiency led to an offer of £1,000 to be paid to the discoverer of coal, motivating the re-discovery of coal on the Collie River in 1889, with operations beginning the following decade. Production in the Collie Basin began in the 1890s, which has remained the only significant site of coal mining in Western Australia up to the present time.\textsuperscript{147} South Australia’s Leigh Creek brown coal deposits have been mined intermittently from 1889 up until the current time, supplying the power stations in Port Augusta.\textsuperscript{148}

Overall, the period between the end of the AAC’s monopoly and World War I was one of steady growth for the Australian black coal industry. However, after reaching 12.6 million tonnes of production in 1914, coal output fluctuated until World War II, dropping as low as around 8.5 million tonnes in the intervening years.\textsuperscript{149}

\textsuperscript{143} Diamond, pp. 29, 35.
\textsuperscript{144} Martin and others, pp. 174–183.
\textsuperscript{146} Martin and others, pp. 172–174.
\textsuperscript{147} Martin and others, pp. 3, 196–197.
\textsuperscript{149} Mudd, Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future; Turner, Coal Mining in Newcastle, 1801-1900, p. 33; Gollan, pp. 10, 137; Saddler, p. 45.
Stagnation and conflict, World War I–1949

The production of black coal in Australia stagnated after World War I, at the same time that brown coal production began to ramp up.

![Graph showing Australian coal production, 1915–1949](image)

A number of interacting forces influenced the decline in coal following World War I. Export markets, which had absorbed a third of New South Wales production between 1860 and 1914, became unreliable during the war years. Victoria’s continued efforts to gain independence from New South Wales coal also significantly reduced the demand in the interwar period, with the establishment of the State Electricity Commission, the Yallourn power station and Morwell briquette works in the 1920s based on the vast brown coal reserves of the Latrobe valley, in Victoria’s south-east. Victoria gained further independence when the state government approved gas manufacture at Yallourn’s brown coal mine, and a pipeline to Melbourne in 1946. South Australia similarly began serious investigations into sources of local energy to free itself from New South Wales in the mid-1940s.

The entry of oil into the energy market was another major factor that eroded the role of coal in Australia in the early twentieth century. From the 1920s, oil and diesel increasingly replaced coal as a fuel in shipping and rail transport, and oil began to be used for industrial heating.

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150 Mudd, *Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future*.
151 Gollan, p. 11; Shaw and Bruns, p. 13.
152 Saddler, p. 46.
153 Shaw and Bruns, pp. 21–22.
The spread of coal-fired electricity in some circumstances only displaced coal gas and the
direct use of coal, and improvements in efficiency of coal-powered electricity generation
meant that less coal was needed per unit of energy produced.\textsuperscript{155} Then the Great Depression
hit, accentuating the on-going reduction in coal demand.\textsuperscript{156} The pressure was sharply felt by
the mining workforce, and the left wing union leadership took advantage of the crisis in the
industry to make more concerted use of direct action.\textsuperscript{157} Some of the nation’s most memorable
industrial disputes occurred in this era, further pushing markets away from coal where
alternative fuels existed.

One of the conflicts to become indelibly stamped in the memory of the Australian labour
movement was at Rothbury, near Maitland in New South Wales’ northern coalfields in mid-
December 1929. Events at Rothbury have inspired numerous retellings, although in the
broader context of economic depression, and with workers and owners clashing in a number
of prominent industries, Rothbury was not the only site of tension.

With the nation’s economic conditions deteriorating, in early 1929 the Northern Collieries
Association attempted to enforce a reduction in their employees’ wages. When the unions
refused, the workers were locked out, despite lockouts being deemed illegal by a previous
ruling. The dispute had been going for nearly ten months when members of the conservative
state government antagonistic to the striking miners became involved. The Minister for Mines
and Forests, Reginald Weaver, declared that three mines would be reopened using non-union
labour.

In the early morning of 16\textsuperscript{th} December about 5,000 union miners marched to ‘mass picket’ the
opening of the Rothbury mine. A smaller picket was planned to maintain the resistance
thereafter. It was not the first such demonstration during the dispute, but was the most
dramatic. Consistent across the varying accounts of the morning’s clashes was the police use of
baton charges and live ammunition in their attempt to control the angry crowd. In the fray, a
number of striking miners were injured, including 28 year old Norman Brown, who was killed
by a police bullet. Injury and death were not unfamiliar to coal mining communities, although
to be killed by the police defending capitalist interests was anathema to the workers, and in
line with Marxist predictions.\textsuperscript{158}

\textsuperscript{155} Shaw and Bruns, p. 16; Saddler, p. 46.
\textsuperscript{156} See Saddler, p. 46; Gollan, p. 177.
\textsuperscript{157} Gibson, p. 229.
\textsuperscript{158} Richard William Evans, “‘Murderous Coppers’: Police, Industrial Disputes and the 1929 Rothbury
The First World War had ushered in further radical political ideology and activity amongst Australian workers, peaking in 1921. The war and the post-war depression were read as the result of inherent failures of capitalism.\(^{159}\) Communist parties formed and various options for proletarian political organisation were actively debated. A sizeable portion of New South Wales coal mining communities remained radical in their political orientation into the mid-1940s, reflected also in the communist leadership of the Miners' Federation from 1934.\(^{160}\)

The importance of coal to Australia’s efforts during World War II led the Commonwealth Government taking control of coal production and distribution in 1941 through the establishment of the Commonwealth Coal Control Board, later, the Coal Commission. This body made concessions to union requests while also taking the right to impose discipline in the interests of preventing and dealing with stoppages.\(^{161}\) Despite these arrangements, and to the frustration of both the government and the Miners’ Federation leadership, coal production began to decline again from 1942, in part due to work stoppages. In defence of post-war reconstruction efforts, the Federal Government decided to maintain an active role in the coal industry following the war. Coordinated legislation was enacted by the New South Wales and Federal parliaments in 1946, called the Coal Industry Acts, which had the broad aim to:

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\ldots \text{regulate, assist and rehabilitate the coal industry within the framework of private ownership, with the proviso that where necessary the Board has power to step in and to control and operate coal mines and ancillary enterprises.}\(^{162}\)
\]

Supporting this legislation, the Joint Coal Board and the Coal Industry Tribunal were established in New South Wales in 1946.\(^{163}\) In Queensland a Central Coal Board and District Coal Boards had been established in the 1930s, but were replaced with the Queensland Coal Board from the beginning of 1949 with similar functions to that in New South Wales but without Commonwealth involvement.\(^{164}\) The New South Wales Joint Coal Board attempted to address constraints in the industry by assisting with the mechanisation and modernisation of mining equipment and organisation, and attempting to soothe the hostile culture between mine workers and owners.\(^{165}\)

\(^{159}\) Gollan, p. 158.

\(^{160}\) Gollan, pp. 220–222, 235; Ross, pp. 353–354.

\(^{161}\) Gollan, p. 224.

\(^{162}\) quoted in Gollan, p. 226.

\(^{163}\) Gollan, p. 227; Ellis, p. 233.


\(^{165}\) Gollan, p. 227; Ellis, p. 233.
The Board opened and operated its own mines and took over a few others that were unable or unwilling to improve inefficiencies. It rapidly acquired mechanised equipment that was then sold or hired out to industry, and enforced screening of coal to improve output quality.\textsuperscript{166} Up until 1950 there was some gain in output from open-cut mines, which the Board helped to promote, as well as some improvement in amenities for mine workers and communities.\textsuperscript{167} But overall the improvements were modest. There had been environmental and technical challenges, as well as reluctance on the part of owners to modernise, and a lack of cooperation by workers and union leaders.\textsuperscript{168} Initially the miners’ union had accepted the direction of the new governance arrangements, although it was critical of the government for not taking the further step of nationalisation.\textsuperscript{169}

While advocating nationalisation domestically in the latter part of the 1940s, the Australian Communist Party was keenly aware of international affairs, especially what they saw as the warmongering and imperialist intentions of the US against the USSR. The Chifley Labor government was more acceptable to the communists than the conservative Menzies Opposition in many respects, but was nonetheless seen as essentially flawed in its allegiance with the US, and in its unwillingness to make fundamental changes to the character of the economy.\textsuperscript{170} Early in 1949, key Communist Party players decided to make a decisive move to gain the leadership of the labour movement, with the Miners’ Federation envisioned to play a central role in the ensuing battle. Building on a century of industrial unrest in New South Wales’ coalfields, the Communist party explicitly articulated a policy that would differentiate it from the Labor Party and would win “the united front among the mine workers”.\textsuperscript{171} The Miners’ Federation put forth their vision that 1949 would be the “worker’s year of triumph”.\textsuperscript{172}

Demands for a 35 hour working week, improved amenities in mines and towns, and three months long service leave for seven years of work had been before for the Coal Industry Tribunal since 1948. A 30 shilling weekly wage increase was added to the list of demands in June 1949. However, the wage increase claim was withdrawn two days after it was made, the issue of working hours adjourned on the request of the Miners’ Federation, and negotiations managed by the Joint Coal Board came to nothing.\textsuperscript{173} A general strike was planned to start on

\textsuperscript{166} Gollan, p. 227; Hartnell, p. 45; Ellis, pp. 233–234; Fisher, pp. 88–93.
\textsuperscript{167} Gollan, p. 228; Ellis, p. 234.
\textsuperscript{168} Gollan, p. 228; see also Ellis, p. 238.
\textsuperscript{169} Gollan, p. 227.
\textsuperscript{170} Gollan, pp. 230–232.
\textsuperscript{171} Gollan, p. 233; see also Ellis, p. 234.
\textsuperscript{172} Quoted in Ellis, p. 234.
\textsuperscript{173} Ellis, pp. 234–235; Gollan, p. 233.
27th June 1949. The mid-winter strike could not have come at a worse time in terms of maintaining employment and economic function of the country.

By the 1940s in Australia, coal had become the pivot for economic activity and post-war reconstruction. An interruption to the supply of the vital energy source posed an enormous threat. By the end of May 1949, coal stocks were critically low in Sydney, and in early June restrictions were imposed so as to safeguard winter supplies. Floods in the Maitland area in mid-June were the worst in more than 50 years, causing several underground and most open-cut mines to cease production. The flood together with the prospect of a strike, led to severe rationing of coal and gas; households had to cut consumption by 75%, and industry by 50%. Tram and railway services halved. In the Broken Hill Proprietary Company’s (BHP) steel works in Newcastle, two blast furnaces and all open hearth steel furnaces went cold for the first time since they were established in 1915. Close to 10,000 jobs were lost, total unemployment reached a million and soup kitchens sprung up in Sydney’s industrial suburbs. There was a sense that Australia was heading back into the awful conditions experienced during the great depression.

The 1949 strike involved 23,000 coal miners across Australia over a seven week period. It was twenty years since the Rothbury conflict, yet still “the ghost of Norman Brown was stalking the coalfields”. The Chifley government responded firmly to the strike. Union funds were frozen, leaders from the Miners’ Federation and the Waterside Workers’ Federation were gaoled, and Prime Minister-approved advertising portrayed the strike as a subversion of arbitration led by communists. Dramatically, the government also sent armed troops into the coalfields to re-establish a coal supply as part ‘Operation Excavate’.

According to most sources, Chifley decided to send in the Army with reluctance, after much pressure from conservative forces and only after the strike had been underway for a number of weeks. Historian Paul Deery, however, argues that military intervention had been planned from near the beginning of the strike, and that rumours the conservative Australian Worker’s Union might take over mining operations were only used as a decoy. The following

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174 This phrase mimics that by Roy Church, who described coal as the “the pivot upon which British pre-eminence rested” in the nineteenth century, quoted in Marsden, p. 6.
176 Phillip Deery, ‘Chifley, the Army and the 1949 Coal Strike’, Labour History, 1995, 80–97 (pp. 89–90); Ellis, p. 237.
178 Quoted in Deery, ‘Chifley, the Army and the 1949 Coal Strike’, p. 82.
179 Gollan, p. 234; Ellis, p. 237.
180 ‘Chifley, the Army and the 1949 Coal Strike’.
communiqué from the Minister of the Army, Cyril Chambers, on 12th July suggests that legal challenges had been considered and overcome just over two weeks into the strike:

I hereby direct the Military Board to authorise... members of the Permanent Military Forces in urgent civil work of national importance, namely the winning, production and transport of coal... and I hereby consent to members of the permanent Military Forces being ordered to work in the place of civilians who have refused or may refuse to work... during the continuance of the dispute at present existing in the coal industry.181

The military plans were set in train by the end of July. During the first two weeks of August 1949, 2,500 armed military personnel worked a total of ten open pits west of Newcastle and produced 103,000 tonnes of coal. The work of delivering coal to power plants and industry was also supported by the Joint Coal Board, the New South Wales Police, and the Australian Railways Union.182

The strong state response to the 1949 strike can be understood as being shaped by several key factors: the crucial role of coal in the nation’s economy; the perceived threat of communism as part of an increasingly fraught, extreme, and polarised cold war political dynamic; and the need for a powerful psychological tool, to display to the striking miners the unmistakable might and resolve of the state not to capitulate. These reasons were compelling enough for Chifley to break the long-held core principle of the Labor Party not to use military force in industrial disputes.183

The 1949 coal miners’ strike marked a turning point in Australia’s labour movement. It crippled the Communist Party, fractured mining unions and set a precedent of Armed Services being used to resist later industrial action.184 The fallout from the strike, including the loss of the Labor government in the December federal election, also proved to be a watershed for the Australian coal industry. Events and trends in the Australian coal industry after 1950 are taken up in the following chapter.

181 Quoted in Deery, ‘Chifley, the Army and the 1949 Coal Strike’, p. 84.
182 Deery, ‘Chifley, the Army and the 1949 Coal Strike’, pp. 87–89.
183 Deery, ‘Chifley, the Army and the 1949 Coal Strike’, pp. 80–81, 89–93.
184 Deery, ‘Chifley, the Army and the 1949 Coal Strike’, p. 93; Ellis, p. 237.
Electricity, iron and steel

Dramatic industrial relations in the nation’s coalfields did not prevent significant coal-related technological and infrastructure developments in Australia in the first half of the twentieth century. Significant advances were made in coal-fired electricity generation and distribution, and in steel manufacture based on coking coal, which together provided enduring domestic markets for coal up until the present time.

Electricity

The overland electric telegraph was the first major application of electricity in Australia. The battery powered telegraph vastly improved communication capability throughout the continent from the 1850s. The second ground breaking use of electricity was in powering lights and lamps. Visiting British Royals were treated to electric arc light displays in the 1860s, generally considered the earliest recorded instances of electric light in Australia. In 1878 electricity shone light on the Sydney Post Office and the following year arc lamps illuminated a night-time football match in the Melbourne Cricket Ground. The following day a report on the debut event included a description of the experience: “The appearance of the ground was very peculiar being something between a strong moonlight and twilight with brilliant points opposite the lights”.

The first electric light company was formed in Melbourne in 1880. The following year the company displayed an electric lamp in the street outside its office powered by a gas engine. In 1882, Sydney, Melbourne and Brisbane all had public displays of electric lamps, within just a couple of years of similar displays in London and New York. Later that decade, advances in the transmission of electricity broke the short tether between where electricity was generated and where it was used.

In November 1888, electricity was deployed for street lighting for the first time in the southern hemisphere. Electric light replaced gas light at one Melbourne city intersection that year. But

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185 Diamond, p. 34; Australian Government, ‘The Overland Telegraph’, 2009
189 CITIPOWER and Powercor Australia; Diamond, p. 34; Australian Government, ‘The Overland Telegraph’, 2009
190 Diamond, p. 34; Australian Government, ‘The Overland Telegraph’, 2009
more significantly, the regional town of Tamworth lit thirteen kilometres of its streets using the new technology. The following year the smaller regional town of Young followed suit.\textsuperscript{190} Electricity gradually lit more public space into the early twentieth century, and began to power factory motors before the Great War.\textsuperscript{191} Electric trams had first been installed in Melbourne in the 1890s, and the tramways in Sydney were the first fully electrified sector of that city’s economy in the early 1900s, consuming most of the electricity produced in that city until the end of the First World War.\textsuperscript{192}

Electricity was not mentioned among the essential elements of nationhood in Australia’s 1901 Federal Constitution. Accordingly, the development of electricity supply was rendered a function of each of the six state governments, which in turn resulted in six unique arrangements. State control at the level of municipalities was common in New South Wales, Queensland and Western Australia, whereas private companies were more conspicuous in Victoria, Tasmania and South Australia.\textsuperscript{193} Up until World War II electricity was still commonly generated in locations proximate to places of high demand, with power lines fanning out from that point due to limitations in distributive technology.\textsuperscript{194} Tasmania was the earliest exception to the mould when it based electricity generation at the site of a power source. The Tasmanian government-owned Waddamana hydroelectric power station began operating in 1916, sending power to Hobart via a 105 kilometre transmission line.\textsuperscript{195} Victoria was next to develop power distribution based on the geography of a power source, beginning in 1924 when the energy of the vast brown coal reserves of the Latrobe Valley began to be transformed into electricity at the government-owned Yallourn power station and transmitted 160 kilometres to Melbourne.\textsuperscript{196}

The heavy capital investments required by the Tasmanian and Victorian schemes resulted in the establishment of state electricity commissions in those states in 1916 and 1921 respectively. Among other things, this enabled an early state-wide focus in their planning of electricity distribution. Most other states had established electricity commissions by 1946. This institutional capacity together with technological capability and a flush of post-war demand for energy, led to a rapid nationwide expansion in the reach of electricity in the 1950s and 60s.\textsuperscript{197}

\textsuperscript{190} Wilkenfeld and Spearritt, p. 2; Proudley; Ian R. Lobsey, \textit{City of Light: A History of the Tamworth Electricity Undertaking and Peel-Cunningham County Council 1888-1988} (Tamworth N.S.W.: Peel-Cunningham County Council, 1988).
\textsuperscript{191} Saddler, p. 51.
\textsuperscript{192} Wilkenfeld and Spearritt, p. 10; Pearse, McKnight and Burton, p. 24.\textsuperscript{193} Brady, pp. 2–3.
\textsuperscript{194} Saddler, p. 51; Brady, p. 5.
\textsuperscript{196} Brady, p. 5.
\textsuperscript{197} Brady, pp. 5–6; Saddler, p. 51.
although some towns and districts still had to wait. For instance, in 1998 the former goldfields’
community of Walhalla deep in the mountains of Victoria, with 2,500 residents, became the
last Australian mainland town to be connected to the electricity grid.\footnote{Walhalla Board of Management Incorporated, \textit{Walhalla Board of Management Incorporated: Introduction & Overall Strategy 2010 - 2015} (Walhalla, Victoria, 2009).}

Electricity took over from the railways as the biggest consumer of Australian coal in the decade
following World War II.\footnote{Elford and McKeown, p. 4; Hartnell, p. 55.} Even though there were efficiency gains in using coal-fired electricity
rather than coal in local steam engines, the total increases in energy demand still led to a
staggering increase in coal production, particularly in Victoria where the aim to gain self-
sufficiency in fuel propelled a massive growth in coal output. At Victoria’s Yallourn coal mine,
production grew from just over 80 thousand tonnes in 1921 to 2.2 million tonnes in 1931 — a
30 fold increase. By 1944 production was 4.9 million tonnes, over 60 times larger than
production in the early 1920s.\footnote{Shaw and Bruns, p. 20.}

The development of distributed electricity networks had a profound impact on the industrial
landscape and human experience. Former General, Sir John Monash, who had been appointed
general manager of Victoria’s State Electricity Commission in 1920,\footnote{See Fletcher, pp. 14–16.} eloquently captured this:

\begin{quote}
Electrical energy has become the servitor of humanity... In the course of a single
generation, we have witnessed the almost complete obliteraton of the social and
economic condition which was thought to have been the acme of progress. Factories,
industrial plants and workshops belching forth pollution through forests of chimney
stacks are almost a thing of the past. The horse-drawn tram, only very recently thought
to be an indispensable public utility, has become a relic of the past. The days of the
steam railway locomotive are numbered.\footnote{John Monash, \textit{Presidential Address to the Australasian Association for the Advancement of Science, 1924}, xvi quoted in; Robert R. Booth, \textit{Warring Tribes: The Story of Power Development in Australia} (Doonan, Qld: Bardak Group, 2003); and Diamond, p. 36.}
\end{quote}

Electricity rapidly took the place of wood, coal, and in some circumstances, oil and diesel. It
removed the previously widespread evidence and experience of fuels. For the first time in
human history, heat and kinetic energy was provided without the various and many users
having to directly obtain and handle fuel or deal with its dirty by-products, such as smoke and
ash. It substantially changed the lives of many women who had previously spent long hours in
labour-intensive house work.\footnote{Some examples from the U.S. are given by Ha-Joon Chang, \textit{23 Things They Don’t Tell You About Capitalism}, Reprint edition (New York: Bloomsbury Press, 2012).} Electricity developed an “aura of a clean and reliable form of
energy”. Saddler describes the “ideology of electrification” that began around 1920 and which peaked in the 1950s and 60s, as the “belief that electricity was the agent and harbinger of efficiency, modernity and the good life at home and workplace alike”.

Coal continued to break the boundaries of the organic economy through its support of electrical power. The combined technological developments in power generation and the industrial machines and domestic devices that consumed power resulted in Australia’s use of energy rising rapidly in the decades before and after World War II. Per capita consumption of electric power in Australia rose by nearly 90% in the decade between 1928–29 and 1938–39, a rate of increase that was comparable to that in the UK, Germany, the US and Sweden in the decades before 1950. The quantity of Australian per capita electricity consumption in this period was slightly higher than the UK and Germany, although significantly less than the US and Sweden.

Iron and steel

The Fitz Roy Iron Works, established in 1848, are believed to have been Australia’s first commercial iron works. Located 90 kilometres south west of Sydney near the town of Mittagong, the works were fed by a rich reserve of bog iron ore discovered during the construction of the Mittagong to Berrima Road in 1833. Locally sourced coal fuelled the smelting operations. Production at Fitz Roy was intermittent and declined in the latter part of the nineteenth century due to cheap imports from Britain, and was finally abandoned in 1910. More successful were the iron works established in 1875 near Lithgow, a small town 160 kilometres north west of Sydney in the centre of the Western Coalfield. These works had the advantage of a cheap and abundant coal supply, and well as government assistance and owners with “tenacity and optimism” in its later years of operation. Nevertheless, like other

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204 Pearse, McKnight and Burton, p. 26.
205 Saddler, p. 51.
attempts of inland production of iron, Lithgow suffered from being dependent on rail and being distant from coastal ports.  

Newcastle’s early industrial heritage was continued when the city became the location of the first large scale iron and steel smelting operation in Australia, operated by BHP, beginning in 1915. The site at Newcastle had been granted to the company in 1912 by the New South Wales Government. Iron ore was shipped from BHP’s deposits in South Australia, limestone flux came from northern Tasmania, and coal for the coke ovens was sourced locally. Three tonnes of coal was required to produce one tonne of steel at the time, so it was economical to bring iron ore to coal. The company could be confident that the works were a sound investment considering production at Lithgow was only able to supply a small fraction of the growing market for iron and steel in Australia; mostly demand was met by imports from Britain, Europe and America.

The BHP works opened less than a year after the outbreak of World War I. Newcastle’s metal output was thus well placed to supply local armaments production, and take over those markets interrupted by wartime trade restrictions. The federal government imposed high tariff barriers when the war ended and imports resumed, which helped to protect domestic production through the 1920s. In 1926 the Hoskins family that operated the Lithgow works formed the Australian Iron and Steel Company and moved their operations to Port Kembla in Wollongong — near New South Wales’ other notable coastal coalfield.

In 1935 BHP also took over Port Kembla, and with a near monopoly in steel production both north and south of Sydney, the company was again well-positioned to manufacture key weaponry and other components for the World War II effort. In addition, the 30,000 tonnes of coal used weekly to produce coke for the blast furnaces yielded important by-products, including tar, benzol, ammonia and naphthalene that substituted for restricted imports of bitumen, oil and fertilisers. By this time BHP had also opened steelworks at Whyalla in South Australia. South Australia’s BHP Indenture Act was enacted in 1938, and by 1941 the Whyalla blast furnaces became operational, producing a new ship for the Royal Australian Navy in its first year.

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209 Diamond, p. 37.
210 Wills, pp. 209–211.
211 Doran, p. 55.
212 Wills, pp. 209–211.
213 Diamond, pp. 37–38; Wills, p. 211.
By the end of the 1930s, production of iron and steel in Australia had reached more than twice the highest pre-depression level of output. The industry provided an increasingly significant and reasonably stable market for coal in the interwar years. For instance, around two million tonnes of coal was processed into coke for iron and steel manufacture in 1937, representing one sixth of Australia’s total black coal output, and one fifth of New South Wales’ coal production. By the early 1950s, the quantity of coal going to the iron and steel industry was greater than that going to fuel railway locomotives, and second only to electricity.

**Conclusion: In coal’s image**

The birth of Australia’s coal industry in the early stages of colonisation established some long-enduring patterns, displaying a mix of influences from Britain, the new colony, and political economic dynamics around coal more generally. The importance of coal as a commodity for local industry, export and economic growth was immediately recognised by the British arrivals. But certain characteristics of the antipodean industry were unique to the circumstances. For instance, the state had a strong hand in the development of the Australian coal industry beginning in the convict era, and coal exports were enthusiastically pursued as a means for raising revenue and supplying other nodes of the British Empire.

As was the case in many other parts of the world, coal became increasingly laced through Australian society over the nineteenth and early twentieth centuries. Coal provided the carbon and energy for industry, it helped move people and products around the vast, sparsely populated continent, and generated the bulk of electricity. As elsewhere, industrial conflict went hand in hand with coal production for the first one and a half centuries in Australia, setting up early examples of coal contestation.

The longer history of coal in Australia is critical for making sense of the proposed coal developments in the Galilee Basin in the twenty-first century. The first 150 years of coal production and consumption laid the foundations for events and trends in the second half of the twentieth century, with Queensland becoming a major coal producing state, coal becoming one of Australia’s most economically important commodities, and the expansion of the coal industry gaining enormous momentum on the back of global economic growth. These issues are taken up in the following chapter.

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215 Shaw and Bruns, pp. 34–35.
216 See data and graphs: Elford and McKeown, p. 4; Hartnell, p. 55; Shaw and Bruns, p. 7.
Chapter 7

COAL SOCIETY

In the second half of the twentieth century the Australian coal industry broke from many of the features that had characterised it over the previous 150 years. Australia’s coal resources became entangled in the global story of growth, fostered by the rationalisation and mechanisation of the industry beginning in the late 1940s. Open-cut production became more common, export markets were secured and boomed, and Queensland became Australia’s largest black coal producer. In this process, Australian governments became ever more dependent on revenue raised from coal mining and export. By the late twentieth century, the coal lobby had made inroads to the heart of Australian policy development and decision making. This period in Australia’s history exposes the continuing story of coal-centred development and the extent to which the coal technology, power and politics has become entrenched in modern Australian society and economy.

A remarkable half century

Environmental historian John McNeill claims that in terms of environmental change “there has never been anything like the twentieth century”. Unique to this period is what McNeill identifies as the “screeching acceleration”, and what others have called the “great acceleration”, of mostly much older patterns of human activities on Earth. The decades since the end of World War II have seen the most dramatic changes. The combined effect of growth in human population, economies and energy consumption have resulted in exponential increases in measures as diverse as fertiliser consumption, international tourism, numbers of dammed rivers, McDonald’s restaurants, and telephones. There have also been corresponding exponential rates of decline in measures of environmental health including deforestation,

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1 J. R. McNeill, *Something New under the Sun*, p. 3.
species extinction, collapse of fisheries, ozone depletion, increases in atmospheric greenhouse gases, and incidence of major floods.4

The increased consumption of energy has been a major part of the story of global environmental change, and coal has played a prominent role. Over the course of the twentieth century global energy use grew by an order of magnitude, from around 44 to over 380 exajoules. The rate of increase was greatest in second half of the century, consistent with the characterisation of the period as a time of massive expansion. Coal provided a third of total energy over the century, the largest share of all sources. It remained the dominant fuel up until the 1960s when oil took over.5 Since 2000, global coal consumption has grown more rapidly than all other fuels, and is projected to again be the largest source of energy by 2017.6

Coal was also critical in the production of steel, a backbone for industrial growth over the second half of the twentieth century. World steel production increased from less than 200 million tonnes in 1950 to around 850 million tonnes in 2000, and there was another substantial increase to 2010, when around 1,400 million tonnes of crude steel was produced.7

The quantity of coal used by the global steel industry between 1950 and 2010 was at least 22 billion tonnes,8 which is enough to fill a coal train wrapped around the globe at the equator nearly 100 times.9

The cumulative impact from centuries of coal combustion on the global environment also became better recognised in the latter half of the 1900s. It is now understood that coal has contributed significantly to the challenge of several “planetary boundaries”, boundaries which

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8 Calculated using data from World Steel Association (formerly International Iron and Steel Institute); and assuming that only 70% steel produced between 1950 and 2010 was in Basic Oxygen Furnaces (which uses coke directly) and not taking into account steel produced in Electric Arc Furnaces, much of which would rely on coal-fired electricity, and assuming around 770kg of coal are require to make one tonne of steel, as stated by World Coal Association, ‘Coal and Steel’.
9 Calculated on the basis that one coal wagon carries 100 tonnes of coal, and 100 wagons extend around 1.76km, and that the circumference of the globe at the equator is 40,075km, based on information from: Queensland Government, *Railings Queensland's Coal: A New Era for Queensland’s Coal Export Industry* (Queensland Government, May 2010), p. 3; and Fraser Cain, ‘Circumference of the Earth’, *Universe Today*, 2009 [http://www.universetoday.com/26461/circumference-of-the-earth/].
delimit “safe spaces” of human activity within planetary limits. In this respect, coal’s planetary transgressions relate to climate change, ocean acidification and chemical pollution — in the latter case, coal is the largest single source of anthropogenic emissions of mercury. The climate implications from using coal and other fossil fuels to date are so large as to be the key defining feature of a new hypothetical geological Epoch, called the Anthropocene.

Researchers Libby Robin and Will Steffen explain that the Anthropocene defines the “momentous and historical change in circumstances whereby the biophysical systems of the world are now no longer independent of the actions of people”. Paul Crutzen, the Nobel-prize winning chemist who coined the term, identified the rise in atmospheric CO₂ — revealed by air trapped in polar ice which coincided with the first coal-powered steam engine in latter part of the eighteenth century — as marking the beginning of the new Epoch. Although others have argued for onsets from different periods.

Quarry Australia

Successive Australian governments were enthusiastic to align the nation’s mineral wealth with the burgeoning global appetite for resources in the second half of the twentieth century. In this pursuit they were able to build on a significant earlier history of mining.

Australian mineral exports began with coal in around 1800 and significant quantities of copper, gold, lead, silver and tin were mined over the following 100 years. Gold was so abundant that it dominated Australian export earnings between 1851 and 1870 and remained important in the following decades. With the exception of gold, there was something of a hiatus in mining from the 1920s until the late 1940s, at which point Australia entered a two decade-long boom and from which time mining and related industries have regularly contributed the majority of

15 Note that this is also a title of a book from 1982 Quarry Australia?: Social and Environmental Perspectives on Managing the Nation’s Resources, ed. by Robert Birrell, Doug Hill, and John Stanley (Melbourne: Oxford University Press, 1982).
16 Blewett, pp. 385–387; Blainey; Doran, p. 52.
17 Doran, p. 47; Blainey, p. 61.
Australia’s export earnings, taking over from agriculture and manufacturing.\textsuperscript{18} Exploration for minerals by mid-century was no longer characterised merely as an occupation for self-made prospectors roaming the outback. From around that time, company-employed specialists began undertaking increasingly expensive and technologically advanced explorations. A novel mix of minerals was discovered and developed, including uranium, bauxite, iron ore, manganese and nickel, fitting for an era of new consumption demands and patterns.\textsuperscript{19}

In 1946 a new federal government agency was established — the Bureau of Mineral Resources, Geology and Geophysics (known as BMR) — with the objective of mapping the continent “to assist industry to uncover new mineral and energy resources”.\textsuperscript{20} The agency was renamed the Australian Geological Survey Organisation (AGSO) in 1992, and merged with the Australian Surveying and Land Information Group (AUSLIG) in 2001 to become Geoscience Australia.\textsuperscript{21} The stated objectives of Geoscience Australia are much the same as the original post-war BMR, although are now couched within twenty-first century policy language:

Geoscience Australia provides geoscientific advice and information to the Australian Government to support it to deliver its priorities. We also provide geoscientific information to industry and other stakeholders where it supports achievement of Australian Government objectives.\textsuperscript{22}

Australian governments variously found other ways to assist mining and mineral processing endeavours, and to safeguard resources for domestic use over the past century. Intervention has come in a number of forms, including subsidies for exploration, import tariffs, infrastructure support and tax concessions.\textsuperscript{23}

Over the course of the twentieth century mining was seen by some as a way to claim “empty” land, especially in Australia’s north.\textsuperscript{24} But more fundamental and pervasive has been the adherence to an ‘ideology of development’, which can be understood as the belief in, and

\textsuperscript{18} Blewett, p. 384; Brian Galligan, \textit{Utah and Queensland Coal: A Study in the Micro Political Economy of Modern Capitalism and the State} (St. Lucia, Qld: University of Queensland Press, 1989), p. 35.

\textsuperscript{19} Blewett, pp. 388–389.


\textsuperscript{24} Burnside, p. 176.
promotion of, industrial growth as a vehicle towards progress. ‘Developmentalism’ often takes
the form of resource extraction, the building of power stations, manufacturing and processing
plants, but also includes the infrastructure and governance mechanisms that support industrial
establishment, growth and operation.25 From this view, land, water, minerals, trees and
airspace are generally regarded as expendable in the pursuit of the betterment of human
lives.26 Mining fitted neatly into this underlying ideology in the post-war years, as it still does
today. In working towards the lofty goal of ‘nation-building’, the development of the mineral
sector was seen as a way that could help Australian industrialise and move away from its
dependence on wool and wheat. It was also a broad vision supported by the political left and
right, and capitalists and workers alike.27

The twentieth century story of mineral growth in Australia is exemplified by the case of iron
ore. An erroneous belief that Australia suffered a shortage of iron reserves led to an embargo
on iron ore exports beginning in 1938. When the ban was lifted in the early 1960s, the vast
reserves of iron ore in Western Australian were available for exploitation. Leading the charge
was Lang Hancock, who claimed to have discovered iron in the Pilbara late in 1952, when he
and his wife Hope were forced to fly low over the Hamersley Ranges in bad weather. He
described encountering a gorge that looked like “solid iron” from the vantage point of his light
plane. He kept his find quiet, but spent the following decade lobbying to get the export ban
lifted, at which point he staked a claim.28

In fact, Western Australia’s iron reserves had been noted 60 years earlier. Englishman Harry
Page Woodward, colonial geologist in the west, recognised and described the Pilbara’s
valuable iron ore deposits in a report published in 1890, noting that “... this is essentially an
iron ore country. There is enough iron ore to supply the whole world, should the present
sources be worked out”.29 Nonetheless, Hancock’s story of discovery is commonly recounted
and the iron ore of ‘Hope Downs’ is part of the portfolio of projects held by Gina Rinehart,
Hancock’s daughter. She also has significant coal interests in the Galilee Basin.30

25 Jillian Koshin, ‘Shifting Visions: Developmentalism and Environmentalism in Australian History’,
Australian Studies, 3 (2011), p. 2; Aynsley Kellow and Simon Niemeyer, ‘The Development of
Environmental Administration in Queensland and Western Australia: Why Are They Different?’,
26 Koshin, p. 2.
27 Burnside, pp. 175–176; Koshin, p. 2.
28 Blewett, p. 463.
463; also see Neill Phillipson, Man of Iron (Melbourne: Wren, 1974).
By 2010, Australia became the world’s largest producer and exporter of iron ore. Annual production increased from less than 7 million tonnes in 1965 to over 520 million tonnes in 2012. Exports grew from zero in the early 1960s to being ranked as the nation’s top export earner in 2010. More generally, since 2010 the resources and energy sectors have contributed around 60% of Australia’s export earnings, and up to 10.1% of Australian’s gross domestic product. Iron ore and coal dominate mineral exports, followed by gold, liquid natural gas, oil, alumina and aluminium, copper, nickel, zinc and uranium. The phenomenal growth of the Australian iron ore industry in the second half of the twentieth century is closely linked to a similar revolution in the coal industry.

Renewing coal in Australia

In the period between the First and Second World Wars, the Australian coal industry is generally understood to have been “retarded by antiquated [mining] methods and poor industrial relations” (as detailed in the last chapter). From an international perspective it was regarded as being “backward” for a capitalist economy, apparently unable to adopt the technical changes occurring in comparable countries such as Germany, the UK and US. By the mid-1960s Australia had become a world leader in the industry. Military threats during World War II had an industrialising influence on Australia as the country bolstered its internal resources and defences. That trend continued over the following decades. After World War II the Australian coal industry not only stabilised, but production grew exponentially. Increases in the production and consumption of coal in Australia closely matched the pattern of unprecedented growth in resource consumption globally. In the 150 years up to 1950, less than 800 million tonnes of black and brown coal was produced. In the following sixty years the figure was close to 11 billion tonnes.

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35 Doran, p. 68.
36 Gibson, p. 227.
37 Pearse, McKnight and Burton, p. 25.
38 Includes black and brown coal, figures from Mudd, *Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future*. 
Between 1950 and 2011-12, Australian annual production of black coal grew from less than 18 million tonnes to around 360 million tonnes — a twentyfold increase. Annual brown coal production increased from less than 8 million tonnes to over 73 million tonnes — a ninefold increase. And by the end of the period black coal exports reached 300 million tonnes, which was more than 100 times larger than the pre-1950 peak of 2.7 million tonnes in 1907 (see Figure 7.1). The increased production of coal was absorbed by a growing domestic population and expanding export industry, as well as increasingly energy dependent society; Australian annual per capita consumption of black coal rose from around two to around three tonnes between 1950 and 2010. There were also significant shifts in the way that coal was consumed over the course of the twentieth century in Australia.

![Figure 7.1 Australian coal production and export, 1950–2009](http://www.bree.gov.au/publications/aes-2013.html)

*Source: Created with data from Mudd 2009 and 2011*

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41 Gavin. M. Mudd, *The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future* (Victoria, Australia: Department of Civil Engineering, Monash
Coal for Australia

In 1946–47, one year after the end of World War II, electricity generation became the largest use of Australian coal for the first time — accounting for around 22% of saleable coal,\(^42\) and taking over from the railways which had previously been the biggest consumer of coal. Nearly one third of all coal produced in Australia had been burnt in locomotives in 1933–34, but the quantity was negligible by the end of the 1960s, by which time diesel had been widely adopted.\(^41\) Exploration for coal resources was vigorously pursued by government bodies in New South Wales in the late 1940s and 1950s, including the State’s Electricity Commission which also began to develop coal deposits. Concurrent private coal exploration in New South Wales in the 1950s was focussed on meeting the needs of the steel industry, while the lack of a local steel industry and a limited domestic market in Queensland helped to align its coal future to export markets in the 1960s.\(^44\)

The trend towards increased coal-fired electricity generation in Australia continued,\(^45\) such that the proportion of coal used to produce iron and steel shrunk noticeably (although the quantitative decline was less significant). In 1970 electricity accounted for 51% of black coal used in the country, with iron and steel taking up 32%. In 1980 two thirds of all coal used in Australia went towards generating electricity, and 22% went to iron and steel.\(^46\) By 2005-2006 the share of domestic coal use deployed in power stations was over 85%, with less than 6% used for iron and steel production. Altogether, the quantity of black coal used for iron and steel, cement and other uses within Australia has not varied greatly over the past thirty years, ranging between ten and thirteen million tonnes.\(^47\)

The demand for brown coal similarly grew over the period, mostly in Victoria where local brown coal reserves provide the power for that state’s electricity. Roughly half as much electricity has been generated from brown coal as from black coal in Australia in recent years,\(^48\) but somewhat surprisingly, there have been larger quantities of brown coal than black coal used for this purpose since before the mid-1980s.\(^49\) This is owing to brown coal’s high

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\(^{43}\) Shaw and Bruns, p. 7; Hartnell, p. 55; Saddler, p. 62; in Queensland electricity took over from the railways as the largest consumer of coal in 1951, see Queensland Coal Board, p. 16.


\(^{46}\) Table O, Bureau of Resources and Energy Economics, *2013 Australian Energy Statistics*.

moisture content and low energy concentration, which is less than half of that of bituminous coal.  

The generation and supply of electricity in Australia has been one of the most prominent ways that the state has been involved in the coal industry during the twentieth century. The enormous capital costs of power stations, transmission grids and distribution networks, as well as the electoral appeal of providing cheap, reliable and abundant energy were probably significant factors behind state governments taking control of electricity supply in the first half of the century. Independence in the provision of fuel for electricity has been a goal of most State Electricity Commissions, although there are varying arrangements within each state. For instance, the New South Wales Electricity Commission owned and operated the mines that generated coal for electricity generation, whereas in Queensland, private mining companies provided the Electricity Generation Board with all the coal required for its uses.

### Coal for the world

At the same time that coal was further penetrating Australian economy and society through electricity generation and the manufacture of industrial products, Australian coal was beginning to drive industrial growth in other countries. Australia has a relatively small human population (in 2014 it is roughly the equivalent to that of Taiwan), on a large landmass not much smaller in size than Brazil (which has a population nearly nine times the size of Australia's), and holds around 7% of the world's black coal resources. These rare circumstances put Australia in a position to export greater quantities of natural resources than it consumes domestically.

Australian black coal exports began to rise consistently from the end of the 1950s. The acceleration was gradual at first and then more rapid from the early to mid-1960s. By 1973–74, under the Whitlam Federal Government, there was more Australian black coal being shipped off-shore than was being used within the country (see Figure 7.1). In 1975–76, coal had become the largest mineral export earner, representing 11% of total national exports. The growing exports of coal in this era were unmistakeable in the transition of the broader

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51 Saddler, pp. 111–114.
53 Huleatt, p. 54; Bureau of Resources and Energy Economics, 2013 Australian Energy Statistics.
Australia is getting a record income from minerals and that will continue. It will offset the export income drops which unfortunately will occur in respect of wool and meat. For the future Australia will not be riding on the sheep’s back; it will be riding in the coal truck. We expect on the basis of negotiated contracts to get $1,440m for our coal exports next year. That is an increase of $616m on what we got last year. It will be a record for a single individual export item.  

The perceived vastness of Australian coal reserves has generated a virtual silence on the question of whether there is a need to preserve a supply for domestic use. As energy analyst Hugh Saddler commented in the early 1980s “the policy has been to export as much coal as could be sold”. Prime Minister Tony Abbott confirmed that such a view still prevails thirty years later. Speaking at a Minerals Industry dinner at Parliament House in May 2014, Abbott stated that “it is our destiny in this country to bring affordable energy to the world”, and that there are “few things more damaging to our future” than leaving Australia’s coal deposits in the ground.

Nonetheless, in the early 1980s there was at least some discussion about the merits of reserving coal deposits with particular characteristics for particular purposes, with a view to rational and efficient exploitation for the national interest. In the 1970s the Miners Federation also expressed strong concerns about the imbalance between open-cut and underground extraction in Queensland. It saw the dominantly foreign-owned companies guilty of “using vandal methods to rip out the easily-accessible outcrop of top-quality coking coal... by low-cost open-cut mining...”. At stake was the greater proportion of the coal resource available only through more expensive underground extraction methods. Prime Minister Gough Whitlam closely echoed these sentiments, concurring that the dominance of open-cut

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56 Saddler, p. 110.


59 Australasian Coal and Shale Employees’ Federation, *Australia Undermined: Coal in Crisis*, A Miners’ Federation Publication (Sydney: Australian Coal & Shale Employees’ Federation (Miners’ Federation), 1972), pp. 3–4; also see Pete Thomas, pp. 303–305.
production in Queensland jeopardised the affordability of coal for Australian industry and long-term export capacities. Queensland stood in contrast to New South Wales at the time which, under the Joint Coal Board, enforced some level of restraint on open-cut mining.60

Australia’s metallurgical coal (also known as coking coal) led the growth in black coal exports, driven by Japan’s post-war demand for steel.61 It began with a trial shipment of 9,000 tons (9,144 tonnes) of coking coal mined in the Burragorang Valley of New South Wales, which was followed by three Japanese survey missions between 1957 and 1965. By 1966–67 Japan received over 95% of Australia’s exported coal, amounting to over eight million tonnes.62 In the 1960s this new Asian trading partner displaced the United Kingdom as the largest recipient of Australian exports.63 By the late 1970s, Japan even proposed forming a ‘Pacific Basin Economic Community’ in which the resources of Australia and Brazil would be developed using Japanese capital and technology to industrialise East Asia.64

Diversified uses of coking coal largely made up for a decline in global steel production in the mid-1970s. By this time there was also a significant resurgence in interest and demand for thermal coal in response to the quadrupling of oil prices during the 1973–74 oil supply crisis, which was only reinforced by the second crisis of 1979–80.65

The industrialised world soon recognised the need for a coordinated strategy to overcome the significant threat posed by the tactics of the Organisation of Petroleum Exporting Countries (OPEC) of imposing oil price increases. Continued economic growth of affluent industrialised countries was at stake. Substitutes for OPEC oil needed to be found and new energy generation technologies needed to be developed. In the interim period, coal was seen as the solution — characterised as an ‘energy bridge’.66 In effect, there was a structural shift in coal demand as a consequence of the oil shocks, with thermal coal joining metallurgical coal as a major globally traded commodity.67 The global swing to coal was also reinforced by substantial public anxiety about nuclear power, which was only heightened by the partial melt down of the Three Mile Island nuclear reactor in 1979 and the explosion at Chernobyl in 1986. Within

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61 Huleatt, p. 53.
62 Hartnell, pp. 57–58.
63 Department of Foreign Affairs and Trade, Merchandise Exports and Imports: One Hundred Years of Trade (Canberra: Department of Foreign Affairs and Trade, 2002), p. 2; Australian Bureau of Statistics, Year Book Australia: No.83, 2001, 2001, pp. 1036–1037; Burnside, p. 175.
66 Birrell, pp. 5–6.
67 Fisher, p. 194.
Australia, there were both social and safety concerns acting as impediments to mining and exporting the country’s substantial uranium deposits.68 The international discussions about meeting global energy demand saw Australia come under significant pressure to increase its production and export of coal. One of the first indications came in the 1977 ‘World Energy Outlook’ report by the Organisation for Economic Co-operation and Development (OECD), in which it was observed that Europe and Japan were not in the US’s position of being able to increase their own oil production. The report identified the “ample” coal reserves in the US, Australia, Canada, South Africa and some developing countries as being able to make up for the anticipated short-fall in energy availability, although was cautious in its assessment of the economic viability of such a move. In the same year, the Japanese Ministry of International Trade and Industry published a report on the country’s long-term energy supply and demand. It outlined the construction of new coal fired power plants fuelled by Australian thermal coal as one option to meet the country’s increasing energy requirements while cutting costs.69

In 1979 Australia became a member of the OECD’s International Energy Agency (IEA), by which time the agency was advocating an expanded role for coal in meeting world energy demands in the medium to long term.70 Also in 1979, leaders from Canada, France, Germany, Italy, Japan, the UK, and the US gathered in Tokyo for the Seven-Nation Economic Summit. With strikingly similar language to OECD statements, they pledged to:

... increase as far as possible coal use, production and trade, without damage to the environment. We will endeavour to substitute coal for oil in the industrial and electrical sectors, encourage the improvement of coal transport, maintain positive attitudes toward investment for coal projects, pledge not to interrupt coal trade under long-term contracts unless required to do so by national emergency, and maintain, by measures which do not obstruct coal imports, those levels of domestic production which are desirable for reasons of energy, regional and social policy.71

By the late 1970s, Carroll Wilson from the Massachusetts Institute of Technology, had also initiated and was coordinating an intensive eighteen-month international investigation into the “role that coal might play in meeting world energy needs” over the subsequent two decades.72 The World Coal Study was a collaboration of private and public sector interests

69 Fisher, p. 195.
70 Fisher, p. 197.
from sixteen major coal-producing and coal-using countries. Several prominent Australian coal companies and numerous State and Commonwealth Departments had either supported or been actively involved. The study culminated in the publication of its final report in 1980, finding that “a massive effort to expand facilities for the production, transport, and use of coal is urgently required to provide for even moderate economic growth in the world between now and the year 2000”. The study acknowledged various environmental concerns associated with coal combustion, noting recent international discussions on global warming and the role of carbon dioxide in driving climate change. It was also recognised that coal emits more carbon dioxide per unit of energy compared to oil and gas. It was nevertheless decided by the study’s participants that “there is time to conduct the necessary further research on the possible effects of CO₂ from fossil fuel combustion on climate” and that:

...the present state of knowledge about CO₂ effects on climate does not justify action to limit or reduce the global use of fossil fuels or delay the expansion of coal use even if a mechanism for such concerted actions by all nations were available.

The study had calculated that to meet world demand for energy up to the turn of the millennium, world coal production would need to increase 2.5 to 3 times and global coal trade by 10 to 15 times. It was anticipated that coal would provide between one half and two thirds of the additional demand for energy over the subsequent two decades. Australia and the US were identified as the countries most able to provide for the increased global coal demand, with Australia foreseen to produce between 160 and 200 million tonnes for the export market by 2000, up from its 1977 production total of 38 million tonnes. There was a flavour of valiant duty in the way that Australia’s role was framed as one of the very few countries in a position to contribute substantially to global coal trade, and the need to consider an increased range of global markets. For instance, one commentator remarked:

This places a responsibility on Australia to assist in meeting global needs and means that Australia must therefore consider all markets around the world while still recognising the pre-eminent importance of the major growing markets on the western rim of the Pacific.

State and federal governments in Australia rose to the significant mobilisation task at hand, encouraged along by international commercial and political interests. Those opposing or critical of the vision of Australia’s future being tied to increased extraction and export of the

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73 See Carroll L. Wilson, pp. xi–xix.
74 Carroll L. Wilson, p. xvi.
75 Carroll L. Wilson, pp. 31–32.
76 Carroll L. Wilson, pp. xvi–xvii.
77 Carroll L. Wilson, p. 111; also cited in Birrell, pp. 6–7; South Africa was also originally regarded as a likely source of coal exports, before it imposed an export limit of 80 Mt per year. See Vine, p. 109.
78 Vine, p. 109.
nation's mineral wealth stood little chance against the weight of dominant ideological justifications, economic pressures and corporate beneficiaries.\(^7\) By 1990–91 coal exports had grown to the point of becoming Australia's largest export earner,\(^8\) a position that has only been challenged by iron ore in recent years. By 2000–01, 193.5 million tonnes of coal were shipped from Australia's export ports, and the 200 million tonne benchmark was surpassed by 2002–03.\(^8\) The trend of increasing coal exports has only accentuated up until the present time, with over 80% of black coal production being exported since 2008,\(^8\) amounting to 336 million tonnes in 2012–2013.\(^8\) Indonesia is the only other country that has rivalled Australia as the world's top coal exporter in recent years (see Figure 7.2).\(^8\)

![Figure 7.2 Average annual world coal exports, 2005–2011](source: Created with data from BREE 2013\(^8\))

Besides reinforcing the conventional uses of coal, the 1970s oil price crisis also sparked serious consideration of a broader application of coal energy. Most notable were initiatives to produce synthetic liquid fuel from coal. There were global efforts to develop the technology and assess national resource capacities, and the Australian Government was eager to be positioned on the leading edge of developments. In the late 1970s Australia’s Department of National Resources was promoting the development of coal-to-liquid fuel technology, with particular interest in the potential for Australia to become a major exporter of coal-based fuels.\(^8\)

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\(^7\) Birrell, pp. 7–8; The arguments against the dominant vision were powerfully summarised in Birrell, Hill and Stanley.


\(^8\) Birrell, p. 7; Bureau of Resources and Energy Economics, *2013 Australian Energy Statistics*.

\(^8\) Huleatt, p. 54; Bureau of Resources and Energy Economics, *2013 Australian Energy Statistics*.


\(^8\) Bureau of Resources and Energy Economics, *Resources and Energy Statistics 2013*, p. 48..
Development and Energy joined with Germany's Ministry of Research and Technology to study the feasibility of producing liquid fuels from selected Australian coals. Germany's extensive experience in developing liquid fuels from coal beginning in the early twentieth century, and its reliance on the product during World War II, gave it significant authority in the joint endeavour. Unlike its position on coal more generally, the Australian Government was concerned from the outset that any synthetic fuel production in Australia should meet domestic needs first and foremost, and policy was designed to reflect this. Australia is still actively pursuing a coal to liquids program in 2014, as part of the government's push for 'clean coal' technology.

The oil shocks of the 1970s also had the effect of accelerating the strategy of large multinational oil companies diversifying into other energy resources, including coal. For instance, in 1977 it was reported that 44% of the coal reserves in the US were controlled by oil and gas companies. Some of the very wealthy and powerful companies also invested in Australia, including Shell, BP, Exxon, Texaco and Standard Oil, and smaller ones such as Houston Oil & Minerals, Atlantic Richfield and Howard Smith. The activity of these companies in Australia helps to explain the fourfold increase in capital investment in coal development between 1972–73 and 1975–76, which amounted to over $100 million in the latter year. Due to their wealth and power, these companies were treated with high degrees of suspicion both in Australia and abroad.

These various international forces and developments coordinated with political, cultural, economic and legislative changes within Australia to enable growth of the coal industry.

Factors enabling growth

The remarkable growth in Australia's coal sector after the mid-twentieth century was not only facilitated by the phenomenal rise in global demand, but also by substantial changes in Australia's ability to produce and supply coal to domestic and international markets. There were a number of dimensions to these changes, related to the shifting dynamic between state

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88 Farrell.
90 Pete Thomas, pp. 444–460.
91 Fisher, p. 194.
92 Pete Thomas, pp. 444–460.
and federal governments, proprietors, workers, technology and global markets, and characteristics of individual state industries.

State intervention

In the early 1950s the New South Wales Coal Board expanded on the programme it had started in the latter half of the 1940s towards increasing efficiency and improving relations in the industry (as summarised in the previous chapter). Queensland’s implementation of extensive control over its coal industry in the 1930s was a notable precursor to the later New South Wales and Federal initiatives. However, the intervention and reorganisation of the coal industry by the state beginning in the late 1940s was greater in scope than any previous similar effort to intervene in Australian industry. It followed decades of discussion and various forms of state involvement and control of the coal industry that can be traced back to the earliest colonial attempts of establishing a coal industry in Newcastle in 1801.

Historically, one of the main avenues for state involvement was through the implementation of conciliation and arbitration, aimed at controlling production processes and managing industrial conflict. It had first been introduced in the 1890s, but was made compulsory in New South Wales from 1901. Other examples of state involvement included ownership of mines and electricity generation and distribution, and the passing of health and safety legislation. But despite various attempted measures, there remained a seemingly intractable set of problems in the coal industry, marked by intermittency of work, unemployment, a low rate of return on mining investment, inability to meet demand and an unmatched history of industrial struggle. Several prominent reports argued the case for yet stronger state intervention. For instance, the 1919 report from the Campbell Commission on the New South Wales coal industry concluded that even though the production and trade in coal was largely in private hands, “... not even the most bigoted advocate of individualism could deny that the interests of the State, and the public are vitally involved in the management both of the industry and the trade”.

A more in depth analysis came a decade later, in 1929, when University of Melbourne economist Frank Mauldon’s book *The Economics of Australian Coal* was published. Mauldon advocated state intervention, at least in the short term. The 1929 Royal Commission on Coal

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93 Fisher, pp. 75–76; also see Queensland Coal Board, p. 15; Dunne, pp. 331–334.
94 Fisher, pp. 25, 67–79; see also Gibson.
95 Fisher, pp. 77–78.
96 Fisher, pp. 77–78, 144.
97 Quoted in Fisher, p. 79.
in New South Wales also recommended an active role for the state in ensuring efficient and effective management of the system of private ownership of the coal industry. It proposed the establishment of a Board, vested with both state and federal powers, to have a broad suite of responsibility over economic and industrial issues in order to address over-capacity and over-manning, and the entrenched culture of antagonism between miners and owners in the New South Wales coalfields.

Conservative governments and coal owners alike were hostile to suggestions that a government body with such far-reaching power was needed. Finally though, the extraordinary circumstances of wartime “demonstrated the need for controls and also made possible the winning of national controls on the peacetime industry”.99 With Labor in power at the Federal level, in Queensland and New South Wales, the joint Coal Industry Acts were passed in 1946.100 The Acts gave the Joint Coal Board wide ranging powers, including the control of prices and output, in order to solve the ‘coal problem’.101

By the end of 1952, coal shortages had been resolved and an end to coal-gas shortages was foreseeable. Since the late 1930s there had been a constant sense of vulnerability in fuel security, as noted in the Coal Board’s 1951–52 report: “for the first time... Australia is reasonably assured of an adequate supply of its basic fuel at least for the next few years”.

The Coal Industry Tribunal that was established alongside the Joint Coal Board also proved to be more successful in dealing with industrial tensions than any preceding agency.103 However, the challenges for the coal industry were not over. From 1953 until 1963 the industry entered a phase of excess capacity; more coal was being mined than what could be taken up by demand, forcing mine closures and price competition. This was also a problem in the early 1970s and 1980s. The over-supply of coal was largely the result of diminished markets for coal, as new Australian refineries added petroleum-derived fuels onto the domestic market from about the same time that liquid fuelled transport began to seriously compete with coal-fired steam trains and ships. The supply of hydro power from the Snowy Mountains scheme and other sources in the mid-1950s also had an impact. The other major factor was mechanisation of the coal mines which had increased the productive capacity of the

99 Fisher, p. 84.
100 Fisher, p. 88.
101 Fisher, p. 144.
102 Quoted in Ellis, p. 241; see also The Coal and Lignite Panels of the Power Survey Sectional Committee, p. 7.
103 Hartnell, p. 51.
industry. Yet despite these market dynamics, there was an increase in Australia’s total black coal production in forty-five out of the fifty years between 1960 and 2010.

The conditions that had originally allowed a strong hand of the state to be involved in the coal industry gradually changed in the two decades between the early 1960s and early 1980s. The close relationship was maintained, albeit in a changed form, whereby governments often found themselves at the behest of large and powerful corporations.

**Mechanisation and technological change**

Methods of winning coal that had persisted with only gradual modification since 1860 began to give way after 1950. Price fixing by the New South Wales Government and industry-friendly tax adjustments from the Commonwealth Government helped coal proprietors raise extra revenue to cover the costs of acquiring the latest mechanical technology. In 1954 a long-standing industrial dispute over mechanical extraction of coal pillars in underground operations was also resolved in favour of further mechanisation. Continuous miners, mechanical cutters, shuttle cars and conveyor belts helped to modernise underground coal mining in the 1950s, and by the 1960s long-wall mining methods were being introduced in New South Wales, although had operated in a few Queensland collieries from at least the 1940s. Coal washeries also became more common, helping to improve the quality of the saleable coal.

Despite the influx of machines, some underground operations retained vestiges of age-old practices well into the second half of the twentieth century. Horses and ponies had been increasingly important beasts of burden for hauling coal in British mines after women’s and children’s labour was banned in 1842, and had been used in Australia since the early 1860s. Horses continued to haul coal in Australian underground coal mines in the 1970s and...

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107 Gollan, p. 235.  
109 Hartnell, pp. 45–47; Gollan, p. 237; Dunne, p. 329; Menghetti, ‘From Underground to Opencut’, p. 354. Menghetti implies that long-wall mining had commenced in at least the 1940s when she says that long-wall mining was contemporaneously being practiced at other Queensland mines as bord and pillar methods at Blair Athol, and that underground mining ceased at Blair Athol in 1946, see pp. 354, 365.  
110 Hartnell, p. 46; The Coal and Lignite Panels of the Power Survey Sectional Committee, p. 10.  
112 Ellis, pp. 102, 139.
80s in New South Wales, and possibly into the 1990s in Collinsville, Queensland. The last two pit ponies in Britain retired only in 1999.

By 1966–67, fully mechanised underground coal mines accounted for around 94% of underground production in New South Wales, and around 85% in Queensland. The changes in underground mining, most notably the adoption of machines, led to significant increases in productivity and reduced numbers in the workforce. The average ‘output per man-shift worked’ (OMS) in underground mines across Australia increased from 2.75 tons in 1950–51, to 5.14 in 1960–61, and 8.27 in 1966–67 (2.8, 5.2 and 8.4 tonnes respectively). In more relatable terms, Gollan explains that between 1950 and 1960 in New South Wales “nearly five million more tons was produced by five thousand less men”. Similarly, Saddler summarises the change between 1950 and 1966 as “the New South Wales industry output doubled... while employment fell 40 per cent”. Wages for the remaining mine workers increased substantially while the cost of labour to produce a unit of coal fell — in New South Wales it dropped from $2.61 per ton in 1954 to $2.01 in 1966. Industrial relations stabilised substantially as working conditions improved and occupational diseases decreased.

On top of the productivity gains in underground operations, open-cut mining contributed progressively more of the total coal output. By the latter part of the 1960s, the OMS from Australian open-cut mines was close to 20 tons (20.3 tonnes), in comparison to around 8 tons (8.1 tonnes) in underground mines. In the first decade of the twenty-first century, around 80% of Australia’s coal production was won from open-cut mines, a mining technique that was first used in Australia’s sub-bituminous coalfields in the first quarter of the twentieth century.

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116 Hartnell, p. 46.

117 Hartnell, p. 46.

118 Gollan, pp. 235–236.

119 Saddler, p. 53.

120 Hartnell, p. 47.

121 Saddler, p. 53.

122 Hartnell, p. 46.
and which became the dominant method of extraction for all coal types in the 1970s.\textsuperscript{123} Victoria’s extensive brown coal reserves had been mined using open-cut methods since the 1920s.\textsuperscript{124} Open-cut mining had been proposed at central Queensland’s Blair Athol immense black coal seam as early as 1919, with open-cut production commencing in 1937.\textsuperscript{125} In 1943 and 1944 respectively, Western Australia and South Australia began open-cut coal extraction. Open-cut pits had also been attempted in New South Wales in the early 1930s, but it was not until 1940 that a large scale open-cut production began in Lithgow.\textsuperscript{126}

The transition to mechanisation and open-cut extraction brought significant changes to the experience of mining and the social structure and culture in mines and mining communities.\textsuperscript{127} Historian Diane Menghetti recounts the experience of men from Blair Athol who lived through the changes in the 1930s and 40s. Many underground skills were also valuable in the open-cut mines, yet men interviewed also spoke about the loss of particular roles, the advantages younger men had in acquiring mechanical skills, the new above-ground workplace discomforts of glare and sunburn, and the lack of clear career paths. The loss of comradeship was also significant: “You were still mates, but not close like underground”.\textsuperscript{128}

\emph{Industrial relations in the era of coal expansion}

Following decades of constant unrest, from 1950 there was a “dramatic improvement” in industrial relations in the Australian coal industry.\textsuperscript{129} There are a range of views as to how the reduction of conflict should be interpreted. One critical view posits that “Labour was cajoled, under threat of unemployment, to accept full mechanisation and new methods of capitalist control by a seemingly neutral state body”, and which was accompanied by a “new aristocracy of labour within the Australian working class”.\textsuperscript{130} Another raises the question of whether there

\begin{footnotes}
\item[123] Mudd, \textit{Data Updated from Mudd 2009: The Sustainability of Mining in Australia: Key Production Trends and Their Environmental Implications for the Future}.
\item[126] The Coal and Lignite Panels of the Power Survey Sectional Committee, p. 7; Menghetti, ‘From Underground to Opencut’, p. 365; Keogh, ‘Coal’; Staff Reporter, ‘Challenge to Australia at Blair Athol Big New Coal Seam: Spooner “Will Do All” to Help’, \textit{The Courier-Mail} (Brisbane, Qld., 5 October 1951), p. 3.
\item[127] The Coal and Lignite Panels of the Power Survey Sectional Committee, pp. 7, 33–34, 61, 95.
\item[128] Sandy Kerr, quoted in Menghetti, ‘From Underground to Opencut’, p. 366; Menghetti, \textit{Blair Athol}, p. 191.
\item[129] Saddler, p. 53.
\item[130] Gibson, pp. 232–233.
\end{footnotes}
was a deliberate "sociological and psychological" restructuring of the industry designed to take
the militant heat out of the body of coal miners. Others instead emphasise the positive
outcome of a more contented workforce, and that the shrinkage in the number of jobs was
more or less offset by rising pay, easier working conditions, more prompt dealing with
grievances, increased amenities and improved housing.

As well as legislative efforts and tangible, physical, changes in the coal mines and surrounding
communities, there were instances of ‘soft’ power being used to influence the nature of
industrial relations. One example from New South Wales is the Coal Miner magazine,
published and distributed by the Combined Colliery Proprietors Association for twenty-four
years beginning in March 1950, with articles pitched to workers as well as their wives and
children, and with constant appeals to a moderate position on industrial issues.

Old antagonisms did not entirely disappear. In New South Wales, mechanisation, the increase
in open-cut production and export markets were new grounds for contest by the Miners
Federation, when work safety, market stability or job retention was threatened. The
Federation did not give up on its call for nationalisation of the coal industry, but there was a
tacit acceptance of some of the post-war changes evident in its response to particular issues.
For instance, it actively worked for the gradual improvement in the conditions of the miners’
working lives. It pushed the government to help displaced miners find alternative employment,
to improve conditions for the remaining miners, and to establish coal-demanding industries
that would help insulate workers from fluctuations in the market.

Industrial relations played out differently in Queensland due to a number of unique features of
the coal industry in that state. In the mid-twentieth century Queensland’s black coal
production was around 18% of that of New South Wales. The oldest coal mining district in
Queensland was in the vicinity of Ipswich, west of Brisbane, in the south-east of the state. This
coilfield predominantly consisted of small, Australian owned and long established
underground mines, providing coal for electricity generation and general industry in the
Brisbane region. The Ipswich coalfields continued to produce the majority of the state’s coal
needs up until around 1950. Only small quantities of coal had been mined elsewhere in the

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131 Fisher, p. 236.
132 Ellis, p. 252; for more detail on the Coal Board’s welfare spending see Fisher, pp. 228–236.
134 Grozier and Wright, pp. 265–268.
136 Hartnell, p. 45.
137 Saddler, pp. 107–108.
138 Ipswich Council, Coal Mining: Then & Now, Ipswich Heritage Trails (Ipswich, Qld: Ipswich City Council, 2007); Dunne, p. 328.
CHAPTER 7: COAL SOCIETY

state from the 1860s, and overall coal production was a far more geographically dispersed compared to that in New South Wales. The Queensland coal industry was also originally aimed at state sufficiency, so that the Queensland Coal Board attempted to balance supply and demand on district levels.

The numerous small coal operators in Queensland were generally unable to afford investment in mechanisation. The Queensland Coal Board’s policies designed to facilitate mechanisation were also more limited. The fragmentation of the industry prevented the formation of specialist unions and although this provided a greater potential for industry-wide unionism, the Queensland Colliery Employee’s Union had difficulty achieving it. Another major difference between Queensland and New South Wales was in regard to open-cut production. In New South Wales open-cut mining was used to buffer periods of undersupply, whereas in Queensland it was driven by a growing export trade.

The industrial conflicts related to open-cut production in Queensland have been described as “tempestuous” compared to those in New South Wales. Much attention has focussed on disputes at Queensland mines controlled by the US Utah company. In 1967, the first year of Utah’s coal operations in Australia, workers at Blackwater mine struck in retaliation to an attempt by the company to stretch production hours. This event marked the beginning of a troubled relationship between workers and management of Utah mines, with one observer noting that “from then on, Utah and industrial trouble went together”. Researcher Claire Williams draws the connection between the trouble at Utah’s mines and the highly centralised authority structure of the “American style of domination”. Kevin Hince goes further, arguing that Utah used industrial relations as a “prime means of regulating production to market requirements”.

Utah was not the only international company under scrutiny. For instance, in 1963, the American Peabody controlled mine at Moura had also faced unrest in relation to poor living conditions of the workers and their families. Five years later, an executive from the Japanese partner company Mitsui also sparked conflict when he publically criticised Australian coal miners, especially those at Moura mine, for going on strike too often.

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139 Whitmore, Coal in Queensland; Whitmore, Coal in Queensland; Dunne.
140 Grozier and Wright, p. 269.
141 Grozier and Wright, p. 269.
142 Grozier and Wright, pp. 269, 272.
143 Pete Thomas, pp. 257–259.
145 Kevin Hince, Conflict and Coal: A Case Study of Industrial Relations in the Open-Cut Coal Mining Industry of Central Queensland (St. Lucia: University of Queensland Press, 1982), p. 3.
Industrial relations were again perceived as a threat to the broader Australian coal industry in the 1980s. A long boom had subsided, and there was unrest across the minerals industry. Barry Ritchie, Chief Executive of the Australian Coal Association at the time, characterised the period as “volatile and turbulent” for the industry. In a speech at the 1987 Coal Power conference, he implored unions and coal owners to “abandon the resentments, suspicions and practices of the past”, and acknowledged that the tensions “may have been hidden by the rapidly increasing production and productivity [of the previous decades]”. He argued that Australia needed to maintain its markets for coal by increasing its competitiveness and ability to cope with price pressures over and above other coal producing countries. He envisaged new technology and automation delivering greater productivity, and promoted reductions in government takings to limit industry’s costs. But more than anything else he stressed that various components of the coal industry — the workforce, unions and management — needed to “work together for the common end of increased productivity and increased industry prosperity”, noting that “it really does look like being a case where we all hang together or we all hang separately”. Besides responding to the specific Australian context, it is possible that the UK’s bitter coal mining disputes in the mid-1980s had provided a stark reminder of underlying fractures that could dramatically split the industry.

Since the 1980s there has been a sharp decline in industrial disputes in the Australian coal industry. Statistics collected by the Australian Government show that the total number of ‘working days lost per thousand employees’ due to industrial disputes in coal mining fell from 7,844 in 1987, to 4,094 in 1997, and dropped as low as 139 in 2007. The reduction in industrial disputes in the coal sector was consistent with the pattern across all Australian mining industries over that time. With fewer industrial troubles, coal production in Australia has been able to expand relatively unimpeded by the turmoil that had dogged the industry since the mid-nineteenth century. A closer look at Queensland provides further insights into the interplay of global markets and domestic settings in the latter half of the twentieth century.

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The rise of coal in Queensland

The mining industry stands astride the Queensland economy like a colossus. In our State mining companies are the biggest and they make the most money (Jack Lunn, Queensland journalist, 1977).\(^{150}\)

Expansion of Australian coal production in the late 1960s was most marked in the state of Queensland. Production in Queensland increased 214% in the decade between 1969-70 and 1979-80, in comparison to which New South Wales’ 38% growth in coal output over the same period seems extraordinarily modest.\(^{151}\) The New South Wales’ coalfields, particularly those north and north-west of Sydney, dominated black coal production in Australia from the early years of colonisation. Even in the early 1950s, New South Wales contributed more than 75% of Australia’s total black coal output and just over 50% of all coal mined.\(^{152}\) However, New South Wales’ dominance in coal mining steadily decreased until it was finally overtaken by Queensland in the mid-1980s, which has been the largest coal producing state in most years up to the present time (see Figure 7.3). The Bowen Basin in central Queensland was the main location of coal expansion, undertaken by companies with significant capital, and with significant foreign ownership. It contrasted with earlier coal operations in Queensland, most of which had been based in the Ipswich district west of Brisbane, and which were originally developed by individuals with very little capital.\(^{153}\)

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\(^{151}\) Grozier and Wright, p. 272.

\(^{152}\) Hartnell, p. 45; The Coal and Lignite Panels of the Power Survey Sectional Committee, p. 7.

\(^{153}\) Dunne, p. 328.
Corporate trail-blazers

Opportunistic events kicked off the phenomenal growth of Queensland’s coal export industry. In 1957 the enterprising businessman Les Thiess visited Japan to purchase surplus equipment from the US Army, stationed there in the aftermath of World War II. Les Thiess and his brothers had a prospective contract to undertake major construction work for the nation-building Snowy Mountains’ hydroelectric scheme in New South Wales, and the sophisticated US machinery would help this job. The Thiess Brothers, from a family of ten boys and one girl, had started out from humble beginnings, working with a chaffcutter in the farming district of the Darling Downs in south-east Queensland in the 1920s. Their experience with machines led to a range of business pursuits, many of which involved hauling or construction.\(^\text{155}\)

By the 1940s, the Thiess Brothers were engaged in contract open-cut coal mining work in both New South Wales (for Muswellbrook Coal Company) and Queensland (for the Blair Athol Coal & Timber Co.). The brothers also operated their own thermal coal mine at Callide in central Queensland from the early 1950s. The Callide mine supplied a three year Victorian contract and one-off deals with Japan and Korea. But it became apparent to Les Thiess that they would need to find the kind of coal that Asian customers were interested in, and on his machinery-finding trip to Japan he learnt that the Japanese steel industry was very much in need of hard coal.


coking coal that could be blended with their own soft local coals. With the expertise of Dr Frederick William Whitehouse (the geologist who also first labelled the Galilee Basin in 1954), hard coking coal deposits were eventually found in 1959. At the end of the 1961, the Thiess-initiated operation at Moura became the first export mine in Queensland’s Bowen Basin.

The Utah Development Company was second onto the Queensland coal export scene, but dominated the industry within a decade of starting operations. Utah produced two thirds of the coal exported from Queensland between 1965 and 1985, peaking in 1978 at 85%. Like Thiess, Utah was originally a family firm, and had been operating in Australia as part of the ‘Snowies’ hydroelectric scheme. But the corporate qualities of Thiess Brothers and Utah were very different. By the time that it begun mining in the Bowen Basin, Utah was an established multi-national company, with a reputation of being one of the most efficient and well run companies in the US. Australian political scientist Brian Galligan observes that “In many respects the difference between Utah and Thiess was that between an experienced professional and a brilliant local amateur”.

Utah had been the first company to supply Japan with iron ore in the post-war years from mines it operated in the US, and this had given the company an appreciation for Japan’s enormous growth potential. Utah had a sophisticated understanding of global resource dynamics and developed a concept of the ‘Pacific Basin’, taking in the western Americas, South-East Asia and Australia. The company purposely aligned its development agenda with the significant market opportunities in Japan, specialising in the delivery of iron ore and coking coal (the key components in the production of steel) from mines around the Pacific Rim. Queensland was favourably seen as a “relatively untapped mining destination” by companies in general, and was described by a Utah executive in charge of Australian operations as “virgin territory” compared to New South Wales.

Utah’s success in Queensland was in part reliant on the substantial financial resources it was able to harness to develop the prime coking deposits as part of the Blackwater, Goonyella, Peak Downs, Saraji and Norwich Park mines. The latter four mines were essentially developed

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156 Galligan, *Utah and Queensland Coal*, p. 39.
158 Utah had first come to Australia in 1950 after winning a contract to construct the Eildon Dam in Victoria, and subsequently also worked on St Mary’s ammunition factory, the Tantangara Dam and tunnel as part of the Snowy scheme in NSW, the lake Moondarra Dam in Queensland and the King Street Bridge in Melbourne. See Alan Trengove, *Discovery: Stories of Modern Mineral Exploration* (Mont Albert, Victoria: Stockwell Press, 1979), pp. 26–56.
159 Galligan, *Utah and Queensland Coal*, p. 41.
161 Fitzgerald, Megarrity and Symons, p. 151.
162 Keith Wallace, quoted in Galligan, *Utah and Queensland Coal*, p. 31.
by Utah, although under the name of the Central Queensland Coal Associates, in which Mitsubishi had a 15% share.\textsuperscript{163} Thiess had also joined with foreign companies with the capital and expertise to develop and market the coal from the Kianga-Moura coalfield. The Moura mine was thus in the end a collaboration of the Australian Thiess (22%), the American Peabody (58%) and the Japanese Mitsui (20%) companies.\textsuperscript{164}

By the end of the 1960s the extent of foreign ownership of mining operations in Australia raised a degree of alarm from the public, unions, both sides of politics, and from within the federal bureaucracy.\textsuperscript{165} The first tentative move to restrict levels of foreign investment came from the Gorton and McMahon conservation coalition governments in the late 1960s.\textsuperscript{166} By the time the Whitlam Labor Government was elected in 1972, the issue had become a conspicuous item on the political agenda. At this time the mineral industry operating in Australia was 47.8% foreign owned and 54.3% foreign controlled, due to capital investment that could not be fulfilled in Australia.\textsuperscript{167} In his policy speech in the lead-up to the election, Whitlam accused the McMahon government of “selling the farm”, and promised an alternative approach under Labor:

> It’s time to stop the great takeover of Australia. But more important, it’s time to start buying Australia back. A Labor Government will enable Australia and ordinary Australians to take part in the ownership, development and use of Australian industries and resources.\textsuperscript{168}

In 1973 Rex Connor, the newly elected Federal Minister for Minerals and Energy, commissioned a report to investigate the economic contribution of the mineral industry to Australian welfare. When the ‘Fitzgerald Report’ was released the following year it weakened the long-held view that resource development automatically progressed Australia’s interests.\textsuperscript{169} The report attempted to quantify the costs and benefits of the nation’s support for the mining industry, and controversially it found that the Australian Government “had actually


\textsuperscript{164} Joan Priest, pp. 168–170; Australasian Coal and Shale Employees’ Federation, p. 6.


\textsuperscript{166} Galligan, ‘The Regulation of Direct Foreign Investment in the Australian Mining Sector’, p. 38; Richardson and Denniss, p. 31.

\textsuperscript{167} Burnside, pp. 176–177.


\textsuperscript{169} Burnside, pp. 176–177.
The report was met with a range of criticisms over its methodology and conclusions, but nonetheless furthered on-going political arguments. Whitlam opined that the fact profits were accruing to a small number of people was bad enough, but the fact that they were located outside of Australia was “scandalous”.

The Whitlam Government had initially proposed strict nationalistic policies, including energy self-sufficiency and 100% Australian ownership for new minerals and energy projects. However, these initiatives were abandoned in the face of economic recession, opposition from state governments and intense pressure from the mining industry. The compromise position of a flexibly implemented 50% Australian participation level was retained by subsequent governments. However, the controversy over mining companies’ contributions and the extent of foreign ownership is far from settled. Reports since 2011 claim that the mining industry operating in Australia is up to 83% foreign-owned, and that significant portions of mining royalties is returned to the industry through government subsidies.

Notwithstanding important questions specifically related to foreign ownership, arguably the more persistent and fundamental issue is one of political economy. In an analysis that uses Utah as a case study to examine the relationship between state and capital, Galligan concludes that:

... at the root of Utah’s success, and more generally in corporate-state relations under modern capitalism, there is a basic complementarity or partnership between state and corporation... governments rely on corporations to provide essential economic functions... For their part corporations depend on the state for their formal existence but also... for essential components of their business.

Utah and other coal companies operating in Queensland were thus provided with the state’s “constitutive, legitimating and facilitative support” through access to the coal resource, and the provision of critical infrastructure such as electricity, water, railways and ports. The more specific context of the Queensland Government’s relationship to coal and coal companies is revealed by looking at the political context before and during the main coal expansion era.

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170 Burnside, p. 172.
174 Richardson and Denniss, pp. 32–33; Naomi Edwards, Foreign Ownership of Australian Mining Profits: Now Are We Selling the Farm? (Briefing paper for the Australian Greens, 2011); M. Peel, R. Campbell and R. Denniss, Mining the Age of Entitlement: State Government Assistance to the Minerals and Fossil Fuel Sector (Canberra, Australia: The Australia Institute, 2014).
175 Galligan, Utah and Queensland Coal, p. 197.
176 Galligan, Utah and Queensland Coal, p. 197.
Governance for growth

Queensland’s intensive era of development is most commonly associated with Bjelke-Petersen’s long and controversial Premiership between 1968 and 1987. However, the foundations were laid in earlier years. Queensland’s population and economy had been strongly decentralised and rural based since early colonial times, and was largely reliant on primary industries and associated primary produce processing. For a century after Queensland became an independent colony in 1859, governments of all persuasions in almost all cases “considered industrialisation, urbanisation and manufacturing as unnatural, undesirable and unnecessary in Queensland”.177 There was no significant capitalist class within Queensland itself, so finance mostly flowed into Queensland from companies based in southern states. Profits too tended to flow out of Queensland, to Melbourne, Sydney and London. This mix of factors helped to create a general disdain for southern influences, a dominance of conservative politics, and a tendency of rural populism marked by a ‘frontier ethos’.178

The Labor Party in Queensland had held power in the state for thirty-nine of the forty-two years between 1915 and 1957.179 Over this time Labor took a serious interest in coal development. For instance, in the 1940s, a shortage in coal supply led the Queensland government to commission a British company to comprehensively survey the Queensland coal industry and to make recommendations for its future development. One result was a widespread exploration program undertaken by state government agencies that spanned the years 1949 to 1991.180 While it is difficult to know how a Labor government might have responded to the increased global demand for coal in the 1960s, they had a strong political interest in protecting the small West Moreton coalfields near Ipswich. This may have dampened their enthusiasm for projects in central Queensland where most of the growth potential existed.181

The final years of the long reign of Labor rule were under the Premiership of Vince Gair, whose antipathy towards the influence of the Australian Workers Union on the parliamentary wing of Labor created turmoil within the party, paving the way for the election of a Country-Liberal

177 Cameron.
coalition in August 1957. The Frank Nicklin Government held power until 1968 and in that
time oversaw a series of substantial infrastructure projects aimed at supporting large scale
capital investment in the state. The building of infrastructure was part of a more general move
to promote the development of Queensland’s mineral resources in response to the increased
global demand for raw industrial materials. Foreign capital was warmly welcomed, to the
extent that 74% of Queensland’s mining industry was under foreign control by 1976–77.

The development and export of Queensland’s coal was eagerly pursued by the Nicklin
Queensland Government. Thiess-Peabody-Mitsui and Utah were prominent among the select
mining companies granted exclusive rights to prospect over vast areas of Queensland in 1962
and 1964. In developing the mines, both companies were covered by Special Agreement
Acts which exempted them from particular pieces of environmental legislation and dovetailed
with various other mechanisms to ensure a ‘fast-tracked’ route to approvals and
development. The first three of the four major coking coal export agreements of the 1960s
were undertaken by the Nicklin Government. These included the original and amended
agreement with Thiess in 1962 and 1965 respectively, and the Utah agreement for its
Blackwater mine in 1964. The fourth agreement with the Central Queensland Coal Associates
was made under the Bjelke-Petersen government in 1968.

Bjelke-Petersen left an indelible stamp on Queensland. The long-standing reputation of the
man and his government that ruled Queensland for nineteen years is neatly summarised thus:

... the Bjelke-Peterson coalition governments in Queensland devised and implemented some of
the most controversial public policies yet seen in Australian political history. Bans on street
marches, curtailments of civil liberties, the politicisation of the police, a determined stand
[against] Aboriginal land rights, a curious attitude to parliamentary procedures and a host of
similar issues evoked images of an authoritarian government which nonetheless maintained a
remarkably successful electoral record. Towering over it all was the image of the Premier
himself: implacably opposed to any political interference from Canberra or the South generally;
self-righteous; frequently triumphing over political giants like Whitlam and Fraser; even testing
the outer limits of the Australian federal system.

182 Fitzgerald, Megarrity and Symons, p. 125.
184 Fitzgerald, Megarrity and Symons, p. 151.
185 Drew Hutton, ‘Mining and the Environment in Queensland: Where the Law Begins and Enforcement
Fails - Regulatory Capture and Implementation Failure’, The Australasian Journal of Natural Resources
186 Hutton, ‘Mining and the Environment in Queensland: Where the Law Begins and Enforcement Fails
187 The Bjelke-Petersen Premiership, 1968-1983: Issues in Public Policy, ed. by Allan Patience (Melbourne,
Australia: Longman Cheshire, 1985) — blurb from back cover.
Aspects of Bjelke-Petersen’s governance that were at first controversial became conclusively damning when the findings from the Fitzgerald Inquiry (so named after Federal Court judge Tony Fitzgerald, who chaired the Commission of Inquiry, and not be confused with the Commonwealth Fitzgerald Report, named after economist and journalist Tom Fitzgerald, mentioned earlier) in the late 1980s found systemic corruption in the Queensland police force and government, from which Bjelke-Petersen himself was not exempt. Among the numerous guilty was Les Thiess who, at a later civil defamation trial, was found to have paid bribes to Bjelke-Petersen on numerous occasions. Nonetheless, the longevity of Bjelke-Petersen’s leadership was testament to success built on Nicklin’s foundations; the new resource developmentalism was embraced while retaining the traditional rural populist appeal. Bjelke-Petersen’s popularity reflected the particular constituency who saw him embodying qualities that represented its concerns. The general cultural conservatism of Queensland was also evident within the Queensland government itself which was “dominated, more than most other states, by an ageing group of men, often with limited formal education”, so that liberal attitudes generally associated with the 1960s came late to Queensland.

The structure of Queensland’s economy was transformed in the Bjelke-Petersen era. From its predominantly rural base, government revenue became more diversified, strengthened by the mining of coal and base metals, the refining and smelting of aluminium and nickel, and through the growth of tourism and property development. Over the course of Bjelke-Petersen’s reign, coal exports from Queensland grew from less than 2 to over 53 million tonnes. Reflecting the 1970s oil crises and the consequent rise in demand for energy coal, Queensland’s thermal coal exports grew rapidly after 1980, increasing in share from 1% to 36% of Queensland coal exports in the years up to 1987. By the mid-1970s, coal royalties provided more than half of the total mineral royalties in the state. In order to market Queensland’s resources, and further differentiate the state as the “free enterprise capital of

190 Galligan, Utah and Queensland Coal, p. 22.
192 Fitzgerald, Megarrity and Symons, p. 144.
193 Galligan, Utah and Queensland Coal, pp. 22–23.
194 Galligan, Utah and Queensland Coal, pp. 27, 232.
195 Stuart, p. 68.
the nation”, Bjelke-Petersen launched the ‘Enterprise Queensland’ campaign in 1982, targeting an audience of Asian trading partners.\footnote{Galligan, \textit{Utah and Queensland Coal}, p. 25.}

Throughout the 1970s, jubilant rhetoric tied economic and political rewards from resource development in Queensland with the fulfilment of greater social outcomes in education, health, welfare, law and order.\footnote{Galligan, \textit{Utah and Queensland Coal}, pp. 22–25.} The forthright developmentalist approach driven by the Mines Department helped to deliver massive profits to coal companies, most notably Utah which became the most profitable company operating in Australia in the late 1970s.\footnote{Stuart, pp. 59, 69, 75; Hince, p. 2.} However, ‘develop at any price polices’ were balanced to some degree by the Treasury Department’s efforts to capture as much revenue for the state as possible.\footnote{Stuart, p. 59.} Under the Nicklin government income from coal development was established so that a minimal royalty was paid on a per tonne basis, while more substantial revenue was gained from rail freight charges. This had the advantage of bolstering the railways, which had been running at a loss, as well as ‘hiding’ the most substantial tax from prospective developers, who would be initially attracted to the low royalty rate.\footnote{Stuart, pp. 58–61; Galligan, \textit{Utah and Queensland Coal}, p. 58.} The Bjelke-Petersen government unilaterally increased the royalty rate on coal extraction in 1974, which delivered $25 million dollars to government coffers in 1976 — more than half of the total mineral royalties in the state.\footnote{Stuart, p. 68.} By 1981–82, coal royalties amounting to $45 million, together with significant coal freight profits and other taxes, totalled around 20% of the Queensland’s non-mineral tax revenue.\footnote{Stuart, p. 72.} Utah alone paid $170 million in rail freight charges in 1985–86.\footnote{Fitzgerald, Megarrity and Symons, p. 152.}

The economic benefit derived from coal production and export gave the industry substantial power in Queensland. One of the prominent ways that this played out was in the stifling of the enactment and enforcement of environmental regulation. An instance of industry power being forcefully applied was revealed by Ken Vaughan, who was Minister for Mines in the Goss Government in the early 1990s. Vaughan described the intimidation he faced when following up on the lack of compliance by BHP in its central Queensland coal mines:

I just couldn’t envisage the ramification of taking on the biggest company in Australia with all the people who would have rallied to their cause... They wielded enormous power... jumped up and down all over the place... They just weren’t used to that sort of treatment.\footnote{Wayne Sanderson, ‘$600m Clean-Up Bill for BHP’, \textit{The Courier-Mail}, 20 June 1997, p. 1; partially quoted in Hutton, ‘Mining and the Environment in Queensland: Where the Law Begins and Enforcement...’}
Insider whistle-blowers who gave evidence at a 1994 inquiry into the illegal disposal of liquid waste revealed that environmental non-compliance was rife at coal and other mines throughout Queensland. The witnesses listed breaches at forty-eight mine sites and estimated that the clean-up cost of abandoned mines across the state would amount to more than $1 billion of taxpayer funds.\(^{205}\) Michael Briody and Tim Prenzler argue that such non-compliance breaches are symptomatic of the mining industry’s ‘regulatory capture’ of government departments. They conclude that the Queensland mining industry asserted its influence particularly on the Environmental Compliance Division of the Department of Mines and Energy, using “political influence, personal interchange, close contact and shared economic interests”.\(^{206}\)

Recent evidence of the continuing close relationship between the Queensland Government and the coal industry do not bode well for future environmental regulation. For instance, in 2014 there were revelations that the head of corporate affairs for coal company QCoal, itself embroiled in environmental controversy, was also working to develop environmental policy for the Queensland Government. Piquing the controversy in this case is the fact that QCoal is owned by Chris Wallin, a former Acting Chief Geologist in the Queensland Government and more recently among Queensland’s richest people, and one of the Liberal-National Party’s biggest donors.\(^{207}\) Another example is that of Geoff Dickie, who within six weeks of finishing up in his role as Deputy Coordinator-General in charge of Project Assessment and Attraction, became a director of Chinese mining company Macmines, which has plans to produce up to 45 million tonnes of saleable coal annually from the Galilee Basin as part of its proposed China Stone project.\(^{208}\)

Queensland’s development agenda under Bjelke-Petersen was not capable of accommodating or meaningfully responding to environmental concerns. Even compared to Western Australia, a resource-rich state counterpart, Queensland’s establishment of environmental administration was tardy. Although an environmental assessment process was established relatively early, in 1972, the responsibility was handed to those same agencies tasked with

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\(^{206}\) Briody and Prenzler, p. 71.


\(^{208}\) Pearse, McKnight and Burton, pp. 95–97; Macmines Austasia Pty. Ltd., Project China Stone: Initial Advice Statement (Brisbane, 2012).
promoting development. When a more thorough response was demanded upon heated and prolonged community opposition to proposed oil drilling in the Great Barrier Reef in the 1960s and 70s, Bjelke-Petersen directed the development-focussed Coordinator-General’s department to undertake a survey of the state’s environment. And instead of creating a separate environment department, an Environmental Control Council was established, also within the Coordinator-General’s departments, and with no provision for public participation. Bjelke-Petersen undoubtedly stymied progress on environmental matters, as significant changes were brought about when Mike Ahern, also a National Party politician, took over the Premiership of Queensland in the wake of the Fitzgerald Inquiry controversy. However, apart from leadership factors, more general economic, demographic and sociocultural characteristics of Queensland were also significant in the timing and nature of the formation and operation of environmental policies and agencies in the state.209

A twenty-year coal boom finally came to an end in the early 1980s, but the impact was barely discernible in Queensland’s ongoing coal output, which has seen an almost uninterrupted upward trajectory until the current time.210 In the 1990s the outlook for coal was relatively weak, and a number of the oil companies that had invested in Australian coal were taken over by the four companies that have come to dominate the Australian coal sector — BHP, Rio Tinto, Xstrata and Anglo America. These companies benefitted when the global coal price rose on the back of Chinese demand and led to another coal boom, between around 2003 and 2012.211

Over the last thirty years there have also been significant changes in coal mining communities and workplaces. Fly-in fly-out (FIFO) and drive-in drive-out (DIDO) positions became more common, representing at least 40% of mining jobs in the Bowen Basin in 2010.212 Some new projects and expansions are even proposing 100% FIFO workforces,213 with a range of negative social and economic impacts reported and debated.214 The number of women employed in coal

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209 Kellow and Niemeyer.
211 Pearse, McKnight and Burton, p. 30.
212 John Rolfe, Submission to the House Standing Committee on Regional Australia of Fly-In and Fly-Out (FIFO) Workforce Practices in Regional Australia (Rockhampton: Central Queensland University, 2011), p. 5.
mining has also risen, but is still very low. Women made up around 8% of operator and production jobs in 2008–09, about one third of geologist positions, as well as their more traditional representation in administrative, financial or clerical roles.\textsuperscript{215} Some Bowen Basin companies have far more ambitious targets of at least 30% women employment by 2015.\textsuperscript{216}

The coal industry in Queensland has continued to receive generous subsidies from the state government up until the present time. For instance, the left-leaning think tank The Australia Institute reports that of the $9.5 billion dollars spent on minerals ‘expenditures and concessions’ in Queensland between 2008 and 2014, more than $7.6 billion went to coal transport.\textsuperscript{217} The Queensland Resources Council was quick to counter claims that the coal industry was a drain on taxpayers, with Chief Executive Michael Roche arguing that the dividends returned to the state outweighed expenditure.\textsuperscript{218} The prospects of further financial returns from mining are at least sufficient for resource extraction to be one of the four pillars in a Newman government plan for Queensland’s future economic growth. Since 2012, a number of legislative changes have been enacted to facilitate exploration and mining, and others are underway or proposed for the future.\textsuperscript{219} If the vision for an expanding minerals industry eventuates as planned, the close relationship between the Queensland government and the minerals industry is likely to continue.

The extended reach of the coal industry

The influence of the coal industry on politics and governance in Queensland has played out at the Commonwealth level as well, at times dramatically, and most notably in relation to attempts to develop climate change policy. Researcher and commentator Guy Pearse provides valuable insights into the inner workings of the coal industry and affiliated lobbyists as they have successfully applied behind-the-scenes pressure in Australia to defend their interests. Self-described as “a former Country Young Liberal of the Year, Howard government ministerial speechwriter and aspiring federal candidate”,\textsuperscript{220} Pearse turned his back on his original

\begin{thebibliography}{9}
\bibitem{PeelCampbellDennis2014} Peel, Campbell and Denniss, pp. 4–5.
\bibitem{Pearse2014} Pearse, \textit{High & Dry}, p. 1.
\end{thebibliography}
conservative political affiliations to expose the ways in which the carbon lobby has helped to
derail critical action to reduce greenhouse gas emissions.

Pearse and his co-authors claim that ‘Big Coal’ in Australia has sought to undermine and co-opt
any initiative that threatened their profits and power over the past twenty years.\textsuperscript{221} The
coordination of such activities began prior to the emergence of widespread concern over
carbon emissions. Aiming to enhance their electoral clout, the fossil fuel industries built solid
relationships with both sides of politics as well as bureaucracies, industry associations, media
commentators, think tanks, and scientific and economic agencies. They fostered the threat of
withdrawing their operations from Australia, and moulded a narrative that bound the national
interest with their own. In this way the carbon lobby was well prepared when climate change
appeared on the national agenda to defend the interests of its constituent industries. Overall
its aim has been to prevent action on climate change in Australia, or otherwise delay action, or
otherwise ensure that its industries do not have to shoulder the burden of emission cuts.\textsuperscript{222}
Such tactics closely echo examples from the US, where there have been coordinated industry-
funded efforts to undermine science, and shape policy and public opinion on issues ranging
from tobacco, to acid rain and climate change.\textsuperscript{223}

The Australian carbon lobby is made up of fossil-energy producers and their biggest customers.
At the centre of activities are the Minerals Council of Australia, the Australian Coal Association
(which has recently been absorbed in the MCA),\textsuperscript{224} the New South Wales Minerals Council, the
Together, it is estimated that these groups spend more than $40 million a year and employ
dozens of staff to pursue their goals.\textsuperscript{225} Mostly their lobbying occurs behind the scenes and
strategies are appropriately varied. For instance, industry leaders are rallied under Liberal
Governments, whereas mining workers are mobilised to extend their reach into the Labor
Party under Labor Governments.\textsuperscript{226}

Pearse’s original research took place in the early 2000s and involved interviews with the core
members of the AIGN, who referred to themselves as the ‘greenhouse mafia’. Almost all of
these were former senior federal public servants and/or ministerial staffers from the industry
portfolio. They had extremely good knowledge of policy and often corresponded with formerly

\textsuperscript{221} Pearse, McKnight and Burton, p. 129.
\textsuperscript{222} Pearse, \textit{Quarry Vision}, p. 31; Pearse, \textit{High & Dry}, pp. 18–20.
\textsuperscript{223} See for instance Naomi Oreskes and Erik M. Conway, \textit{Merchants of Doubt: How a Handful of
Scientists Obscured the Truth on Issues from Tobacco Smoke to Global Warming} (New York: Bloomsbury
\textsuperscript{224} See Matthew Stevens, ‘Divestment Critique Is “Black Gold”’, \textit{The Australian Financial Review}, 23 June
2014.
\textsuperscript{225} Pearse, McKnight and Burton, pp. 134–140.
\textsuperscript{226} Pearse, McKnight and Burton, p. 129.
subordinate colleagues in the department. They were commonly represented on government advisory committees and various other consultation processes and programs. At times they were enlisted to help form departmental advice on environmental issues to government ministers, which involved writing cabinet submissions, ministerial briefings, and costings on proposed climate change policies. Over the same period, these AIGN members were also giving advice to government from their role as lobbyists for fossil fuel interests, the result being that the government was receiving an incredibly consistent message.  

These various activities coincided with a couple of key changes in John Howard’s government’s position on fundamental climate change policy issues. Most prominently, it was decided in August 2000 that the development of an emissions trading scheme would be postponed for at least another eight years. And despite having negotiated substantial concessions for the country in 1997, John Howard announced in June 2002 that Australia would not be ratifying the Kyoto Protocol. Howard maintained that he wanted Australia to become a world leader in carbon capture and storage. This was strongly supported by Australian fossil fuel interests. Overall, the influence of the carbon lobby in steering Australia away from strong action on climate change in the Howard years is compelling.

Eleven and a half years of John Howard’s Prime Ministership came to an end in December 2007, with the election of Kevin Rudd’s Labor Government. Rudd was initially strong on developing climate change policy. He was quick to ratify the Kyoto protocol, his government had increased the renewable energy target to 20% by 2020, and had designed a sophisticated cap and trade system for carbon emissions under the guise of the Carbon Pollution Reduction Scheme (CPRS). However, the CPRS failed to pass the senate on two occasions, blocked by the Liberal-Nationals and the Australian Greens, and it was abandoned before the third attempt. The mishandling and shelving of the CPRS was also ultimately a major component of Rudd’s leadership controversies and the tumultuous leadership spill that saw Julia Gillard become Prime Minister in June 2010. In late 2014, the survival of the renewable energy target is now also under question. Academic and journalist Philip Chubb argues that weakness and failures in the Federal Labor Government under Rudd and Gillard made it possible for the ‘greenhouse

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227 Pearse, *High & Dry*, pp. 18–20; Pearse, McKnight and Burton, pp. 134–140.
mafia’ to again strongly influence the downfall of the proposed CPRS and later carbon pricing mechanisms in the period of 2007 to 2013.\footnote{231 Philip Chubb, Power Failure: The inside Story of Climate Politics under Rudd and Gillard (Collingwood, Vic.: Penguin), pp. 251–252.} The repeal of the carbon tax finally passed through both houses of federal parliament on 17\textsuperscript{th} July 2014.

There have been several explicit displays of coal and political interests working in concert in the push to open up the Galilee Basin. In late 2009, while her company’s Alpha Coal Project was under Queensland government review, Gina Rinehart hosted a number of the Queensland’s Labor Government ministers on board the exclusive luxury cruise ship \textit{The World} while it was docked in Brisbane. When details of the event became public, Premier Anna Bligh was quick to defend her government against accusations of questionable integrity, stating "what I want to see is strong and appropriate links between my ministers and my government and business".\footnote{232 Patrick Lion and Ursula Heger, ‘Ministers’ Secret Luxury Dinner Hosted by Gina Rinehart’, \textit{The Courier-Mail}, 27 January 2010 [<http://www.couriermail.com.au/news/queensland/ministers-secret-luxury-dinner-hosted-by-gina-rinehart/story-e6freoof-1225823761293?nk=2fc24dffe7a27ddc4124670a7c433eb1>] [accessed 26 September 2014]; Queensland Resources Council, ‘Media Release: Dinner Coverage “all at Sea”’, \textit{Queensland Resources Council}, 2010 [<https://www.qrc.org.au/01_cms/details.asp?ID=2144>] [accessed 26 September 2014].}

Within just a couple of months of Rinehart’s cruise ship dinner, businessman Clive Palmer and Premier Bligh, generally regarded as political enemies, stood side by side in a press conference to announce the signing of a coal export contract between Palmer’s company Resourcehouse and a Chinese company, and to proclaim the benefits the ‘China First’ mine (later re-badged the Galilee Coal Project) would have for the state.\footnote{233 Paul Hayes, ‘Palmer Secures QLD Future with Massive Export Deal’, \textit{Australian Mining}, 2010 [<http://www.miningaustralia.com.au/news/palmer-secures-qld-future-with-massive-export-deal> [accessed 26 September 2014].} Over the following days, the purported ‘contract’ was revealed to be only a ‘framework agreement’,\footnote{234 Brigid Glanville, ‘Clive Palmer Claims Big Coal Deal with China’, \textit{PM} (ABC Radio National, 2014) [<http://www.abc.net.au/pm/content/2010/s2815929.htm>] [accessed 26 September 2014].} but the resulting controversy did not prevent the pair from appearing together again in June 2011 at a dinner in Beijing to promote Queensland as a place for Chinese investment. The then Premier is reported to have said "the Queensland economy is above politics" and that "Clive and I have our differences, but when it comes to promoting Queensland we’re always on the same page".\footnote{235 Stephen McDonell, ‘Palmer, Bligh Unite in China’, \textit{ABC News}, 23 June 2011 [<http://www.abc.net.au/news/2011-06-23/palmer-bligh-unite-in-china/2768220>] [accessed 26 September 2014].}

Around the same time, Gina Rinehart drew on her networks in Australian federal politics when negotiating a deal with Indian company GVK to buy a majority share in Hancock Coal’s Galilee Basin coal interests. Rinehart flew the Liberal’s deputy leader Julie Bishop (current Australian...
Foreign Minister) and National Senate leader Barnaby Joyce (current Minister for Agriculture) in a private jet to attend the wedding of the granddaughter of GVK’s founder, GV Krishna Reddy. Several months later, Rinehart’s company successfully sold the coal assets to GVK for $1.2 billion.236

More recently in New South Wales, the questionable conduct of government ministers in coal licensing matters has formally come under the scrutiny of the Independent Commission Against Corruption (ICAC). Initial investigations were sparked by an allegation that confidential information had been leaked during the tendering process for a coal tenement in 2008. The Commission found a number of people guilty of engaging in corrupt dealings. Among them was the former Labor Minister for Primary Industries and Mineral Resources, Ian Macdonald, his fellow member of parliament Eddie Obeid, Eddie Obeid’s son Moses, and several businessmen. The crux of the case was that the Obeid family and their associates stood to make significant financial gains from the allocation of the coal tenement over their properties in the Bylong Valley, and that Minister Macdonald had acted contrary to his duty in assisting the Obeids.237

Following the investigation into Macdonald and the Obeids, in October 2013 ICAC released a report entitled Reducing the Opportunities and Incentives for Corruption in the State’s Management of Coal Resources. The report found that corruption could not so much be blamed on “a rogue minister for mineral resources”;238 as the structure of the coal allocation system in which there are embedded “perverse incentives and opportunities” prone to distorting “the decision-making process on what and when coal deposits should be released, as well as the pathway that an allocation process will follow”.239 Revealingly, the Commission noted that the policy and regulatory environment for granting coal exploration leases in New South Wales would not be “considered acceptable in any comparable state operation”, 240 and


238 Independent Commission Against Corruption, Reducing the Opportunities and Incentives for Corruption in the State’s Management of Coal Resources, p. 6.

239 Independent Commission Against Corruption, Reducing the Opportunities and Incentives for Corruption in the State’s Management of Coal Resources, p. 5.

240 Independent Commission Against Corruption, Reducing the Opportunities and Incentives for Corruption in the State’s Management of Coal Resources, p. 6.
that there were so many risks and opportunities for corruption that “it was almost inevitable that corruption would occur at some point”.241

In August 2014, the New South Wales government announced several measures to increase accountability and transparency in the management of the state’s coal resources in response to ICAC’s report: an independent Chair was appointed to the newly formed Coal Exploration Steering Group; the ‘Strategic Statement on NSW Coal’ was released, and; consultation on the ‘Interim Guidelines for the Allocation of Coal Resources’ commenced.242 Evident throughout these responses and associated media releases is the entrenched place of coal in the New South Wales government’s vision for the future of the state. They firmly exalt coal’s dominance in economic development, electricity generation and export income. The Strategic Statement articulates seven objectives and outcomes that will guide the “growth and performance of the NSW coal sector”, the first three of which read:

- Co-existence — Land use decisions do not exclude other potential uses without considering the benefits and consequences for other land users and all residents of NSW
- Transparency — Coal release, exploration and production decisions are open, transparent and evidence-based to minimise corruption risks
- Sustainability — Coal release, exploration and production decisions are governed by triple bottom line considerations to promote comprehensive and balanced decision making243

It remains to be seen how well the New South Wales government can transform its management of coal resources in accordance with the objectives, but there are a number of factors that already suggest tensions will persist in New South Wales and across Australia more generally. At a fundamental level is the risk that Australian institutions (including governments) will be increasingly captured by fossil fuel interests. Political theorist Terry Lynn Karl provides an in-depth analysis of how dynamics have played out in ‘petrostates’ which gives rise to a general description:

... dependence on a particular export commodity shapes not only social classes and regime types... but also the very institutions of the state, the framework for decision-making, and the decision calculus of policy-makers.244

Drawing on Karl’s work, Kevin Taft, an author and ex-politician from Canada, points out that the Australian economy became sharply concentrated on mining between 2006–07 and 2010–

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11, at the same time that the share of manufacturing exports declined. Thus, a crucial question will be whether or not state strategies for increasing transparency and accountability can gain meaningful traction in the face of the coal industry's structural power. Perhaps more significant though is the apparent strength of the state's adherence to a coal-centred economy and society. Evidence to date suggests that fairly judging the claims of 'other land users' and making decisions according to genuine 'triple bottom line considerations' will be severely limited by the weight given to coal development.

Conclusion: An uneven balance

The political power of the Australian coal industry in the twenty-first century cannot be sensibly separated from the context in which it exists. At the broadest structural level, coal represents cheap and abundant energy on which industrial societies are utterly dependent. Successive governments in Australia actively promoted coal development since the earliest days of colonisation. This momentum was propelled by the phenomenal resource-intensive growth since the end of World War II, and the demands of global industrial development for Australian resources. The emergence of the coal export industry from the 1960s reinforced the trajectory. Substantial revenue flows benefitted both state and federal governments, as well as the companies and workers that make up the industry.

With this context in mind it would be surprising if the coal industry was not powerful and did not lobby to defend its interests, or that the state was not responsive to the industry. However, rather than simply being resigned to a seemingly inevitable status quo, the interconnecting social, political, economic and environmental histories provide further important insights into the role of coal in modern society, and how and why it is being actively challenged from a number of fronts in the twenty-first century. The following chapter steps out to take a broad view of the various conflicts and controversies that have surrounded coal beyond Queensland over most of the last millennium.

\[245\] Taft, p. 15.
Struggles over coal’s costs and benefits, like those being played out in the Galilee Basin in the twenty-first century, are not new. Negative repercussions from mining, transport, processing and combustion have existed alongside the widely perceived benefits of coal for centuries. Various controversies, conflicts and tensions have ensued, and these have presented massive scientific, technological, ethical, legislative and governance challenges. Tracing the history of coal contestations reveals dimensions of both change and continuity in the substance of concerns, how they are represented, and responded to over time. A focus on concerns and conflicts throws further light on the role of coal in society, particularly in regard to its relationship to other issues, values, industries and land-uses. It also provides a rich context for understanding current opposition to coal in the Galilee Basin and elsewhere.1

On the ground

Mining versus others

In his famous 1556 treatise on mining, *De Re Metallica*, Georgius Agricola spends the first of twelve books detailing the arguments made against mining in his era, which in turn draws on earlier texts and legends. Much of the discussion concerns the mined product, usually metal, and the effect that it has on the person bearing it, or longing for it. However, Agricola identifies agricultural and environmental consequences of mining as the “strongest argument of the detractors”, and summarises their views:

> ... [their argument] is that the fields are devastated by mining operations, for which reason formerly Italians were warned by law that no one should dig the earth for metals and so injure their very fertile fields, their vineyards, and their olive groves. Also they argue that the woods and groves are cut down, for there is need of an endless amount of wood for timbers, machines, and the smelting of metals. And when the woods and groves are felled, then are exterminated the beasts and birds, very many of which

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1 Some of the material in this chapter also appears in Duus, ‘Coal Contestations: Learning from a Long, Broad View’.
furnish a pleasant and agreeable food for man. Further, when the ores are washed, the water which has been used poisons the brooks and streams, and either destroys the fish or drives them away. Therefore the inhabitants of these regions, on account of the devastation of their fields, woods, groves, brooks and rivers, find great difficulty in procuring the necessaries of life, and by reason of the destruction of the timber they are forced to greater expense in erecting buildings. Thus it is said, it is clear to all that there is greater detriment from mining than the value of the metals which the mining produces.²

Agricola heartily disagrees with the detractors’ sentiments. In defence of mining where it coincides with fertile land, he quotes Xenophon from the fourth century BCE on the Athenian silver mines:

There is land of such a nature that if you sow, it does not yield crops, but if you dig, it nourishes many more than if it had borne fruit.³

The passage suggests that thought and discussion about the division of land between mining and agriculture may stretch back at least two millennia. It is also conceivable that questions were raised from the very earliest days of mineral extraction wherever mining coincided with other land values, for instance when copper and tin began to be worked in the late fifth and fourth millennium BCE in early agricultural civilisations.⁴

Agricola also emphasises the barrenness of land where minerals are dug and promotes the redeeming aspects of mining:

Moreover, as the miners dig almost exclusively in mountains otherwise unproductive, and in valleys invested in gloom, they do either slight damage to the fields or none at all. Lastly, where woods and glades are cut down, they may be sown with grain after they have been cleared from the roots of shrubs and trees. These new fields soon produce rich crops, so that they repair the losses which the inhabitants suffer from increased cost of timber. Moreover, with the metals which are melted from the ore, birds without

³ Quoted in Agricola, p. 6. Note, an alternative longer translation is given as: “Then there is land which, although it yields no fruit to the sower, needs only to be quarried in order to feed many times more mouths than it could as corn-land. Doubtless we owe it to a divine dispensation that our land is veined with silver; if we consider how many neighbouring states lie round us by land and sea and yet into none of them does a single thinnest vein of silver penetrate” in Xenophon, On Revenues, trans. by Henry Graham Dakyns, 1998 <http://www.gutenberg.org/ebooks/1179?msg=welcome_stranger> [accessed 24 April 2014].
⁴ Scholarship on the early history of mining and metallurgy is likely to be informative on this question, see for instance Mircea Eliade, The Forge and the Crucible (London: Rider, 1962).
number, edible beasts and fish can be purchased elsewhere and brought to these mountainous regions.\(^5\)

Revealing of his time, the mention of ‘woods’ ‘birds’ and ‘fish’ are strongly in the context of resources for human consumption, whereas similar complaints from the twentieth century, if not earlier, reflect a growing conception of ‘environment’ and the value of nature for its own sake.

Agricola’s comments were made in an era when the physical expanse of mining was a mere fraction of what it is today. Institutional and governance structures were much simpler, the number of minerals on which society depended was far fewer, and the understanding of environmental processes was more limited. Nonetheless, Agricola’s arguments echo debates and justifications in our own era, and illuminate core and persistent questions about the share and distribution of costs and benefits of mining.

**Coal in the landscape**

In the centuries following the publication of *De Re Metallica*, coal mining in England, Scotland and Wales expanded considerably to supply growing demand in the major towns and cities of Britain. The consequences for other landscape uses and values are surprisingly absent from historical discussions, which focus overwhelmingly on the stunning economic transformation that was underway.\(^6\) But there is no doubt that the landscape transformations from coal mining, albeit localised, were striking to observers at the time. In his tour of Great Britain in the 1720s, Daniel Defoe described the experience of encountering north-east English landscapes that fuelled industrial production:

> From hence the road to Newcastle gives a view of the inexhausted store of coals and coal pits, from whence not London only, but all the south part of England is continually supplied; and whereas when we are in London and see the prodigious fleets of ships which come constantly in with coals for this increasing city, we are apt to wonder whence they come and that they do not bring the whole country away; so on the contrary, when in this country we see the prodigious heaps, I may say mountains of coals which are dug up at every pit, and how many of these pits there are, we are filled with equal wonder to consider where the people live that can consume them.\(^7\)


While Defoe refrains from negative judgement on coal mining in this passage, the implications of coal-fuelled industrialisation for British landscapes and heritage were more solemnly observed by others, including D.H. Lawrence in *Lady Chatterley's Lover* in the early twentieth century:

This is history. One England blots out another. The mines had made the halls wealthy. Now they were blotting them out, as they had already blotted out the cottages. The industrial England blots out the agricultural England. One meaning blots out another. The new England blots out the old England. And the continuity is not organic, but mechanical.8

The impact of industrial change was perhaps felt most acutely by those farmers and townspeople who lived and worked on the land overlying the increasingly valuable coal seams. As demand for coal increased in Britain, landscapes that supplied the coal were put under increasing pressure.

The copyhold farmers of Whickham, a parish in north-east England, faced substantial expansion of coal mining in their region at the beginning of the seventeenth century in response to increasing demand for coal in London. David Levine and Keith Wrightson in *The Making of Industrial Society* explain that there had been some background level of coal mining in the Whickham area for around 250 years, at least since 1356.9 Locals had been employed in the budding coal industry and benefitted from the off-farm income and compensation payments. But there came a cross-over point when the “balance of advantages and disadvantages” changed dramatically.10 Abruptly, the benefits to the farmers were “offset by the devastation of the physical environment and the threatened dislocation of the agrarian economy that such spreading desolation entailed”.11

The farmers of Whickham eventually took their grievances to local courts, in at least two separate cases. They described how mining practices had drained natural springs and other reliable water sources in the area. Water seepage from coal waste had contaminated a significant area of grassland, preventing the grass from growing in some places. Coal dust from mining, handling and transport spread onto crops, hay and water, at times rendering hay and pasture inedible and water non-potable to livestock. Underground mining had led to subsidence — it had damaged houses and threatened a local church. Nearby forests had also

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9 Levine and Wrightson, p. 13.
10 Levine and Wrightson, p. 106.
been despoiled on a massive scale by harvesting for pits, staithes and rail lines. Unfenced mine voids had proved hazards to people and animals, leading to fatalities. Old mines had not been properly filled in, nor rehabilitated, and the damaged surrounding land compromised farmers' returns.

Roads and other transport routes through farmland were constant and significant concerns. Whickham's farmers were no longer consulted over the location of new roads, as had been the former practice. Some coal transport roads had been driven straight through cropland and some of the area's best pastures. These roads were used even in wet weather, causing damage and creating further by-pass roads, which took over progressively more farming land. Good land was also being sacrificed to buildings associated with the coal mining operations. Farmers complained that monetary compensation paid to them was inadequate and was not being paid regularly, and that the mining leaseholders would sometimes operate against their explicit wishes.

Altogether, it was estimated that between a quarter and a third of the parish area had been spoiled by mining and associated activities. Besides the obvious impact this had on farming practice, there was a fear that people would have to move away to find new livelihoods. There were deep concerns about the employment of 'stranger' workers, people not from the local area. Farmers felt that the resident population should be given preferential employment, particularly in the transport of coal.

The miners denied most of the accusations, but the evidence was in favour of most of the farmers' complaints. Indeed, some farmers were so incensed by the damage and intrusion on their land and the employment of 'stranger' workers, they took direct physical action, both before and after having their concerns heard in court. On a number of occasions they successfully stopped the transport of coal through their farms. At one stage the farmers organised themselves into a group so as to regularly disrupt the movement of coal. The coal interests affected by such actions countered by taking the farmers in question to court over the harassment and interruption to their business.12

In ruling on one of the Whickham cases in 1621, the judge observed that the loss, hurt and damage inflicted by the activities of the mining leaseholders was clearly greater than in the past, but also ruled that ultimately the national interest needed to take priority:

...'the uttering and venting of coles from thence is become a matter of great necessitie and much concerninge the generall good of the kingdome'. The 'getting and wynning and working of coals' and their transportation 'To London and to the most porte Townes

12 Levine and Wrightson, pp. 110–151.
and parts of this kingdome ... and lykewyse into forren parts beyond the seaes' was of ‘great benefit and commoditie’ both to his majesty the King and to many of his subjects.\(^\text{13}\)

This 1621 ruling captures a remarkable moment in history, when the value of coal for providing energy for heating, cooking and industrial processes was determined to be so great that it overrode the significance of impacts at the place of production.

Agricola’s work reveals that similar sentiments existed for mining generally in this early modern period. But coal was emerging as pivotal for human society, thus the mining and transport of coal was becoming more extensive. As industrialisation developed and expanded, other minerals would be gathered in the industrial web. For instance, copper became crucial for carrying electricity, subsequently resulting in some of the largest scale mining operations on the planet.\(^\text{14}\) More broadly, the increased scale of mining in conjunction with laissez-faire driven economics and practices clashed with other values.

A case in point was the long battle between farmers and gold miners in California in the latter half of the nineteenth century, where the broad sweeping freedoms bestowed on free enterprise in the post-civil war years came head to head with the wider community. In the mountains above the Sacramento Valley, large hydraulic mining operations led to massive quantities of gravel, sand and mud being carried down-river, where it spread over farming land, caused severe floods, affected river navigation, and polluted town water. The resulting conflict was dragged through courts and the legislature before a legal victory was finally delivered to the farmers in the early 1880s, on the basis of ‘general welfare’.\(^\text{15}\) In Australia, the contest between miners and farmers came to prominence a century after these events in California. However, there were other grounds for disputing the expanding coal mining industry beginning in the late nineteenth century, which were also taken to court and centred on the closely related concept of ‘public trust’.\(^\text{16}\)

Contesting coal in Australia

Aesthetics, amenity, public space, recreation and conservation were among some of the first motivations of opposition to coal mining in Australia outside of the ubiquitous labour disputes that had characterised the Australian coal industry up until the mid-twentieth century. These

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\(^{13}\) Levine and Wrightson, p. 130.
\(^{15}\) See Robert Lloyd Kelley, *Gold vs. Grain, the Hydraulic Mining Controversy in California’s Sacramento Valley*; (California U.S.A.: Glendale, 1959).
issues emerged strongly in Sydney Harbour, which was touted by some as an optimal location for coal development in the latter part of the nineteenth century.

Speculation that coal found north and south of Sydney was probably part of the same deposit led to efforts to find coal in Sydney itself. The government of the day provided assistance for exploration work and advocates lauded the prospect of having a source of coal within the city, as well as the jobs and revenue a local colliery would create. Proposals were put forward to mine at Cremorne and Bradley's Head, but they were met with strong criticism. The issue was fleshed out in the newspapers of the day, with parliamentarians, members of the general public and the high profile artist Arthur Streeton among the critics. The proposal to mine at Cremorne ended up in the Mining Warden’s Court and was overturned on the basis that a mining lease would exclude public access to the land. The preservation of public space on the foreshore was again a central argument in parliamentary debates and a subsequent court case over the siting of a wharf to service the proposed colliery at Bradley’s Head, which was also eventually overturned.\(^{17}\)

The risk of violating the beauty of the harbour was also a significant concern, and included issues that would today be considered synonymous with nature conservation sentiments. Nearly four decades after the dispute, Streeton recalled a scene of destruction:

.. the long tree-covered slopes of Mosman, Athol and Bradley's Head were lovely in the late afternoon; amber and gold lighting up the myriads of eucalypts, light echoing upon light, and the surface of the bay below like a robe of intense blue satin... A coaling company was formed, and in some clever way acquired permits to bore for coal. One day the thousands of gum trees had been cut down. The multitude of trees lying low was a shocking sight.\(^{18}\)

Others were similarly horrified at the prospect of sacrificing Sydney’s most precious aesthetic asset, as expressed by one \textit{Sydney Morning Herald} reader in 1896:

Will such a grimy institution not absolutely divest that especial part of the harbor of its pristine beauty? And if so, how much money expended in wages, how many dividends sent home to England, will compensate this country for so grand an act of vandalism?\(^{19}\)

Other concerns included that the local atmosphere would be spoiled by coal smoke, that local waters would be filled with coal vessels, that the process for public comment was flawed, and


\(^{19}\) SMH, 6 Feb 1896, p.5, quoted in Bonyhady, \textit{The Colonial Earth}, p. 335.
that the investment of government money would only profit “a few bulbous capitalists”.20

Mining was eventually ruled out in these relatively exclusive parts of the harbour, but the coal company did succeed in gaining a site in the working class area of Balmain, where they enjoyed a greater level of community support. Two significant shafts were sunk, and coal was produced on and off until 1931, after which gas was extracted until 1950.21 However, during its production years the site was generally regarded as unsafe and unprofitable.22

Also within the vicinity of Sydney, there has been suggestion that the creation of the National Park (later Royal National Park) in 1879 was in part pushed along by the desire to save the area, which is underlain by the extensive Illawarra seams, from coal mining.23 Nonetheless, the Park was considered for coal mining in 1915 and again in 1920, and was only stalled due to a lack of agreement over royalty payments. While the area was safe from mining itself, controversy erupted in 1920 when the public learnt of an agreement between the park’s Trust and the Metropolitan Coal Company to harvest timber within the Park to supply pit props to the Illawarra mine. The deal drew fierce opposition and the contract was cancelled within a couple of years, following an effective campaign run by conservationists in the Wildlife Preservation Society and with the support of the *Sydney Morning Herald*.24

Significantly, the Royal National Park dispute from the early 1920s is possibly the first example in Australia of explicit environmental concerns being rallied against activities associated with coal mining. Mining plans for the area lay dormant for around sixty years. Then, in 1980, conservationists were again stirred to respond to a proposal to allow coal mining in New South Wales’ national parks; the Royal was one of thirteen national parks and reserves in the Sydney Basin considered for coal extraction.25 By that time a wider critique of mining’s impact on the environment had emerged. Beginning in the mid to late-1960s, a growing conservation movement turned its attention to a number of mining operations proposed in areas of conservation value — including limestone mining in the Mount Etna bat caves and on the Ellison Reef in Queensland, and sand mining at Myall Lakes in New South Wales.26 A broad

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21 NSW Department of Primary Industries, ‘Primefact 556, Balmain’s Own Coal Mine’ (NSW Department of Primary Industries, 2007).
22 Bonyhady, *The Colonial Earth*, p. 337; NSW Department of Primary Industries.
narrative against mining soon developed. For instance, the Australian Conservation Foundation argued in a pamphlet published in 1972:

Mining by its very nature is always antagonistic to environmental values. It must dig holes, dump overburdens, discharge tailings, create dust and noise, rip open country and bring in power and water supplies, construct roads, change drainage systems and even establish towns where there is no other reason for their existence.

Environmental groups were therefore keyed to respond to issues around coal mining when they arose in subsequent decades.

*Industries collide*

The history of conflict specifically between coal mining and agriculture in Australia largely began to appear in the 1980s. In 1982 the General Manager of the Queensland Graingrowers’ Association asserted at a Chamber of Mines seminar:

In just two short years since we first took at active interest, my organisation has found itself thrust into the field of mining policy. The reason is that the great surge in coal mining activity has put the pressure on landholders in closely settled cropping areas for the first time.27

By the late 1980s, farmers in central Queensland coalfields stepped up their efforts to protest mining’s impact on farmland. For instance, the National Party’s Blackwater Branch put forward a motion that no further mining should be allowed until existing mines had fulfilled their rehabilitation obligations.28 Concerns were also being expressed in New South Wales, such as in the following extract from a newspaper article in 1980, which combined concerns about the impact on agriculture, tourism and aesthetics:

The problems posed by coal developments are not those of local residents alone. They will affect everyone who visits the area for business or pleasure. Large areas of the Upper Hunter will lose what is at present a pleasant rural aspect and will become an expanse of open-cut mine with extended amounts of disgorged topsoil.29

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27 G.T. Houen, ‘Mining Agricultural or Grazing Land’ (unpublished paper presented at the Mining As a Land Use, Queensland Chamber of Mines Seminar, Brisbane, 1982).
By the early to mid-1980s, the growing tension between coal and agriculture began to receive comment in Australian academic literature.\(^{30}\) In 1985, Peter Langkamp in a role as Environmental Adviser with Shell Australia, wrote a paper entitled ‘Potential Conflict between the Coal and Arable Land Resources in Australia: a Case for Corporate Responsibility’. In it, he identified the “simultaneous occurrence of arable land and black coal” in the Darling Downs (Queensland) and Liverpool Plains (New South Wales), and the potential for conflict between the two industries.\(^{31}\) Conflict in these locations indeed came to a head over twenty years later, with the efforts of landholders and local communities to oppose coal mining and CSG covered by local, state and national media. The Caroona Coal Action Group from the Liverpool Plains summarise their concerns as such:

The community is concerned about the possible destruction or contamination of aquifer systems, subsidence from longwall mining, and toxic mine by-products polluting air, land and waterways.\(^{32}\)

In the Darling Downs, the Friends of Felton Group successfully opposed a coal project, with their position and aims expressed simply:

... to stop mining development at Felton, and set a precedent to allow protection of other threatened prime agricultural areas across Australia.

Mining at Felton would have unacceptable impact on agriculture, the environment, and a large number of people.

Evident in these quotes is the significant junction between environmental and agricultural concerns, an overlap which helps to explain the phenomenon of agricultural and environmental interests uniting in common opposition to coal development in the twenty-first century. There are however at least a couple of precedents from the late-twentieth century. In 1984 it was reported that environmentalists and farmers in South Australia stood together in their concern over potential groundwater impacts from the proposed development of low-grade brown coal in the south east of the state. The unlikeliness of the alliance was the leading motif in an article on page two of *The Canberra Times*:

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Water and energy are two of South Australia’s crucial needs for future development. They go together like the proverbial horse and carriage in any projections to lift the economy... Less likely to travel in tandem in any situation are farmers and conservationists, but an alliance between them has formed in response to latest developments concerning the State’s scarcest resource, water, and a mining project which, it is said, may in future provide economic and alternative sources of energy.33

Another coalition of resistance against coal mining formed in Western Australia in 1989–1990, when Rio Tinto proposed a coal mine near Mt Lesueur, north of Perth. The proposal met an organised campaign of opposition initiated by local farmers, but which eventually comprised a network of organisations including local residents, unions, environmental groups, scientists and artists.34 Rio Tinto withdrew its proposal in 1990 and Mt Lesueur became a national park in 1992. The model of a broad coalition of groups and individuals opposing coal mining, and now CSG, in Australia has become a feature of many local and national campaigns, and is core characteristic of the Lock the Gate movement.35

Many of the conflicts over coal and CSG in Australia in recent decades rest, at least in part, on issues of mineral ownership and responsibility for resource decision making. Current mining law in Australia determines that minerals in almost all circumstances are ‘reserved to the Crown’ and vested in the relevant state government.36 There are a number of consequences from this basic legal architecture. State governments have the capacity and power to determine how exploration and mining is governed, and to collect rent and royalties from these activities. State governments can use their resource titles to defend against any Federal attempt to impinge on their control of resource exploration and exploitation.37 It also means that rights to minerals can be disposed separately from the surface of the land, “giving rise to the real likelihood of conflict between the occupier of the surface of the land and the prospector or miner seeking to exercise the mining rights conferred upon him [sic]”.38

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34 Janis Bailey.
35 Hutton, ‘Behind the Seams’.
Current mining laws are largely taken for granted. But no matter how entrenched mining legislation seems to be in Australia in the twenty-first century, in the context of a longer history, notions of mineral ownership and rights to mine are an expression of broader cultural, ideological and economic changes in society. A broad historical view can offer useful insights. The mining history of Britain is particularly relevant to Australia given this country’s colonial roots, but a wider exploration is also illuminating.

**Law of the land**

Throughout history, ownership and rights to minerals have reflected the balance of power between the “dramatis personae”, usually understood to include the ‘Overlord’ (in some cases, the Monarch or the Bishop), the community or state, the landowner and the mine operator. In many ancient civilisations mineral ownership was simply assigned to the Overlord, along with all property and subjects within a given territory. The actual mining was most often undertaken by soldiers or slaves. The notion and custom of ‘regalian’ rights — royal or state ownership of valuable minerals — emerged from the established proprietorship of the Overlord.

Greek texts from the fourth and fifth centuries BCE make clear that minerals were considered property of the Greek state from at least that period in time, and that deposits were operated by mine lessees to serve the optimal interests of the state. This conception was maintained by the Romans, and was also apparent during the Middle Ages in Europe, when hundreds of autocratic rulers asserted their rights to minerals found within their realms. Coal and other non-metallic minerals are unlikely to have been included in any of these early arrangements given their relative lack of value at the time.

The ownership of minerals was less uniform in England, with varying power relationships between landlords and royalty. Access and rights to minerals varied across Britain as a result of the melding of Roman, Old English, Saxon, Danish and Norman influences. At different times

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44 Lloyd, p. 34.
45 See Ryan, p. 104.
and places there were free exploration rights, free mining rights, fees payable to the Crown, or
sometimes to both the landlord and the Crown. In some cases there were obligations to work
the mines constantly, and there were other variations, such as whether the extent of a mining
lease was determined by surface boundaries or by the vein of the ore.46

A ‘royal prerogative’ over silver and gold was legally established in the 1568 Case of Mines, and
is significant in the history of British mining law.47 The first argument put forward by the
counsel for Queen Elizabeth I in the case is revealing of the times:

[In] respect of the excellency of the thing, for of all things which the soil within this
realm produces or yields, gold and silver is the most excellent; and of all persons in the
realm the King is in the eye of the law most excellent. And the common law, which is
founded upon reason, appropriates every thing to the persons whom it best suits, as
common and trivial things to the common people, things of more worth to persons in a
higher and superior class, and things most excellent to those persons who excel all
other; and because gold and silver are the most excellent things which the soil contains,
the law has appointed them (as in reason it ought) to the person who is most excellent,
and this is the King.48

Even though the logic expressed in this quote seems outlandish to modern sensibilities, the
Case of Mines has been influential in Australia. It was important in determining the law during
the gold rushes of Australia and New Zealand in the 1850s, with both countries having
inherited the Royal prerogative to gold and silver with colonisation. Particulars of the 1568
case and modifications over the following century were also critical in deciding a royalty
dispute in New South Wales as recently as 2010.49

In the several centuries following the 1568 case, there was a substantial shift towards private
ownership of minerals in Britain. Over the course of the seventeenth and eighteenth centuries
the maxim of Cujus est solum, ejus est usque ad coelume et usque ad inferos (to whomsoever
the soil belongs, he owns also to the sky and to the depths) gradually became fixed in common
law.50 An increasing dominance of laissez faire attitudes, and greater importance placed upon

46 Hoover and Hoover, pp. 85–86.
47 See J. R. S. Forbes and A. G. Lang, Australian Mining and Petroleum Laws, 2nd ed (Sydney:
Butterworths, 1987), p. 16; Michael W. Hunt, Mining Law in Western Australia, 3rd ed (Sydney:
Federation Press, 2001), p. 28; also see C.W O’Hare, ‘A History of Mining Law in Australia’, Australian
Law Journal, 45 (1971), 281–93 (p. 282) who mentions the ruling by Henry IV in 1403 that mining or
smelting gold or silver was a crime.
48 Quoted in David V. Williams, ‘Gold, the Case of Mines (1568) and the Waitangi Tribunal’, Australian
49 See David V. Williams; High Court of Australia, Cadia Holdings Pty Ltd v State of New South Wales
[2010], High Court of Australia, 2010.
50 Lloyd, pp. 2, 148–150, 656; Michael W. Hunt, Mining Law in Western Australia, p. 27; Hoover and
Hoover, pp. 84–85; see also John U. Nef, The Rise of the British Coal Industry, 2 vols. (London: Routledge,
individual rights and private property roughly coincided with the transition from a predominantly agrarian economy to one characterised by both agriculture and mining. With the aim of encouraging private enterprise, the royal prerogative over mines of copper, lead, tin, iron and other minerals gradually weakened. With metal mining freed up in this way, new mining districts opened up without the customary rights inherent in older mining districts — giving landholders greater freedoms to exploit the minerals beneath their soil. Perhaps most significant in reinforcing the rights of landholders over this period was the increasing importance of coal, and the fact that it was, by and large, free of either royal claim or customary codes.\textsuperscript{51}

**Coal under law**

For most of human history, coal did not have the importance and value it has since the industrial revolution. As late as the sixteenth century, coal in England was regarded as “noxious and disgusting”, a far cry from the Royal minerals which were recognised for their inherent “excellence” and importance for national defence.\textsuperscript{52} Coal was commonly thought to be on par with kindling wood, turf and peat.\textsuperscript{53} As such, it was covered by the 1217 Forest Charter that permitted manorial lords in most instances to “without fear or question, dig or break ground in their own holdings”.\textsuperscript{54} With ample reserves at or near the land surface in Britain, tenants could pick up or dig out coal for their domestic fires as a customary right.\textsuperscript{55}

In the transition to becoming “by far the most important single mineral” in the mid-eighteenth century,\textsuperscript{56} the ownership and right to mine coal became a more conspicuous concern. In Scotland from as early as the sixteenth century there is some evidence of coal being a royal right.\textsuperscript{57} In England there is only one recorded instance of an attempt to claim wide ownership of coal in medieval times; a claim from the Bishop of Durham in the early fourteenth century.\textsuperscript{58}

Crown control of coal in England became a more serious proposition during the seventeenth century when private, regional, monopolies increasingly controlled the coal trade, and when there was growing sense of frustration that small landholders were not properly exploiting

\textsuperscript{1932), I, p. 270. For a comprehensive explanation of the development of this maxim see Lloyd 1966, Appendix I, pp. 637-670.}
\textsuperscript{51} Lloyd, pp. 148, 667–668.
\textsuperscript{52} Nef, The Rise of the British Coal Industry, I, pp. 269–270.
\textsuperscript{53} Lloyd, p. 667.
\textsuperscript{56} Lloyd, p. 667.
their own mineral wealth.\(^{59}\) Both Crown ownership of the nation’s coal reserves and Crown control of the coal mines were considered.\(^{60}\) Ultimately though, private ownership of coal was reinforced along with a strengthening of landholder rights to minerals more generally.\(^{61}\)

Britain’s coal deposits were finally nationalised under the 1938 Coal Act, in an attempt to stabilise the industry and increase production.\(^{62}\) Australia however had strayed from British mining law a century earlier to regulate and legislate the mining of coal and other minerals.

*Development of mining law in Australia*

Coal was the most important mineral in the early decades of British occupation of Australia and it was the product of the first commercial mine on this continent (as discussed in Chapter Six).\(^{63}\) It appears to have been the first mineral to attract a number of government proclamations in the colony, beginning in 1801, when Governor King announced that all coal and timber procured at Hunter River were “exclusive property of the Crown”.\(^{64}\) Variations to coal ownership ensued over the next half century.\(^{65}\) But notwithstanding these various early perturbations, overall it is understood that from the beginning of colonisation until the mid-nineteenth century, resources in Australia were considered to be part of the land. With the exception of Royal metals, minerals were conferred to the grantee of property as stipulated by British common law.\(^{66}\)

The development of Australian mining law is commonly regarded to have properly begun in response to the challenges arising from the New South Wales and Victorian gold rushes of the 1850s.\(^{67}\) What followed was a “profusion of legislative experiments”\(^{68}\) across Australia to codify


\(^{61}\) Lloyd, p. 7.


\(^{63}\) Forbes and Lang, p. 1.

\(^{64}\) NSW Colonial Government; Turner, *Coal Mining in Newcastle, 1801-1900*, p. 15.

\(^{65}\) See O’Hare.


\(^{67}\) See for instance Michael W. Hunt, *Mining Law in Western Australia*, p. 1; Lloyd, pp. 12, 16.

\(^{68}\) O’Hare, p. 290.
mining practice, which in some states continued well into the twentieth century. Issues of administration, safety, technical regulation and the control of Crown grants were covered alongside the important business of clarifying prospecting and mining rights.69

Australia diverged from other common law countries (including Britain, the US and Canada) when it was decided that the Crown comprehensively owned the continent’s minerals, and not just its gold and silver.70 With the formation of individual Constitutions, each colonial parliament was able to free itself of British control and determine its own policy for mineral ownership. Resources constituted a valuable asset and offered a potential revenue source, so one by one, the colonies opted for minerals to be retained by the Crown in future grants of freehold title land.71 In this way, the common law principle of landholder ownership of minerals (with the exception of the gold and silver) has been virtually “abolished by statute in Australia”.72 But in its preclusionary operation, legal historian Lewis Lloyd observes that “although the common law has been buried, it still rules Australian mining statutes from its grave”.73

Issues pertaining to the right to mine minerals have also been shaped by Australia’s historical circumstance. The Miner’s Right has been a keystone feature. It originated in the aftermath of the 1850s Victorian gold field conflicts, and bestowed certain rights, privileges and entitlements on miners.74 For instance, it encoded principles of free entry onto Crown lands, and security of mineral rights to the first entrant.75 Further legislation passed in Victoria in the 1880s and 1890s extended the rights of miners to Crown minerals on private land, whereby a prospecting licence could be gained without the consent of the landholder, although it was subject to compensation payments. All other Australian jurisdictions eventually passed similar legislation.76 Lawyers J. R. S. Forbes and A. G. Lang observe that the extension of free miners’ rights to include all Crown minerals “confirmed that the hasty response to the gold rush had become an integral part of Australian mining legislation rather than a mere historical aberration”.77 The possessory title has remained a feature of Australian mining law, but as the

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69 O’Hare, p. 290.
73 Lloyd, p. 20.
74 Ryan, p. 108.
76 Forbes and Lang, pp. 3–6; O’Hare, pp. 290–292.
77 Forbes and Lang, p. 6.
scale of mining operations has grown, it has been overshadowed by the increased use of discretionary titles.\footnote{Michael W. Hunt, ‘Government Policy and Legislation Regarding Mineral and Petroleum Resources’, p. 850.}

Despite Australia’s unique history, the evolution of Australian mining law has been said to still essentially be “the story of the interplay of the claims” between the land owner, the mineral owner, the miner and the state.\footnote{Alfredson, p. 58; paraphrasing O’Hare, p. 281.} In balancing these various interests, the mining legislation of each Australian state has traced slightly different paths over the course of the twentieth century and up until the present time. A positive view of the overall result is that of a well-struck “social harmony”:

> Mining legislation offers the prospective miner every assistance in acquiring rights of entry upon land and rewards him for his enterprise by clothing him with title to the minerals won. The general law owner is compensated for the loss of his minerals, proportional to the value of his minerals, by the payment of royalties. The land owner is requited for the use of his land by a rental return. The State gains all those socio-economic advantages which stem from the development of the natural resources of the country. The evolution of this social harmony is the history of the mining laws.\footnote{O’Hare, p. 293.}

This summary and the claim of ‘social harmony’ however ignores the continuing and at times significant level of dissatisfaction and distress experienced by the various groups involved, and the degree to which concerns in the realm of mining can spill over into broader public discussions and political decisions. Journalist and commentator Paul Cleary identifies the last decade as the time when “the frenzied pace of Australian resource development has tipped the balance of coexistence to the point where mining dominates our society, our economy and even our political system”.\footnote{Cleary, Mine-Field, p. xi.} This may be true, but it has not occurred in a vacuum. In reality, various aspects of the political economy of mining have been under contention in Australia for a number of decades.\footnote{See for instance Donald Horne, Money Made Us (Ringwood, Vic.: Penguin Books, 1976), pp. 62–75; Birrell, Hill and Stanley.}

Often missed in popular analyses is the ubiquitous role of the state in mining matters. As noted by solicitor and scholar I. D. Alfredson, “The State has an interest in each of [the] four contending groups and is the adjudicator between them”.\footnote{Alfredson, p. 58; For an extensive exploration and analysis of the role of the state in regards to coal see Fisher; and also Gibson.} In light of this, the ability of governments to act impartially when making decisions and actively regulating mining is highly
questionable. Other significant power imbalances are also hidden within the framing of a balanced social harmony. For instance, the prompt and aggressive reaction from the mining industry to native title laws in the 1990s, its successful $22 million campaign against mining tax reform in 2010, and its efforts to undermine the Rudd government’s Carbon Pollution Reduction Scheme and the Gillard government’s carbon tax, have dramatically shown the industry to be a major force in influencing Australia’s political and economic directions. Some commentators also emphasize the mining industry’s enormous behind-the-scenes lobbying and promotion activities, as discussed in the previous chapter.

A view from the twenty-first century highlights the importance and prominence of local communities and the natural environment as other key players in mining issues. Arguably, at least environmental conservation groups should be considered a fifth pillar of influence in discussions of mining law in Australia over the past several decades. Environmental impacts from mining were unmistakable during the nineteenth century in Australia. But it was only from the 1960s in Australia that they began to be more properly considered, and in the 1970s that they “frequently” affected the development of mining ventures. Historian Geoffrey Blainey argues that in the 1970s, “the conservation issues had become one of the tightest brakes on the expansion of mining”, and that “for the first time in Australia’s history a small, ardent minority was virtually arguing that the long rush at last should end”. Far from coming to an end, mining booms in the early 1980s and mid 2000s saw mining contribute ever larger shares to the domestic economy and export income. Nonetheless, environmental contests around mining have become increasingly visible and relevant to legal decisions. Indeed, sand mining on Fraser Island, mining for gold, platinum and palladium at Coronation Hill, drilling for

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87 Blainey, p. 364.
88 See for instance Pearse, McKnight and Burton; Pearse, Quarry Vision; Pearse, High & Dry.
90 Blainey, p. 363; also see Hancock, pp. 70–73, 177–178.
91 Blainey, p. 364.
92 Cleary, Too Much Luck, p. 5.
petroleum in the Great Barrier Reef, and uranium mining generally, have been among the most prominent environmental disputes over the past fifty years in Australia.

While some mining projects have been halted on the grounds of environmental impact, the more common result of environmental concern has been mandatory mine site rehabilitation, tighter regulation, the introduction of mandatory environmental impact assessments into the assessment process for new development projects, and the development of various codes and guides, particularly since the 1970s. Despite the achievements and ongoing challenges with mandatory environmental assessments, the legislative inclusion of environmental concerns has so far failed to systematically account for the whole-of-life impacts of the mined product, which is of particular relevance to coal in an era of anthropogenic global warming.

In the air

Smoke nuisance

The burning of coal had emerged as a significant nuisance to public health, amenities, infrastructure and vegetation long before coal mining began to seriously compete with other land uses. When coal is not completely combusted, smoke and soot are produced along with water vapour, ash and carbon dioxide. Meanwhile, the sulphur content in coal readily oxidises to form pungent sulphur dioxide. The stench, smoke and grime from coal was legendary in medieval times; it would have been with mixed feelings that householders and tradesmen

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97 See for instance Scott, ii, p. 459; Shepherd, p. 396. Scott suggests that the noxious fumes complained about in earlier times can be attributed to the fact that the coal was obtained from seams near the land surface, gathered as ‘sea-coal’ or from shallow pits. Shepherd explains that outcrop coal is often high in sulphur, ash and moisture which results in “heavy production” of smoke and sulphurous fumes.
turned from wood to coal from the early centuries of the second millennium in China, Europe and Britain. By the thirteenth century in London the use of coal for burning lime, and to a lesser extent for use by smiths, brewers and dyers, was causing probably the first documented active tensions related to coal use.98

Queen Eleanor was famously compelled to leave Nottingham Castle in 1257 because of disagreeable coal smoke, which she feared threatened her health.99 Similar complaints were made by citizens from right across the social strata, and in 1288 a commission was instituted in London to investigate the problem.100 The reputation of coal also suffered because of its sulphurous smells that evoked connection to the demonic underworld. Coal fragments resembled bubonic swelling and this further associated coal with suffering and death.101

In the early 1300s, following fifteen years of commissions into coal smoke, King Edward I is reported to have decreed “Be it known to all within the sound of my voice, whosoever shall be found guilty of burning coal shall suffer the loss of his head”, a major threat that in fact did little to reduce the use of coal at that time.102 As discussed in Chapter Five, the severe human toll from the Black Plague led to a reduction in the use of coal, but consumption levels recovered when the British population re-established, and when declining local sources of wood dictated a return to coal again as an energy source in the sixteenth century.

In 1661 John Evelyn, a founding member of the Royal Society, addressed the King in a pamphlet he wrote about air pollution, entitled *Fumifugium: or the inconvenience of the aer and Smoake of London dissipated*. Plain in his disgruntlement with the “Hellish and dismal Cloud of SEA-COALE” that “universally mixed with the otherwise wholesome and excellent Aer”,103 he wrote:

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98 See Hatcher, i, p. 25.
100 Hatcher, i, p. 25.
101 Freese, pp. 27–28.
103 John Evelyn, *Fumifugium; Or, the Inconvenience of the Aer and Smoake of London* (Humphries, 1772), p. 18.
That this Glorious and Antient City... which commands the Proud Ocean to the Indies and reaches the farthest Antipodes, should wrap her stately head in Clowds of Smoake and Sulphur, so full of Stink and Darknesse, I deplore with just indignation.\footnote{Evelyn, p. 8; also cited in Boyden, p. 200.}

His suggested solution to the problem was to move coal-dependent trades beyond the limits of the city:

... Removal of such trades as are manifest Nuisances to the City, which, I would have placed at farther distances; especially, such as in their Works Fournaces use great quantitie of Sea-Coale, the sole and only cause of those prodigious Cloud of Smoake, which so universally and so fatally infest the Aer, and would in no City of Europe be permitted, where Men had either respect to Health or Ornament.\footnote{Evelyn, p. 34.}

The cost of coal smoke on human health in London was quantified at this time by demographer John Graunt. Graunt studied the weekly Bills of Mortality and found that between one fifth and one quarter of all deaths were caused by respiratory illness, which he attributed to the prevalence of coal smoke in the city.\footnote{Hiltner, p. 557; Freese, pp. 40–41; Eric Ashby and Mary Anderson, \textit{The Politics of Clean Air} (Oxford, UK: Clarendon Press, 1981), p. 1.} Graunt’s line of investigation has since been elaborated using more sophisticated understandings of particulate matter and its effect on human bodies. New findings include a wide range of health implications from the mining and burning of coal.\footnote{See for instance American Lung Association, \textit{Toxic Air: The Case for Cleaning up Coal-Fired Power Plants} (U.S.A., March 2011); Ruth Colagiuri, Johanne Cochrane and Seham Girgis, \textit{Health and Social Harms of Coal Mining in Local Communities: Spotlight on the Hunter Region} (Melbourne: Beyond Zero Emissions, October 2012).}

From these earliest works onward, connection was drawn between pollution and health, and between social changes and environmental consequences. But curbing the negative effects of coal burning remained a significant challenge for countries around the world for centuries, and still is a major problem in the major cities of China and India. The eighteenth century saw the invention of the steam engine, and with it, coal was used for ever more applications. Individuals and groups of people continued to agitate for political, legislative and technological solutions to the ever-growing smoke nuisance.\footnote{See for instance Ashby and Anderson; Mosley; Stern and others, pp. 7–8; Angela Gugliotta, ‘Class, Gender, and Coal Smoke: Gender Ideology and Environmental Injustice in Pittsburgh, 1868-1914’, \textit{Environmental History}, 5 (2000), 165–93 \texttt{<http://dx.doi.org/10.2307/3985634>}; Frank Uekötter, \textit{The Age of Smoke: Environmental Policy in Germany and the United States, 1880-1970} (Pittsburgh: University of Pittsburgh Press, 2009).}
Smoke from the nineteenth century on

Accounts of Melbourne’s sights and smells in the latter half of the nineteenth century is an important reminder that coal pollution was just one among multiple products of various “noxious trades” that filled the air, water and streets of industrial towns and cities in an era before stringent regulation. The stench was enough to earn Melbourne the title of “Marvellous Smellbourne”. In 1870 Royal Commissioners investigating the “nuisance or injury to public health” from various trades in the city found:

... fellmongers, tanners, tallow-boilers, soapmakers and bonemillers in the immediate vicinity of the city made little attempt to clean their drainage or suppress noxious effluvia.

Elsewhere around the world, industrial processes such as alkali production and metal smelting caused significant damage and conflict where pollution affected its urban and rural neighbours. Nonetheless, the problem of coal smoke was extremely widespread internationally, and in numerous industrial cities it dominated all other airborne nuisances.

Manchester in north-west England earned its title as the “the chimney of the world” through rapid urban growth and the rise of an intensive manufacturing industry during the nineteenth century. Similarly, coal smoke smothered the industrial city of Pittsburgh, in the eastern US, to such an extent that it was pronounced “hell with the lid taken off” by a columnist in 1868.

Even in Australia’s relatively small towns and cities, including Newcastle — Australia’s “Coalopolis” — coal pollution was described by observers, portrayed by notable artists, discussed in parliament, and complained about in letters to local newspapers from at least the early 1860s. Writing in 1875, John Dunmore Lang described the change in Sydney’s air quality as local wood resources diminished:

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111 Lack, p. 172.

112 Dingle; Uekötter, The Age of Smoke, p. 2; LeCain, pp. 68–72.

113 See Uekötter, The Age of Smoke, pp. 2–3.

114 Mosley, p. 2.

115 Gugliotta, p. 165.

116 Cushing, ‘Coalopolis to Steel City’.

The city of Sydney covered no longer, as of yore, with a thin transparent cloud of whitish smoke, curling slowly upwards from its numerous wood fires, but with a regular blackish cloud from the smoke of Newcastle coal, like that which overshadows most English towns, occupies a considerable portion of the field of vision.\textsuperscript{118}

In the early twentieth century, coal-based development reached the South African town and coal mining district of Witbank, where pollution was legendary.\textsuperscript{119} The severe twenty-first century smogs in Beijing, which disrupted preparation for the 2008 Olympics, are a stark reminder that the problem persists in the world today.\textsuperscript{120} Disasters like the fire in an abandoned section of the Hazelwood Coal Mine in Victoria, which resulted in smoke infiltrating the town of Morwell for several weeks in 2014, also shows that Australia is not immune from the problem today.\textsuperscript{121}

Despite the significant inconveniences of dirt and grime, and obvious health impacts, coal smoke was not universally condemned in the industrial era. In his extensive expose of responses to coal smoke in Manchester in the late nineteenth and early twentieth centuries, historian Stephen Mosley argues that there was no single or objective perception of the city's pollution:

There was (and is) no pure sensation as such — no disinterested ‘naked eye’; only engaged perspectives that were formed from active experience of a blackened cityscape which was at one and the same time a physical reality and a shadowy \textit{milieu} suffused with cultural values and beliefs. At bottom, sensory perceptions of air pollution can not be disentangled from the particular urban-industrial context in which Manchester’s citizens lived out their lives.\textsuperscript{122}

Effects of pollution were also experienced unevenly across lines of gender, class and race.\textsuperscript{123} Inevitably then, there was a variety of responses to the “dark volumes of sulphurous smoke” in

\textsuperscript{118} Quoted in Coward, pp. 193–194.
\textsuperscript{122} Mosley, p. 69.
\textsuperscript{123} Uekötter, \textit{The Age of Smoke}, p. 3.
Manchester at the height of its manufacturing fame, and in other places around the world where coal fires burned, including London where the famous ‘pea soup’ fogs dogged the city for decades. A dominant narrative interpreted smoke as a signal of well-being and progress, even the “golden breath of life,” and as invoking industrial aesthetic charm.

Understandably, workers commonly associated bellowing chimneys with jobs and financial well-being. Manufacturers and officials who directly benefitted from the profits of industry also had an interest in maintaining coal-fired productivity. Writing about Newcastle Australia, cultural historian Nancy Cushing observes that smoke was “part of the Faustian bargain” which residents accepted “in exchange for employment and membership in a family of industrial cities.” In Pittsburgh, historian Angela Gugliotta notes that smoke was portrayed as an artefact of virtuous, productive and manly labour, and so by implication, any desire to abate smoke could be marginalised as “sentimental” and a “frivolous aesthetic concern reducible to feminine vanity”. The miasma theory of disease, dominant until the 1880s, often promoted carbon and sulphur pollution from coal combustion as having a cleansing influence on the cocktail of other foul domestic and urban odours that contributed to ‘bad air’. Even after the miasma theory was disproved, the widespread acceptance of contagion theory only served to perpetuate a lack of concern about the effects of smoke on health.

There were nonetheless other grounds for opposition to coal smoke. Smoke abatement efforts took various forms. In Manchester from the 1840s, anti-smoke societies emerged among the ranks of the middle-class, educated and professional elite. Their concerns centred on the waste of a nationally important finite resource and the desecration of built and natural spaces. They eventually also came to express concern about human health. Besides respiratory illness, there was a fear that the smoky pall over Britain’s industrial towns and cities could lead to the physical degeneration of the British people. Foreshadowing twenty-first century

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124 Mosley, p. 69.
125 From a poem entitled ‘The Smokeless Chimney’ written by Mrs E.J. Bellasis in 1862, quoted in Mosley, pp. 72–73.
126 Singer, p. 289; Andrews, pp. 65–66; J. R. McNeill, Something New under the Sun, p. 59; for further discussion on coal as an allegory of progress see Callahan, Lofton and Seales.
127 Mosley, p. 70; Cushing, ‘Australia’s Smoke City’, pp. 21–22.
129 Gugliotta, pp. 168, 175. Such a claim could only be made in the context of a cultural marginalisation of women’s domestic labour, for women bore the lion’s share of the burden of scrubbing and cleaning coal smoke grime. See Gugliotta, pp. 168–169; Mosley, pp. 54–56.
130 Mosley, pp. 78–84; Thorsheim, pp. 10–18; Coward, p. 193.
131 Uekötter, The Age of Smoke, p. 4.
132 Mosley, p. 89.
133 Mosley, pp. 96–107.
cost-benefit calculations were undertaken in both Manchester and London by the mid-nineteenth century, to demonstrate the significant sums of money that people spent on cleaning and washing houses, furniture, clothing and human bodies as the result of burning coal. In Pittsburgh, the smoke abatement cause was taken up by mostly male civic elite in the early-twentieth century, but their work followed efforts and events from previous decades; the positive cultural associations with smoke were weakened when a period of natural gas availability was followed by “independent and complementary” critiques of bituminous coal by elite women and working men in the nineteenth century.

It would have been rare for anyone to argue for a cessation of coal use in the industrial era, given the centrality of coal to the functioning of industrial economies, the strong cultural attachment to domestic coal fires and the absence of viable alternatives. Rather, efforts were focussed on smoke reduction. In Manchester, various smoke-consuming technologies were put forward — over sixty such devices were on the market in 1843. Issues of expense, reliability and a lack of legal and legislative support served to reinforce the priority of coal-fired productivity. Increasing the height of factory chimneys, some to over ninety metres tall, enhanced the performance of the steam engines at the same time as dispersing coal smoke higher into the atmosphere, away from where it caused direct, visible damage. Where it was available, gas and anthracite coal provided popular alternatives to smoky, bituminous coal. This option was quickly adopted by some Sydney hotels and factories in the early-twentieth century after the discovery and promotion of anthracite in a coal seam by local colliery proprietors.

Overall, comprehensive solutions to the problem of coal smoke were elusive in the nineteenth century. The cause of the coal smoke dilemma was deep rooted, whereby the costs and benefits of coal use could hardly be disentangled — they were “two sides of the same coin”. In Britain’s manufacturing areas at least, the shift in political, economic and cultural attitudes towards industrialisation was reflected in legal cases that increasingly found smoke abatement was “more than outweighed by the possible negative repercussions of pollution injections for

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135 Mosley, pp. 91–92.
136 Gugliotta, p. 184.
137 See Mosley, p. 120.
138 Mosley, p. 122.
139 Mosley, p. 130.
141 Mosley, p. 115.
industrial growth”. Legislative attempts to stem the smoke nuisance also struggled to gain traction for a range of interrelated reasons, including the difficulty of proving the source of pollution, a lack of evidence that linked smoke with ill health, the representation of pro-coal interests in magistracy and local councils, and the inadequacy of enforcement and sanctions.

With particular striking parallels to Australian politics in the late twentieth and early twenty-first centuries, multiple anti-smoke Bills were thwarted by the efforts of a politically influential manufacturing lobby in Britain in the mid-nineteenth century. Although, as historian Frank Uekötter notes, it is overly simplistic to cast businesspeople as universally opposed to smoke abatement.

Sydney’s coal consumption grew from an estimated 52 tons in 1850 to 625 tons in 1881 (53 and 635 tonnes respectively). By the end of 1862, the quantities of smoke emitted from coal-burning industries in the city were sufficient to prompt Edward Deas Thomson to initiate a private members bill in the Legislative Council, based on existing Acts in London and Scotland. He hoped that the existing level of smoke nuisance would be abated, but his particular interest was to stem the problem from getting worse. He argued that for a small cost, existing furnaces could be made to operate more efficiently, and that what would be an inconvenience for a few, would be a benefit “for the general and public good”. The council overwhelmingly agreed with Thomson’s proposal. The lone detractor was a former director of the Australian Steam Navigation Company who argued that the bill would lead to “unneighbourly quarrels and ill-feeling” and “give rise to many legal squabbles”. There was also active debate outside of parliament. Manufacturers, bankers, and businessmen were among those who vocally opposed the Bill, and characterised those who supported it as elites only interested in protecting their own interests. One meeting of business owners resolved that the proposal would “entail great hardship on manufacturers, without any benefit to the public”. By contrast, one pro-Bill petition claimed the manufacturers were the ones who were self-

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142 Mosley, p. 134.
143 Mosley, p. 141.
144 Pearse, Quarry Vision; Pearse, High & Dry.
145 Mosley, pp. 141–142. Mosley also quotes a summary of a statement made by Harry Grimshaw, a Manchester magistrate, manufacturer and member of the City Council who told a public meeting in 1889:
“A certain quantity of coal had to be burnt, as a natural result smoke was produced... It was an easy thing to drive away industries from one centre to another, and it behoved Manchester people, if they were not indifferent to their own interests, to be just and candid in the matter of the smoke nuisance. They must endeavour to clear the city atmosphere without harassing... trade almost to the verge of extinction... Corporations should have consideration for the industries that had made our cities and towns”, see p. 178.
interested. The Bill was stalled in the Assembly, but was passed with amendments and became effective several years later, from 1st July 1866.\textsuperscript{147}

The successes of the New South Wales Smoke Nuisance Abatement Act include that it helped to deliver recognition and legal acceptance of the coal smoke problem as a public nuisance, and paved the way for prosecutions. The major weakness with it was a lack of clear provisions for policing. Although there was some level of initial enforcement, it appears that the effectiveness of the Act diminished over the subsequent decades, at the same time as polluting industries grew in Sydney, and the apparent public interest became more entangled with coal-based industries.\textsuperscript{148} Historian Dan Coward also identifies some timeless dilemmas:

Moreover, given that public agencies were simultaneously polluters and policemen of the Smoke Nuisance Abatement Act, a conflict of interest existed. Who policed the policeman? Which interest was to prevail? Indeed, was the conflict explicitly recognised?\textsuperscript{149}

Such questions are equally relevant to the regulation of polluting industries 150 years later.

Dealing with air pollution is often regarded as one of the environmental success stories of the twentieth century, with air quality improving notably in the latter half of the period in the western world. In Britain, major advances in regulation occurred following the deaths of 4,000 people in the 1952 London smog, when the mix of smoke and fog was so bad as to reduce visibility to less than thirty centimetres.\textsuperscript{150} In 1956, the UK's Clean Air Act was passed,\textsuperscript{151} followed by a 1970 Act of the same name in the US.\textsuperscript{152} Technological innovations applied to coal-fired plants were a significant part in reducing air pollution. Engineer Edward Rubin describes how a late-twentieth century coal-fired power plant emits "less particular matter, sulphur dioxide and nitrogen oxides" in its lifetime compared to the emissions from an older-generation power plant in a single year — a result he describes as "nothing less than miraculous".\textsuperscript{153}

In his research that investigates responses to coal smoke in the US and Germany, Uekötter argues that there were two parallel environmental revolutions that took place, one societal and one institutional. These were a cumulative effect of technical engineering

\textsuperscript{147} Coward, pp. 194–198.
\textsuperscript{148} Coward, p. 197.
\textsuperscript{149} Coward, p. 198.
\textsuperscript{150} Freese, pp. 167–168 gives a vivid account.
\textsuperscript{151} Boyden, p. 201; Mosley, p. 186.
\textsuperscript{152} Uekötter, \textit{The Age of Smoke}, pp. 260–261.
accomplishments, control programs working at various levels of government, the willingness of industry to cooperate, as well as the work of countless activists who pushed for change.\(^{154}\) In Pittsburgh in the early 1940s for instance, the combined effort of citizens, engineers and politicians successfully enacted smoke prevention legislation after the example was set in St Louis.\(^{155}\) Uekötter describes how coal smoke was the “the crucial institution-builder in the field of air pollution control”, and emphasises the enormity of the task faced:

> In retrospect, the fight against smoke looks like a protracted and mostly ineffectual battle — had it been otherwise, the age of smoke would have been a mere episode. But such a reading underestimates the huge extent of the problem and the obstacles to addressing it... For an industrial society with almost universal coal combustion, the smoke nuisance presented a gigantic challenge.\(^{156}\)

While the precise manoeuvres, mechanisms and broader context of smoke abatement is unique to each country, often down to the level of local jurisdictions, many of the themes are consistent. Usefully, these provide a flavour of one of the most persistent coal contestations over the past several centuries, the hard-won public and institutional responses to the challenge, and some important parallels to current dilemmas.

**Powerful invisibles**

After centuries of focus on visible coal smoke, public debate over recent decades has turned to concerns about the invisible emissions from coal combustion. A list of hazardous air pollutants from coal-fired power plants in the twenty-first century includes acid gases (such as hydrogen chloride and hydrogen fluoride), benzene, toluene, dioxins, furans, formaldehyde, lead, arsenic, mercury, Poly Aromatic Hydrocarbons, and radioactive materials.\(^{157}\) The total load of these pollutants can be significant. For instance, mercury from coal burning is the largest of all anthropogenic emissions, amounting to about 45% of the total quantity released into the environment every year.\(^{158}\)

After smoke, acid rain or ‘acid deposition’,\(^{159}\) emerged as a serious and far reaching negative consequences of burning fossil fuels. The destructive acidic consequences of sulphur and other


\(^{156}\) Uekötter, *The Age of Smoke*, p. 3.


\(^{158}\) UNEP Chemicals Branch, p. 2.

constituents of coal released during combustion were first understood in the mid-1800s when Scottish chemist Robert Angus Smith investigated the chemical composition of rain in Manchester. Findings from his further extensive research on the topic were published in his 1872 book, *Air and Rain: the beginnings of chemical climatology*, earning him the reputation as the ‘father of acid rain’. Nearly one hundred years later, Swedish chemist Svante Odén hypothesised the connection between rising acidity in Swedish rivers and lakes with long-range industrial pollution from Britain and continental Europe. He worked with “scientific acumen and activist zeal” to bring attention to the issue which he saw as “an insidious chemical war”.

In 1972, attention was focussed on acid rain as a major public policy challenge when it was discussed at the UN Conference on Humans and the Environment in Stockholm. Beginning in the late 1960s, Sweden and Norway unsuccessfully pressured their European neighbours to reduce sulphur emissions for the sake of Scandinavian lakes and streams. More complex repercussions from acid rain and sulphate particles were subsequently studied and speculated on, including the impact on ecological communities, soils, agricultural crops, human health, and as a reflector of solar radiation. Finally, in the early 1980s, Germany joined with Sweden and Norway to press for action on the trans-boundary pollution problem on the back of new scientific evidence of the effects of acid deposition on forests.

In North America, the industrial mid-west of the US was a major source of acid-forming pollution that landed on sensitive soils and lakes in Canada and in the north-east of the US. Both countries successfully reduced sulphur emissions by 15-25% after 1975, but it was not until 1990 that the *Clean Air Act Amendments* were passed in the US that deeper reductions were made. Acid rain was also a trans-boundary problem in East Asia, with Japan suffering the consequences of pollution from China and Korea. Overall, collaborative science, adversarial

160 See p. 383 onwards in Smith.
diplomacy, negotiated protocols and binding regulatory instruments have marked efforts to respond to the challenge of acid rain internationally.\textsuperscript{166} 

Alongside formal negotiations and agreements, acid rain also became a campaign focus for environmental activists. For instance, in the early 1980s German and Canadian environmentalists initiated mass protests and awareness-raising stunts around factory chimneys as well as forests and historic buildings under threat from acidic erosion.\textsuperscript{167} Parts of the coal industry responded in a similarly recognisable way to the increasing public concern. In April 1984, Carl Bagge, the US National Coal Association President, was reported as denying that sulphur dioxide emissions and acidity were increasing. He stated that “acid rain has become a political fraud, perpetuated by environmentalists who espouse a no-growth philosophy”.\textsuperscript{168} 

Scientists however have calculated that coal combustion has been the largest single contributor of anthropogenic sulphur dioxide emissions since 1850. From the first half of the twentieth century other sources grew in significance, including petroleum combustion, international shipping, metal smelting and waste. Nonetheless, the burning of coal remained dominant and contributed close to 50\% of global emissions in 2005.\textsuperscript{169} Europe and North America were the largest emitters of sulphur up until around 1950. Since that time, other regions have become more significant contributors — particularly Asia which made up around 40\% of global emissions in 2005, and with China contributing 28\% of the global total.\textsuperscript{170} 

Global emissions of sulphur dioxide reached a low in the early 2000s as the result of various global and regional agreements and efforts,\textsuperscript{171} although have increased again since that time.\textsuperscript{172} A group of thirty-two European countries succeeded in reducing its total emissions by 66\% between 1990 and 2005;\textsuperscript{173} several of these countries made reductions of close to 80\%.\textsuperscript{174}

\textsuperscript{166} Levy. 
\textsuperscript{168} ‘U.S.A.: Acid Rain “Political Fraud”’, \textit{The Canberra Times} (ACT, 26 April 1984), p. 4. 
\textsuperscript{170} Smith and others, ‘Anthropogenic Sulfur Dioxide Emissions’, p. 1109. 
\textsuperscript{171} Brady and Selle, pp. 225–228. 
\textsuperscript{174} S. Reis and others, ‘From Acid Rain to Climate Change’, \textit{Science}, 338 (2012), 1153–54 (p. 1153) <http://dx.doi.org/10.1126/science.1226514>.
Similarly, the US achieved a drop in sulphur emissions of 67% between 1980 and 2009,\textsuperscript{175} which was in part achieved through the establishment of a large scale cap and trade system, the first example of its kind in the world for pollution control.\textsuperscript{176} Several factors have contributed to the reduction in worldwide emissions from coal in particular; altogether, sulphur emissions from a unit of coal were 40% lower in 2005 than 1970.\textsuperscript{177} A transition away from high-sulphur coal to either low-sulphur coal or gas has been important, as has the fitting of post-combustion ‘scrubber’ and flue-gas desulphurisation technology.\textsuperscript{178}

Acid rain was an important precursor to the monumental challenge of global warming — both are trans-boundary problems entwined in science and politics, dependent on technological innovation for solutions, with unavoidable economic dimensions, involving both state and non-state actors, and pitted against dominant forms of energy generation. Likewise, the international effort to address the hole in the Ozone Layer is often cited as a forerunning dilemma to climate change, because reducing the global production and consumption of ozone depleting substances involved similar political dynamics, and contributed to an international alertness to global atmospheric risks.\textsuperscript{179} In contrast though, simple technical and chemical substitutes existed in the case of ozone depleting substances.

There are important lessons to be learned from looking across the range of society’s pollution challenges over the past several centuries. Not least of which is the question of how to effectively intervene with energy sources and industries that are central to modern society, especially when the costs and benefits of intervention are actively disputed. The experiences of battling the smoke and acidic consequences of coal burning are particularly pertinent to current issues in trying to limit carbon emissions.

As with acid rain, there was a substantial lag time between when Earth’s greenhouse effect was first theorised and described and when carbon emissions from fossil fuels were taken seriously as a potent force in Earth’s atmosphere that demanded a committed response.

\textsuperscript{177} Smith and others, ‘Anthropogenic Sulfur Dioxide Emissions’, p. 1110.
A warming Earth

In the early 1820s, French mathematician Jean-Baptiste Joseph Fourier turned his attention to the question of how the heat from the sun was sufficiently retained by Earth’s atmosphere to support life on the planet’s surface. In an article published in 1824, he proposed that water vapour together with other gases in the atmosphere formed a barrier like an enormous bell jar, conserving the heat necessary for life.180 In 1859, Irish scientist John Tyndall established that carbon dioxide was opaque to infrared heat (unlike oxygen and nitrogen which are transparent), and thus a key greenhouse gas. And then in 1896, Swedish scientist Svante Arrhenius calculated the relationship between temperature and carbon dioxide levels, and identified theoretical connections between fossil fuel combustion, increased carbon dioxide concentrations in the atmosphere, and rising temperatures.181

The likelihood that human activity could have a significant impact on the atmosphere and Earth’s temperature seemed extremely remote in the late nineteenth and early twentieth centuries. But by the late 1930s, British engineer Guy Stewart Callendar presented research he claimed showed that warming was already underway. Callendar also attributed the warming to fossil fuel combustion, but viewed the predicted temperature increases as having positive consequences.182 His work was largely dismissed at the time and was overlooked for the next twenty years because it was predominantly believed that the oceans would absorb the carbon emissions from human activity.183

Over the intervening decades, scientists have been able to confirm the increase in global temperatures, and are now confident that greenhouse gas emissions from human activity are responsible for the warming. For instance, the fifth IPCC Assessment Report states that “It is

183 Paterson, p. 22.
extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century”.\textsuperscript{184} Another scientific investigation reports that July 2014 was the 353\textsuperscript{rd} consecutive month in which global land and ocean surface temperatures were greater than the twentieth century average, and that there is a 99.999\% probability that the warming is the result of anthropogenic greenhouse gas emissions.\textsuperscript{185}

Possibly one of the earliest reports in Australia on the climate-changing impacts of burning coal appeared on page two of Sydney’s \textit{Evening News} newspaper on 8\textsuperscript{th} October 1912. The article entitled ‘Coal Smoke. Effect on Atmosphere’ describes carbon dioxide as the one positive product of coal combustion, and may well have been written as a synopsis of Arrhenius’ 1908 publication of \textit{Worlds in the Making}, which contained similar arguments.\textsuperscript{186} Readers of the Sydney paper learnt:

> The vicious effects of coal smoke upon health, the fearful wastefulness of costly fuel that it shows, the destruction of vegetation that it causes, form together so severe an attack upon the city smoke that it is pleasant to find one small word which can be said in its defence. This sole favorable argument is that smoke makes the climate milder, according to a recent discovery. In the burning of coal a large amount of a gas known as carbon dioxide is produced, almost three times as many tons of gas as the original coal consumed.

The article succinctly reports on the greenhouse effect (“the effect of carbon dioxide in the air is to act as a means for holding the heat of the sun”), and the estimated climate sensitivity (“the doubling of the quantity of gas would increase the temperature of the world seven degrees”). The anticipated consequences of such a warming were reported as being largely positive for the spread of agriculture into formerly cold latitudes and with even the Polar Regions losing “much of their terror”. It was however acknowledged that tropical regions would “suffer heavily, and a great change in the vegetation would result”. And somewhat ambiguously, “this presents many other interesting phases”, including the prospect of factory work becoming impossible during the hot mid-summer days in the previously mild weather of New York.\textsuperscript{187} Evidently, no concern was expressed about the possible effects of a warmer world

\textsuperscript{184} International Panel on Climate Change, ‘Summary for Policymakers’, p. 17.
\textsuperscript{187} \textit{Evening News}, ‘Coal Smoke. Effect On Atmosphere.’, \textit{Evening News} (Sydney, NSW, 8 October 1912), p. 2. This article was most likely a re-print from U.S. media.
on the Australian continent, even though the nation had suffered the long and severe ‘Federation Drought’ just a decade earlier.

Such enthusiasm for the contribution of coal to atmospheric carbon dioxide levels seems odd in the twenty-first century, with present understandings of Earth’s climate system. In 1957, the accepted view that the oceans could absorb anthropogenic carbon dioxide was turned around with the publication of a paper in the journal *Tellus*, which predicted a significant increase in atmospheric carbon dioxide levels from the continued burning of fossil fuels.\textsuperscript{188} It was followed by the establishment of a permanent carbon dioxide measuring station at Mauna Loa which has proved the continuous annual increase in atmospheric carbon dioxide since 1958.\textsuperscript{189} The prospect of global warming was publicised for broader audience around this time, through articles such as one in 1959 in the popular science magazine *Scientific American*; ‘Carbon Dioxide and Climate’ was illustrated with a bold image of factories spewing coal smoke from their chimneys, and warned of potential warming of up to 3 degrees by the end of that century.\textsuperscript{190}

It is now understood that the burning of fossil fuels have been the primary contributor to elevated levels of carbon dioxide in the Earth’s atmosphere, which have increased by 40% since pre-industrial times, and have also contributed the increase of the heat-trapping gases methane and nitrous oxide. The concentration of these greenhouse gases are believed to be at the highest level for the past 800,000 years.\textsuperscript{191} Cumulatively, carbon dioxide from the burning of coal accounts for nearly 50% of all carbon dioxide that has been emitted from fossil fuels since the mid-1700s.\textsuperscript{192} Annually, coal burning has represented at least 40% of total carbon dioxide from fossil fuels in recent years,\textsuperscript{193} and is the single largest contributor to total greenhouse gas emissions from all sources with a proportion of around 39%.\textsuperscript{194}

\textsuperscript{188} Roger Revelle and Hans E. Suess, ‘Carbon Dioxide Exchange Between Atmosphere and Ocean and the Question of an Increase of Atmospheric CO$_2$ during the Past Decades’, *Tellus*, 9 (1957), 18–27 [http://dx.doi.org/10.1111/j.2153-3490.1957.tb01849.x]; Paterson, p. 22.

\textsuperscript{189} Paterson, pp. 22–23.

\textsuperscript{190} Gilbert N. Plass, ‘Carbon Dioxide and Climate’, *Scientific American*, 201 (1959) [http://www.scientificamerican.com/magazine/sa/1959/07-01/]; described in Corfee-Morlot, Maslin and Burgess, p. 2741.

\textsuperscript{191} International Panel on Climate Change, ‘Summary for Policymakers’, p. 7.


\textsuperscript{194} Boden, Marland and Andres; Ailun Yang and Yiyun Cui, *Global Coal Risk Assessment: Data Analysis and Market Research* (U.S.A.: World Resources Institute, 2012), p. 2. A similar figure for coal’s contribution to CO$_2$ emissions is found by considering a 2005 IPCC report on global emissions, whereby it is reported that “the power and industry sectors” account “for about 60% of total CO$_2$ emissions”
Mobilisation on climate change

Opponents of coal smoke in previous centuries were aggrieved by phenomena that could be readily seen, smelt and touched. They were less influenced by the nuanced insights into issues such as health impacts and local effects of acid rain that were emerging in scientific literature. By contrast, once sufficient evidence had mounted, it was scientists who raised the alarm about the potentially disastrous ramifications of human-induced global warming: an invisible threat. The first clear announcements from scientists on the reality of anthropogenic climate change emerged in the mid to late-1970s. This included a statement from participants of the world’s first World Climate Conference in Geneva in 1979:

We can say with some confidence that the burning of fossil fuels, deforestation, and changes of land use have increased the amount of carbon dioxide in the atmosphere by about 15 per cent during the last century and it is at present increasing by about 0.4 per cent per year. It is likely that an increase will continue in the future. Carbon dioxide plays a fundamental role in determining the temperature of the earth’s atmosphere, and it appears plausible that an increased amount of carbon dioxide in the atmosphere can contribute to a gradual warming of the lower atmosphere, especially at high latitudes. Patterns of change would be likely to affect the distribution of temperature, rainfall and other meteorological parameters, but the details of the changes are still poorly understood.  

Concern over climate change became more public in the mid-1980s, but by the late 1980s, the term the ‘greenhouse effect’ firmly appeared in the public domain, at least in the western world. At that time the scientific community had generally accepted that anthropogenic global warming was under way, and they worked to put the issue in full public view. The unusually warm years of the 1980s and extreme weather events in the US spurred awareness and concern of climate impacts. An intergovernmental conference on climate change was held in Toronto in June 1988, and in November that year the IPCC was formed in Geneva, as a collaboration between the United Nations Environment Program and the World Meteorological Organisation. Conservative British Prime Minister and former chemist

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(p.77). A table that represents over 85% of the largest power and industry sectors lists emissions from coal-fired power stations as making up 59.69% — or 30% of global emissions. However, this proportion would increase when including emissions from other industries that also use coal, such as cement production and iron and steel production (which represent 6.97% and 4.71% of CO2 emissions form the largest power and industry sectors respectively); John Bradshaw and others, ‘Sources of CO2’, in IPCC Special Report: Carbon Dioxide Capture and Storage (Technical Summary), ed. by Edward Rubin, Leo Meyer, and Heleen de Coninck (IPCC, 2005), pp. 77–103 (pp. 77, 81).


196 Corfee-Morlot, Maslin and Burgess, p. 2743; Paterson, p. 30.

In Australia, in a rare bipartisan moment, the Hawke Government and Liberal National Opposition both spoke out strongly on society’s contribution to the greenhouse effect and the need for coordinated research and action. For instance, in 1988 then Minister for Environment, Graham Richardson, was quoted as proclaiming that global warming was:

... [not] just another isolated environment problem. It is powerful evidence that our continuing abuse and overuse of the earth’s finite and life-sustaining resources must stop... It is an issue, therefore, which must be acknowledged and addressed by all sectors of society.\footnote{Keith Scott, ‘Climate Study Review’, The Canberra Times (ACT, 4 November 1988), p. 2.}

Meanwhile, the Opposition’s spokesman for science, Warwick Smith, criticised Prime Minister Bob Hawke for his lack of leadership on the issue and called for the establishment of a National Climate Program, made up of the CSIRO, Academy of Science, Department of Foreign Affairs and Trade, and universities. The following year $7.8 million was committed by the Hawke Government to a research program on the enhanced greenhouse effect, aimed to put Australia at the “forefront” of international efforts.\footnote{Lenore Taylor, ‘Greenhouse Research Gets $7.8m Boost’, The Canberra Times (ACT, 7 April 1989), p. 10; Keith Scott.}

From the early 1990s, international momentum on global warming resulted in the 1992 UN Framework Convention on Climate Change signed in Rio, and the adoption of unilateral targets to limit greenhouse gas emissions by numerous industrial states.\footnote{Paterson, p. 1.} Since then, concrete outcomes have generally proved elusive, as the world grapples with what has proved to be an enormously complex and difficult set of issues. Translating scientific understanding of risk, itself with degrees of uncertainty, into effective policy encounters highly contested questions related to things like the most appropriate economic instruments and technological innovations for limiting greenhouse gases. The difficulty of dealing effectively with coal smoke in previous centuries highlights the dogged persistence of such policy and technical challenges. Another layer of complexity comes from the imperative to engage with questions of social justice, power and distribution.\footnote{See The Governance of Climate Change, ed. by David Held, Marika Theros, and Angus Fane-Hervey (Cambridge, Massachusetts: Polity, 2011), p. 5.} There is also human society’s systemic dependence on
carbon fuels to maintain its current high energy regime. Ultimately, the level of transformation required would involve "a fundamental reorganisation of the way in which modern industrial economies are constituted", amounting to a "level of disruption" reminiscent of past monumental society-wide changes such as those brought about by the industrial and information technology revolutions.202

There were signs in the latter part of the twentieth century that coal would be increasingly seen as an enemy of a safe climate. For instance, in 1991, participants of the World Coal Institute conference in London heard that "...it would be naïve to think that coal will not be singled out as a villain in the global climate debate".203 However, it was also clear that coal proponents were reluctant to take a precautionary stance on the issue. For instance, the authors of the 1980 World Coal Study (discussed in Chapter Seven) concluded that "...the present state of knowledge about CO₂ effects on climate does not justify action to limit or reduce the global use of fossil fuels or delay the expansion of coal use...".204 There is also evidence that the industry struggled to form a coherent position on climate change into the 1990s. For instance, a 1994 booklet on the Hunter Valley based Coal & Allied Industries includes a page on 'The Environment', claiming:

Coal & Allied and the coal industry in general are taking a very responsible approach to the greenhouse debate, firstly by arguing to keep the matter in perspective and secondly, by positive action for abatement of greenhouse gases.205

The document outlines four measures the local industry was pursuing to "reduce coal's contribution to the "greenhouse effect"", which altogether reflect an awkward and largely inconsequential response to the issue: "production of environmentally acceptable coals for world markets"; "backing for research to examine the still-to-be-proven link between greenhouse gases and forecast climate changes"; "pressure on government to increase community awareness of the need for energy, and to encourage conservation", and; "a massive tree-planting program to reduce levels of carbon dioxide".206

In the absence of clear and decisive leadership to deal with climate change from government and industry, pressure for meaningful action has come from elsewhere. The numerous potential implications of global warming span issues as diverse as health, poverty, ecology,

203 Rubin, p. 32.
204 Carroll L. Wilson, pp. 31–32.
206 Coal & Allied, Coal & Allied Industries Limited, p. 23.
economics, disaster management, real estate, and business sustainability. Unsurprisingly then, climate activism represents a broad church of individuals and organisations pursuing various means for change.\(^{207}\) Such efforts are not without their own complexities and challenges related to the nature of the global warming dilemma and to collective organisation more generally.\(^{208}\) Nonetheless, internationally-networked groups such as 350.org are maintaining momentum on the issue created by earlier movements, such as that following Al Gore’s *An Inconvenient Truth*.

The concept and quantification of human’s remaining ‘carbon budget’ since 2009 (discussed in Chapter Two) has added traction in debates about action on climate change, and specifically by focussing attention on the world’s remaining fossil fuels reserves. The framing of the carbon budget highlights the fact that coal makes up the greatest share of remaining fossil fuels as well as dominating current anthropogenic emissions of CO\(_2\). It is therefore unsurprising that coal has been particularly targeted by climate change activists in the twenty-first century.

**Conclusion: A new turn?**

Human societies have wrestled with the costs and benefits of mining and burning coal for at least 700 years. When considering coal from a broad historical view, what emerges is the recurring conclusion that, overall, the negative impacts of coal on land, air, water, people and infrastructure have been overwhelmed by the positive repercussions of coal. In light of the remarkable role of coal in human society, it is not surprising that this has been the case.

However, it appears that the long-entrenched acceptance of coal is now being seriously questioned. The forever-increasing scale of coal mining throughout the twentieth and early twenty-first centuries has meant that impacts from mining, processing and transportation are forever more expansive, and clashing with many other land use values. There is also better scientific understanding of the effects of both visible and invisible products from burning coal on human health and the environment. Arguably, the world’s relatively recent understanding


of coal’s large and on-going contribution of greenhouse gases to the global atmosphere has
tipped the balance of perceived costs and benefits more than anything else. The impacts of
coal are no longer only local or even national, but global.

With the future of a safe climate for humanity and other life on Earth at stake, novel coalitions
and networks have formed between climate activists, scientists, landholders, health
practitioners, progressive economists, religious leaders, elected politicians and individual
concerned citizens. There are calls to substantially wind back if not finally end humanity’s
dependence on coal. There are also now financially viable alternative energy sources. With the
capabilities of the internet and social media, anti-fossil fuel campaigns have gathered
remarkable momentum in recent years.

This new narrative for coal has also emerged in mainstream analyses, such as in a 2014 report
by the Global Commission on the Economy and Climate. Among nine other key points, the
Commission recommends that all levels of government as well as businesses, financial
institutions and civil society organisation “accelerate the shift away from polluting coal-fired
power generation”,209 and further argues that:

Given the known risks associated with coal, it is time to reverse the “burden of proof”,
so coal is no longer assumed to be an economically sound choice by default. Instead,
governments should require that new coal construction be preceded by a full
assessment showing that other options are infeasible, and the benefits of coal outweigh
the full costs.210

Nonetheless, coal continues to play a crucial role in maintaining patterns of production and
consumption that are the basis of society as we know it. Humanity has not been forced to
consciously shift away from such a fundamental energy source since the transition from wood
to coal in earlier centuries. Therefore, there is effectively no precedent for dealing with the
manifold challenges that we are likely to encounter, nor the scale of these. Systemic change is
difficult and will probably be resisted. In its place, technological solutions such as carbon
capture and storage may ameliorate coal’s gaseous emissions. More effective policies and
practices from governments and industry in response to landholder and community impact
concerns could also dampen other aspects of opposition. Industry and governments could also
simply roll on with planned coal expansions in spite of widespread concerns, driven by
economic and institutional structures and cultures that remain wedded to coal.

209 The Global Commission on the Economy and Climate, Better Growth Better Climate: The New Climate
210 The Global Commission on the Economy and Climate, p. 37.
This chapter has focussed on issues with particular relevance to controversies surrounding the planned opening up of the Galilee Basin. While they are not within the scope of this thesis, a more complete survey of the history of coal contestations would also include those related to workers and coal mining communities. There are valuable resources that deal with these issues, with a number of excellent published works covering around 150 years of depravation, inequality, struggle and open conflict in various forms. Incorporating these other important aspects of coal history would further enrich our understanding of the complex, and often fraught, role of coal in human society.

Chapter 9

REFRACTIONS OF COAL

On 28th July 2014 the Australian Environment Minister, Greg Hunt, announced the approval of the Carmichael coal mine — the fourth mine in Queensland’s yet-to-be-opened Galilee Basin to be given the green light by both state and federal governments. With a proposed output of 60 million tonnes per annum, Carmichael, owned by Indian company Adani, would be the largest of all the Galilee Basin mines. It would be four times the size of the existing largest coal mine in Queensland and the largest coal mine to operate in Australia.

Hunt was keenly aware of controversy surrounding the mine. When announcing his decision, he explained that the “absolute strictest of conditions have been imposed”, which would “ensure the proponent meets the highest environmental standards and that all impacts, including cumulative impacts, are avoided, mitigated or offset”. He emphasised the quality of the environmental assessment process, as well as the significant financial rewards for the region and the state’s economy, the generation of local jobs, and stated that “up to 100 million people in India” would be provided with electricity as a result of the mine going ahead.¹

Environment groups in Australia and abroad found little to no comfort in Hunt’s assurances. They vocally opposed the Carmichael decision, citing damage to local ecosystems and groundwater, as well as the negative effects from the associated port development on the Great Barrier Reef, and the ‘catastrophic’ climate change consequences.² The news also roused a broader public interest and drew at least one celebrity response, with Australian model Robyn Lawley scribing “stop coal mining” in red lipstick on her naked torso before posting the image on Instagram along with an explanation for her actions:

... Instead of joining countries such as Germany and introducing more renewable energy to protect our great land for us and future generations, we continue to go backwards. Coal is soon going to be a dead commodity only bought buy [sic] irresponsible countries

who do not care about climate change and the damage on the world. I’m shocked and feel powerless so I decided to get people to read this one way or another, we have to stop them.....before its [sic] too late.³

Of all the coal provinces ‘opened up’ in Australia over the past 200 years, the Galilee Basin is undoubtedly the most contested. Lawley’s stunt is but one example of the degree to which opposition to coal expansion, and coal expansion in the Galilee Basin in particular, has entered mainstream consciousness in Australia, and the extent to which civil action against coal has become commonplace. Much of the energy in the Australian and global anti-coal movements has gathered since this research commenced in 2010, which reinforces the topicality and importance of the topic.

The Galilee conundrum

In this thesis I have argued that the conflict surrounding developments in the Galilee Basin is symptomatic of a deeper conundrum in human society’s relationship with coal. Coal has helped to deliver modern society as we know it, but a continuing reliance on coal will severely challenge the basic limits of human survival on Planet Earth. The significant contribution of coal to global warming demands that long-entrenched patterns of production and consumption be re-shaped. There are signs that this is beginning to happen. However, relatively little attention has been paid to thinking about the deeper aspects of modernity’s dependence on coal. Understanding the systemic forces at play may prove to be a vital component in the work of disentangling coal from human society, as well as shaping more appropriate energy systems into the future. This research has been conducted to contribute to such a discussion.

In particular, this research answers the question of why there are serious plans to develop a new large coal province in central-west Queensland despite significant and growing concerns about the environmental and human impacts from mining, transporting and burning coal. The majority of this research has focussed on key aspects of coal that inform current plans and controversies. It draws on history, politics and other human dimensions surrounding coal development in Queensland and beyond in order to identify some of the deeper patterns and drivers. It explores a number of nested historical contexts that help to explain the complex role, and consequences, of coal in human society through time, and identifies issues for future energy choices.

³ Robyn Lawley, ‘Stop Coal Mining’, Instagram, 2014
I find that the momentum towards coal development in the Galilee Basin in the twenty-first century substantially relates to the central place of coal in human society. Therefore, a meaningful interruption to current plans for coal expansion in the Galilee Basin (and elsewhere in Australia and the world) will require a fundamental shift in the role of coal in human systems. Given the centrality of coal and other fossil fuels in industrial society’s current high energy regime, addressing coal dilemmas may ultimately require systemic change in the ecology of the human species.

**Findings from the key nested historical contexts**

Each historical context explored in this thesis reveals important dimensions of how and why coal became embedded in society. At the broadest level, coal is a product of carbon partitioning on a planetary scale and across geological time. Coal sits in the family of fossil fuels, which represent biological activity (ultimately photosynthetically captured solar energy) that escaped decay in former eras ranging from tens to hundreds of millions of years ago. This broad view helps us to see that the human intervention in the carbon cycle through the mining and combustion of fossil fuels is astonishingly recent and, as a non-renewable resource, inherently unsustainable. It also helps foster an appreciation of the gravity of humans transferring great stores of carbon to the atmosphere, to the extent that a new geological epoch, the *Anthropocene*, has been proposed to characterise the unprecedented influence of the human species on Earth’s systems.

On a human timescale, coal is essentially a story of energy. For the vast bulk of human history, the energy available to humans was limited to the amount of solar energy reaching the Earth, captured by photosynthesis, and circulated in the biosphere between plants and animals. For the duration of this time, humans were operating within energetic-ecological boundaries similar to those of all other animals. Coal became conspicuously entwined in human affairs through the industrial revolution. Drawing energy from coal rather than forests and cropping lands freed up land for other uses, and also ramped up iron and steel production, thereby implicating coal in the very structure of industrial systems. The geographically concentrated nature of coal mining, transport and consumption determined the location and development of industrial and other cities, and also had substantial political ramifications for the organisation and power of workers.

Tapping into the energy reserves in peat, coal, and later mineral oil and gas, made available to humans millions of years-worth of captured solar energy. No longer were humans bound to operate within the bounds of the organic economy, but were able to live off the Earth’s energy savings. This represented a dramatic and unprecedented shift and provided a differential advantage to the human species. Although there are major inequalities in how energy...
consumption is distributed, the harnessing of energy in fossil fuels has overall launched human society into a high energy regime that can be sharply distinguished from earlier phases.

The British colonisation of Australia in the latter part of the eighteenth century heralded the arrival of an already coal-dependent industrial society on the Australian continent. The British sought and found coal in the new colonies. Characteristics of Australia’s geology, geography, culture and history all shaped Australia’s relationship with coal; the size of the Australian continent, the dispersed nature of major towns and cities, and a desire for energy independence and the management of natural resources at a state level has seen coal keenly sought after and mined right across the country. Domestic coal resources have fired the national electricity supply to a larger extent than other countries with less local supplies.

The strong hand of the state in the coal industry was fostered in the early decades of convict labour in colonial Australia. It was further entrenched at various times over the nineteenth century when mining legislation of the colonies transferred ownership of coal deposits to the Crown, and was visibly displayed in the mid-twentieth century when state and federal governments directly intervened in the functioning of the coal industry. The second half of the twentieth century saw coal production in Australia grow exponentially in step with unprecedented economic growth internationally. Queensland took over from New South Wales as Australia’s main coal producing state. Open-cut methods of extraction, new Asian markets, and a changed regulatory environment all contributed to Australia becoming the world’s largest exporter of black coal. At the same time, Australian governments became evermore dependent on revenue raised from coal exploration, mining and export. By the late twentieth century, the coal lobby had made inroads to the heart of Australian policy development and decision making at both state and federal levels.

Altogether what emerges is a picture of coal that is thoroughly entrenched in human systems. Most fundamentally, coal has been critical in the supply of cheap and abundant energy. In this way, coal has transformed the ecology of the human species and set us on a path of energy dependence, from which it is now extremely difficult to deviate. Similarly, coal-dependent technological pathways have become ‘locked in’. These physical characteristics of coal in human society also have strong cultural, political and economic dimensions. In Australia, it has meant that coal production and consumption is fiercely defended by both state and industry.

This broad historical outline and conceptualisation of coal goes a long way to explain why the Galilee Basin is being considered seriously for coal development in the twenty-first century. Against the backdrop of coal’s broader history, pivotal role in modern industrial society, and more specific history in Australia and Queensland, it is unsurprising and virtually inevitable that the known thermal coal reserves in the Galilee Basin would be seriously considered for
development as soon as more proximate factors fell into place — namely an increase in the price of thermal coal.

Nonetheless, a growing opposition movement is energetically attempting to check the momentum towards coal development in the Galilee Basin. Climate change concerns and the potential damage to the Great Barrier Reef from port dredging at Abbot Point have drawn in a host of individuals and organisations from Australia and around the world to the Galilee Basin debate. These have helped to amplify awareness of the substantial potential impacts to groundwater, biodiversity and livelihoods. The bundling of issues and concerns, and the diverse make-up of opposition is characteristic of the broader anti-coal and CSG movement in Australia. But opposition to coal is hardly novel.

Contestations today follow many centuries of tension and conflict as human societies have wrestled with the costs and benefits of mining and burning coal. There are examples of campaign efforts in various parts of the world successfully curtailing coal pollution and disrupting plans for coal development. But overall, the dominant theme across space, time and issues has been the judgement that the benefits of coal have outweighed its costs. In light of the remarkable and revolutionary role of coal in human society, a lack of alternative fuels, and a belief that the negative consequences of coal use were relatively localised compared to the extent of positive outcomes, it is not surprising that, overall, coal has been beyond reproach.

However, the monumental risks and the global dimensions of climate change are forcing a re-evaluation of human's dependence on fossil fuels, and coal in particular. Unique to the twenty-first century are serious calls to fundamentally change human's relationship with coal; to severely limit, if not eliminate the role of coal in human society. As such, current proposals to development the coal resources of the Galilee Basin exist at an important crossroad in time. How events play out in the region over the next couple of years will, to a large extent, reflect the complex global struggle between a long entrenched, coal-dependent, development pathway, and a future beyond coal.

Wider implications

With mounting evidence that the world needs to move beyond its current dependence on coal, a crucial task is to consider how such change might come about. This research suggests that as well as swapping coal for other energy sources, there may be a need to engage with, if not directly confront, some of the deep and tenacious roots of coal's power and embeddedness in current systems.
One aspect to consider is the sheer quantity of fossilised energy that human society has come to rely on through its use of coal. The mostly unrestrained extraction of fossil fuels over the past several centuries has vastly improved a great number of human lives, but at the same time has shaped an industrial world that is inherently unsustainable and that would simply cease to function without continuing high levels of energy input. Appreciating the anomaly of fossil energy in the long span of human existence leads to questions such as: What level of energy consumption is desirable? Could and should energy consumption be more equitably distributed? Can the dilemmas we face in the twenty-first century be characterised as less of an energy crisis and more of a consumption crisis? Is it possible to fundamentally change the ecology of the human species?

Another important aspect is the way in which coal has become ‘locked in’ through associated technologies, institutions, cultural norms, economic structures, industry power and so forth. Shifting this strong nexus of factors may require a transformation akin to the industrial revolution in its scale and scope. However, in contrast to wood scarcities driving a transition to coal in earlier centuries, fossil fuel resources, and especially coal, are still relatively abundant. Thus, the motivation for transitioning away from carbon based energy is profoundly different to the factors that first led the move to coal in Western Europe. While appropriate price signals are likely to be an important vehicle for shifting away from coal, the failed attempt to put a price on carbon in Australia highlights the need for popular support and leadership. This research demonstrates why such leadership is unlikely to come from government or existing industry in Australia, which in turn suggests that civil society is going to need to push for change, and that it is likely to involve civil disobedience. Crucially though, no future energy source is going to be problem free. In considering future energy directions, there are important lessons that can be gleaned from experiences with coal and the longer history of energy transitions.

One of the significant features of coal controversies addressed in this research is the bundled nature of concerns. Coal is not only implicated in global warming, but also land-use conflict, impacts to water, agriculture and biodiversity, air quality, aesthetics, human health, worker safety, issues of industry power, and the relationship between state and capital, among other issues that have surfaced through the centuries. This provides a critical challenge in the design of future energy systems. Not only do future energy sources need to be low carbon emitters,

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4 Such questions are explored in popular books such as Ozzie Zehner, *Green Illusions: The Dirty Secrets of Clean Energy and the Future of Environmentalism* (Lincoln: University of Nebraska Press, 2012); and in more academic works such as Allan Mazur, *Energy and Electricity in Industrial Nations: The Sociology and Technology of Energy*, 1 edition (London: Routledge, 2013).

5 Ocampo; Held, Theros and Fane-Hervey, pp. 1–2.
but they must also endeavour to minimise collateral effects. Overall, there are vast opportunities to improve practices across the lifecycle of procuring, generating and distributing energy with a mind to genuine human well-being and sustainable development pathways.⁶

The history of coal highlights possible future conundrums related to the spatial reach and patterning of energy production. Prior to industrialisation, large areas of woodlands and pastures were required to generate fuel for human society, and this competed with other land uses. With coal and oil, energy production has become ‘punctiform’ (restricted in spatial extent) because of the concentration of energy in fossil sources. However, the spatial extent of energy production is almost certain to expand due to less-concentrated energy available through renewable technologies.

The long view of the Galilee Basin area in this thesis reveals that the current proposed coal developments build on a dramatic history of invasion, resource acquisition and landscape change associated with pastoral expansion over the past 150 years. In many ways, large scale mining in the twenty-first century can be seen as another wave of social, economic and physical transformation. The power of dominant modes of culture and economy to superimpose on existing ones emerges as a persistent pattern, and is a potential risk with renewable energy industries. Public opposition to biofuels and the siting of wind farms and solar installations are just a few examples of the kind of conflict and competition with other land users that are likely to be more common in the future.⁷ Unresolved questions of water impacts in CSG production, significant and persisting concerns of waste disposal with nuclear energy, and environmental consequences of mining rare earth minerals for low carbon technologies, demonstrate the need for views and approaches that can deal with the complex picture of energy in its broad and historical context.

The many and various issues directly addressed in this research, and others that have only been briefly touched upon, can be considered as being held together by a view that has

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⁶ For an example of scholarship that engages with these ideas, see Benjamin K. Sovacool, Roman V. Sidortsov and Benjamin R. Jones, *Energy Security, Inequality and Justice* (Oxfordshire: Routledge, 2013); Catherine Gross, *Fairness and Justice in Environmental Decision Making: Water under the Bridge*, Routledge Explorations in Environmental Studies (Abingdon, Oxon: Routledge, 2014).

attempted to encompass what might be termed the ‘multi-dimensional energy landscape’. 

_Landscape_ in this sense refers to the physical environment as well as less immediate and tangible things that affect or are affected by energy choices. It is an approach underpinned by a motive to understand issues systemically, and as they actually occur in the world; with inseparable interrelationships between physical and human systems, with linkages across wide space and deep time, and with small patterns reflected in the big picture, and vice versa. It is an approach that could potentially be useful in future research looking to comprehend existing and future implications of human energy choices, and a framework that can incorporate a range of biophysical and sociocultural disciplines.

Adopting such a broad framework is necessary to be able to determine whether or not specific energy projects make sense in light of planetary boundaries and the full spectrum of costs and benefits at local and global scales, including questions of ethics and justice.

**Further potential explorations**

This research has begun the process of mapping and synthesising the large and complex terrain of coal issues, and has demonstrated the value of a broad historical approach in considering current dilemmas. There is much potential to further explore the issues and questions raised in this thesis.

The civil movement against coal and CSG in Australia and worldwide is of key interest given the important role of public pressure and protest in the transition away from fossil fuels. The alliance of historically divided groups, such as environmentalists and farmers, is a particularly interesting space for exploration. The history of the relationship between the coal industry and government authorities in Australia, and the bearing that has on current dynamics is also ripe for closer research. Comparing and contrasting Australia with other fossil fuel dependent nations would provide important insights, and the political science literature on ‘petrostates’ is likely to offer useful theoretical frameworks for such an analysis.8 Finally, there is much scope to further develop the conceptual framework of the ‘multi-dimensional energy landscape’, which could be used to engage people from a range of backgrounds in a transdisciplinary conversation about how we might shape more sustainable energy futures in light of the lessons from our long history with coal.

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8 For instance Karl; Timothy Mitchell.
Appendix 1

RESEARCH APPROACH

This research aims to unveil some of the complexity that constitutes current dilemmas with coal. Humans' relationship with coal exists at the nexus of numerous overlapping systems, issues and concerns. The range of effects associated with the mining, transport and utilisation of coal also cross multiple spatial and temporal scales. Any small part of this big coal picture is a worthy subject of research, but the particular interest of this investigation is to retain a wide-angle view so as to develop a better understanding of current dilemmas with coal from a broad and historical perspective.

Not all aspects of the long and broad coal story can possibly be covered in any one dissertation, and no two people would approach the topic in the same way, or draw the same conclusions. This Appendix therefore outlines and explains the methodological approach that I have taken and the particular methods I have used. By way of clarifying key terms, ‘methodology’ here refers to the theoretical ideas that justify the use of particular ‘methods’, or techniques. Methodology forms an intermediary link between questions of philosophy and the application of specific research practices.¹

The conceptual framework that underpins this research project recognises that values are an inherent component of processes and outcomes of inquiry. It is thus appropriate upfront to acknowledge my own background and what I bring to this project. As described in the Preface, my motivation to undertake this research emerged directly from my experience with a current coal conflict in Queensland, Australia. I openly acknowledge that my experience with Bimblebox Nature Refuge, and through it, a connection to a growing anti-coal movement in Australia, has inevitably influenced my views on coal and my approach to this research. However, I have been motivated from the beginning to understand human society’s coal conundrum as thoroughly and meaningfully as possible, and not to produce a simplistic polemic. To be effective, I realise that my work needs to be well grounded, have integrity, and be able to speak to a wide audience. I believe that working towards a saner future will require finding common ground beyond political and ideological divides. And while I have engaged

with this topic with a predominantly environmental focus, I acknowledge that there are other legitimate aspects that are equally worthy of investigation.

This Appendix proceeds by introducing the academic fields of human ecology and environmental history, which have informed and guided the methodology for this research. I then consider some of the issues and themes within these fields, with a particular focus on inter- and trans-disciplinarity. This is followed by an outline of a conceptual framework that is relevant to both human ecology and environmental history. In light of the conceptual framework, I then go on to describe how this research has been conducted.

Research fields

Human ecology and environmental history are both interested in the dynamics and tensions between human and non-human systems, explored through interdisciplinary or transdisciplinary techniques. They attend to the temporal dimensions of current issues, both past and future. Both have a strong emphasis on research that is relevant to pressing issues, and which has some capacity to make a difference. Both fields have considerable strengths to offer research into complex and pertinent challenges.

Human ecology

Evolutionary biology and the work of Charles Darwin in the mid-nineteenth century, as well as his predecessors and successors, have been identified as marking the “formal beginnings of the ecological approach to the study of man [sic]”.

These scientists are unlikely to have identified as human ecologists, but they provided the concepts that could be applied to human

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communities by later scholars; most fundamentally and irrevocably, that like all other species on the planet, humans affect and are affected by their environments.

It is both possible and useful to understand humans and human systems within an ecological frame, despite the common assumption that human activities somehow operate outside of natural processes. A human ecological perspective helps to identify biological limits and stresses caused by human activity. It also lends itself to understanding human and environmental interactions in the framework of system dynamics, incorporating various feedback mechanisms. In human ecological inquiries there is also scope to incorporate the complexity of human societies — the ever-changing influence of culture and technology, and the variety in type and scale of human impacts on the environment and environmental impacts on humans. A human ecological approach can be applied both when looking at big, global systems, as well as at smaller, sub-system scales.

Given that *Homo sapiens* is a species embedded in cultural, economic and political systems and with highly developed technological abilities, the study of the ecology of humans inevitably involves drawing on multiple fields of knowledge that can encompass these various domains. It is of little surprise then, that the value of interdisciplinary research was identified as early as the mid-1900s by human ecology scholars. Increasingly, there is also reference to transdisciplinarity within the field of human ecology, which is discussed further below.

Far from having a linear and unified path of development, the study of human ecology is said to have emerged independently in a wide range of existing academic disciplines, where the basic concepts have been applied in various ways. The term ‘human ecology’ was first used in 1921, in the social sciences, following on from earlier framings of human societies in ecological terms beginning in the 1870s. Since then, ecological approaches have been developed in disciplines as diverse as geography, psychology, anthropology, agriculture, politics and architecture.

Human ecology is commonly regarded not so much a discipline as an “approach” or “perspective”. But it also exists as a field in its own right, accompanied by dedicated teaching programs in numerous international universities, including at the Australian National

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8 Gerald L. Young, ‘Human Ecology as an Interdisciplinary Concept’, p. 11.
10 Gerald L. Young, ‘Proceedings of Session I: Status of Human Ecology’, p. 34.
University. There is also an international academic society and dedicated research journals. There is a significant diversity within the intellectual community, but most converge on “the quest for a human ecology that can provide some means to examine and analyse contemporary human/environment interactions in a holistic, integrative, interdisciplinary way”. There is often an emphasis on long-term views and decision making, as well as a strong orientation towards practical solutions. This is described by human ecology scholar Jacqueline Russell:

Human ecologists anticipate that their work will have the capacity to not only investigate the causes of the interrelated environmental and social problems before us, but also to develop solutions to these problems and to generate models of alternative cultures which are ecologically sustainable and socially just alternatives to our contemporary (ecologically unsustainable) cultures.

In many of these respects, there are significant parallels with field of environmental history.

Environmental history

The French *Annales* historical school also had roots in the 1870s, and through its emphasis on the environment and geographical studies, was a key forerunner to the modern day field of environmental history. As a specific, named, and recognised area of study, environmental history is commonly described as beginning as a sub-discipline of history in the US in the 1960s and 70s. Its emergence was largely in response to the rising consciousness and concern about human impacts on the natural environment. As such, it was “born out of a moral purpose, with strong political commitments behind it”. It has since become a highly diverse field and even within the US there is a significant range in interests and approaches to environmental history scholarship, although scholar Donald Hughes observes that:

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14 Gerald L. Young, ‘Proceedings of Session I: Status of Human Ecology’, p. 34.
17 Worster, p. 290.
Environmental historians tend to think that the unavoidable fact that human societies and individuals are interrelated with the environment in mutual change deserves constant recognition in the writing of history.\textsuperscript{18}

A seminal paper by Roderick Nash on environmental history in the US highlights the commonality with the foundations of human ecology, and the role of history in this ecological view:

\begin{quote}
I felt that the environmental historian, like the ecologist, would think in terms of wholes, of communities, of interrelationships, and of balances. He [sic] should take as his first axiom John Muir’s statement ... that "when we try to pick out anything by itself, we find it hitched to everything in the universe." This applied, I thought, not only to everything in the present but to everything in the past as well. The continuum between past and present was also involved.\textsuperscript{19}
\end{quote}

These broad descriptions hold for Australian environmental historians as well, despite a different heritage of the field in this country. Environmental history in Australia has been described as a "confluence of disciplines" with geographers and physical scientists being prominent, and having been strongly shaped by agricultural, ecological, and forest sciences.\textsuperscript{20} Likewise, environmental history has grown in numerous other countries around the world, with various contributing influences and resulting styles and emphases.\textsuperscript{21} No matter where environmental history is studied, it seems that interdisciplinarity is a common defining feature.\textsuperscript{22} One variation to this is Libby Robin’s claim that environmental history in Australia is becoming an "interdisciplinary metadiscipline", which might be imagined as a broad umbrella under which multiple disciplines, styles and combinations are welcomed. Like human ecology, environmental history has dedicated academic journals, conferences and other characteristics of an organised discipline.

Wherever it is undertaken, the themes covered in works of environmental history generally focus on one or more of the following three categories: the influence of the environment on human history; the ‘rebound’ effects of human induced environmental impact back on human

\textsuperscript{18} Hughes, p. 1.
\textsuperscript{23} Robin, ‘Australia in Global Environmental History’, p. 191.
societies, and; the history of thought and attitudes of people towards the environment. Some also emphasise the focus on taking a historic ecological view to explain landscapes and issues of today as a means to identify the opportunities and challenges for the future. The relevance of history in policy development towards sustainability has been an explicit theme in Australian environmental history writing. For instance, interdisciplinary academic Stephen Dovers has noted:

The achievement of sustainability is thus a very big, complex and difficult challenge, and the problem of unsustainability a systemic one. The roots of unsustainability go very deep; at least as deep in a practical sense as those of the key political, social and economic institutions of modern societies, and this proposes structural disjunctions between human and natural systems. It seems a fair enough argument that the longer view into the future demanded by sustainability needs be matched by a longer view back. Thus the generic notion that an historical context will help understanding of the present and future might be especially the case for sustainability.

With this background established, there remains the question of how human ecological and environmental historical inquiries are actually conducted, and what it means in practice to focus on research questions that span multiple traditional disciplinary approaches.

**Issues and themes in human ecology and environmental history**

There is such convergence in the aims and perspectives of environmental history and human ecology that in some respects they are indistinguishable. Given that neither field has prescriptive methods or methodologies, a piece of research that considers the interrelationship between humans and the non-human world, from a long-term and ecological view, could rightly be claimed as a work of environmental history and/or human ecology. Indeed, prominent works, such as Rolfe Sieferle’s *The Subterranean Forest*, Stephen Boyden’s *Western Civilization in Biological Perspective: Patterns in Biohistory*, Stephen Boyden and others’ *The Ecology of a city and its people: the case of Hong Kong*, and John McNeill’s *Something New Under the Sun* would all be appropriately found on bookshelves of human ecology and environmental history scholars alike. There are also examples of research in this vein which have emerged independently, or from other disciplines with strong parallels, such

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24 Hughes, p. 3.
as human geography and historical geography. Ecological economics is another research field that shares very similar territory, and where “methodological pluralism” has been advocated as a way to comprehend complex systems.

Despite the many similarities between human ecology and environmental history, there are also some notable differences. The scholarly communities generally exist quite separately, for instance, writing to different journals and attending different conferences. There are also some characteristic differences in style, with environmental history often presented in narrative form and human ecology tending to be more analytical and aiming for policy relevance. Human ecology does not routinely consider historical dimensions, although a long-term view is not uncommon. Some examples of environmental history are quite close in content and style to more traditional, specialised, historical studies and so not particularly resembling human ecology. Altogether, the differences between the two fields are minimal and the fields are complementary rather than oppositional.

The disciplinarities

In recent years there has been discussion in both human ecology and environmental history literature related to research methodology, and in particular in reference to the inter- and transdisciplinary research space.

It has been remarked of both human ecology and environmental history that the research approaches and products have not been taken as seriously as is perhaps warranted. For example, Sverker Sörlin and Paul Warde have noted that environmental history’s common reference to the natural sciences has contributed to a “lack of interest or comprehension from other historians” in environmental history. In the case of human ecology at the Australian National University, especially in the early days, there was an inability of the university’s institutional structure to deal with a course that sat between science and arts. In both instances, the combining of information and methods from science, arts and humanities creates something that is no doubt of high value, but also unfamiliar to the ways in which knowledge has been traditionally created and communicated in the academic world. This however does look to be changing, with greater general acknowledgement of the value of non-traditional research endeavours.

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29 Sörlin and Warde, p. 114.
While ‘multi-‘, ‘inter-‘ and ‘transdisciplinarity’ can sometimes seem like the latest of overused buzz words, they have significant meaning in the research context, and some of their core underlying pursuits can be traced to ancient times. Understanding these terms is hardly aided by their lack of consistent meaning and application, so some clarification is relevant here. I take regular disciplinarity to refer to academic disciplines that generally have a high degree of specialisation. This can be most easily recognised in the traditional and discrete disciplines of things like mathematics, chemistry and physics. The research concepts, techniques and findings in these fields have been hugely important and influential for the development of modern society, and in large part are the result of the focussed and bounded nature of their inquiries.

Multidisciplinary research happens when two or more disciplines come together but retain their disciplinary methods and concepts. Research might be regarded as interdisciplinary when multiple research disciplines and outcomes are composed in a more integrated fashion, often applied to advance understanding or solve problems that are out of reach of any single research area or research area.

Transdisciplinary inquiry has been variously described, often using metaphors, but quite consistent is the notion of transgressing traditional boundaries and producing something that is greater than the sum of its parts. Researcher and practitioner Valerie Brown and her co-authors particularly emphasise the point that a transdisciplinary endeavour is one that includes more than just specialised academic knowledge but also “the personal, the local and the strategic”. Following Russell, they also include the further distinction of ‘open’ transdisciplinarity, which incorporates “all validated constructions of knowledge and their worldviews and methods of inquiry”. Frequently it is in response to particularly complex and

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35 Roderick J. Lawrence, pp. 18–20.
37 Brown and others, p. 4.
persistent challenges — sometimes called ‘wicked’ problems — that transdisciplinary approaches are recommended.38

Important to re-emphasise here is that disciplinarity, multidisciplinarity, interdisciplinarity and transdisciplinarity all have their useful applications. For instance, it would most likely be unhelpful to gather a transdisciplinary research team to solve a very specific unresolved bio-molecular research question, as it would be inappropriate to call on engineers alone to solve complex social or health challenges. Rather, it is a matter of right fit between the nature of the problem, and what is required as a response.39

While discussions around these different forms of disciplinarity often assume that an inquiry is taking place in the context of a research team, they can also be applied in the research work of individuals, such as a doctoral candidate. Through the development and deployment of a particular mindset, or ‘imagination’, and a well-tuned set of skills, it is possible for individual researchers to transcend many of the usual boundaries through the questions they ask, the range of sources and methods they call on, and the general approach to the inquiry. In other words, multi-, inter- and transdisciplinarity can be thought of as research techniques rather than just characterising the makeup of research teams.

So, how can this inquiry be described in methodological terms? This research deals with coal and related themes encompassing geology, geography, technology, energy, culture, politics, economics, environment, climate, and more. The issues involved demand dealing with past, present and future. Consideration is given to biophysical as well as social and ethical dimensions. Important sources of information include academic literature, popular media, email lists and websites. Accordingly, the most useful methodology is one that can accommodate an open, exploratory, normative, and ‘un-disciplined’ approach, while also ensuring academic integrity and rigour.

I consider this inquiry to be at least interdisciplinary in its synthesis of sources, methods and findings from a number of disciplines and research areas in response to a complex and multi-faceted issue. It is also has features of transdisciplinarity in its incorporation of views and ‘expertise’ outside of academic disciplines that have influenced my thinking and inquiry process — largely from the input of interviewees and the range of perspectives on the ‘front

line’ of coal conflict in Australia, gathered from the media, internet and campaign material, as well as my own personal experience. If the outcome of the research is deemed novel beyond what could be produced from the mere combining or integration of multiple disciplinary approaches, then it might further be regarded as an example of transdisciplinary research.

**Towards a conceptual framework**

Russell proposes a sophisticated conceptual framework to help strengthen and advance the foundations of human ecology research. Her thinking is equally applicable to all inquiries dealing with human-environmental interrelationships that are oriented towards social justice and ecological sustainability.\(^{40}\) As such, Russell’s framework is adopted to provide guidance to this inquiry which straddles the fields of human ecology and environmental history, and which has an explicit normative motivation.

Fields such as human ecology and environmental history that attempt to broach the gap between the human and non-human worlds in novel ways, face the challenge and criticism that they are not properly rooted in established conceptual frameworks and research methodologies. That is, researchers in these fields are apparently not committed to an agreed upon amalgam of values, beliefs, assumptions and theories that underpin their work, let alone the practical methods of inquiry.\(^{41}\) To an outsider, this might seem an obscure and pedantic point of little consequence. But in terms of creating valid, rigorous and acceptable scholarship, it is a serious matter. On this point Russell remarks:

> ... the lack of a comprehensive and cohesive conceptual framework that is recognised and accepted by the broader scholarly community has constrained the realisation of the fuller potential of the work of human ecologists to respond to the environmental and social ‘problematiques’ before us.\(^{42}\)

She further explains that “... different combinations of ontological, epistemological and ethical commitments result in quite different approaches to inquiry”,\(^{43}\) and the importance of having a conceptual framework in terms of the degree of confidence with which the research practice and output might be regarded:

> The process of defining one’s own constellation of metaphysical, methodological, theoretical and ethical commitments in relation to others serves to demarcate one’s

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\(^{43}\) Russell, ‘A Philosophical Framework for an Open and Critical Transdisciplinary Inquiry’, p. 34.
own identity, which has important consequences for the legitimacy of any knowledge system.44

In order to develop a conceptual framework that is philosophically integrated and defensible Russell engages with the critical social sciences,45 and in particular critical theory and critical systems approach to science, as promoted by thinkers such as Jurgen Habermas, Werner Ulrich and Gerald Midgley.46 Midgley’s articulation of the concept of *systemic intervention* is particularly relevant to this approach.47

Core to generating a conceptual framework is discussion around what constitutes valid knowledge, which in turn rests on ideas about the nature of reality, how we know the world and our ethical orientation to it. I concur with Russell’s reasoning and framing of the various commitments and principles required for open and critical transdisciplinary approaches to inquiry, which are summarised in Box 1. These points are not intended to be prescriptive or to go unchallenged, but rather serve as an important guide to navigate an inquiry terrain where boundaries are crossed and where there is an explicit aim to create improvement in the world.

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47 Midgley.
Box 1. Guiding principles for critical and open transdisciplinary inquiry, based on the work of Russell\textsuperscript{48}

- **Ontological commitments:**
  - The world exists independently of what I think about it. Physical things as well as cultural things are real, and so both are legitimate subjects of inquiry, as are the interlinkages between physical and cultural things. Further, both the physical and cultural parts of the world unfold in dynamic and heterogeneously complex ways.

- **Partiality, plurality and provisionality of knowing:**
  - While a real world exists, our perception and understanding of it cannot be complete, thus our knowledge can only ever be partial. Also, there is a significant diversity of factors that influence our conduct of inquiry, including our historically situated cultures, and our values, interests and purposes. The outcome is a plurality in our ways of knowing. Due to this partiality and plurality, our knowledge is provisional, thus needs to remain open to revision and improvement.
  - Knowledge generation is embedded in social contexts. As a result, the historically and culturally formed values and purposes of the inquiry cannot be separated from apparent facts and logic.

- **Foundations for reliable knowledge:**
  - Evidence and reason are the traditionally recognised pillars of legitimate inquiry, but a social process of critical deliberation is also required to support the reliability of knowledge. This might take the form of critical scrutiny, debate and defence. This process will entail that underlying assumptions, interests and values to come to the fore.
  - This critical deliberation should be open to people beyond the particular knowledge community in question — including other academic fields and wider communities beyond that. This is to avoid a relativist position where unquestioned standards and knowledge is generated by an unquestioned knowledge community.

- **Validity and critical rationality:**
  - Inter-subjective critical reflection is required for inquirers to become cognisant of how the process, outcomes and consequences of their inquiry have been influenced by their values, agendas, purposes, etc.

- **Include both facts and values in the inquiry processes and validation:**
  - As a consequence of the understanding that both processes and outcomes of inquiry are not value free, there is a need to be aware of both ‘facts’ and values that that inform our decisions of where and how we establish boundaries in our inquiries, as well as the ethical implications of our work.
  - Systems of inquiry inevitably are forms of interventions in the world. We therefore have capacity to decide to orient our work towards goals such as social justice and ecological sustainability.

**Openness across the three philosophical commitments:**
- The domains of ontology, epistemology, and ethics are explicitly accounted for, and that they are characterised as being ‘open’ rather than ‘closed’.\textsuperscript{49}
  - Ontologically, this means that the nature of the world exhibits heterogeneous and dynamic complexity, rather than it being conceived as linear and predictable.


Epistemologically, it means that our understanding of things is subject to change due to the ever-changing nature of the world and the limitations of human consciousness to know the world fully. As such, it is necessary to engage critically with both ‘facts’ and values in our pursuit to improve our understanding of the world as well as the ethical consequences of our inquiry based interventions.

In terms of ethics, ‘openness’ includes accepting that inquiries are unavoidably interventions in the world and that these interventions can be designed to promote improvement. In turn, critical reflection, deliberation and transparency are necessary in the process of establishing the boundaries in an inquiry. In the course of critical reflection, the notion of improvement would be examined in terms of improvement of what kind, for whom, by whom and a consideration of power and authority to make the requisite decisions. An ethical openness would also likely include an understanding that moral judgements are most often not universally applicable, but rather contingent on the particularities of space and time. Any conceptualisation around ethics will then in itself also need to be considered provisional and thus necessarily open to critical deliberation, and so also subject to challenge, revision and change.

### Openness across the three rationalities

An ‘openness across the three rationalities’ refers to an understanding and acceptance that there are various dimensions to existence which can generally be thought of as corresponding to the physical external world, the inner subjective world, and the normative social world. These do not necessarily exist separately or discretely, but naming them separately allows for further development of a conceptual framework for inquiries that include more than one of the dimensions. This framing draws on the work of Jurgen Habermas, and is expanded briefly here:

- The physical external world is related to a technical interest and instrumental rationality which is interested in knowledge about external physical things that can help to meet human physical needs for survival. This dimension is associated with the empirical-analytical/physical sciences.
- The inner subjective world is related to ‘practical interest’, which refers to the human need to communicate and establish mutual understanding in the process of coordinating efforts for survival. This dimension is interested in inherent values and is associated with the social, hermeneutic and historical sciences.
- The normative social world which is related to ‘emancipatory interest’ and which relies on ‘critical rationality’ to detect and respond to problems. This dimension is associated with the critical social sciences and critical systems theory.

### Include ecological conditions in human interests and knowledge:

- Expanding Habermas’ theory of ‘knowledge and the human interests’ in survival to include an interest in the ecological conditions required for life to exist.

There is now the task of considering my research approach in light of some of the key issues raised by Russell’s proposed conceptual framework, and to describe in more detail how this research has been undertaken.
What kind of intervention?

As mentioned above, a fundamental view informing this methodology is that both processes and outcomes of inquiry are not value free, and that inquiries are inevitably interventions in the world. Researchers therefore have capacity to orient their work towards particular kinds of interventions, for instance, creating improvement in the world. The idea of ‘improvement’ adopted here is that which progresses outcomes towards social justice and ecological sustainability.

Rather than being fixed and prescriptive, specific forms of ‘improvement’ are accepted as being temporarily and locally defined. Actions and behaviours deemed appropriate in one circumstance are likely to change depending on what information is at hand and the balance of priorities at any particular time and place. Nonetheless, the broader goals of social justice and ecological sustainability are likely to endure. For this inquiry, ‘improvement’ includes an intention to contribute to public debate and action that aim to reduce the significant harm caused by society’s current dependence on fossil fuels. By taking a broad and historical perspective, it is hoped that discussions spurred by this research might consider the interaction of a wide range of factors that make up a systemic view of coal in society.

Making decisions/establishing boundaries

Taking a long, broad, view of coal from a transdisciplinary perspective opens up innumerable options as to which particular dimensions are investigated, as well as how and to what depth they are handled. There are therefore potentially many forms and outcomes of the inquiry. Choices are made and boundaries are established at every stage of inquiry, consciously or not. Critically reflecting on this process is referred to as ‘boundary critique’ or ‘boundary judgement’ by researchers such as Gerald Midgley and Werner Ulrich.

Recognising embeddedness is fundamental to a reflection on boundaries. That is, an inquirer does not autonomously know and act in the world, but is inextricably linked to the physical, cultural, institutional and other worlds in which they operate. Boundary judgements are inherently related to values, and carry ethical implications. Summarising the foundations for a theory of boundary critique based on the work of Charles Churchman, Midgley writes:

50 Midgley, p. 130.
52 Midgley, p. 135.
APPENDIX 1: RESEARCH APPROACH

... boundaries are constructs, and may therefore be placed in a variety of places, bringing forth markedly different ‘realities’; they are associated with values, in that different values (associated with different ideas of improvement) may result in boundaries being constructed in different places; participation from a variety of stakeholders is important, because different stakeholders may bring different insights to bear; and even our most cherished ideas should be subject to critique from time to time to test their worth in the light of other systems.\textsuperscript{54}

In conducting this research, I have attempted to be as open as possible to a variety of perspectives and world-views that are relevant to the topic through talking with residents and people interested in my case study area. I have received valuable reflections from a range of people in the course of writing essays, papers and articles, and presenting my work to students and to new and established researchers over the course of the PhD. I have invited and welcomed critical feedback from supervisors, blind-reviewers, peers, friends and family which has pushed me to rethink some of my basic assumptions and biases. Listening to current news and commentary provides a constant stream of material on which I am forced to reflect “how does that fit into my research, how does my research fit into that?” I am also hopeful that the thesis itself will generate feedback, which will further refine the process of critically engaging with my values and chosen boundaries on a topic that is likely to hold my fascination for years to come.

Another way to think about boundaries is what is excluded from the inquiry — the obvious judgements are based on what I see as a combination of irrelevant and uninteresting to the research topic. There are also practicalities of what can be done in one study, by one person, in the context of doctoral research, and the trade-offs that must be made along the way due to time, resources, and access to sources. A more subtle selection process goes on when, for instance, I emphasise the cumulative negative costs of coal over the importance of the industry for numerous workers and their families, and to communities who might be desperate for electricity. In these cases, the long, broad perspective of this inquiry directs me to ask what values would align society closer to the goal of sustainability over the long term. In the end, the practice of making daily research and writing decisions is better described as iterative and organic rather than carefully systematic.

The choice of the Galilee Basin as a case study area was both obvious and tentative. Obvious for its status as the newest coal province in Australia, its significant size, its surprising anonymity to the general population at the outset of the research, and because of my own interest in the area from having lived in the region for several years. It was also tentative due

\textsuperscript{54} Midgley, p. 138.
to my close association with the region, and its distance from the Canberra region where I live and where I have conducted the majority of the research. However, given that the inquiry is mostly based on secondary sources, the distance was relatively unimportant. And given my choice of methodology accommodates personal experience and values in the conduct of the research, the reasons for hesitation were easily overcome.

Sources

This research provides a fresh synthesis of peer-reviewed academic papers and books from a number of disciplines that cover the long, broad, story of coal. It also draws strongly on material representing current coal dilemmas, including media stories, press releases, government reports, environmental impact assessments, newsletters, public commentary, email lists and websites. In the initial stages of research, wide database searches for ‘coal’ were conducted which exposed threads of relevant discussion in a range of disciplines. Interest in the breadth of academic work was maintained by surveying reference lists of journal articles and conference papers.

The original material used in this inquiry includes twelve semi-structured interviews I conducted between April and June 2012. Eight of the people I spoke with were living in the Galilee Basin area, either in small regional towns or on grazing properties. All the others had relevant interest and/or expertise in the Galilee Basin, and were mostly based in central Queensland. Information was also drawn from a community CSG forum in Barcaldine which was included in the 2012 field work. Approval for the interviews was gained from the Australian National University’s Human Ethics Committee in September 2011.55

Interviewees were initially selected through my connections in central-west Queensland and were expanded through a snowballing technique. The interviews were not intended to be representative of the range of the extant views and experiences of the community, industry and government. Rather, the purpose of the interviews was to expose issues not encountered in the literature and media, and to enliven and expand upon documentary sources by providing voices of lived experience. There was a particular interest to engage with people whose experiences and views are not commonly represented in formal sources, including government employees, regional townspeople and landholders, and Indigenous people. Even though overall there is not a widespread Indigenous presence in the Galilee Basin, both the historic and normative interests of this research render Indigenous perspectives highly pertinent. Other relevant voices and perspectives not captured in interviews were revealed

55 Protocol number 2011/135
through local media stories, and through the informal connections and conversations I had while travelling in the area.

I developed an interview guide prior to the interviews, based on the suggestions provided by human geographer Kevin Dunn (provided in Appendix 2). The questions were refined for each person based on relevance, and from reflecting on the previous interviews. Topics and questions were also adjusted during the course of each interview, depending on the level of engagement and what naturally emerged in the conversation. The interviews lasted from between 40 and 138 minutes, and all but one was audio recorded and later transcribed. Transcripts were emailed and/or posted to interviewees for review and they were invited to add or change anything that they considered outstanding. Only one participant replied with a slight amendment.

The interviews transcripts were analysed by identifying key issues, themes, and pertinent quotes. I paid particular attention to content that was either common across the interviews, unique to an individual’s experience, in accordance or discordance with the general literature and media reporting, or notably insightful or revealing about some aspect of the coal developments and what they mean for people in the region. This analysis then informed the relevant chapters of the thesis — especially chapters two and three.

The interviews exposed a number of issues and themes particular to the region that are not commonly represented elsewhere. For instance, the unprecedented scale of the proposed mines, the location of the Galilee Basin directly adjacent to an existing large coalfield where effects of mining on the land and communities are observed, and a high level of broader community interest are features relatively unique to the Galilee Basin.

**Approach and style**

I have tried to approach this inquiry in an open and exploratory manner. One important value has been accessibility. I hope that the research will be of interest to rural landholders and townspeople in the Galilee Basin area, whose lives are directly affected by the proposed coal developments and for whom ‘making sense’ of the potential transformation of their region has the most tangible implications. A landholder friend in the region had said to me “I won’t forgive you if you don’t make it a good yarn”, which has challenged me to write and present my research in a compelling and enjoyable way. But as a PhD, it is ultimately only worthwhile if it makes an original contribution to academic discourse. My aim then has been to strike on a mix of interest, relevance and rigour. A widely-relevant and accessible document increases the

chances of on-going discussion and debate both within academia and across the Australian public more generally. This in turn invites the kind of critical deliberation recommended by Russell, which can go towards improving the range of information and ideas considered, and the conclusions that are drawn.
Appendix 2

INTERVIEW GUIDE

General questions

- Personal history and connection to region
  - E.g. Could tell me a bit about your background and connection to this region?
  - What is your role in the community?
  - What are the things that you value about your region?

- Aspirations for the region into the future
  - E.g. What would you like to see in this region — in 50 to 100 years’ time?

- Awareness of Galilee Basin coal developments
  - E.g. When did you first become aware of the coal developments proposed for this region?
  - Why do you think there is a lot of action around the coal developments now?
  - Do you have a sense of how big the proposed developments are compared with other mines and mining areas in Australia?

- Identity of region
  - E.g. When did you first hear of the Galilee Basin being used as a name for this region?
  - What name would you usually use to identify your region?

- Perceived impacts from coal development in the Galilee Basin
  - E.g. What do think about the proposed coal developments?
    - What kind of negative impacts, if any, do you expect to see?
    - What kind of positive impacts, if any, do you expect to see?
  - Has your opinion changed through time?
  - What are some of the lessons that could be learnt from coal development in the (neighbouring) Bowen Basin?

- Perception of mining companies
  - E.g. How do you find the conduct of mining companies and their staff?
  - Have you noticed any changes in the attitude and approach of the mining companies over time?
APPENDIX 2: INTERVIEW GUIDE

- Some people say that mining companies have too much power and influence over government — what do you think?

- Perceived future implications
  - E.g. What do you imagine this region will be like in 10, 20, or 50 years’ time if the mines go ahead?

- Perceived implications for climate change from the proposed mines
  - E.g. Do you think climate change could become a big enough issue to interfere with the operation of the proposed mines? (For instance, if the world got serious about cutting greenhouse gas emissions?)

- Connection to global energy provision
  - E.g. What do you make of the argument that it is Australia’s responsibility to supply coal as a cheap energy source for poorer nations like China and India?

- Significance of the projects in the local region
  - E.g. Are the mines a big topic of conversation around Alpha [or other local township]? Do you think people are worried, or excited?

- Ideal outcomes or improvements
  - E.g. If you could have influence over government, what changes would you make?
  - What major issues need to be addressed by government, in terms of legislative change?

- Thoughts about resources generally
  - E.g. What do you think Australia should be doing with our coal and coal seam gas resources?

Questions for landholders and bureaucrats

- Level of understanding in the region about government processes around mining
  - Do you think landholders understand the government processes for mining development assessment and approval?

- Possibility of co-existence between farming and fossil fuel development
  - Do you think there is any way for CSG and farming to co-exist, or is it more of a case of one or the other?
  - What advice would you have for people in a new coal region, such as in the Galilee Basin? [question or landholder in neighbouring coal basin]
Question for active opponents of fossil fuel development

- Could you estimate how much time you have spent trying to fight coal/CSG so far?

Questions for Indigenous interviewees

Some of these questions are additional, others slightly refocussed versions of the general questions

- Background and characteristics of Indigenous community in region
  - Can you give me some idea about the Aboriginal history in this region? And over the area now called the Galilee Basin? (As far down as Charleville, Winton to Alpha, up to Richmond and Hughenden in the north)
  - How would you describe the current Aboriginal community in the region?
  - Even though the area has been dominated by pastoral leases for many years, is there a sense of responsibility for the land and water?
    - How does that work with the fact that most of the land around here is owned by European descent people?
    - Speaking for yourself, and if you like for the broader Aboriginal community, how would you describe your connection to the country and landscape in this region?
  - What's important and perhaps unique about Aboriginal views and input into landscape scale management out here, especially when it comes to these new proposed developments?

- Reaction to white landholder sympathies
  - I have come across at least one newspaper article where a white landholder said something along the lines that the current invasion of mining interests on their land has made them relate to what Aboriginal people went through to have their land taken — how would respond to that?

- The Indigenous community and the proposed mining developments
  - What do you think is the feeling about the proposed developments amongst people you speak with, and Aboriginal people in particular?
  - Can you tell me about what you think about the proposed new developments?
    - Are there any negative impacts that you can see from these developments? If so, what are they? Particularly for Aboriginal people and Aboriginal interests in this region?
    - Are there any positive impacts that you can see from these developments? If so, what are they? Particularly for Aboriginal people and Aboriginal interests in this region?
  - Do you think the companies coming into this region have made enough effort in their dealings with Aboriginal people?
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