



Australian
National
University

Banking on Paris: The roles of public green banks in the transition to net zero emissions

Michelle Inez Lyons

October 2024

A thesis submitted for the degree of Doctor of Philosophy of
The Australian National University

© Copyright by Michelle Inez Lyons 2024
All Rights Reserved

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any university. To the best of the author's knowledge, it contains no material previously published or written by another person, except where due reference is made in the text.

Michelle Inez Lyons

October 2024

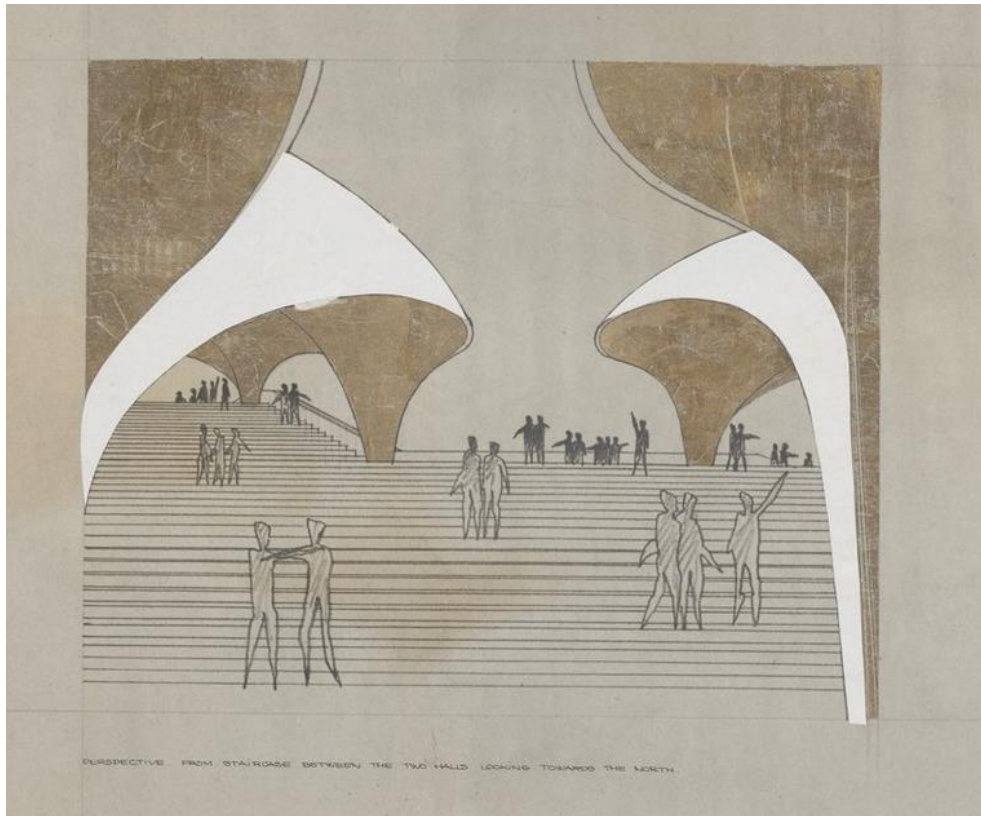


Photo: Jørn Utzon's Competition Entry, Page 1, Perspective from staircase between the two halls looking towards the north (1956)

Acknowledgements

A copy of this sketch, made in 1956 by Danish architect Jørn Utzon, sits in my kitchen; it has moved through numerous homes with me over the years. It is the first page of Utzon's winning competition entry to design the Sydney Opera House, where I worked as a tour guide during university. The contrast between this initial sketch and Utzon's final spherical solution to construct the famous roof sails, always gives me pause for thought. The Sydney Opera House is now seen as a visionary building, but at the time of its construction it was contentious and expensive. What drew me to work on climate change 15 years ago were visions of a better world we could build through the net zero transition; sustainable, secure, equitable. But just as the Sydney Opera House construction did not go to plan, the net zero transition is also off track. It is shifting from being a question of technological possibility to one of investment, justice and skills: can we invest enough, in the right places, with people with the necessary skills to deliver the outputs needed to reach net zero emissions? These are vital questions; my dissertation focuses on a tiny segment of the answer.

No one starts a PhD with a 10-month-old, a 2-year-old and a 9-year-old in a global pandemic and finishes without a fantastic, supportive supervisory panel. Huge thanks to Professor Frank Jotzo (Chair), Associate Professor Emma Aisbett, Dr Lee V White and Dr Arjuna Dibley for their guidance and constructive feedback which has added so much to my dissertation. I look forward to continuing to seek out your expertise after I return to the Australian Public Service (APS), but more importantly to many years of friendship with you all. Any errors in the final document remain mine alone.

Without financial support from the Sir Roland Wilson Foundation and the Department of Climate Change, Environment Energy and Water this dissertation would not have been written. The opportunity to earn a living wage and to travel while pursuing my PhD has been an extraordinary privilege. Being awarded the scholarship resulted from the support and generosity of many APS colleagues; I particularly want to acknowledge the mentorship of Jo Evans, Kushla Munro, Brad Archer, Eliza Murray and Katie Eberle over many years. I have had endless discussions about the geopolitics and geoeconomics of the net zero transition with Jia Yan for nearly a decade which shaped much of this work; I thank him for his generosity and friendship.

I am very grateful to the Sir Roland Wilson Foundation and Board, particularly former Board Chair Dr Ken Henry AC, Executive Director Rebecca Gibb, current staff including Dunkan Yip, Meggan Fitzgerald, Cassie Peisley, Liz Long and former staff Jennifer Andersson, Melanie Broder, Sally-Ann Henfrey and Fiona Scotney for their support.

A range of academic colleagues have supported me through my PhD, many of whom I met while working as a Research Fellow on the ANU Grand Challenge for Zero Carbon Energy in the Asia Pacific. Associate Professor Christian Downie, Dr Thang Do, Dr Wenting Cheng, Dr Max Peterson, Dr Kirsty Ananatharajah and Associate Professor Llewelyn Hughes have all taught me so much – I thank them and acknowledge their generosity and camaraderie over the past four years.

I want to pay thanks to the many experts who were generous in sharing their time and insights through the interview process. Special thanks go to Paul Greenop who fielded all manner of email requests from me over several years. I was privileged to speak with a range of Australian, Fijian and Indonesian public servants and diplomats as part of my study – I thank them all for sharing their expertise and candid insights.

I am very grateful to Roland Rajah, Hervé Lemahieu and Michael Fullilove for the opportunity to work as a Climate Change Research Fellow in the Indo-Pacific Development Centre at the Lowy Institute while I pursued my PhD studies. I owe so much to all my colleagues there, particularly my co-authors Roland Rajah, Grace Stanhope and Ryan Neelam.

Among the greatest joys of the PhD journey are the friends you make. I'm grateful for Niko, Hannah, Cathy, Helen, Jen, Jacob, Carla, Katrina, Maathu, Kat, Conrad, Emily, Ben, Carlyn, Anna, Tristram, Alex, Dipika, Melissa, and many others. Much thanks to Crawford academic skills advisor Megan Poore, whose kindness and dry wit were always appreciated.

Beth Battrick did a wonderful job editing and proofreading the dissertation in line with ANU guidelines. I'd also like to acknowledge the editorial team at the *Australian Journal of Public Administration* for their assistance in publishing Chapter 4, and my Lowy Institute editors Sam Roggeveen, Hervé Lemahieu, Clare Caldwell and Daniel Flitton for their assistance in publishing Chapter 7.

I want to acknowledge the Lyons and Gyngell families. Firstly, to my Mum – thank you for being the most selfless, generous and extraordinary parent who instilled in me the value of education and a lifelong love of learning. To my older sister Kerry, my best friend – it has been a joy to share my PhD experience with you, to trade favourite papers and writing strategies and motivate each other to submit. You are an extraordinary writer, and I am so proud of you. To my three brothers, Greg, Jeff and Chris, thank you for your love and support. To the Gyngell family: Catherine, thank you for being a wonderful mother-in-law who supported me starting this degree and who has stepped into babysit and help whenever she could. Chris, Kat, Dom and Ali have all offered much support and encouragement for this work. I wish my beloved Dad, grandparents, father-in-law Allan and brother-in-law Toby were here to see I managed to get to the finish line. I miss you all so much.

Finally, to my husband Joe and my children Annie, Otto and Clara. All of you have been forced to listen to more about green banks, climate finance, economic development, economic security, Mazzucato and the political economy of institutions than any family should ever have to endure. Thank you. Joe, I'm forever grateful for the single golden thread which tied me to you. Annie, Otto and Clara, I hope when you're older, you realise that the reason I do this work and work so hard to manage this juggle is that the net zero transition is an opportunity to create a better world. Everything I do, at work and at home, is for the three of you.

Abstract

Meeting the Paris Agreement goals will require massive public and private sector investments across all emissions sectors. Using public finance to mobilise additional private sector investment in clean energy investments will be vital. This dissertation investigates the roles of public financial institutions, particularly green banks, in mobilising additional private finance for the net zero transition.

It addresses important gaps in the literature. Little comparative analysis has been undertaken of public financial institutions mobilising additional private sector investment for climate change. Empirical data on green banks is rare because they are a nascent form of institution, and existing datasets do not capture the technological and financial innovation which underpins their organisational mission. This dissertation begins to fill this gap, adopting a mixed methods approach underpinned by 65 expert interviews, a systematic literature review and development of a novel dataset exploring the role of the Clean Energy Finance Corporation (CEFC) in accelerating technological and financial innovation in Australia's large-scale solar sector. Theoretically, it draws on economics, institutional political economy and public management theory focused on three key concepts; market failure, market shaping and public value.

It examines the history and development of public green banks, their potential application in developing markets, and how they could operate at the multilateral level. In doing so, it sheds light on the roles of green banks, barriers to investment in scaling up climate finance in different kinds of developing markets, and the capacity of the existing international financial architecture to scale up climate change investment in the Indo-Pacific to achieve Paris Agreement goals. It finds green banks play an important role in mobilising additional private sector investment for climate change, that they are perceived to create public value through their investments, and their knowledge-sharing and transparency functions have valuable lessons for other public financial institutions.

List of Abbreviations

ACT	Australian Capital Territory
ADB	Asian Development Bank
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AIIB	Asian Infrastructure Investment Bank
ARENA	Australian Renewable Energy Agency
ARPA-E	Advanced Research Projects Agency–Energy
BRI	Belt and Road Initiative
CEFC	Clean Energy Finance Corporation
COP	Conference of Parties
DFI	development finance institution
DPL	development programme loans
EBRD	European Bank for Reconstruction and Development
ECA	export credit agency
EFL	Energy Fiji Limited
EMDE	emerging markets and developing economies

EPC	engineering, procurement and construction
ERF	Emissions Reduction Fund
ESB	Energy Security Board
ESG	environmental and social governance
EXIM	Export Import Bank
FITs	feed-in tariffs
FNPF	Fiji National Provident Fund
GCF	Green Climate Fund
GWh	giga-watt hours
IBRD	International Bank for Reconstruction and Development
IEA	International Energy Agency
IFC	International Finance Corporation
IPEF	Indo-Pacific Economic Forum
IPGB	Indo-Pacific Green Bank
IMF	International Monetary Fund
INA	Indonesia Investment Authority
IPCC	Inter-governmental Panel on Climate Change
JETP	Just Energy Transition Partnership

LCOE	levelised cost of energy
LDCs	<u>least developed countries</u>
LGCs	large-scale generation certificates
LIC	low-income country
LMIC	lower-middle-income country
LRET	large-scale renewable energy target
MCGB	Montgomery Countygreen bank
MDB	multilateral development bank
MGF	multilateral green fund
MLF	marginal loss factor
NDC	nationally determined contribution
NEM	national electricity market
NYGB	New York Green Bank
NYSERDA	New York State Energy Research and Development Authority
NZGIF	New Zealand Green Investment Finance
OECD	Organisation for Economic Co-operation and Development
PICs	Pacific Island countries
PLN	Perusahaan Listrik Negara

PT SMI	PT Sarana Multi Infrastruktur
PV	photovoltaic
RET	Renewable Energy Target
RPS	Renewable Portfolio Standard
SIDS	small island developing states
SME	small and medium enterprises
SOE	state-owned enterprises
SRES	small-scale renewable energy scheme
UNFCCC	United Nations Framework Convention on Climate Change
WBG	World Bank Group

Table of Contents

Declaration.....	ii
Acknowledgements	iii
Abstract.....	vi
List of Abbreviations	vii
Table of Contents.....	xi
List of Charts	xiv
List of Tables	xv
List of Figures.....	xvi
List of Boxes.....	xvii
Chapter 1 Introduction	1
1.1 Research problem: Closing the climate finance gap	1
1.2 Public finance for climate change	3
1.3 Research Framework.....	5
1.4 Conceptual Background.....	10
1.5 Methods.....	13
1.6 Roadmap of the dissertation	15
Chapter 2 A typology of public financial institutions mobilising private finance in the transition to net zero emissions	16
2.1 Introduction.....	16
2.2 Methods.....	19
2.2.1 Expert Interviews.....	19
2.2.2 Systematic literature review	19
2.3 Results.....	22
2.3.1 Actor Types	23
2.3.2 Similarities and differences between actor types	34
2.4 Discussion	37
2.5 Conclusion.....	39
Chapter 3 How green banks can create multiple types of value in the transition to net zero emissions.....	40
3.1 Introduction.....	40
3.2 Methods.....	43
3.2.1 Case overview	46
3.2.2 Archival study	48
3.2.3 Expert interviews	48
3.2.4 Synthesis of document and interview data	48
3.3 Results and discussion	50
3.3.1 Hybrid governance of green banks.....	50

3.3.2	The roles of green banks in creating and capturing value	58
3.3.3	Crosscutting discussion	64
3.4	Conclusion.....	66
Chapter 4	The Clean Energy Finance Corporation and large-scale solar deployment in Australia	68
4.1	Introduction.....	68
4.2	Context	70
4.3.1	Case study: Australia's large-scale solar sector.....	70
4.3	Methods.....	76
4.3.1	Development of a large-scale solar database	76
4.3.2	Expert interviews	76
4.3.3	Synthesis of database and interview data	77
4.4	Results.....	78
4.4.1	Development of the Australian large-scale solar sector.....	78
4.4.2	Leading the market	79
4.4.3	The evolution of offtaking	83
4.4.4	De-risking through knowledge sharing	84
4.4.5	Financing innovative projects.....	85
4.5	Discussion	86
4.6	Conclusion.....	90
Chapter 5	Exploring the viability of an Indonesian green bank	91
5.1	Introduction.....	92
5.2	Methods.....	96
5.2.1	Systematic literature review	96
5.2.2	Expert interviews	97
5.2.3	Synthesis of document and interview data	98
5.3	Results.....	99
5.3.1	Barriers to accelerating climate finance investment in Indonesia	99
5.3.2	Pathways to creating an Indonesian green bank	103
5.4	Discussion	106
5.5	Conclusion.....	108
Chapter 6	Exploring the viability of a Fiji green bank	110
6.1	Introduction.....	110
6.2	Methods.....	113
6.2.1	Case overview	116
6.2.2	Expert interviews	116
6.2.3	Systematic literature review	117
6.2.4	Synthesis of expert interview and literature review data	118
6.3	Results.....	118

6.3.1	Barriers to climate finance investment in Fiji	118
6.3.2	Governance options for a Fiji green bank.....	124
6.4	Policy implications	127
6.4.1	More grant finance is needed	127
6.4.2	Projects must be adaptation-focused	127
6.4.3	Building skills and capacity in Fiji is critical to the success of Fiji's net zero transition 128	
6.4.4	Easier access to finance is critical to building local capacity	129
6.5	Conclusion.....	131
Chapter 7	Does the Indo-Pacific need a multilateral green bank?.....	132
7.1	Enhancing economic security through multilateral finance	133
7.2	The public finance landscape in the Indo-Pacific	136
7.2.1	Multilateral development banks	138
7.2.2	Export credit agencies.....	139
7.2.3	Green banks.....	140
7.2.4	Other public finance provision in the Indo-Pacific	141
7.3	Creating a multilateral bank for the Indo-Pacific.....	142
7.3.1	Mission	145
7.3.2	Governance.....	145
7.3.3	Operational considerations	147
7.4	Policy implications and conclusion	156
Chapter 8	Conclusion.....	158
8.1	Contributions to existing literature	158
8.2	Insights for policymakers.....	161
8.3	Further research.....	162
Appendix A-	expert interviewees	163
Appendix B-	review protocols	169
	Chapter 2 example literature review protocol	169
	Chapter 5 example literature review protocol	170
	Chapter 6 example literature review protocol	172
Appendix C-	CEFC large-scale solar projects	174
Appendix D-	Options for MDB reform.....	177
References		179

List of Charts

Chart 1-1 Climate finance for developing countries: amounts provided and mobilised by developed countries, billion USD	2
Chart 2-1 Overview of methodology process	20
Chart 2-2 Aggregated articles in systematic literature review by actor type	22
Chart 4-1 Average MW of large-scale solar projects, overall sector vs CEFC projects by year commissioned	80
Chart 4-2 Average size of utility solar projects commissioned in Australia by year	81
Chart 4-3 Average capital cost (A\$) per MW of large-scale solar projects, Overall vs CEFC projects by year commissioned.....	83
Chart 4-4 Large-scale solar project developer overview	84
Chart 4-5 CEFC large-scale solar project novelty	87
Chart 5-1 Share of Indonesian electricity generation by source, 1985–2022	93
Chart 5-2 Count of barriers to financing clean energy technology investments in Indonesia from systematic literature review	98
Chart 5-3 Indonesia power sector finance 2015–2021	107
Chart 6-1 Count of barriers to scaling up climate finance in Fiji from systematic literature review, entire sample versus Pacific Island country (PIC) authors	119
Chart 6-2 Support for a green bank entity in the Pacific	126

List of Tables

Table 1-1 Categories of financing used by public financial institutions for climate change.....	4
Table 1-2 Dissertation chapter overview	8
Table 2-1 Global overview of multilateral development banks.....	31
Table 2-2 Global prevalence of multilateral green funds.....	32
Table 2-3 Governance levels of public financial institutions mobilising private finance for climate change.	35
Table 2-4 Summary of financial instruments used by public financial institutions to mobilise additional private sector investment.	36
Table 3-1 Green bank organisational overview.....	44
Table 3-2 Interview count of perceived value creation in green banks.....	49
Table 3-3 Overview of organisational hybridity in green banks	52
Table 3-4 Perceived value created through energy efficient, low-income housing investment	61

List of Figures

Figure 1-1 The technology innovation cycle	4
Figure 1-2 Research framework for this dissertation.....	6
Figure 1-3 Conceptual Framework	10
Figure 2-1 Global prevalence of central banks.....	23
Figure 2-2 Global prevalence of state investment banks	25
Figure 2-3 Global prevalence of green banks.	27
Figure 2-4 Global prevalence of export credit agencies.....	29
Figure 2-5 Global prevalence of development finance institutions.	30
Figure 2-6 Overview of public financial institution organisational missions	34
Figure 4-1 Overview of Commonwealth climate change policy measures 2012-2024.....	72
Figure 4-2 Australian large-scale solar projects >5MW (CEFC projects highlighted in blue)	79
Figure 4-3 Australian large-scale solar projects >4.95MW with electricity transmission lines	82
Figure 4-4 The financial innovation chain for large-scale solar projects in Australia.....	88
Figure 6-1 Overview of methodological approach.....	115
Figure 6-2 Institutional efforts to address barriers to climate finance investments in Fiji	125
Figure 6-3 Selected examples of multilateral, bilateral and NGO/private sector/philanthropic climate finance provision in Fiji	130
Figure 7-1 Complementarities and trade-offs between economic security, climate and development.....	136
Figure 7-2 The multilateral economic security governance gap	143
Figure 7-3 Indo-Pacific Green Bank's possible investment focus.....	149

List of Boxes

Box 2-1 Scopus search string	21
Box 5-1 Scopus search strings used in systematic literature review	97
Box 6-2 Scopus search strings used for literature review	117
Box 6-3 Scaling up climate skills support in Fiji.....	128
Box 7-1 Scaling up large-scale solar: Australia vs Zambia	152
Box 7-2 Mapping potential electric vehicle manufacturing capability across Indo-Pacific countries	154

Chapter 1 Introduction

At its core, this dissertation seeks to further our understanding of the role of public finance in mobilising additional private finance to accelerate progress towards net zero emissions. It explores what kinds of public financial institutions are mobilising additional private finance for the transition, and how they differ from one another. It has a particular focus on the history and development of public green banks, how existing green bank governance could be adapted for developing country markets, and how they could operate at the multilateral level. In doing so, it sheds light on the roles of green banks, barriers to investment in scaling up climate finance in different kinds of developing markets, and the ability of the existing international financial architecture to scale up climate change investment to achieve Paris Agreement goals.

This introductory chapter outlines the research problem and hypothesis of the dissertation, the current state of public finance for climate change, the research framework, conceptual background and methods which underpin this dissertation.

1.1 Research problem: Closing the climate finance gap

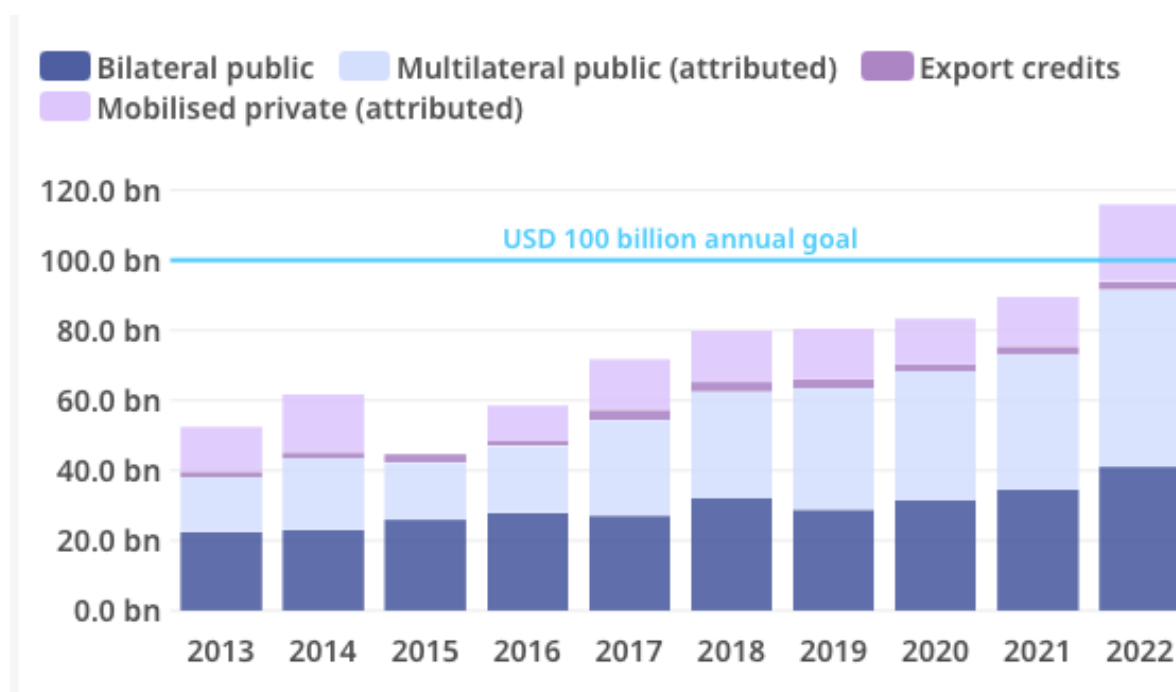
The emission of greenhouse gases into the atmosphere has been increasing global temperatures for well over a century. Annual energy-related CO₂ emissions reached a new record of 37.4 billion tonnes in 2023 (IEA, 2024a). The Intergovernmental Panel on Climate Change, which assesses the latest peer-reviewed climate change science, is clear that governments around the world must make rapid, deep and in most cases, immediate cuts in global greenhouse gas emissions in all sectors to keep warming to 1.5°C above pre-industrial levels (IPCC, 2022). The first global stocktake completed under the Paris Agreement last year concluded that global greenhouse gas emissions should be reduced by 43% by 2030 (UNFCCC, 2023).

Rapidly cutting emissions will require vast amounts of investment, mostly in the energy sector where almost two thirds of global emissions are generated (IEA, 2021). The International Energy Agency (IEA) estimates to reach net zero emissions by 2050, annual clean energy investment worldwide will need to more than triple by 2030 to around US\$4 trillion (IEA, 2023). Emerging markets and developing countries outside of China are estimated to need US\$2.4 trillion of investment a year by 2030 to fund just energy transition, adaptation and resilience, loss and damage and the conservation and restoration of nature (Bhattacharya et al., 2023). The post 2020 climate finance goal agreed at COP29 in Baku, US\$300 billion per year from developed to developing countries falls far short of what is needed. And despite the investment required to reach net zero being a relatively small proportion of annual global investment

(Bracking & Leffel, 2021; OECD, 2017b), at present the net zero transition is off track in all regions, types of economies and emissions sectors around the world (IPCC, 2022). Globally, there is a significant gap between the investment required to reach net zero emissions and the annual finance being committed. Global energy governance is fragmented, diverse and dominated by national decision-making processes which are not effectively integrated into global institutions (Dubash & Florini, 2011).

The energy sector is forecast to grow strongly in coming decades as emerging economies, particularly South-East Asia and Africa, continue their economic development. Recognising different development pathways sits at the heart of the Paris Agreement. Developed countries have committed to provide public finance for climate change in the form of climate finance to developing countries as part of a just transition to net zero emissions. This builds on the commitment of Annex II (developed) countries in Copenhagen to provide US\$100 billion per year in climate finance to Annex I (developing) countries by 2020; a commitment which was not met until 2022 (see Chart 1-1). The provision of climate finance for developing countries has largely been channelled through public development institutions rather than private finance.

Chart 1-1 Climate finance for developing countries: amounts provided and mobilised by developed countries, billion USD



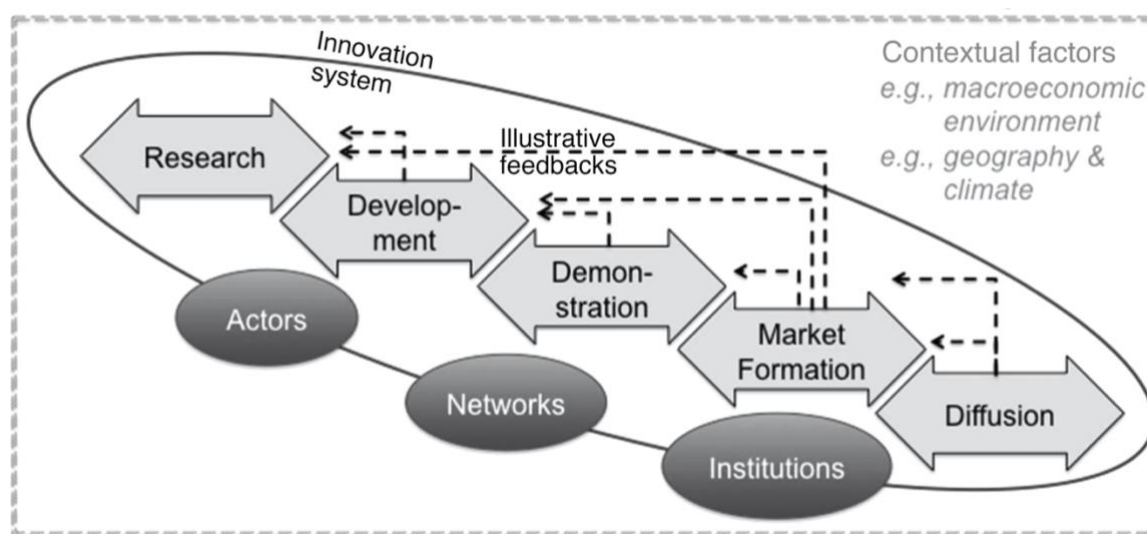
Source: OECD (2024)

Among policymakers there is a hypothesis that public finance can be used to mobilise additional private finance to help close the climate finance funding gap. This model sought to take billions of dollars in multilateral finance and official development assistance (ODA) and use it to mobilise trillions of dollars in private sector investment for the net zero transition. It also underpins the “billions to trillions” financing for development model adopted by many multilateral development banks to try and achieve the sustainable development goals (World Bank, 2015, Bhattacharya et al. 2023, Summers et al., 2023). This forms the basis of public green bank investment models where every dollar of investment must be matched by at least a dollar of private sector finance.

This dissertation tests this hypothesis in relation to green banks, across a range of governance levels and economies. Research to date has not determined to what extent green bank investments have used public finance to mobilise additional private finance for climate change investment. Nor is it clear whether green banks are merely correcting failures within existing markets or if they are shaping these markets and creating new ones through their investment. There is also a high degree of uncertainty whether this hypothesis is applicable at different governance levels or in different types of economies. The objective of this dissertation is to investigate these knowledge gaps, which are vital to accelerating investment in the net zero transition. The roles of public finance for climate change investment are discussed in further detail in the next section, while the conceptual underpinnings of this hypothesis are discussed in more detail in Section 1.4

1.2 Public finance for climate change

Public finance, defined here as finance provided by governments at all levels or through international financial institutions, is critical to accelerating clean energy investment. The net zero transition requires commercialisation of a range of renewable energy, storage and demand management technologies. Many of these net zero technologies are still progressing through the technology innovation cycle (Gallagher et al., 2012; Grubb, 2004) and are yet to be commercialised (see Figure 1-1). Energy technology costs decline with cumulative investment, with at-scale investment leading to cost reductions (Grubb et al., 2021). There is an inverse relationship between public and private finance across the technology innovation cycle; public finance is more prominent in the early stages while private finance is concentrated at the final stages where risks are lower (Egli et al., 2018). This is because the private sector has a lower risk tolerance than the public sector (Laplane & Mazzucato, 2020; Lazonick & Mazzucato, 2013) and is unwilling to bankroll technology innovation in its early stages, when it is too high risk.

Figure 1-1 The technology innovation cycle

Source: Gallagher et al., 2012.

Public financial institutions utilise different forms of finance at different phases of the technology innovation cycle. Table 1-1 broadly describes the financial instruments used by public financial institutions making climate change investments. In practice public finance for climate change is a mix of financial instruments across the technology innovation cycle. In the research phase of the technology innovation cycle, public grant funding dominates; as it progresses to development and demonstration, equity investments increase before a rise in the use of concessional loans and guarantees in the market formation phase. Once technologies reach the diffusion stage, they can be financed by market loans from the private sector and no longer need public support.

Table 1-1 Categories of financing used by public financial institutions for climate change

Financial instrument	Description
Grants	Money is paid directly to an entity to assist the funder in meeting its objectives.
Equity	Direct ownership in the project or company and, as such, a claim to some portion of the profits generated by the project or company.
Market loans	Loans extended on commercial terms.

Concessional loans	Loans that are extended on terms substantially more generous than market loans. The concession is normally a lower interest rate than market rate, a longer repayment period, or income-contingent repayments.
Loan aggregation	Aggregation of numerous small loans into “pools” of capital that are more appealing to investors.
Securitisation	Cash generating but illiquid assets are pooled, bundled, and then transferred to limited liability corporations.
Guarantees	A promise by one party to assume the debt of a defaulting borrower in the event of a missed payment.
Derivatives	An instrument to mitigate and manage risk by assigning a value to a green asset.

Source: Author’s summary based on Bhattacharyya, 2022; Krupa & Harvey, 2017.

This dissertation focuses on the roles of public financial institutions in mobilising additional private finance for commercially viable technologies for climate change in the market formation and diffusion stages of the technology innovation cycle because this is where public green banks are designed to operate. Existing literature identifies a range of roles in this regard. Firstly, they play an important role in capital provision, including a countercyclical role during times of economic downturns (Mazzucato & Penna, 2016). Secondly, they play an important de-risking role, by developing superior understanding of the risks of new technologies or developing new applications of financial instruments for investments which are commercially viable but where the private sector refuses to invest. Thirdly, they have an educational role, building significant internal expertise to better assess investment risks while also diffusing this knowledge throughout the private sector to catalyse additional investment. They also play signalling, first and early mover roles, investing in innovative projects and building trust among private sector financiers, so that a decision on their part to invest in a project ensures it has been through a robust due diligence process.

1.3 Research Framework

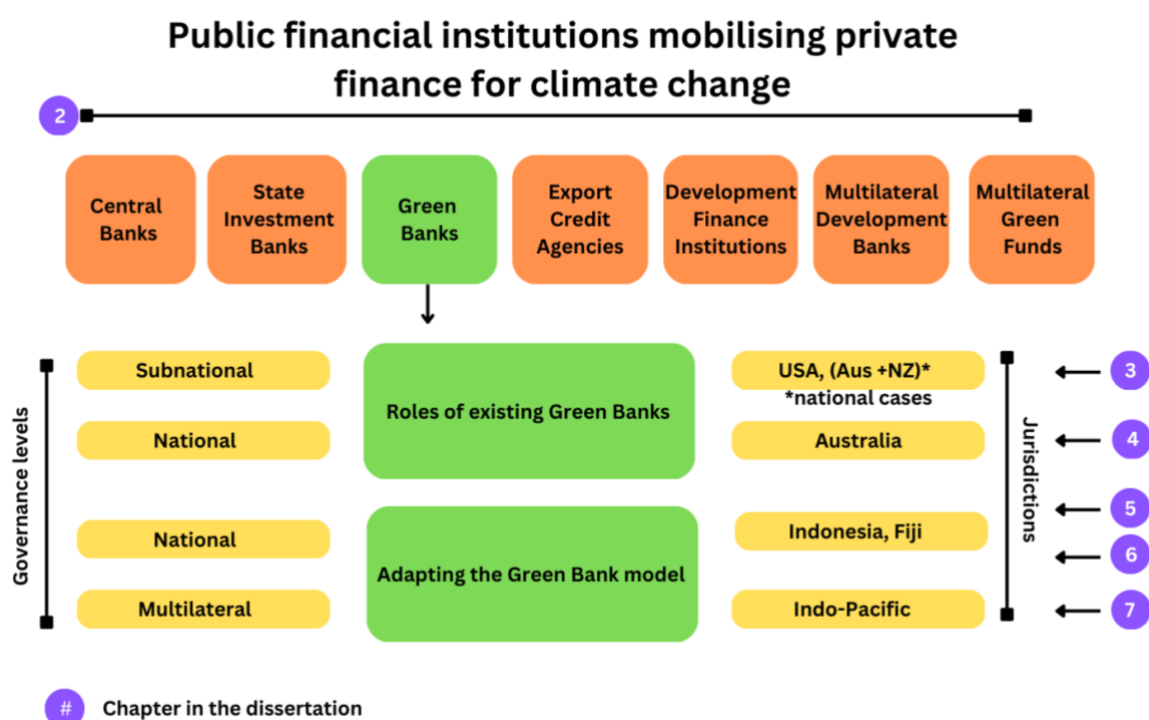
Closing the global climate change finance gap requires deeper understanding of the public financial institutions involved in the transition and their roles in mobilising additional private

sector investment. Therefore, I address the following overall research question in this dissertation:

What are the current and potential roles of public financial institutions, particularly green banks, in mobilising additional private finance to accelerate the net zero transition?

In answering this question, I had three main objectives. Firstly, I explored the different kinds of public financial institutions shaping and creating markets for the net zero transition (Mazzucato & Penna, 2016), with a primary focus on renewable energy markets. Secondly, I examined in what ways, if any, green banks are distinct from existing institutions, and if green banks have lessons for other public financial institutions in mobilising additional private finance. Lastly, I explored how the green bank model could be adapted for differing kinds of developing country markets and the risks and opportunities of creating a multilateral green bank for the Indo-Pacific. Figure 1-2 presents the overarching research framework and the role of each chapter.

Figure 1-2 Research framework for this dissertation



Source: Author's summary

The original contributions of the dissertation are primarily empirical, with some conceptual and methodological contributions. The methods are discussed in further detail in Section 1.4. As a policy practitioner I wanted these contributions to be relevant for governments and drew on the approach of former Biden senior administration official Jed Kolko. Kolko, (2023) argues that

much of academic research is not useful to policymakers as it assumes familiarity with existing literature and rewards academics who make empirical or theoretical contributions that push the boundaries of their discipline. He argues that policy-relevant economic research generally falls into one of three categories: new metrics to measure the economy; broad literature reviews; or analyses that directly quantify or simulate policy decisions. This dissertation has focused on the latter two categories. Chapters 2, 3, 5 and 6 provide policymakers with systematic literature reviews relevant to scaling up climate finance. Chapters 5–7 explore three different policy decisions around adapting the green bank model in different jurisdictions.

Chapter 2 develops a typology of public financial institutions mobilising private finance for climate change, based on a systematic literature review and expert interviews. It identifies seven actor types; namely central banks, state investment banks, green banks, export credit agencies, development finance institutions, multilateral development banks and multilateral green funds. It finds three factors, mission, governance and finance provision, that distinguish between these actors, and that green banks are a distinct and important new form of public financial institution. Chapters 3 and 4 make an empirical contribution to data on existing green banks. Chapter 3 provides the first cross-case comparison of green banks at national, state and county levels, focused on four existing green banks in Australia, New Zealand and the United States. It was published in the *Australian Journal of Public Administration* (Lyons & White, 2023). Chapter 4 analyses the role of the CEFC in the development of the Australian large-scale solar sector drawing on a novel dataset of 186 large-scale solar projects developed as part of this dissertation. Chapters 5 and 6 examines the potential for the green bank model to be deployed in differing developing country markets; Indonesia and Fiji, based on expert interviews and systematic literature reviews. Chapter 8 is largely conceptual, exploring how a multilateral green bank could operate in the Indo-Pacific.

These chapters address important gaps in the literature. Climate finance is understudied in the finance literature (Diaz-Rainey et al., 2017). While critical work has been undertaken examining barriers to mobilising private finance for low-carbon innovation (Polzin, 2017) and how policies mobilise private finance for renewable energy (Egli et al., 2022), research exploring the role of green banks in the transition has been identified as an important avenue for research (Egli et al., 2022). Empirical data on green banks is rare, with the exception of Geddes et al., (2018, 2020); Peters, (2018); Schub, (2015); Waidelich & Steffen, (2024). This is partly that they are a nascent form of institution, but also because existing datasets do not capture the technological and financial innovation which underpins their organisational mission. An overview of each chapter is presented in Table 1-2.

Table 1-2 Dissertation chapter overview

Chapter	Title	Case	Data	Method	Status
2	A typology of public financial institutions mobilising private finance for climate change	Public financial institutions mobilising private finance for climate change.	32 expert interviews and systematic literature review of 73 studies	Quantitative and qualitative	N/A
3	How green banks can create multiple types of value in the transition to net zero emissions	Green banks at national state and local levels in Australia, New Zealand and the United States	29 expert interviews and archival study of 43 documents.	Quantitative and qualitative	Published in the <i>Australian Journal of Public Administration</i> (co-authored with Dr Lee V. White)
4	The Clean Energy Finance Corporation and large-scale solar deployment in Australia	Australian large-scale solar projects from 2015 to 2023	Novel database of 186 projects and 16 expert interviews.	Quantitative and qualitative	N/A
5	Exploring the viability of an Indonesian green bank	Indonesia	33 expert interviews and systematic literature review of 40 papers	Quantitative and qualitative	N/A

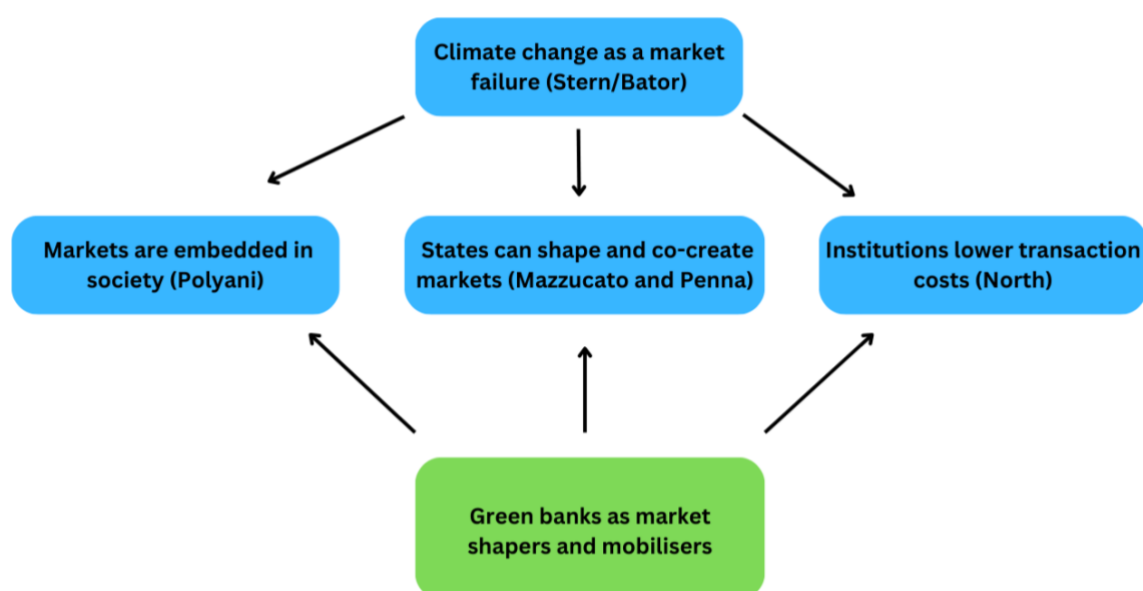
6	Exploring the viability of a Fijian green bank	Fiji	39 expert interviews and systematic literature review of 27 papers	Quantitative and qualitative	N/A
7	Does the Indo-Pacific need a multilateral green bank?	Indo-Pacific public finance options	32 expert interviews	Conceptual	Published as a <i>Lowy Institute Analysis</i> (co-authored with Roland Rajah and Grace Stanhope)

Source: Author's summary

1.4 Conceptual Background

In this dissertation I draw on economics, political economy and public management literatures to explain why public financial institutions need to mobilise private finance for climate change and to investigate why the climate finance gap persists. At its core, this dissertation investigates how public green banks intervene to reshape markets for low-carbon investment, through mobilising additional private capital and actively re-embedding financial, economic and social structures in support of public goods (see figure 1.3). Green banks seek to shape clean energy technology markets through correcting various market failures, and their roles can be best understood through an examination of public and private goods, transaction costs and risk/return profiles.

Figure 1-3 Conceptual Framework



Source: Author's summary

"Climate change is the greatest market failure the world has ever seen, and it interacts with other market imperfections" (Stern, 2006). This sentiment from the Stern review reflects a broader pattern among economists and policymakers over the past 20 years, which considers climate change as a form of market failure (Bator, 1958). This failure is commonly characterised as a negative externality resulting from a failure to price greenhouse gas emissions. In fact, as Stern notes, there are many different forms of market failures relevant to renewable energy (Gillingham & Sweeney, 2010) and climate change more broadly. Other important market failures include labour market imbalances, economies of scale, market power, imperfect capture of future payoffs from current actions, information failures and

How green banks can create multiple types of value in the transition to net zero emissions regulatory failures. The net zero transition has many instances where market failures have prevailed over market creation (Emery, 2023).

These failures are underpinned by markets designed to maximise economic efficiency (Jevons, 1871; Marshall, 1890; Robbins, 1945), where price is a direct measure of value and government intervention is discouraged. This financialisation of value has resulted in public investments for climate change adopting a conception of value which does not consider public goods, co-benefits, destruction or transaction costs associated with creating net zero markets adequately (Bracking, 2019; Mazzucato, 2018). Present climate change investment governance often ignores the broader value creation or destruction dimensions of investments, with the important exceptions of environmental and social governance (ESG) and climate change taxonomies. For example, clean energy manufacturing can be powered by fossil fuels which creates value while also destroying it. But there are increasing calls for new, more holistic conceptions of value in both economics (Carney, 2021; Mazzucato, 2018) and public management literatures (Moore, 1995; O'Flynn, 2021) to more accurately gauge the value and co-benefits (Ürge-Vorsatz et al., 2014) of investments in the transition to net zero emissions.

Parallel to these calls for rethinking value, evolutionary economists have long argued that rather than merely correcting market failures, states have important roles in shaping and creating markets. Traditionally states have sought to play a market shaping role by correcting market failures through various policy instruments (Polzin et al., 2019), which either price carbon (emissions trading schemes/carbon taxes), improve energy efficiency (e.g. white certificate schemes), influence supply and demand of clean energy technologies (e.g. renewable energy targets) or encourage reduced emissions (e.g. offset schemes). But states can also shape markets through their investments and institutions. Mazzucato and Penna (2016) identify four roles played by state investment banks in shaping markets; namely, countercyclical finance provision, capital development, venture capitalist, and challenge led. The economic restructuring required by the Paris Agreement requires significant market creation across a range of sectors, particularly energy. It could also transform the way public investments are valued so that the non-financial value and trade-offs of investments are more accurately considered.

A range of barriers exist to scaling up finance for climate change. Infrastructure investments, including clean energy investments, include positive externalities like the provision of public goods (Samuelson, 1954), which private sector investors are reticent to fund. The political economy of mobilising finance for climate change infrastructure is also difficult, particularly in the current global environment. The world is in polycrisis (Lawrence et al., 2024; Tooze, 2022),

with climate change exacerbating other global challenges like the Covid-19 pandemic, stalling poverty reductions, high levels of public debt and rising inequality. Governments have many demands on budgets and scaling up finance for climate change is challenging (Granoff et al., 2016), despite clear evidence that immediate action is the least expensive form of action (Kompas et al., 2018). While climate change has been perceived as the largest global risk of the past decade, in the short-term rising costs of living are seen as an increasing challenge (World Economic Forum, 2023).

The failure to close the investment gap for climate change can also be understood as an issue of transaction costs (Arrow, 1969; Coase, 1937, 1960). Private sector investors who are focused on the volume of transactions they can deliver, rather than public goods, will often choose familiar fossil fuel investments over clean energy investments. This is where institutional political economy provides a useful lens to understanding public finance for climate change and the importance of public financial institutions. As Nobel Prize winning economist Douglass North notes, “when it is costly to transact, institutions matter” (North, 1990). Public financial institutions have a higher risk tolerance than the private sector (Laplane & Mazzucato, 2020; Lazonick & Mazzucato, 2013) and they have been shown to play important leadership, education and signalling roles to de-risk and mobilise additional private sector investment. Strong public financial institutions have also been identified as a key factor in national success (Acemoglu & Robinson, 2013) and climate change ambition (Victor et al., 2022), although there is ongoing debate about the causality between effective institutions and economic development (Chang, 2011).

Climate change investments in developing countries can face a range of additional risks and barriers (Li, 2023). Broadly, these include uncompetitive markets, weak institutions, skills and capacity issues and data gaps. They also face financial barriers including a lack of liquidity in the borrowing market, poor credit ratings and foreign exchange risks (Hoschka, 2005). Lastly, political risks and corruption are significant financing concerns in many developing countries. This dissertation builds on earlier findings that developing countries need suitable policy and incentive frameworks for low-carbon energy deployment to be compatible with economic growth and development objectives (Dibley, 2021; Fankhauser & Jotzo, 2018).

Increasingly, we are seeing state actors move away from an investment paradigm focused on economic efficiency to one focused on economic security. In recent years, state actors have become increasingly nationalistic, focused on enhancing economic security and domestic resilience to global supply and demand shocks. Industrial policy is undergoing a global resurgence as countries seek to capture new markets emerging from the net zero transition

How green banks can create multiple types of value in the transition to net zero emissions while competing with the domestic subsidies offered through the US Inflation Reduction Act, Made in China 2025 initiative, EU Net Zero industry Act and others. Increasing use of tariffs and other punitive trade measures risk further fragmentation of the global trade system, which will also slow progress towards global climate and development goals. But as discussed in Chapter 7, the shift in focus to prioritise economic security also offers opportunities to close the climate finance gap.

In this dissertation, I draw on the work of Polanyi (1957), Mazzucato (2013), and North (1990) to situate public green banks within broader debates about the co-constitution of markets and state institutions. From Polanyi, it adopts the insight that markets are embedded within and exist within broader social and institutional frameworks. In doing so, I frame green banks as more than passive institutions but as active agents re-embedding clean energy investment within broader social and institutional systems. From Mazzucato, it draws on conceptions of entrepreneurial states which shape and co-create value in markets (Mazzucato, 2015, 2018). Thus, green banks are conceptualised here not only as risk mitigators but as market creators — proactively shaping new spaces for clean energy deployment. From North (1990), it recognises that transaction costs and institutional design are critical determinants of investment behaviour. I apply an empirical lens to North’s insights to better understand what institutional design features underpin their successful operation, including their private finance mobilisation, knowledge-sharing and value creation dimensions. I focus on how green banks differ to other forms of public financial institutions, how different forms of green banks compare to one another, and how they could enhance a just transition to net zero emissions through their potential deployment in developing country markets and multilaterally. Each empirical chapter investigates how green banks overcome transaction costs, reshape investment norms, and mobilise private capital — consistent with the need for embedded, actively shaped markets to accelerate the net zero transition.

1.5 Methods

To address my questions on how green banks compare to other public financial institutions and to one another, and how they could enhance a just transition to net zero emissions, I adopt a mixed methods approach, based primarily on expert interviews, systematic literature reviews and development of a novel quantitative database exploring financing data of large-scale solar projects. The selection of methods was designed to correlate with the objective of each research question: cross-comparison of green banks and their application in developing markets was well suited to expert interviews given the nuanced nature of the questions being investigated and the lack of empirical data. All of my chapters are empirical, with the exception of Chapter 7, which is mostly conceptual. Below, I outline the methodological approach

adopted in the expert interviews and the systematic reviews which is common across multiple chapters.

1.4.1 Expert interviews

I conducted 65 expert interviews with current and former public financial institution staff, clients, co-financiers, public servants, and political advisors between December 2021 and January 2024 (see [Appendix A](#)). The interviews were one hour long and semi-structured with open-ended questions. Ethics approval was obtained before the interviews commenced (ANU HREC Protocol 2021/279). Consent processes included asking whether participants preferred to be anonymised at the level of organisation or institutional sector. Participation was voluntary and no financial incentives were provided. Interviewees were selected using my network of colleagues (I have been a climate change policy practitioner in the Australian Government for over a decade) and snowball sampling of interview participants. Following the interviews, quoted participants were sent a draft copy of the relevant chapter to ensure accuracy of quotes.

Interviews allow for in-depth exploration of participant views and are commonly used to supplement and clarify themes emerging from literature reviews (Knott et al., 2022). In this instance, I sought interviewee views on the roles of public financial institutions, particularly green banks, in mobilising additional private finance to accelerate the net zero transition, barriers to investment, their strengths and weaknesses, and how they differed from one another. While interviewee views are subjective, they provide useful insights into differing perspectives between categories of interview participants.

1.4.2 Systematic literature reviews

Systematic reviews aim to “comprehensively locate and synthesize research that bears on a particular question, using organized, transparent, and replicable procedures at each step in the process” (Littell et al., 2008, p. 2). They are an accepted method within climate change finance literatures (Polzin et al., 2019; Rahman et al., 2022). I adapted Stechemesser and Guenther's (2012) framework as the basis of my methodology. They apply a four-step framework, based on Fink (1998) and (Tranfield et al., 2003). In the first step, I identified research questions, the literature database and, notable grey literature sources, and defined the search terms. Then, I used practical review criteria to screen the resulting literature for relevance. In the third step, I developed and applied methodological review criteria. Lastly, I synthesised research findings. The systematic literature reviews for Chapters 2, 3, 5 and 6 are available online (Lyons, 2024).

1.4.3 Database development and analysis

Chapter 4 is underpinned by a comprehensive quantitative database of all Australian large-scale solar projects commissioned between 2016 and 2023, including 35 funded by the CEFC. The database was coded using data (with permission) from Australia's Clean Energy Council, comprising project name, state, latitude, longitude and estimated project cost. This was supplemented with publicly available online data from media releases and project developer websites to capture a range of additional descriptive variables including owner, project size (MW), commissioning (month/year), whether it included public investment (CEFC, ARENA, other), whether there was any investment from foreign governments (agency), project developer (name), offtakers (any listed power purchase agreements (PPAs), the percentage of the generation which was offtaken and contract length), fully merchant projects and project novelty. This information was drawn from publicly available data including government websites, press releases, project development applications and project websites. The database provides insights about the evolution of the large-scale solar finance in Australia over time and the role of the CEFC in funding projects.

1.6 Roadmap of the dissertation

The remaining six chapters of the dissertation are organised as follows. Chapter 2 develops a typology of public financial actors mobilising private finance for climate, and illustrates that green banks are a distinct novel form of public financial institution. Chapters 3 and 4 focus on the role of existing green banks in developed country markets, addressing the empirical research gap on existing green banks. Chapters 5 and 6 present two case studies of how green banks could be adapted for differing developing country markets, namely Indonesia and Fiji. Chapter 7 explores the opportunity to extend the green bank model by creating a new form of multilateral green bank in the Indo-Pacific. Chapter 8 summarises the key findings and original contributions of the dissertation, details implications for policymakers and identifies areas for future research.

Chapter 2 A typology of public financial institutions mobilising private finance in the transition to net zero emissions

Transitioning to net zero emissions in line with the temperature targets of the Paris Agreement requires rapidly scaling up investment in low-carbon, climate-resilient infrastructure. Current levels of financing are inadequate, particularly private sector investment. A range of public financial institutions are seeking to address this gap, by using public finance to mobilise additional private sector investment. To date, within the climate finance literature there has been little comparative analysis of these institutions, and how they differ from one another. This chapter adopts a mixed methods approach, using a systematic literature review, coupled with expert interviews as the basis for developing a typology of public financial institutions mobilising private finance in the transition to net zero emissions. The typology identifies seven key actor types: central banks, state investment banks, green banks, export credit agencies, development finance institutions, multilateral development banks and multilateral green funds. I find three organisational factors, namely mission, governance, and finance provision, which differentiate between actor types. The typology takes the first steps in developing a public finance institutional toolkit for policymakers deploying green infrastructure investments in the transition to net zero emissions.

2.1 Introduction

Latest estimates suggest additional investment of US\$4.5 trillion per year is needed globally to keep the 1.5°C temperature goal of the Paris Agreement in reach (IEA, 2023). Within this, there is a well-documented global climate finance gap between the funding that is required versus what is committed (Timperley, 2021). While the United Nations Framework Convention on Climate Change (UNFCCC) defines climate finance broadly, as “local, national or transnational financing – drawn from public, private and alternative sources of financing – that seeks to support mitigation and adaptation actions that will address climate change” (UNFCCC, 2022), traditionally climate finance has been conceived as concessional loans and grants, similar to development aid in the 1980s (Bracking & Leffel, 2021). Over US\$2 trillion of climate finance per year needs to be invested in low-carbon, climate-resilient infrastructure in emerging markets and developing countries outside of China to 2030 (Bhattacharya et al., 2023). There are a range of investment barriers which have limited private sector investment

How green banks can create multiple types of value in the transition to net zero emissions in low-carbon investments (Granoff et al., 2016). There are shortfalls in all areas of climate finance, particularly private sector funding and financing for adaptation projects.

Climate change policy and governance has traditionally prioritised a financialised, market-based approach focused on the financial returns of investments (Bracking, 2019). However, this has overlooked the significant transaction costs involved in commercialising new technologies and developing new applications of financial instruments to drive low-carbon, climate-resilient investments in the transition (North, 1990). Transaction costs and institutional governance have long been critical factors to the development of climate change markets (Michaelowa & Jotzo, 2005). Transaction costs, as famously defined by Coase (Coase, 1937), “affect not only contractual arrangements but also what goods and services are produced” (Coase, 1991). Transaction costs vary considerably including “negotiations to be undertaken, contracts have to be drawn up, inspections have to be made, arrangements have to be made to settle disputes, and so on” (Coase, 1991). Coase viewed consideration of transaction costs not only critical to understanding the operation of firms, but also as a vital component of economic analysis. Williamson (1985) posited that transaction costs could be grouped into three main categories; information costs, decision costs and compliance costs. Information costs include a range of non-price barriers such as market research. Decision costs include development, negotiation and agreement of contracts and legal documentation. Compliance costs include monitoring, compliance, dispute resolution and arbitration costs.

This work was further developed through new institutional economics (Acemoglu et al., 2005; North, 1990; Williamson, 2000) where a key area of research focus is on how institutions overcome transaction costs at different levels, addressing both formal and informal institutional constraints. This dissertation focuses on the institutional and governance levels (Williamson, 2000). Critics of new institutional economics have argued that the discipline oversimplifies the relationship between economic development in a number of ways (Chang, 2011). It has also been criticised for underplaying the importance of power relations in shaping and being shaped by, institutions (Stilwell, 2006).

In this dissertation, I argue public financial institutions have a critical role to play in the net zero transition by overcoming information and decision transaction costs and encouraging private sector capital into low-carbon investments. Public financial institutions, defined here as majority state-owned actors which make investments in the national interest, are uniquely positioned to catalyse decarbonisation because “they influence, enable, and depend on the behaviour of other economic actors through investment and lending activities” (Klasen et al., 2022, p. 711). Strong public institutions have been shown to be a critical factor in economic

development (Acemoglu & Robinson, 2013; Rodrik et al., 2004). Strong political institutions have also been identified as a key factor in making credible climate change pledges (Victor et al., 2022). As global energy trade patterns are restructured in the transition to net zero emissions (Kompas et al., 2018), public financial institutions will play vital roles in directing climate finance flows to shape new clean energy markets in the net zero transition (Mazzucato & Penna, 2016).

While the number of public financial actors leveraging private investment in the transition to net zero emissions is increasing (Bazbauers & Engel, 2021; Macfarlane & Mazzucato, 2018; Marois, 2021; Steffen, 2021), limited comparative analysis of these institutions has been undertaken to date. Public financial institutions are key actors (Meckling et al., 2022), which can shape both the rate and direction of clean energy technology innovation and deployment (Mazzucato, 2011; Steffen & Schmidt, 2019). They also have a higher risk appetite than the private sector (Laplane & Mazzucato, 2020; Lazonick & Mazzucato, 2013). This allows them to mobilise additional private sector investment to clean energy technologies, particularly when they take on senior debt or provide concessional finance (Geddes et al., 2018). They can also deliver a range of public goods and co-benefits in addition to their financial returns of their investments (Lyons & White, 2023).

This chapter makes three original contributions. Firstly, it systematically draws together literature on public financial institutions which mobilise additional private investment in low-carbon infrastructure; an area of vital importance to the net zero transition. Secondly it uses this systematic review, supplemented with expert interviews, as the basis for developing a typology of public financial institutions leveraging private finance in the net zero transition. Finally, it identifies key institutional actors which have been understudied in relation to public finance being used to mobilise additional private finance; namely green banks, multilateral green funds, development finance institutions and export credit agencies.

The rest of the chapter is structured as follows. The methods section outlines the methodological approach employed through the systematic review, interviews and data analysis. The results and discussion sections provide an overview of the institutions profiled and comparative analysis of the key themes and data to emerge from the literature and interviews.

2.2 Methods

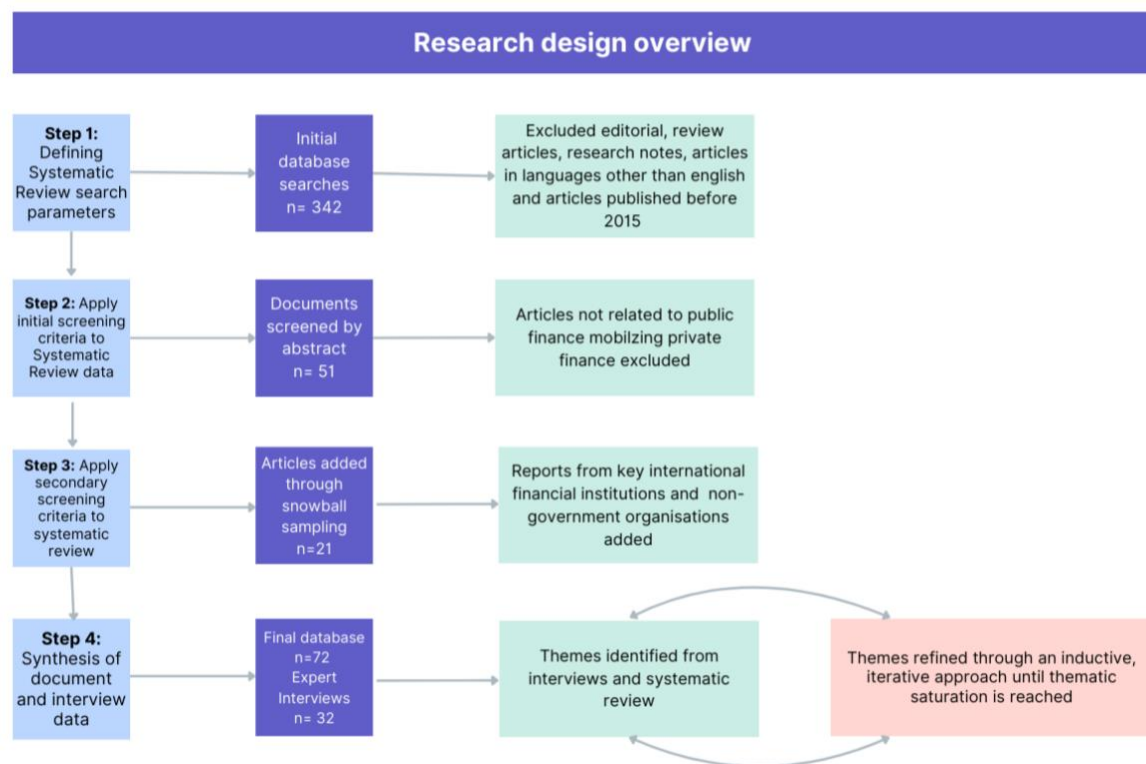
This study adopted a largely qualitative approach, coupling a systematic literature review with expert interviews, to identify institutional actors, and explore how they differ from one another. The findings from these two stages are analysed using an iterative, inductive approach to explore key themes. These stages are outlined in more detail in the following sections.

2.2.1 Expert Interviews

Of the 65 expert interviews conducted for this dissertation, 32 were with current and former public financial institution staff, clients, co-financiers, public servants, and political advisors between December 2021 and January 2024 (a list of participants is available in Appendix A). Ethics approval was obtained before the interviews commenced (ANU HREC Protocol 2021/279) and participants provided written consent to partake in the research. In this instance, I sought interviewee views on what kinds of public financial institutions were mobilising private finance for climate, their strengths, and weaknesses, and how they differed from one another. While interviewee views are subjective, they provide useful insights into differing perspectives between categories of interview participants. The interviews were one hour long and semi-structured with open-ended questions. Following the interviews, quoted participants were sent a draft copy of the chapter to ensure accuracy of quotes. The interview sample has limitations in that there were a higher proportion of current and former green bank employees compared to staff from other institutions; and also that it did not include interviews with central bankers or export credit agency staff as they were either not a significant focus of the research (central banks), or I was unable to find participants willing to participate in interviews (export credit agencies).

2.2.2 Systematic literature review

I adapted Stechemesser and Guenther's (2012) framework for the systematic literature review in this chapter. They apply a four-step framework, based on Fink (1998) and Tranfield et al. (2003). The process is outlined in Chart 2-1 in more detail.

Chart 2-1 Overview of methodology process

2.2.2.1 Step one: Defining search parameters

Because I was unable to identify any existing typologies of public financial institutions leveraging private finance for climate change my first research question asks: *What are the different types of public financial institutions leveraging private finance to invest in low-carbon or climate-resilient infrastructure?* My second research question asks: *How do they differ from one another?*

In considering what constitutes a public financial institution, I adopted the approach of Schmit et al. (2011) who in their study of European public financial institutions, identified two main actor types: banks and funds. In doing so, I exclude a range of public actors that can also leverage private finance for climate change such as government aid agencies and state-owned enterprises in the energy sector. While these actors are important, their inclusion would be beyond the scope of this dissertation.

In identifying relevant studies for stage two, I used the electronic database Scopus which captures over 90 million records from 7,000 publishers (Elsevier, 2024). It captures over 99% of records from Web of Science (Singh et al., 2021). The search string (see Box 2-1), executed in March 2024 was deliberately broad.

Box 2-1 Scopus search string

(TITLE-ABS-KEY ("public finance") OR TITLE-ABS-KEY (bank*) AND TITLE-ABS-KEY ("climate change") AND TITLE-ABS-KEY (investment)) AND PUBYEAR > 2015
--

2.2.2.2 *Step two: Applying initial screening criteria*

In the second stage, I applied a range of screening criteria to the Scopus search results. Firstly, I limited the results to documents from 2016 onwards to reflect the importance of the Paris Agreement (reached in December 2015) on climate change investment. I restricted results to articles in English, which excluded 8 records (three each in French, Persian and Spanish, two each in Chinese and German and one each in Russian and Finnish). I also excluded editorials, review articles, research notes, short surveys and errata as I wanted to focus on original research. Journal rankings were not used for exclusion purposes because this review aims to give a comprehensive overview of original research. When these criteria were applied, I ended up with a database of 342 records. The search terms were not exhaustive in profiling all public financial institutions which leverage private finance for climate change investment. Some institutions, particularly export finance agencies and green banks relied more on snowball sampling of relevant papers.

I then screened the abstracts of each of these articles to determine their relevance to the research questions; 52 studies remained. A further 21 studies were added into the research sample through reverse snowball sampling techniques and by searching the websites of key institutions for relevant reports. This resulted in a database of 73 studies. The final literature database is available online (Lyons, 2024).

2.2.2.3 *Step three: Applying secondary screening criteria*

In stage three a review protocol (see [Appendix B](#)) was developed to undertake the content analysis of the publications, building upon the bibliographic content captured by Scopus. I coded the literature and developed a database of key information extracted from research articles including the method (qualitative/quantitative/mixed etc.), research question/s, original contributions, thematic scope (key conclusions, regional scope) institutional type and governance (bank versus infrastructure fund and multilateral/ bilateral/national/subnational), organisational mission and financial instruments profiled (concessional debt, equity, green bonds, insurance, guarantees, grants). This was an iterative process with shifting institutional classifications based on the systematic review and expert interviews.

2.2.2.4 *Synthesis of document and interview data*

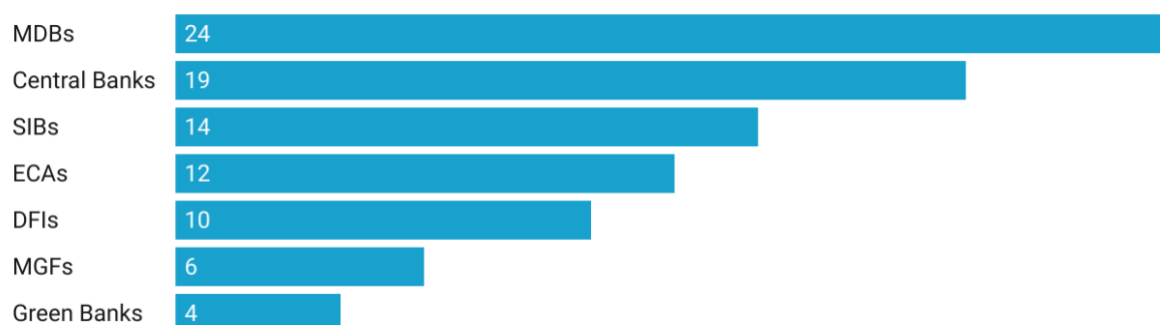
Document and interview themes were identified via a qualitative content analysis. The literature review undertook counts of institution types mentioned in each article. Where more than one kind of institution was mentioned in the same article, for example, if it referenced multilateral development banks and development finance institutions, both were recorded in the count. Where a single institution performed the roles of multiple actor types, for example, KfW acting as both a development finance institution and a state investment bank, only the function which was the focus of the article was recorded in the count. Interviews were recorded and transcribed with the permission of participants to allow for this thematic coding. After initial coding by institution, thematic analysis focused on the organisations' mission, governance and finance provision was undertaken. This analysis drew on both the expert interviews and the literature review. The primary and secondary data were coded using Excel then imported into NVIVO software and categorised in nodes according to institution type. Within these categories, key themes were identified using an iterative procedure. I continued holding interviews until thematic saturation was reached (Yin, 1993).

2.3 Results

I identified seven different types of public financial institutions which leverage private finance in the transition to net zero emissions, namely: central banks, state investment banks (SIBs), green banks, export credit agencies (ECAs), development finance institutions (DFIs), multilateral development banks (MDBs), and multilateral green funds (MGFs). Some articles mentioned multiple actor types and each instance was recorded in the count. It is important to note some actors are atypical and straddle multiple institutional categories. For example, the German bank KfW can be categorised as an SIB with green banking functions, a DFI and an ECA. In those instances, the institutional type was recorded in alignment with the function which constituted the primary focus of each reviewed research article.

Chart 2-1 illustrates the aggregated count of each actor type through the review database. MDBs recorded the highest number of articles exploring how they were mobilising private sector finance for climate. Central banks, ECAs and DFIs have been the focus of 10 or more articles since the Paris Agreement was signed. At the other end of the spectrum, there is limited research into the roles of MGFs and green banks in mobilising private finance for climate change.

Chart 2-2 Aggregated articles in systematic literature review by actor type



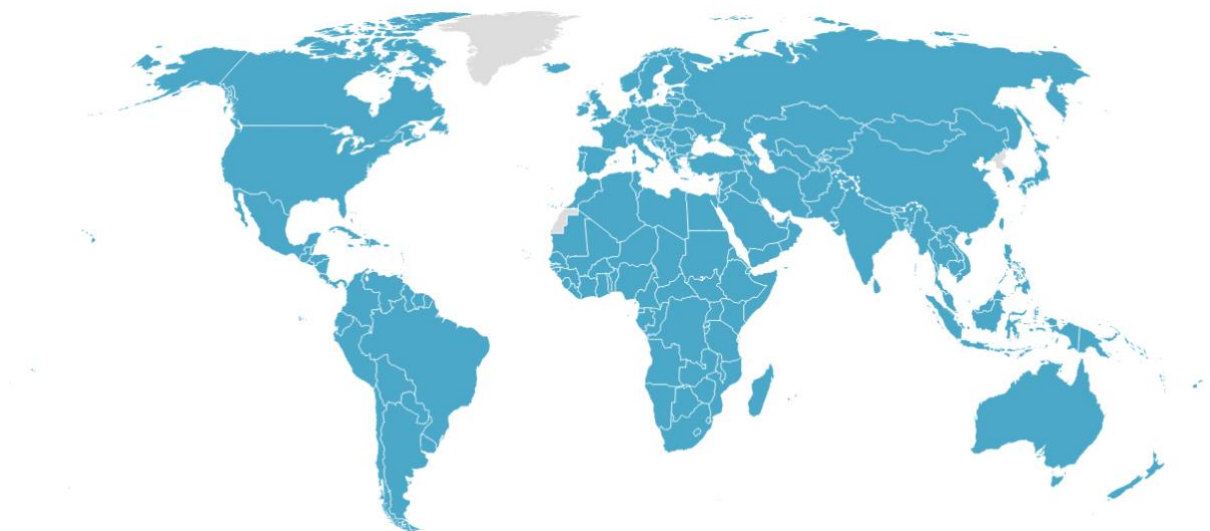
2.3.1 Actor Types

The following results section provides a broad overview of each actor type's mission, governance and financial instruments utilised to mobilise private finance for climate change investments, drawing on the systematic literature review and insights from expert interviews.

2.3.1.1 Central banks

Central banks emerged in the Victorian era before climate change was a global concern. Despite this, their role in mitigating climate change is increasingly scrutinised. They had the second-highest number of articles of any actor profiled. Goodhart (2011) identifies three traditional roles occupied by central banks. First, they maintain price stability, subject to the monetary regime in operation, for example, the gold standard or inflation targets. Secondly, they are tasked with maintaining financial stability and fostering economic development more broadly. Lastly, they support the state in times of financial crisis and constrain misuse of the state's financial powers. Nearly every country in the world has a central bank (see Figure 2-1), aside from a few small island states and autonomous territories like Greenland. Most central banks operate nationally, but there are four multistate central banks. These are the European Central Bank, the Central Bank of West African States, the Bank of Central African States and the Eastern Caribbean Central Bank (Rose & Samuel, 2013).

Figure 2-1 Global prevalence of central banks



Source: BIS (2014).

In the lead-up to the Paris Agreement, the Governor of the Bank of England, Mark Carney argued that climate change was a significant threat to financial stability, posing physical, liability and transition risks to economies which central banks could not ignore (Carney, 2015). The role(s) central banks should play in the net zero transition has been an increasing focus in recent years (Aguila & Wullweber, 2024; Gunningham, 2020a, 2020b). Climate change is shaping the discourse and practices of central banks (Thiemann et al., 2023). This has manifested in different ways, with the Dutch central bank being influenced by a small group within the bank (Siderius, 2023), while in China “window guidance” targets adopted by the People’s Bank of China directed bank lending to support national sustainability targets (Dikau & Volz, 2021). Some central banks also play important roles in implementing policy instruments such as prudential regulation tools to better manage financial risks stemming from climate change (Hidalgo-Oñate et al., 2023).

Central banks have issued sovereign green bonds worth US\$263.3 billion have been issued to date, representing about one-fifth of the Green Bond market (Monnin et al., 2024). Central banks can mobilise more private finance for climate change by continuing to increase their volume of green bonds and issuance of innovative forms of green bonds which encourage additional private sector investment.

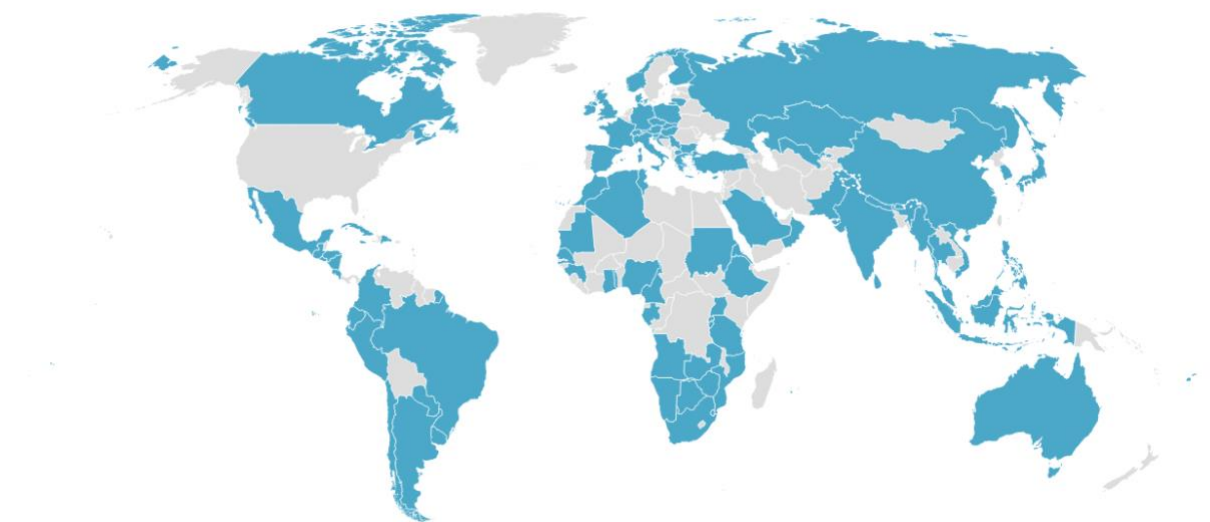
2.3.1.2 *State Investment Banks*

State Investment Banks (SIBs) are “majority public-owned entities that have a mandate to pursue socio-economic goals in a defined geographical area, sector or market segment through the use of repayable financial instruments” (Macfarlane and Mazzucato, 2018, p.7).

While the first SIBs were founded as part of the Marshall Plan for post–Second World War reconstruction, they differ to MDBs in that they are domestic rather than multilateral institutions. There are over 100 national SIBs globally (see Figure 2-2). SIBs have been criticised as inefficient and at times corrupt institutions (Porta et al., 2002). Most SIBs are domestically focused, some such as KfW operate as hybrid institutions with a bilateral DFI or ECA function (see section 2.3.1.5).

Today many of these institutions are diversifying their missions and investment mandates to help leverage private finance through their climate change investments in the net zero transition. Historically, Mazzucato and Penna (2016) argue, SIBs play four key institutional roles. Firstly, they play an important countercyclical finance role in times of economic crisis when private institutions are more cautious about lending. During these periods SIBs provide short-term economic stimulus through their investments. Secondly, SIBs promote strategic investments for economic development during periods of economic growth. Thirdly, SIBs focus on investments to support new businesses, either through providing innovation technology support or funding for small and medium enterprises (SMEs). Lastly, SIBs are active in promoting mission-led finance, particularly in relation to climate change investment. Griffith-Jones (2020) notes an additional role of SIBs is to support the provision of public goods. Governance arrangements of SIBs vary widely. SIBs use a range of financial instruments to achieve these roles including debt and equity finance, grants and guarantees.

Figure 2-2 Global prevalence of state investment banks



Source: Authors summary based on Case-Ruchala, D. (2024).

2.3.1.3 *Green Banks*

Green banks are a relatively new form of public financial institution that mobilise additional private finance for climate change. Most green banks operate nationally (although the United States has numerous green banks operating subnationally, both at the state and county levels). There are currently 16 countries with green banks (see Figure 2-3). Australia (has the world's largest and longest running public green bank (Lyons & White, 2023, Diaz-Rainey & Sise, 2018). Green banks seek to accelerate the investment transition to net zero emissions by targeting their investments to mobilise additional private sector investment which would otherwise not occur. They also seek to make catalytic investments which encourage the private sector to invest in additional projects without public finance (Schub 2015).

Green bank operations are focused around overcoming two barriers to investment: finance provision and capacity building. On finance provision, green banks work with domestic capital providers to de-risk investment. This is primarily achieved through the green bank undertaking specialist due diligence to have a superior understanding of financial, technology or policy risks compared to their private sector counterparts (Lyons & White, 2023). For example, there may be a need to develop a new application of a financial instrument to get a project approved. Or it may be the first time a commercialised technology has been deployed in a particular jurisdiction. Lastly, there may be a policy implemented where green banks have an information arbitrage compared to their private sector counterparts. In all instances the transaction costs associated with understanding and mitigating these risks are too expensive for the private sector, and the projects would not proceed without green bank involvement.

When the COVID-19 pandemic struck in 2020 and restaurants shut for lockdown, NYGB was able to provide an extra US\$1 million in finance to Agbotic to continue operating to donate its produce to food pantries to help address food insecurity in the region.

2.3.1.4 Export Credit Agencies

Export credit agencies (ECAs) are an increasingly prevalent form of public financial institution which are primarily focused on advancing trade interests through their investments. There are 116 ECAs in operation around the world (see Figure 2-4) (USEXIM, 2021). As Hopewell (2017) notes, for most major economies ECAs are a core element of industrial policy and strategies to foster economic growth. ECAs play an important role in financing large energy and infrastructure projects, particularly in developing countries (Blackmon, 2016; Hopewell, 2019). These investments can help actors advance strategic interests through investments in critical infrastructure in developing countries. In short, ECAs “support national economic interests abroad” (Shishlov et al., 2021, p. 2).

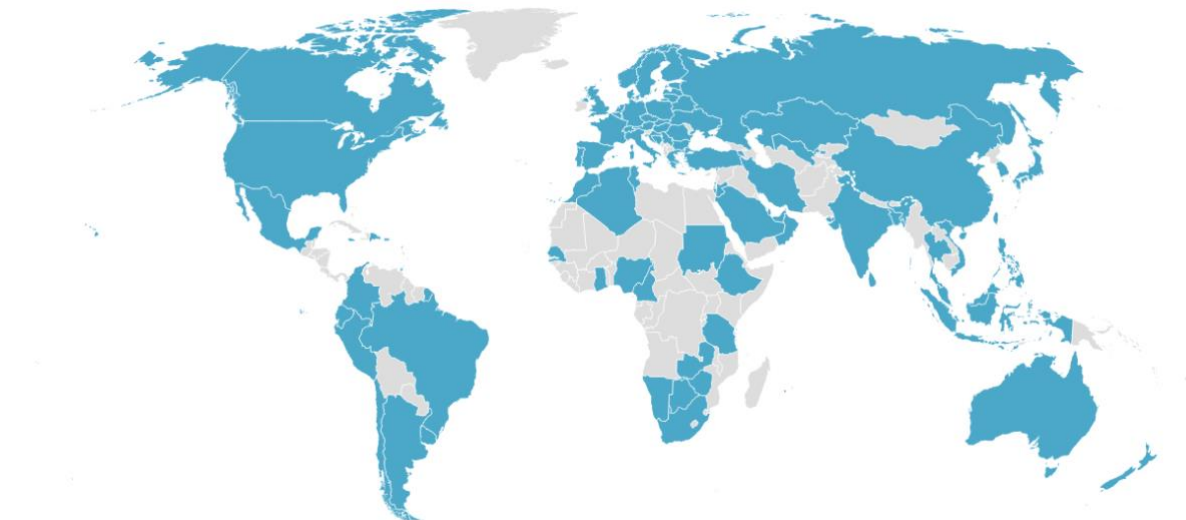
ECAs are largely opaque institutions and their investments lack transparency. For example, in recent years, Australia has provided A\$6 billion to its ECA, Export Finance Australia, for infrastructure financing facilities in the Pacific and Southeast Asia, with a strong climate and development focus but very limited transparency of project outcomes. At present there is no global governance regime for ECAs. Instead, Organisation for Economic Co-operation and Development (OECD) member countries with ECAs take a voluntary, club-based approach to governance, which has proven ineffective (Liao, 2021) in the absence of leading ECAs, like China's CHEXIM. ECAs are also required to comply with World Trade Organisation (WTO) rules, specifically the Agreement on Subsidies and Countervailing Measures (SCM Agreement), which governs the use of subsidies, including export credits. From 2019 to 2021 ECAs provided at least \$US34 billion per year to fossil fuel projects versus an average of US\$4.7 billion for clean energy projects (O'Manique et al., 2022). Many of these investments do not adequately assess climate risks, particularly stranded asset risks (Hughes & Downie, 2023).

ECA governance varies but their operation generally falls into three broad categories; as independent agencies, government departments or state-owned enterprises. The degree of government control over ECA operation varies widely: while some have a high degree of investment independence, others are subject to high levels of government oversight.

ECAs provide public financial support in the form of loan guarantees, insurance, or direct financing to mobilise additional private sector investment. Specifically, they offer direct loans

How green banks can create multiple types of value in the transition to net zero emissions to foreign buyers for the purchase of the owner country's exports, as well as insurance for exporters to cover political or other risks affecting payment (Peterson & Downie, 2023).

Figure 2-4 Global prevalence of export credit agencies.

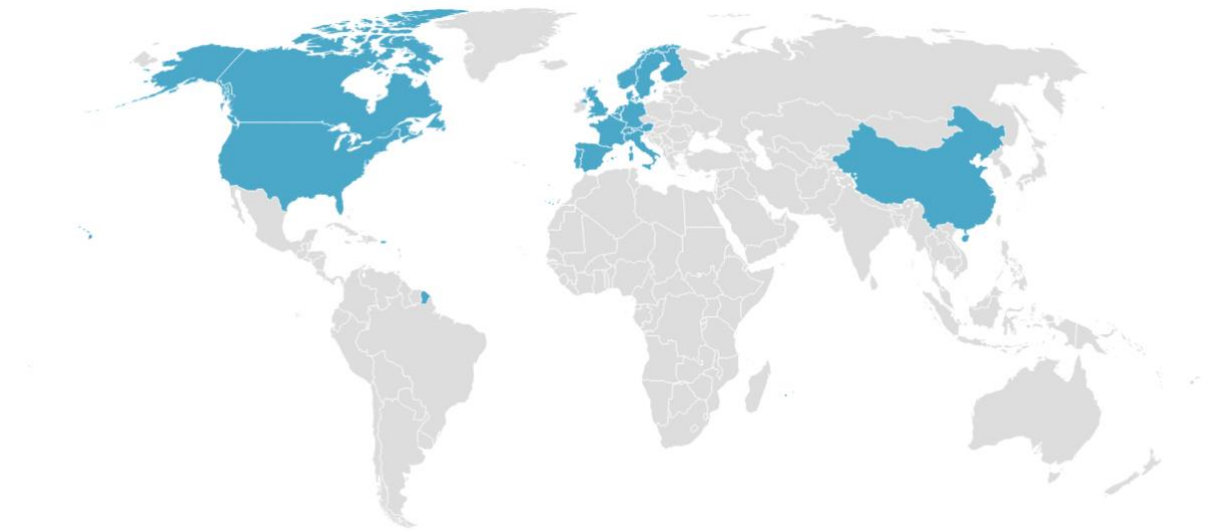


Source: USEXIM (2021)

2.3.1.5 Development Finance Institutions

Development finance institutions (DFIs) are bilateral entities usually established by actors in the global North to assist developing countries in meeting their economic development goals. Traditionally these goals have been to ensure basic infrastructure construction, adequate clean water supply and to alleviate energy poverty. Increasingly DFIs are focusing on provision of clean energy technology supply or decommissioning existing fossil fuel infrastructure. They achieve these goals through provision of concessional loans, guarantees and equity.

Currently there are 18 DFIs globally, which are concentrated among members of the global North (see Figure 2-5). This number is increasing due to the increasing complexity of development goals which also need to embed climate change, economic security and sustainable development goals. Like ECAs, DFIs have been criticised for their lack of global governance and having weaker transparency and information disclosure policies on grounds of commercial sensitivity or client confidentiality (Tan, 2019) than other actor types. DFIs have also faced criticism for their provision of finance for fossil fuel projects in developing countries following the Paris Agreement (Edianto et al., 2022). Finally, they are facing increasing criticism for their high use of loans that reduce the fiscal head room of developing countries and result in high levels of developing country debt distress (Bhattacharya et al., 2023).

Figure 2-5 Global prevalence of development finance institutions.

Source: Authors summary

2.3.1.6 Multilateral Development Banks

The first multilateral development banks (MDBs) were borne out of the Bretton Woods conference in 1944. MDBs were originally designed to assist with the reconstruction efforts in postwar Europe but have since become important financial institutions to encourage economic and social development in low and middle-income countries worldwide (Humphrey, 2022). MDBs focus on the provision of significant technical support to encourage economic and institutional development in recipient countries, as well as significant finance provision. In recent years there has been a strong push to get MDBs to also address climate change and the sustainable development goals. MDBs have sovereign state members which exchange paid-in capital for institutional voting rights. One expert interviewee noted that “MDBs have been exceptionally successful in leveraging international capital markets with small amounts of paid in capital” (Interview no 11, 21 January 2023). For example, With US\$19.2 billion of paid-in capital, the World Bank has been able to provide more than US\$750 billion in loans over its lifetime.

Bazbauers and Engel (2021) identify 30 functional multilateral development banks globally, which they organise into four categories: multilateral (e.g. World Bank), regional (e.g. Asian Development Bank), sub-regional (e.g. Caribbean Development Bank), and specialised (e.g. Islamic Development Bank) (see Table 2-1).

Table 2-1 Global overview of multilateral development banks.

MDB name	Year founded	Country headquarters
African Development Bank	1963	Cote d'Ivoire
Arab Bank for Economic Development in Africa	1974	Sudan
Arab Fund for Economic and Social Development	1971	Kuwait
Asian Development Bank	1966	Philippines
Asian Infrastructure Investment Bank	2015	China
Black Sea Trade and Development Bank	1997	Greece
Caribbean Development Bank	1970	Barbados
Central American Bank for Economic Integration	1960	Honduras
Council of Europe Development Bank	1956	France
Development Bank of Central African States	1975	Republic of Congo
Development Bank of Latin America (CAF)	1970	Venezuela
East African Development Bank	1967	Uganda
Eastern and Southern African Trade and Development Bank	1985	Burundi
ECO Trade and Development Bank	2005	Turkey
ECOWAS Bank for Investment and Development	1975	Togo
Eurasian Development Bank	2006	Kazakhstan
European Bank for Reconstruction and Development	1991	United Kingdom
European Investment Bank	1958	Luxembourg
FONPLATA Development Bank	1974	Bolivia
Inter-American Development Bank	1959	United States of America
International Bank for Economic Cooperation	1963	Russia
International Fund for Agricultural Development	1977	Italy
International Investment Bank	1970	Hungary
Islamic Development Bank	1974	Saudi Arabia
New Development Bank	2014	China
Nordic Investment Bank	1976	Helsinki

OPEC Fund for International Development	1976	Austria
Pacific Islands Development Bank	1989	Guam (United States of America)
West African Development Bank	1973	Togo
World Bank	1945	United States of America

Source: Authors own compilation based on Bazbauers and Engel (2021)

MDBs use public finance to mobilise additional private sector investment for climate change mitigation in two ways. Firstly, they signal a state's creditworthiness to private financiers and can encourage greater private sector investment in markets where it would otherwise not occur (Bazbauers & Engel, 2021). Secondly, they can help to de-risk investments through their superior understanding of technology or financial risk to shape markets (Steffen & Schmidt, 2019). They also have an important role as stewards of institutional knowledge and expertise. MDBs are often seen as "lenders of last resort", which step in to fund projects the private sector would not otherwise finance.

Most MDBs offer three main types of loans; investment project finance, development programme loans (DPLs) and programme-for-results lending (Bazbauers & Engel, 2021). Investment project loans normally take the form of a loan, credit, or guarantee and can be in any sector. DPLs provide budget support to developing country governments contingent on policy or institutional reform. Programme-for-results lending is focused on specific sectors, and funding is only released when certain results are achieved. Of these three loan types, investment project finance is primary form of loan which directly mobilises additional private sector finance for climate change.

2.3.1.7 Multilateral Green Funds

The final type of institutional actor profiled in this typology are multilateral green funds (MGFs), defined here as funds established through international agreements involving three or more states. Globally, there are seven multilateral public funds which mobilise private finance for climate change, (see Table 2-2). The functions of these funds vary, but they generally provide grants and concessional finance for climate change investment.

Table 2-2 Global prevalence of multilateral green funds.

MDB name	Year founded	Country headquarters	Lifetime investment commitments
Green Climate Fund	2010	Republic of Korea	US\$10 billion
Global Green Growth	2010	Republic of Korea	US\$8.75 billion

Institute			
Global Environment Fund	1991	United States of America	US\$5.33 billion (current replenishment cycle)
Climate Investment Funds	2008	United States of America	US\$12.1 billion
Adaptation Fund	2001	United States of America	US\$1.2 billion
Loss and Damage Fund	2023	United States of America	US\$661 million
Private Infrastructure Development Group	2005	United Kingdom	US\$2.054 billion

Source: Authors summary

The largest MGF, the Green Climate Fund (GCF), was founded in 2010 through the UNFCCC as a dedicated financing vehicle for developing countries. It uses a combination of grants, concessional debt, bonds, guarantees and equity instruments to leverage blended finance and crowd-in private investment for climate action in developing countries. The GCF disburses funding to a range of financial institutions which have gone through a screening and accreditation process to become GCF “accredited entities”. Entities seeking accreditation to the GCF have their internal policies and operational practices assessed against three sets of standards: fiduciary standards, environmental and social safeguards, and gender policy (De Jonge, 2017). Its investments are split equally between mitigation and adaptation, with at least 50% of adaptation investments required in the most vulnerable countries (small island developing states, least developed countries and African states) (GCF, 2021).

But the GCF has been beset with governance issues since its inception and has struggled to deploy finance rapidly. Over its lifetime the GCF has approved US\$13.9 billion in funding, however only US\$4.3 billion has been disbursed. The slow rate of disbursements has long been a source of criticism of the GCF, as have calls to broaden the range of instruments it deploys to include auctioned price floors (Bodnar et al., 2018). US\$3.7 billion has been approved for investments which leverage private sector funding through the GCF’s dedicated private sector facility. Most of its private sector funding goes to loans, with smaller investments in equity, grants and guarantees. One interviewee noted that challenge for the GCF to scale up investment was in direct tension with its goal to work on innovative financing projects:

if you want us to do paradigm shift and to look for these more exciting innovative projects, it takes more time to make them. It takes more time to work with our partners on them. (expert interview no. 7, 4 November 2022)

In 2023 a Loss and Damage Fund was established through the UNFCCC. The Paris Agreement recognised that many states are facing unavoidable or irreversible climate impacts which cannot be addressed through mitigation or adaptation actions which it termed “Loss and Damage” (UNFCCC, 2015). But the Paris Agreement failed to connect “Loss and Damage” to a financial mechanism and years of negotiations followed before a funding mechanism was agreed at COP28 in Dubai. The Loss and Damage fund is notable for being the only climate fund with a mandate to address non-economic losses resulting from climate change (Pill and Hammersley, 2024). This means the Fund is unlikely to mobilise private sector finance other than philanthropic funding.

2.3.2 Similarities and differences between actor types

This section seeks to answer my second research question, namely, how do different types of public financial institutions which mobilise private finance for climate change investments differ from one another? What emerges from the results reported here, is that there are three organisational factors which distinguish between actor types; mission, governance, and forms of finance. These are discussed in more detail below:

2.3.2.1 *Mission*

There was significant variation between actors in terms of their “organisational mission”, defined here as the overriding purpose of the institution (Darbi, 2012). Figure 2-6 provides a summary of each actor type and their organisational missions based on the systematic review and expert interviews. What is striking is that for most public financial institutions, addressing climate change mitigation and adaptation is not their primary mission, let alone the more challenging task of mobilising private finance for climate change. Indeed, green banks are the only actors which mobilise private sector finance for climate change as their primary mission. MGFs are the only actor type to prioritise climate change adaptation as a primary mission.

Figure 2-6 Overview of public financial institution organisational missions

How green banks can create multiple types of value in the transition to net zero emissions

	Central Banks	Green Banks	Other State Investment Banks	Development Finance Institutions	Export Credit Agencies	Multilateral Development Banks	Multilateral Green Funds
Mobilising private climate finance		●		○		○	○
Climate Change mitigation		●	○	○	○	○	●
Climate Change Adaptation		○		○		○	●
Financial stability	●						
Monetary policy	●						
Development			●	●		●	○
Trade			○	○	●	○	
National Security					○		
Capacity Building		●	○			●	○

● Primary mission ○ Secondary mission

Source: Authors summary

2.3.2.2 Governance

Governance of the profiled institutions varies widely. One important factor is the level at which the institutions operate; either multilaterally like the MDBs and MGFs, bilaterally like DFIs and EFAs or nationally like the majority of central banks, SIBs and green banks (see Table 2-3). This governance level determines whether organisations are operationalised through national or subnational legislation, like central banks, SIBs, ECAs and green banks or through Articles of Agreement, like MDBs and MGFs. Another important distinction between actor types is whether institutions are banks or funds. While MDBs, SIBs and ECAs mostly operate as banks, transforming small amounts of paid-in capital to much larger amounts of funding via international capital markets. In contrast, green banks are not actually banks. They are, as one interviewee noted, “terribly named, and in fact are state-sponsored infrastructure funds” (Expert interview no. 18, 4 August 2022).

Table 2-3 Governance levels of public financial institutions mobilising private finance for climate change.

	Multilateral	Bilateral	National	Subnational
Central banks	x	-	x	-
SIBs	-	-	x	x
Green banks	-	-	x	x
ECAs	-	x	-	-
DFIs	-	x	-	-
MDBs	x	-	-	-
MGFs	x	-	-	-

Source: Author's summary

2.3.2.3 Finance provision

There are several areas where actor types diverged in relation to finance. Firstly, in regard to the financial products they offered. Most actors, aside from central banks, use multiple forms of financial instruments to mobilise additional private finance for climate change investment. This includes equity, loans, guarantees, blended finance, securitisations, derivatives, insurance products and Islamic finance (for more detail see Table 2-4). All actors (aside from central banks) offered debt finance, and for most actors this was the primary form of financial instrument used. Provision of grant funding was more limited and mostly used by MDBs, SIBs and DFIs. Use of insurance products was also limited and mostly utilised by ECAs and DFIs. Use of climate change bonds is becoming increasingly common.

Table 2-4 Summary of financial instruments used by public financial institutions to mobilise additional private sector investment.

	Central Banks	SIBs	Green banks	ECAs	DFIs	MDBs	MGFs
Grants	-	x	-	-	x	x	x
Equity	-	x	x	x	x	x	x
Market loans	-	-	-	x	x	x	-
Concessional loans	-	x	x	x	x	x	x
Loan aggregation	-	x	x	-	-	x	-
Securitisation	-	-	x	x	-	-	-
Guarantees	-	x	x	x	x	x	x
Derivatives	x	x	x	x	x	x	-

Source: Author's summary

Another key area of difference between actor types were the kinds of co-financiers they worked with. MBDs, DFIs and MGFs often co-invest alongside one another and use international

How green banks can create multiple types of value in the transition to net zero emissions capital markets. In contrast, green banks primarily work within domestic capital markets leveraging local capital to make their investments. Central banks work independently, allowing the private sector to invest in their bonds. ECAs are more likely to work with private companies, providing concessional loans for investment. They also work with insurers to provide insurance to domestic firms against various forms of risks within the markets they are investing in. This diversity of co-financiers is important as the quantum of climate finance required is such that a wide variety of finance sources is needed.

2.4 Discussion

From the results section there are a range of areas which warrant further discussion. Firstly, the systematic literature review shows that academic research has prioritised some forms of public financial institutions while neglecting others. For example, there are 24 studies on MDBs, compared to four on green banks, illustrating the limited research into and understanding of green banks at present. This is concerning given the role of green banks in using public concessional finance to attract additional domestic private sector investment; three out of the four areas identified as priorities for scaling up climate finance by the UNFCCC High Level Expert Group on Climate Finance (Bhattacharya et al., 2023).

The lack of public financial institutions focused on climate change adaptation may be an important factor contributing to the well-documented financing gap for adaptation (Timperley, 2021). MGFs are the only form of public financial institution to make climate change adaptation a primary organisational mission and this is not a universal feature of MGFs. There is a clear need for additional public institutions focused on accelerating climate change adaptation investments. The political economy of establishing and maintaining these institutions is complex given adaptation investments are not generally profitable when assessed with current investment screening tools (Bose, 2021). New financial instruments are needed which evaluate the costs and benefits of these investments against escalating costs of physical climate impacts more effectively.

Figure 2-6 clearly illustrates that all institutions are seeking to meet multiple organisational missions. For example, MDBs have recently been the focus of sustained reform efforts to expand their focus beyond economic development to address climate change. This layering of organisational goals broadly supports the work of other studies in this area (Kern & Howlett, 2009; van Geet et al., 2019). It is clear there will increasingly be trade-offs between these goals in the transition to net zero emissions (Coffey, 2021; Coghill, 2021). For example, human rights issues associated with the manufacture of Chinese solar panels is well documented. The use of new coal-fired power plants to build lithium battery factories for electric vehicles in Indonesia

is another example of the types of incongruent goals policymakers will face in the net zero transition, which will involve trade-offs between value creation and destruction (Lyons & White, 2023; Swilling, 2011).

Interestingly, several interviewees noted the challenge in managing the goal incongruence between achieving financial returns on investment versus funding more innovative or more catalytic projects. This was a common theme across green banks, SIBs, MDBs and MGFs.

Green banks were illustrated to be a distinct and significant new form of public financial institution mobilising additional private sector finance for the net zero transition. Their narrow investment remits help them to develop high degree of staff expertise regarding financial structures and technology and policy risks. They apply this expertise to develop innovative transactions which are too labour-intensive for the private sector. Their knowledge-sharing and leadership roles help to educate the private sector and catalyse additional investment (Geddes et al., 2018). Finally, they have a very important role in scaling up private finance from the domestic banking sector in their home jurisdiction. At present green banks are underrepresented compared to other actors (see Figure 2-3), and there is an important role for scaling up public green banks in the net zero transition. Green banks could have a role to play in many developing countries in South-East Asia and Africa which are significantly underinvesting in their net zero transition at present and will need finance beyond climate finance to meet their net zero goals (Bhattacharya et al., 2023; Larasati & Mafira, 2023a).

My systematic literature review and expert interviews suggest the slow increases in climate finance investment by public financial institutions stem from two key causes. First, there are a range of barriers preventing the acceleration of spending (Granoff et al., 2016), from traditional positive externalities associated with infrastructure investments, to barriers associated with low-carbon investments to additional barriers faced by developing countries. Secondly, it appears that existing institutions which have traditionally been focused on other policy goals like economic development or trade, find these goals at times incongruous with reducing emissions or increasing investment. These kinds of value trade-offs have limited focus in the academic literature at present and are an important avenue for future research (Coffey, 2021; Cui & Aulton, 2023).

This chapter provides a range of implications for policymakers. It illustrates the range of distinct public financial institutions mobilising private finance for climate which have important differences from one another. Considering the missions, governance and finance provisions

How green banks can create multiple types of value in the transition to net zero emissions of these institutions is vital for policymakers to successfully target the right finance gaps in order to mobilise additional private finance for climate change.

2.5 Conclusion

There are a range of public financial institutions seeking to mobilise additional private finance for climate change. My systematic review and expert interviews identified seven key institution types: central banks, SIBs, green banks, ECAs, DFIs, MDBs, and MGFs. These organisations demonstrated significant variation in terms of their mission, governance and finance provision. The majority of actors were not established to address climate change and focus on a range of other policy goals including economic development and trade. There is a deficit in public financial institutions mobilising private finance for climate change adaptation at the bilateral and national levels which needs to be addressed. Green banks emerged as an important new form of institutional actor which combine financing and knowledge-sharing capabilities to catalyse additional investments. Understanding how these institutions operate and interact with one another will be vital to scaling up investment in the net zero transition and helping to close the global climate finance gap.

Chapter 3 How green banks can create multiple types of value in the transition to net zero emissions

This chapter is adapted from a journal article published in December 2023 by the Australian Journal of Public Administration and co-authored with my Associate Supervisor Dr Lee V. White.

Current levels of investment are insufficient to meet the goals of the Paris Agreement, and private sector funding shortfalls are acute. Despite this, little research has been undertaken into green banks, a new form of institution which mixes public and private institutional logics to mobilise additional private investment in the net zero transition. This paper examines how hybridity manifests in green banks and the ways these institutions create value through their investments. We adopt a mixed method, case study approach, combining primary document study with interviews, to elicit information on different forms of hybrid governance and value creation in four green banks (located in Australia, New Zealand, and the United States). We find some commonalities in how hybridity manifests between cases (e.g. combining public knowledge-sharing logics with private investment logics), but also significant differences (e.g. in investment focus), as policymakers adapt organisational governance to suit jurisdictional circumstances. Green banks are perceived to create value beyond their core financial roles, including knowledge spillovers, social equity benefits and enhanced energy security. Current evaluation approaches focus on financial metrics, and often exclude these broader areas of value creation. Development of additional value capture metrics could make green bank contributions more visible.

3.1 Introduction

Decarbonising the global economy requires a significant increase in funding for low-carbon, climate-resilient infrastructure. Global annual clean energy investment needs to accelerate to US\$4 billion per annum (IEA, 2021) to achieve Paris Agreement targets. The current shortfall in private sector funding is acute (Timperley, 2021). Different varieties of green capitalism are gaining traction, with ongoing debate about the role and responsibilities of the financial sector in addressing environment and sustainability challenges (Tienhaara, 2014). Green banks are an institutional form of green capitalism, with governments recognising that markets alone cannot deliver the investment, technological innovation or just transition required through the net zero transition. Green banks provide debt and equity financing to private companies which are unable to secure commercial funding, due to a range of investment barriers (Geddes et

How green banks can create multiple types of value in the transition to net zero emissions al., 2018). Investment in public green banks reflects a perspective that public sector managers have an important role to play in shaping the rate and direction of clean technology innovation, and driving dynamic value creation for different actors at societal, organisational and individual levels (Mazzucato, 2019).

Hybridity is a logical conceptual lens to explore green banks as institutions. Hybrid institutions mix characteristics of the state and civil society in different ways (Brandson and Karré, 2011), to try to create value. Organisational studies literature has explored where hybridity is located within the continuum between public and private institutions for decades (Battilana and Lee, 2014; Perry and Rainey, 1988; Wamsley and Zald, 1973). More recent research has highlighted hybridity as a form of institutional logic (Skelcher and Smith, 2015), latent elements of organisational hybridity (Seibel, 2015) and the evolution of hybrid organisational structures through blending or layering (Polzer et al., 2016). We draw primarily on the work of Vakkuri and Johanson (2021), who conceptualise hybrid governance in two ways: as either organisational dimensions (mixed ownership, goal incongruence and competition, multiplicity of funding sources, and forms of social and financial control) or through their approaches to value creation (mixing values, compromising on values, legitimising values).

There is increasing recognition climate change and sustainable development require new modes of governance which transcend the anthropocentrism of unsustainable development and consider value creation more broadly (Coffey, 2021; Gale, 2019; Swilling, 2011). green banks are one attempt to develop this governance and create value, defined as “the process through which an individual, organisation or society develops novel and innovative tasks and services” (Vakkuri and Johanson, 2021, p. 9). Value creation is at the core of conceptions of public value in public administration and management and economics literatures (Alford and O’Flynn, 2009; Moore, 1995; O’Flynn, 2021). While public value is a nebulous concept, it can be broadly defined as a collective commitment to solving societal problems, led by an innovative public sector (Alford and O’Flynn, 2009; Hartley et al., 2017; Mazzucato and Ryan-Collins, 2022; Moore, 1995). Public value scholarship has been vigorously challenged, due to its anthropocentric approach (Coffey, 2021; Swilling, 2011). Sustainability value is increasingly seen as a vital component of public value which must be balanced against, or even transcend, traditional exchange value, use value, labour value and function value (Gale, 2019; Swilling, 2011).

This work draws on the perspective put forth in recent work (Mazzucato and Ryan-Collins, 2022) that public sector managers have a key role in shaping the provision of services such as green banks that are intended to create public value. This perspective recognises public

value “is not created by the public sector alone” (Benington, 2011, p. 46) and the private sector is an important source of public value creation, which can be shaped by public finance (Mazzucato and Ryan-Collins, 2022). Conversely, governments and the private sector can also be responsible for public value destruction, for example, through promotion of ecologically degrading practices (Coffey, 2021).

This chapter expands literature on green banks by exploring the concept of hybridity as it manifests in their organisational governance and value creation. We seek to answer two research questions. First, *How does hybridity manifest in green banks?*, for which we use Vakkuri and Johanson (2021) as the conceptual starting point for our analysis to examine hybridity in terms of mixed ownership, goal incongruence and competition, multiplicity of funding arrangements, and public and private forms of financial and social control. Second, *How do hybrid green banks create value through their investments?*, which builds on the existing literature exploring mechanisms for value creation and value capture (Johanson and Vakkuri, 2017; Lepak et al., 2007; Mazzucato, 2019; O’Flynn, 2021). We explore how value accrues at individual, organisational and societal levels (Cui and Aulton, 2023; Osborne et al., 2022) and at different points in the policy cycle for different actors (Dudau et al., 2019). In seeking to answer these questions, we hope to provide insights into the hybrid governance provisions of green banks that contribute to their effectiveness, and to provide policymakers with increased understanding of this novel form of institution.

This chapter contributes to theoretical development in the space of hybridity and green banks in three ways. Firstly, it builds on the existing literature (Geddes et al., 2018, 2020; Peters, 2018; Schub, 2015) on green banks, by providing the first (to our knowledge) case study analysis of green banks at the national, state and local levels. It extends the analysis of Geddes et al. (2018) by arguing that, in addition to their capital provision, de-risking, educational, signalling and early mover roles, green banks also play an important role in creating value through the public goods and co-benefits of their investments. Secondly, it builds on the current research on hybridity in two areas where acknowledged research gaps exist, by adding to empirical data on hybrid organisations (Dudau et al., 2019; Hartley et al., 2017) and through its case selections within the environmental sector (Coffey, 2021; Coghill, 2021). Lastly, it draws together notions of value in public administration, public management and economic literatures in the context of green banks and the net zero transition, to explore the role of green banks in creating value for individuals, organisations and society (Cui and Aulton, 2023; Mazzucato, 2019; O’Flynn, 2021; Osborne et al., 2022).

The rest of the chapter is structured as follows. The methods section outlines the methodological approach employed through the archival study, interviews and data analysis. The results and discussion section provides a comparative analysis of the key themes and data to emerge from the organisational documents and interviews.

3.2 Methods

We took a qualitative, case study approach (Yin, 1993) with the scope of the study considering four hybrid green banks: Australia's Clean Energy Finance Corporation (CEFC), New York Green Bank (NYGB), Montgomery County Green Bank (MCGB) and New Zealand Green Investment Finance (NZGIF). We chose three of the oldest, largest, green banks at national, state and county levels (CEFC, NYGB and MCGB). In addition, we included NZGIF due to New Zealand's unusual emissions profile (large agricultural sector and significant use of hydropower in the electricity sector). Interviewees noted its financial market structure (lack of liquidity) could also provide insights into the development of green banks in smaller, emerging markets. Table 3-1 provides a summary of key characteristics of each of these organisations including mission, jurisdiction and governance. It illustrates the significant differences in organisational structure between the four cases, discussed in more detail below (section 3.2.1). We began by undertaking an archival document study (Das et al., 2018) of each case to understand key characteristics and development history. We then conducted a range of interviews to understand how organisational hybridity and value creation manifests in different kinds of green banks. Finally, we analysed the findings from these two stages using an iterative, inductive approach to explore key themes. These stages are described in the following sections.

Table 3-1 Green bank organisational overview

	CEFC	NYGB	MCGB	NZGIF
Jurisdiction	Australia (national)	United States, New York (state)	United States, Maryland, Montgomery (county)	New Zealand (national)
Established	2012	2013	2015	2019
Mission/goals	The CEFC is a specialist investor at the centre of efforts to help deliver on Australia's ambitions for a thriving, low emissions future. With a strong investment track record, we are committed to accelerating our transition to net zero emissions by 2050.	To work in collaboration with the private sector to transform financing markets in ways that accelerate clean energy investments to combat climate change and deliver benefits equitably to all.	To help Montgomery County achieve its climate goals by leveraging capital and innovative partnerships to make clean energy and climate-resilient solutions more accessible and affordable for all residents and businesses.	To accelerate domestic low emissions investment.
Independent Board of Directors	Yes	No	Yes	Yes
No. of employees	~124	~39	~11	~8

How green banks can create multiple types of value in the transition to net zero emissions

Initial investment capitalisation	A\$10 billion	US\$1 billion	~US\$16 million	NZ\$100 million
Total transaction value	A\$37.15 billion	US\$4.5 billion	N/A	NZ\$50.4 million
Portfolio leverage ratio	A\$2.42: A\$1.00	US\$2.65: US\$1.00	N/A	NZ\$1.27: NZ\$1
Emissions reductions*	~200 Mt CO ₂ -e	~30.6 Mt CO ₂ -e	N/A	~0.275Mt CO ₂ -e
Transactions	~265	105	N/A	5

*emissions reductions are not directly comparable due to different estimation methodologies

3.2.1 Case overview

This section provides an overview of the four green banks selected as case studies. There are around 30 public green banks globally and they play many roles in helping to mobilise private investment in the transition to net zero emissions. Firstly, as with other forms of state investment banks, they provide capital, including countercyclical capital, during economic downturns. Green banks also play a financial and technological de-risking role by providing debt and equity financing to private companies which are unable to secure commercial funding. One senior green banker characterised their investments as being “high value and low volume”, which accelerate investment to reduce or enable emissions reductions (expert interview 6, 15 February 2022). For example, CEFC investments in energy efficient low-income community housing have helped to catalyse similar investments in energy efficient commercial housing by demonstrating their profitability and feasibility.

Green banks can play an important role in signalling to the commercial sector that projects are worthy of trust, and educating developers and financiers to better assess risks and develop innovative financial structures (Geddes et al., 2020). They undertake novel applications of financial products in market segments where they have not been applied (Schub, 2015). These loan structures are then replicated by commercial markets (expert interview 7, 17 February 2022). Green banks play a role in funding first-of-a-kind technology investments, where those technologies have been successfully deployed commercially overseas. Finally, green banks play an important role in creating public value through their investments, through delivering public goods and co-benefits beyond the financial indicators of their investments.

3.2.1.1 *Clean Energy Finance Corporation*

Australia’s national green bank, the CEFC, was founded in 2012 (*Clean Energy Finance Corporation Act*, 2012). Interview subjects noted the significant role the CEFC played in catalysing investment in clean energy technologies over the past decade, in large part due to the policy uncertainty which existed around climate change in Australia. The CEFC operates under the *Clean Energy Finance Corporation Act 2012*, which stipulates at least 50 per cent of CEFC investments must be in renewable energy technologies. The CEFC evaluates its investment performance based on four criteria: catalysing private sector capital, reducing emissions by investing in innovation technologies and infrastructure, financial sustainability, and qualitative indicators (CEFC, 2022b).

The CEFC is governed by an independent Board of Directors who set the strategic direction of the organisation and ensure its proper and efficient performance. The board consists of a Chair and between four and six members, which are appointed by Minister for Climate Change and Energy. Board members cannot be drawn from the Australian Public Service and must have significant professional expertise relevant to the CEFC's aims. The day-to-day operations of the CEFC are managed by the organisation's CEO who reports to the chair of the CEFC board.

3.2.1.2 New York Green Bank

The NYGB was established in 2013 as part of New York's Climate Leadership and Community Protection Act (New York State Climate Leadership and Community Protection Act, 2013). The Act mandated an 85% reduction in greenhouse gas emissions by 2050 and 100% clean electric grid by 2040. NYGB is the largest subnational green bank in the United States. It invests across a range of asset classes including clean energy generation, energy efficiency, clean transportation, clean storage, sustainable agriculture and sustainable water infrastructure (NYGB, 2022). It assesses investment performance based upon the potential for greenhouse gas reduction in support of New York State's clean energy policies, contribution to market transformation in terms of mobilisation of private capital, and the additionality of proposed investments and their economic and technical feasibility (NYGB, 2022).

3.2.1.3 Montgomery County Green Bank

MCGB was founded in 2015 as a non-profit organisation to assist Montgomery County achieve its target of reaching net zero emissions by 2035 (MCGB, 2022). It is the world's first county-level green bank, located in Maryland, just outside Washington DC. Economically, Montgomery County is a hub for biotechnology, finance and defence industry and, as one MCGB employee noted, "we're actually GDP-wise, larger than some states in the US" (expert interview 37, 9 December 2022). MCGB targets investments in renewable energy and energy efficiency and seeks to leverage private capital at a ratio of US\$3 to for every US\$1 of public investment (Office of Legislative Oversight, 2021).

3.2.1.4 New Zealand Green Investment Finance

NZGIF was founded in 2019 to assist the New Zealand government in achieving its target of net zero emissions by 2050 (NZGIF, 2019). It operates as an independent company under Schedule 4A of the New Zealand Public Finance Act 1989. NZGIF has six target investment sectors (NZGIF, 2022): transport, agriculture, process heat, distributed energy resources, waste, plastics, and energy efficiency. It evaluates investments based on four objectives:

investing to reduce emissions, investing on a commercial basis, showing market leadership and crowding in private capital.

3.2.2 Archival study

Archival research is an established method within organisational studies for examining where research gaps exist around new forms of organisations (Das et al., 2018). Key documents examined for each case study included annual reports, impact reports, legislation, evaluation and reporting documents, and consultant and non-government organisation (NGO) reports. Forty-three documents were identified. A full list of primary documents reviewed is online (Lyons and White, 2003).

3.2.3 Expert interviews

We conducted 29 interviews with current and former green bank staff, clients, co-financiers, public servants and ministerial staff between December 2021 and January 2023 (a list of participants is available at [Appendix A](#)). Ethics approval was obtained before the interviews commenced (ANU HREC Protocol 2021/279) and participants provided written consent to partake in the research. Interviews allow for in-depth exploration of participant views (Knott et al., 2022) and are commonly used to supplement archival study when undertaking organisational case studies (Das et al., 2018; Yin, 1993). In this instance we sought interviewee views on how hybridity manifested in the governance of green banks as well as the ways they created and captured value through their investments. While interviewee views are not definitive, they provide useful insights into differing perspectives between distinct categories of interview participants. The interviews were one hour and semi-structured with open-ended questions. Consent processes included asking whether participants were happy to be identified by name or if they preferred to be anonymised at the level of organisation or position. Participation was voluntary and no financial incentives were provided. Interviewees were selected using the lead author's network of colleagues (she has been a climate change policy practitioner in the Australian Government for over a decade), and snowball sampling of interview participants. Following the interviews, quoted participants were sent a draft copy of the chapter to ensure accuracy of quotes.

3.2.4 Synthesis of document and interview data

Document and interview themes were identified via a qualitative content analysis. Interviews were recorded and transcribed with the permission of participants to allow for this thematic coding. The primary and secondary data was coded using Excel then imported into NVIVO

How green banks can create multiple types of value in the transition to net zero emissions software and categorised according to seven thematic nodes (organisational goals, evaluation metrics, investment profile, governance, public value, co-benefits, public goods) relating to hybridity and public value. Within these categories key themes were identified using an iterative procedure. Primary themes included trade-offs between investment goals, optimising the risk/return nexus, investment barriers and evaluation approaches. This coding was used to develop and refine these themes, through secondary searches of archival documents and iterative testing with subsequent interview subjects. For example, the count outlined in Table 3-2 was undertaken by searching interview transcripts for instances where “value”, “public goods”, “benefit”, “knowledge” or “innovation” were mentioned. These instances were tallied according to actor type (green bank staff, public servants, project proponents/co-financiers) and categorised based on the type of value being described (knowledge spillovers, social equity benefits, enhanced energy security, or other value creation). We continued holding interviews until thematic saturation was reached (Yin, 1993).

Table 3-2 Interview count of perceived value creation in green banks

	Green bank staff n=17	Public servants n=7	Project proponents/co- financiers n=4
Knowledge spillovers	94%	29%	50%
Social equity benefits	47%	29%	0%
Enhanced energy security	12%	14%	0%
Other value creation	41%	29%	50%

3.3 Results and discussion

3.3.1 Hybrid governance of green banks

This section addresses our first research question: we examine how hybridity manifests in green banks, by drawing primarily on the views expressed by respondents in the interviews to provide insight into the organisational dimensions of hybridity for each case. The following subsections address the four features of hybrids identified by Vakkuri and Johanson (2021). While hybridity is core to all green banks, the way organisational dimensions of hybridity manifest are different for each case. Table 3-3 provides a summary of how these features manifest in each case; we provide more detailed analysis of these themes in each of following subsections.

3.3.1.1 *Mixed ownership*

Each case study exhibits distinct characteristics of mixed ownership, defined here as entities that combine the political goals of states with private sector business logics (Thynne, 2011). The CEFC and NZGIF are similar, in that while their responsible government ministers can set a broad investment direction, each organisation has an independent Board of Directors and control over its investment decisions and pipeline. The CEFC is publicly owned by the Commonwealth of Australia but operates independently as a Corporate Commonwealth Entity. As one employee noted “it’s a public institution, but it has a public/private type mentality” (expert interview 8, 18 February 2022).

Unlike most public service agencies, the majority of CEFC staff are drawn from the private sector, often working for commercial banks. Interviewees were open about the hybrid nature of organisation and the tension this could cause at times. For example, the investment profile of the CEFC has been criticised for being too conservative given virtually none of its investments have failed. As the CEFC Head of Risk and Compliance notes, “it’s the area where we, I think internally debate and push the hardest.” While the CEFC is set up “a lot like a commercial bank would be set up”, at its core, it is a public sector organisation, with stringent risk processes to ensure appropriate spending of public money. He continued:

The traditional tension there is that the investment team want to take more risk and the risk function says, “well, steady on”. That’s a result of the structure that we have, that’s the way it’s designed and that’s the way it works. So yes, there’s a healthy tension. (Expert interview no. 8, 18 February 2022)

How green banks can create multiple types of value in the transition to net zero emissions

The risk/return profile is a clear example of where competition between public and private sector institutional logics has manifested in the CEFC. Interestingly, this profile is changing as the CEFC becomes a more mature institution, with several interviewees noting that the risk appetite is increasing as the organisation's legitimacy increases through its investment success.

The Minister for Climate Change and Energy issues periodic investment mandates which outline government priorities for investment. Several specialised funds have been included in these mandates – for example, the A\$300 million Advancing Hydrogen Fund – as ministers try to use CEFC investments to shape the rate and direction of clean energy technology diffusion. NZGIF has a slightly different ownership arrangement, where the New Zealand Minister of Finance and Minister for Climate Change each hold 50% of its shareholding capital. The shareholding ministers send an annual letter of expectations to the Chair of the NZGIF board, which outlines their expectations on the roles, governance, diversity, and engagement of NZGIF, including it “operate within the parameters set for it by the government and be transparent and accountable for its decisions” (J. Shaw, personal communication, 2020).

Table 3-3 Overview of organisational hybridity in green banks

	Mixed ownership	Goal incongruence and competition	Multiplicity of funding sources	Public and private forms of financial and social control
CEFC	Ownership: Corporate Commonwealth Entity (public entity). Governance: Board of Directors made up of representatives from the private sector.	Goal incongruence: Rate of return in ministerial investment mandate incongruent with innovative investments. Competition: With other SOEs* rates of return.	Investment capital: Budget appropriations and investment returns. Variety of funding instruments and investors.	Ministerial Investment mandate (public control), compliance with CEFC Act (public control).
NYGB	Ownership: Division of NYSERDA[^] (public entity). Governance: Investment advisory committee made up of representatives from the private sector (private logic).	Competition: With other programs of NYSERDA (e.g. NY-Sun[^], NYCEEC[^]) financing community solar and energy efficiency.	Investment capital: Tax revenue, NYSERDA funding reallocation, private sector capital raising and investment returns. Variety of funding instruments and investors.	NYSERDA investment approval (public control), public reporting requirements (public control). Advisory committee members reviewed and confirmed by NYSERDA CEO (public control).

How green banks can create multiple types of value in the transition to net zero emissions

MCGB	Ownership: 501(c)(3) non-profit organisation. Governance: Board of Directors made up of representatives from both private and public sectors.	Goal incongruence and competition: Trade-offs between project size and market impact.	Investment capital: Annual budget appropriation, Fuel Tax revenue, grants. Variety of funding instruments and investors.	Montgomery County representation on MCGB board (public control).
NZGIF	Ownership: Public Finance Act 1989 Schedule 4A company (public entity). Governance: Board of Directors made up of representatives from both private and public sectors.	Goal incongruence and competition: Trade-offs between investment evaluation objectives.	Investment capital: Government appropriation. Variety of funding instruments and investors.	Ministerial letter of expectation (public control).

* The CEFC has the same rate of return as other state-owned enterprises (SOEs) with far wider investment remits like the Future Fund.

^The New New York State Energy Research and Development Authority (NYSERDA) works to promote energy efficiency, renewable energy, and emissions reduction across New York state. NY-Sun provides incentives and financing to make solar-generated electricity accessible and affordable for all New York homeowners, renters, and businesses. The New York City Energy Efficiency Cooperation (NYCEEC) delivers financing solutions and advance markets for energy efficiency and clean energy in communities.

In contrast, MCGB is a 501(c)(3) non-profit organisation, operating as a private foundation. Like the CEFC and NZGIF, MCGB has an independent Board of Directors which sets its strategic direction. Montgomery County officials hold two ex-officio board member positions, but they do not hold a majority of seats. The remaining nine board members hold a mix of environmental NGO, sustainable finance and green bank expertise, and overall MCGB considers itself, “an independent entity. We have a self-governing board. The board elects its own members. The board creates its own committees ...” (expert interview 37, 9 December 2022). Despite Montgomery County providing ongoing funding and being represented on the MCGB board, staff viewed organisational independence as a key factor for MCGB’s success and effectiveness. As its CEO noted, “we need that independence to draw in private capital. That’s been key for us” (expert interview 37, 9 December 2022).

NYGB has a different model of mixed ownership, operating as a division of the New York State Energy Research and Development Authority (NYSERDA). NYSERDA is a public benefit corporation which offers a range of funding, information and innovation support to help address climate change. Unlike the other case studies in this chapter, NYGB is not governed by an independent Board of Directors; instead it is guided by an independent advisory committee, primarily made up of private sector investment specialists. The CEO of NYSERDA is required to sign off on NYGB investment decisions.

Interviewees from each of the case studies noted maintaining independence from political interference despite mixed ownership structures was a critical component of green bank success. On senior manager at the CEFC noted that being able to pursue organisational goals “in a commercial manner with guidance that’s appropriate, but without interference from any groups or parties that have their own vested interests at heart is absolutely critical” (interview no. 5, 14 February 2022).

3.3.1.2 Goal incongruence and competing institutional logics

The second organisational feature to characterise hybrids is goal incongruence and competition, defined as “institutions that aim to balance the logic of profit seeking vis a vis the logic of societal effectiveness” (Johanson and Vakkuri, 2017, p. 3). This builds upon empirical examinations of the congruence between policy goals and means which demonstrated the evolving nature of policy congruence (Kern and Howlett, 2009; van Geet et al., 2019).

All four case studies demonstrated various forms of goal incongruence, particularly in managing trade-offs between investment priorities. As the CEO of MCGB explains, smaller, innovative deals “that are very impactful from a market perspective”, need to be balanced with

How green banks can create multiple types of value in the transition to net zero emissions larger infrastructure investments which “make up the vast majority of our metrics in terms of project volume or GHG [greenhouse gas] mitigation for that year” (expert interview 37, 9 December 2022). This focus on financial metrics, which is common to all the cases studied (not just MCGB), means catalysing market creation and making investments which create value is reliant on the skill of the banking staff managing these deals. These attempts to balance profit seeking versus the logic of societal effectiveness are captured in the CEO’s observation:

“small and large deals both make important impacts. At the end of every year, we have to reach our goals, but there is no value in reaching our goals faster if we don’t maximize our market impact (expert interview 37, 9 December 2022).”

As noted in Table 3-3, the CEFC, NYGB and NZGIF must meet mandated public financial reporting requirements. They each also estimate emissions reductions, as also noted in Table 3-3. These are both relatively quantifiable metrics compared to broader societal goods such as improved wellbeing.

Balancing different investment priorities is also the primary way goal incongruence and competition manifests for NZGIF, which has four self-defined objectives to guide investment decisions, namely: invest to reduce emissions, invest on a commercial basis, crowd-in private capital and show market leadership (NZGIF, 2022). As its CEO noted, these objectives “are unweighted, [and] can be more or less important depending on where the market is, and where it’s moving” (interview no. 20, 14 June 2022). In short, the success of NZGIF depends on how well it manages balancing these at times incongruent objectives across its investment portfolio.

The challenge for green banks is to reconcile the goal incongruence which exists between accelerating investments to reduce emissions and doing so in a way which is consistent with the principles of climate justice. As one green bank staff member noted “one of the most interesting areas for innovation is figuring out here at the front lines, how does the green bank support equity?” (expert interview 41, 6 January 2023). green banks in our cases provided several examples of partnering with community organisations to best realise value in these spaces. For example, in January 2022, MCGB announced a funding partnership with Virginia Community Capital and the New York City Energy Efficiency Corporation to fund a 2.2MW rooftop solar array, and energy efficiency upgrades to Seneca Village Apartments, a 684-unit, 58-building affordable multifamily property. In addition to being a catalytic investment with an innovative financial structure, this investment has tangible benefits for the building owners and tenants. In disadvantaged communities, energy accounts for a greater proportion of household

income than wealthy communities and bill reductions can lead to increases in financial and social wellbeing.

All four case studies demonstrated the capacity to balance the logic of profit seeking versus societal effectiveness through their investment portfolios. For example, the CEFC invested A\$170 million in low-income energy efficient housing with St George Community Housing to build 500 energy efficient homes, including 300 for the NSW Government's Social and Affordable Housing Fund. The Head of Portfolio Management at the CEFC noted "we always have a central focus on driving abatement and flow of capital ... but there's often the opportunity to deliver more and we don't want to neglect that opportunity" (expert interview 6, 15 February 2022). A study by the CEFC found these homes generated an average annual reduction of A\$500 in energy costs for tenants (CEFC, 2020). While the CEFC did seek to capture energy costs savings, these estimates do not capture improved thermal comfort and other intangible benefits of this investment.

3.3.1.3 Multiplicity of funding arrangements

All four green banks demonstrated hybrid funding arrangements in two ways; their capitalisation and the investment instruments they utilise. Each of the four green banks profiled was capitalised differently, depending on national circumstances and government ambition (see Tables 3-2 and 3-3). The CEFC was initially funded through a one-off A\$10 billion budget appropriation (paid over five years) in 2012. In 2023, the CEFC received an additional A\$20.5 billion to accelerate progress towards Australia's transition to net zero emissions by 2050. Capital and profits from its investments are recycled into new investments. Like the CEFC, NZGIF is funded through government appropriations, although they are structured differently. NZGIF has NZ\$400 million of investment capital, with an additional NZ\$30 million of operating capital. When NZGIF meets certain profitability criteria, its shareholding ministers can require up to 50% of NZGIF's annual profits to be repaid to government.

Compared with the CEFC and NZGIF, NYGB has a broader range of funding sources. It was capitalised with US\$1 billion in funding, mainly from a surcharge on energy bills for New York residents as well as income from the Regional Greenhouse Gas Initiative. In 2021, it undertook a private capital raise to refinance part of its loan portfolio and increase its liquidity, resulting in a US\$314 million transaction with Bank of America (NYGB, 2021).

As a non-profit 501(c)(3) corporation, MCGB also receives funding from a range of sources. It receives an annual budget appropriation from Montgomery County which equates to 10% of revenue from the Fuel Energy Tax. This equates to approximately US\$20 million per annum.

How green banks can create multiple types of value in the transition to net zero emissions
It has also received a range of grants from private philanthropic organisations including the General Motors Private Equity Fund and the Town Creek Foundation (MCGB, 2022).

As expected, all four banks use their capital to crowd-in private sector investment using a range of financial instruments. This multiplicity of funding arrangements spans concessional debt and equity financing, green bonds, warehousing, securitisations and guarantees. This sees green banks working with a broad range of private actors including commercial banks, institutional investors, fund managers and renewable energy project proponents. While concessional finance forms most investments across cases, there is variation in the emissions sectors being targeted depending on the national circumstances of the jurisdiction. For example, over half of NZGIF's capital committed to date is in the transport sector, which is responsible for almost three times the country's electricity sector emissions (NZGIF, 2022). In contrast, the CEFC has made over half of its investments in renewable energy helping to accelerate the decarbonisation of Australia's largest emissions sector, electricity (CEFC, 2022b).

3.3.1.4 Public and private forms of social and financial control

The fourth and final feature to define hybrid organisations is public and private forms of financial and social control. Johanson and Vakkuri (2017) have argued "in hybrid settings ... forms of control are usually mixed". This is borne out through an analysis of control systems in the four case studies profiled (see Table 3-3). For example, as public entities the CEFC, NYGB and NZGIF are all required to publicly report their performance against a range of financial metrics. The NYGB has a number of reporting and operational obligations under New York's Public Authorities Law, including public filings of quarterly metrics reports, annual business plans and yearly audited financial statements (Peters, 2018). The CEFC and NZGIF have statutory obligations to publish annual reports. All three of these green banks are required to adhere to external forms of financial control. As a smaller, non-profit organisation, MCGB has more flexibility than the other green banks in the timing and metrics it reports publicly.

Social control is "based on informal norms which govern interpersonal relationships" (Horwitz, 1990, p. 5). green banks demonstrate mixed forms of social control. Private sector norms underpin green bank organisational culture. A former CEO of the CEFC noted, "when we set up the CEFC, I wanted to operate with a commercial flavour", because "most people who have worked in banking have not experienced public service". He explained:

you don't build a public service instrument and expect it to be embraced by people who have never dealt with it before, you build a private sector instrument ... and make it operate in a way that's familiar to them (expert interview 33, 25 September 2022).

Green banks also exerted a degree of social control over the commercial banking sector through the signalling and educational roles they play (Geddes et al., 2018) socialising the commercial banking sector to the innovative technologies they invest in.

3.3.2 The roles of green banks in creating and capturing value

In this section we use our case studies and interview data to explore how green banks are perceived to create value through their investments (our second research question). The following subsections explore first the creation of value then mechanisms to capture value.

3.3.2.1 Creating value

Hybrid green banks mix public and private expertise to overcome investment barriers, accelerate investment and create value in the transition to net zero emissions. Our interviews identified a range of areas where green banks were perceived to create value (see Table 3-1). Knowledge spillovers were the most frequently identified category, which is unsurprising given that the technical expertise of green banks is key to unlocking private capital. For example, the CEFC invested heavily in developing the technical expertise of its staff, which was enhanced through their proximity to public servants. As former CEFC CEO noted; “You have an information arbitrage the other banks don’t have because you’re so close to policymakers” (interview no. 16, 2022). In the CEO’s view, the CEFC used this arbitrage to “make better investment decisions and encourage[d] others to follow” (expert interview 33, 25 September 2022). NYGB also benefited significantly from the technical expertise related to clean energy technologies within NYSERDA, with the Director of Strategy, Impact, and Investor Relations, noting the value of integration with NYSERDA:

in allow[ing] us to bring technical expertise to our financing capabilities in a way that I think other lenders just aren't designed to ... If there's a new technology we're looking at, that we don't have experience with, we have a whole team [at NYSERDA] that probably does” (expert interview 18, 9 June 2022).

These examples speak to how green banks can mix expertise in novel ways to create value through knowledge spillovers.

Social equity benefits were perceived as an area of value creation by almost half of the green bankers interviewed. Other forms of value created from green bank investments included enhanced food security, biodiversity, gender and water co-benefits. Compare NYGB’s funding of Agbotic, as discussed previously in section 2.3.1.3 These loans created very different forms of public value for different actors at different times in Agbotic’s existence (Dudau et al., 2019).

How green banks can create multiple types of value in the transition to net zero emissions

They demonstrate how individual investments can achieve incongruent policy goals at different times. NYGB's first investment was to see the business expand on commercial terms through cutting energy cost margins and reducing emissions, while the second was to provide countercyclical finance to serve the public good during a time of deep economic uncertainty, before reverting to the original policy goal following the pandemic.

Interestingly, across all categories green bank value creation was more likely to be identified by green bankers rather than the public servants, project proponents or co-financiers interviewed. The cases reported here illustrate the role green banks see for themselves in legitimising the transition to net zero emissions, particularly through their efforts to support vulnerable communities. That is, these cases all demonstrated that green banks prioritised value creation in a societal effectiveness sense rather than solely financially, although this value creation does not yet appear to be equally visible to their stakeholders. While green banks directly create financial value through their investments, they are also perceived to create value through the public goods (e.g. knowledge spillovers) and co-benefits (e.g. reductions in air pollution) of their investments (Moore, 1995). Though this value is less visible to public servants and proponents than to green bank staff themselves, it was nonetheless identified in interviews across all respondent categories (see Table 3-1).

In addition to creating value across multiple categories, green banks also have the capacity to create value across multiple levels, and understanding the capacity for green banks to create value at individual, organisational and societal levels allows for a more differentiated understanding of value (Cui and Aulton, 2023). Table 3-4 illustrates these three categories of value with the example of the CEFC's investment in St George Community Housing to build low-income, energy efficient housing which has created a range of perceived value at societal, organisational and individual levels. The CEFC primarily made these investments to demonstrate to private investors that energy efficient housing stock was profitable and could be constructed for a small premium compared to traditional housing. However, this investment also demonstrated significant public value creation, with the CEFC facilitating knowledge spillovers to co-financiers and project developers, while the housing tenants benefited from lower energy costs, increased disposable income and the health benefits which ensue from energy efficient homes.

3.3.2.2 *Capturing value*

When considering how green banks create value it is particularly important to consider if their investment evaluation captures this value and the different perceptions of value creation across stakeholders. The four green banks profiled had similar approaches to investment

evaluation, focused on capturing exchange value through financial metrics. Three metrics were used by all four institutions: (1) capital committed, (2) the ratio of private sector finance crowded in and (3) emissions reductions. Each institution used slightly different methods for calculating these metrics. While green bank staff were aware of other forms of value created through their investments none sought to fully capture this value through their investment evaluation. Interviewees noted to do so would be too costly and time consuming, and would distract from their core mission of accelerating investment, despite stating the provision of these public goods was “highly motivating” (interview no. 6, 15 February 2022). Value trade-offs are not considered, while value destruction is addressed to varying degrees through the environmental, social and corporate governance (ESG) policies of these banks (CEFC, 2022b; NYGB, 2022; NZGIF, 2022).

Table 3-4 Perceived value created through energy efficient, low-income housing investment

Dimension of value	Actor	Private value creation	Public value creation
Societal level	N/A	Accelerated investment to assist in meeting nationally determined contribution and Paris Agreement goals.	Climate change sustainability benefits of reduced emissions. Enhanced public housing stock which assists with social cohesion.
Organisational level	Green bank	Catalytic investment in low-income, energy efficient housing. Profit margin on concessional loan.	Institutional value of staff expertise in de-risking this market segment. Leadership and coordination role in brokering the investment.
	Co-financiers	De-risked investment with commercial return.	Knowledge spillovers about investment instrument used by green bank and/or technology.
	Project developer	Commercial return for their project which would otherwise not proceed.	Knowledge spillovers about investment instrument used by green bank and/or technology.
Individual level	Project users	Increased disposable income due to lower energy costs.	Enhanced wellbeing due to increased thermal comfort and reduced air pollution in home.

		Lower health costs associated with energy efficient homes.	
	green bank staff	Increased private sector employability.	Enhanced wellbeing through meaningful work.
	Co-financiers staff, project developer staff	Increased private sector employability.	Enhanced wellbeing through meaningful work.

Source: Authors summary

However, in not seeking to capture these societal benefits, the full value of green bank investments is not being recorded by current reporting (see Tables 3-1 and 3-4), and risks prioritising exchange value over sustainability value (Gale, 2019). A range of benefits are being undervalued at an organisational level, including improved community wellbeing in the form of comfort and food security. These are basic areas of human function that are innately valuable but difficult to quantify (Nussbaum and Sen, 1993). The Paris Agreement also prioritises sustainability broadly, including equity benefits, which are often not well captured in reporting (Robiou du Pont et al., 2017). This reflects a broader problem across the public sector where public evaluation focuses on financial metrics rather than other forms of value creation, and in doing so devalues the contribution of these institutions. It demonstrates the need for new, more dynamic means of capturing the value of investments (Mazzucato, 2019) and their significance in relation to the financial evaluation of individual and portfolio investments.

3.3.3 Crosscutting discussion

We set out to investigate how hybridity manifests in green banks, and how green banks create and capture value. Considering green banks through the four-dimensional framework developed by Johanson and Vakkuri (2017), hybridity of green banks was visible in ownership structures, multiple goals, financial arrangements and sources of control. These organisations are public–private hybrids that, while varied in structure according to jurisdictional needs and history, share a commonality in seeking to create different forms of value, including sustainability value (Gale, 2019). They are also beholden to stakeholders across sectors, and facing control from private and public realms.

Green banks seek to create broader societal value beyond their financial investments, and this was apparent in green bank staff's perceptions of value created by their organisations and their dedication to managing the goal incongruence between private and public value creation. Interviews highlighted the tension faced by green banks in having multiple goals and a diversity of reporting metrics, varying from those mandated by the public sector to those which were self-imposed to improve equity of outcomes. The drive of green banks to seek broader societal improvements is linked to their hybrid nature – the goal incongruence and inconsistency that is a feature of hybridity, and a challenge for reporting, also broadens their mandate for value creation. Our interviews reflected how staff at these banks seek to shape value creation (Mazzucato and Ryan-Collins, 2022). Public reporting metrics for financial and emissions goals are highly visible and quantitative for most of these banks, but the challenges in capturing

broader public goods may be hampering visibility of the overall value creation of these institutions.

Our work extends Vakkuri and Johanson's (2021) conception of hybrid value creation, considering how value is created not only at the organisational level but also at individual and societal levels (Cui and Aulton, 2023). CEFC investments in energy efficient housing illustrated perceived public and private value creation across these levels (see Table 3-4) and the inherent challenge in capturing these qualitative forms of value (Ferguson, 2015; Traxler and Greiling, 2018). While our research did not explore value destruction, this is an issue of increasing concern in the net zero transition. Value creation and destruction can occur simultaneously; for example, through clean technology manufacturing which is reliant on fossil fuels (Cui and Aulton, 2023). Managing trade-offs between value creation and value destruction will become increasingly complex through the net zero transition. For example, public managers and ministers responsible for approving large-scale renewable energy projects must consider broader ecosystem impacts and First Nations land rights as part of their approval processes. The urgency of meeting the Paris temperature goals must not supersede other sustainability and justice considerations in the net zero transition, and the Paris Agreement likewise emphasises the need to consider sustainability more broadly. Case studies exploring these trade-offs between public value creation and destruction and developing decision-making frameworks to make these trade-offs are important areas for future research.

The case studies demonstrated that green banks have common areas of goal incongruence and competition within their organisations which can result in value compromises. This was illustrated in the trade-offs between the four organisational goals at NZGIF, but also through the competition to fund high-impact, low-leverage transactions versus low-impact, high-leverage transactions at MCOB. In each of these instances, the competition between the competing policy goals (that is, technological or financial innovation versus higher returns on investment) needed to be balanced across the investment portfolio for the green bank to maximise their value creation. This requires a high degree of organisational flexibility and expertise. As the investment transition accelerates, several interview participants noted it will be an increasing challenge for future green banks to retain staff with the necessary capabilities to ensure organisational success.

Our research also demonstrated that in addition to goal incongruence and competition, hybridity provided the green bank cases with a degree of competitive advantage over their private sector counterparts. The access of NYGB to technical experts at NYERDA and the

close relationships between the CEFC, NZGIF and their respective bureaucracies meant they were able to understand the impacts of public policies and programs on financial markets in far more detail than their commercial counterparts and to use this knowledge to the advantage of their investment portfolios. Thus, green banks create value through mixing public and private technology expertise.

All four cases demonstrated evaluation procedures to capture financial value of investments but faced challenges in capturing public value benefits from investments as this fell outside standardised reporting metrics. The expert interviews also illustrated the provision of a range of other public goods by green banks, including social equity improvements for low-income housing tenants (MCGB/CEFC/NYGB) and enhanced food security for vulnerable communities during the COVID-19 pandemic (NYGB). While green banks are creating value beyond the financial benefits of their investments this value is not fully captured through present investment screening and evaluation processes. This leads to another key finding, that the new forms of investment governance and evaluation needed in the transition to net zero provide a unique opportunity to better capture the value of public investments.

The hybrid nature of green banks and the multiple levels across which they can create value (see Table 3-4) may also drive the differences in perception of broader value creation between different actors. The differences in perception of value creation by different cohorts of interviewees suggests an avenue for further research, to determine whether this misalignment in perception is caused by differences in visibility of value creation, or in differences of assessing or considering value creation. Further comparative analysis with other forms of hybrid financial institutions making low-carbon investments is also needed to assess how green banks compare in terms of their value creation.

3.4 Conclusion

Public green banks are a form of hybrid organisation emerging in response to the climate crisis. Our interview-based study of the CEFC, NYGB, MCGB and NZGIF shows hybridity manifests differently in green banks but all exhibit mixed ownership, goal incongruence, multiplicity of funding arrangements and hybrid forms of control. Staff expertise was shown to play an important role in managing goal incongruence to ensure green banks were not only financially sustainable but could deliver other forms of value, including knowledge spillovers, social equity benefits and enhanced energy security. These broader forms of value are identified by green bank staff, public servants and often project proponents and co-financiers. However, current mechanisms to formally capture value provided by green banks are predominantly financial,

and broader forms of value are not being fully captured by organisational evaluation reporting for some of the case studies at present. It remains to be seen if green banks can continue to successfully transcend the anthropocentrism of unsustainable development and contribute to a new paradigm of hybrid public management.

Chapter 4 The Clean Energy Finance Corporation and large-scale solar deployment in Australia

Scaling up deployment of solar technologies will be critical to a successful net zero transition. A variety of government incentives have been offered to try and accelerate the deployment of large-scale solar. This chapter explores the role of Australia's public green bank, the CEFC, in mobilising additional private investment in the large-scale solar sector through its provision of concessional finance and knowledge sharing. I develop a novel database of Australian large-scale solar projects, from 2015 to 2023 to assess to whether the CEFC mobilised additional private investment in this sector. I adopted a mixed methods case study approach, combining quantitative data analysis with sixteen one-hour expert interviews with CEFC staff, project developers, co-financiers and public servants. I find the CEFC did accelerate the deployment of large-scale solar through provision of concessional capital, and was critical in de-risking technological, financial and site-specific barriers to investment. They also played a vital knowledge-sharing role in increasing transparency and reducing investor risk through their funding for large-scale solar projects. However, the successful development of Australia's large-scale solar sector was also influenced by a range of other factors, particularly the renewable energy target and subnational actors.

4.1 Introduction

Governments around the world are seeking to accelerate uptake of solar technologies to decarbonise electricity systems to meet net zero goals. Solar technologies have higher capital costs than fossil fuel technologies like gas but require no fuel inputs. Whether solar is cost competitive depends on the cost of the solar technology, the expected savings from the technology it is replacing and the presence of subsidies for renewable energy (Sarzynski et al., 2012). There are two main forms of solar technology: solar photovoltaic (PV) and solar thermal. This chapter focuses on the deployment of large-scale solar PV.

There is a long history of government incentives for solar PV, which have evolved over time as different forms of the technology have matured and scaled in different markets. Germany was an early adopter of solar incentives; its national feed-in tariffs (FITs) began in the 1990s, but these did not significantly contribute to technology innovation and were expensive for the German government to administer (Böhringer et al., 2017). FITs have also been an important policy tool for China to drive an increase in utility solar investment (Zhang et al., 2022). In the United States, solar incentives were largely driven at the subnational level between 1997 and 2009, with some states offering cash incentives like rebates and grants, and others developing

renewable energy portfolio standards (Shittu & Weigelt, 2022; Sun & Sankar, 2022). Competitive auctions for utility-scale solar are also playing an increasingly important role in developed markets (White et al., 2021) and developing markets (Do et al., 2021; Dobrotkova et al., 2018; Frate & Brannstrom, 2017). Each of these incentives is a form of policy instrument; they are generally implemented through government departments or regulators.

However, in recent years, a range of public institutions dedicated to accelerating the deployment of clean energy technologies, including solar, have emerged. Some institutions focus on the first half of the technology chain (that is, public research, demonstration and deployment); for example, the Advanced Research Projects Agency–Energy (ARPA-E) in the United States or the Australian Renewable Energy Agency (ARENA) in Australia. Public green banks, the focus of this chapter, primarily focus on moving technologies through the final three phases of the technology innovation chain (that is, the commercialisation, market accumulation and diffusion phases). Green banks are state-owned infrastructure funds which mobilise additional private sector investment by investing in first-of-a-kind country technology deployments or developing innovative financial transaction structures that are too labour-intensive for the private sector to develop. They provide a range of concessional financing and technical expertise to attract private capital for clean energy technology investments. As discussed in Chapter 3, they are hybrid institutions which operate with a high degree of independence from government. Australia has the world’s largest and longest-running green bank, the CEFC, which, along with the Australia’s clean energy research and development agency ARENA, played an important role in scaling up Australia’s large-scale solar industry.

This chapter seeks to build upon the work of Geddes et al. (2018) and Schub (2015) by investigating the extent to which green banks are overcoming investment barriers to mobilise additional private sector investment in the net zero transition. I investigate: *To what extent did the CEFC investments in large-scale solar projects mobilise additional private sector investment in the sector in Australia?* In doing so, I am seeking to understand how the incentives given to develop the large-scale solar sector in Australia evolve over time. I hypothesize firstly, that as the large-scale solar industry scales, the types of projects the CEFC finances will increase in size and decrease in cost as was the case in the CEFC and ARENA’s evaluation of the large-scale solar sector (CEFC and ARENA, 2020). Secondly, the diversity of project developers, co-financiers and offtakers will also increase over time. Lastly, I hypothesize that the CEFC’s knowledge provision will be a core factor in leading the development of the market as Geddes et al. (2018) found. If these hypotheses prove correct it will illustrate how the CEFC is actively shaping and co-creating the solar market in Australia

through its leadership, knowledge sharing and finance provision (Mazzucato and Penna, 2016, Geddes et al., 2018). Each of these hypotheses will be explored throughout the chapter.

In investigating the impact of the CEFC on private sector investments in Australian solar, I seek to make three original contributions. Firstly, I make an empirical contribution through the development of a novel dataset which tracks the financing of 185 large-scale solar projects in Australia, which sheds light on previously unexplored financing dynamics in the Australian utility solar sector. Secondly, I contribute to literature exploring the role of public finance in shaping the rate and direction of clean energy technology adoption (Mazzucato, 2011; Mazzucato & Penna, 2016) by examining the role of the CEFC and other public finance in the development of the sector and building on existing literature in this area. Thirdly, I contribute to understanding the public sector's role in shaping private sector investment through information provision. This has implications for the development of large-scale solar in other jurisdictions, but potentially for new clean energy industries such as offshore wind, green hydrogen and geothermal.

The rest of the chapter is structured as follows. The methods section outlines the methodological approach adopted through the database development, expert interviews and data analysis. The results and discussion sections provide a comparative analysis of the key data and themes to emerge from the data analysis and interviews.

4.2 Context

This paper takes a mixed methods approach, using installation data to describe changes in large-scale (greater than 4.95MW) solar capacity. This is coupled with interviews to understand the factors shaping solar investment decisions. The scope of the study considers Australian large-scale solar projects operating or under construction from 2015 to 2023. This period was chosen to coincide with the inception of the sector in Australia. The 4.95MW threshold was chosen to capture installations just below the 5MW generator registration threshold of the Australian Energy Market Operator. The database excludes large-scale solar projects in planning or approval phases.

4.3.1 Case study: Australia's large-scale solar sector

There are over 3.84 million PV installations in Australia, with a combined capacity of over 36.6GW (APVI, 2024). Just under 12GW of this capacity is comprised of large-scale solar installations. Over the past decade, Australia has developed a large-scale solar sector, due in large part to a range of public policy and financial supports at national, state and local levels.

This section provides an overview of Australia's electricity markets, Commonwealth, state, territory and local support for large-scale solar and the role of the CEFC.

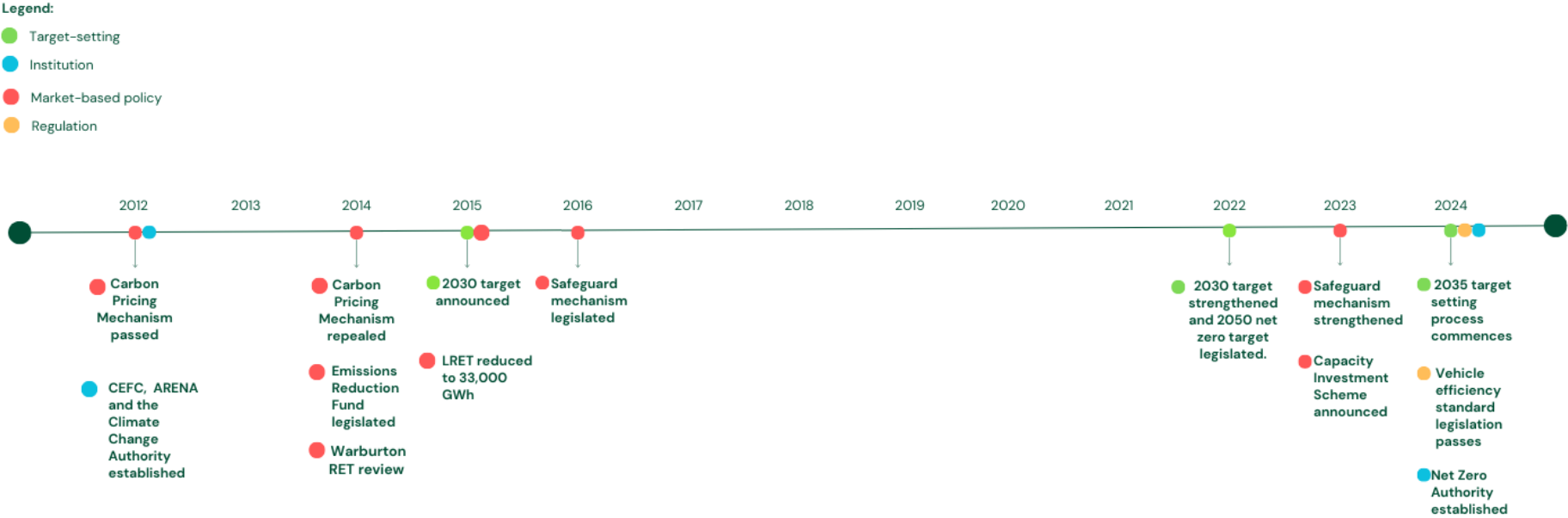
4.2.1.1 Australia's electricity markets

Australia's electricity market consists of three separate large-scale systems; the National Electricity Market (NEM), the Western Australian Wholesale Electricity Market, made up of the South-West Interconnected System and the North-West Interconnected System, and the Darwin to Katherine Network (Commonwealth of Australia, 2022). Of these three systems, the NEM is the largest market, supplying around 80% of Australia's electricity, along the east coast, to South Australia and Tasmania. The NEM is governed by four bodies. The Australian Energy Market Commission (AEMC) makes the NEM rules and provides strategic and operational advice to the minister. The Australian Energy Regulator enforces the AEMC rules and regulates the eastern electricity and gas markets. The Australian Energy Market Operator (AEMO) manages the operation of the wholesale and retail electricity markets, including the NEM and a range of gas markets. The Energy Security Board provides advice to Commonwealth, state and territory energy ministers on energy security, reliability and long-term planning.

4.2.1.2 Commonwealth climate change policy settings

Over the past decade, Australia has experienced a high degree of policy uncertainty and political contention over its national climate change policies (Jotzo et al., 2012; Wilkinson, 2020) despite strong voter support for Australia reducing its greenhouse gas emissions (Colvin & Jotzo, 2021). The centre-right Liberal/National party coalition takes a more direct approach to climate change policy preferring to pay polluting entities to reduce or offset emissions. The centre-left Australia Labor Party has taken a more classical market-based approach to reducing emissions. Australia has used a broad suite of climate change policy measures to develop clean energy technology markets, including large-scale solar. These include national emissions targets, emissions pricing mechanisms, technology pull policies, regulations, research and development funding, and knowledge-sharing programs (see Figure 4-1).

Figure 4-1 Overview of Commonwealth climate change policy measures 2012-2024



Source: Author’s summary

Australia had a conditional 2020 emissions reduction target of at least –5% (and up to –25% dependent on global action) based on 2000 emissions levels. In 2015, Australia set a 2030 target of a reduction of 26–28% by 2030 based on 2005 levels. In 2022, after a change of government, the 2030 target was strengthened to a –43% reduction by 2030 based on 2005 levels and a net zero target by 2050 was legislated. These targets provide investors with a degree of certainty about Australia’s future emission trajectory. However, implementing policies at the national level to achieve these targets has been fraught. It took several attempts before Australia was able to legislate a carbon price in 2012 (Jotzo, 2012). The carbon price was designed with broad coverage, a fixed price for the first three years of the scheme and recycled permit revenue while decreasing income tax. In 2013, after a year of operation it was repealed, following a change of government, and replaced with an offset scheme, the Emissions Reduction Fund. The repeal of the carbon price initially had significant impacts on Australian renewable energy investment, including large-scale solar projects, as investors placed a high premium on the uncertainty stemming from a lack of bipartisanship on national climate change policy. This was followed by a renewable investment supercycle from 2016 to 2021, where substantial investment took place in solar and wind projects (Simshauser & Gilmore, 2022).

As part of the carbon pricing package, the Australian government also legislated the creation of two institutions dedicated to accelerating the deployment of clean energy technology, ARENA and the CEFC (described in more detail in section 4.2.1.4 below). While these institutions have continued to operate, the Coalition government made multiple efforts to abolish them, illustrating Australia’s unstable climate institutions over the past decade (Dubash, 2021).

ARENA operates across the research, development and deployment phases of the technology innovation chain, funding projects across basic research, development, demonstration and deployment dimensions. ARENA was designed to support improvements in the competitiveness and supply of renewable energy and the uptake of energy efficiency and electrification by providing financial assistance and sharing knowledge (ARENA, 2024). ARENA provides grant funding and needs regular budget replenishment; it was endowed with an initial appropriation of A\$2 billion and received an additional A\$1.62 billion in 2020 and A\$7.1 billion in 2024. As of 2023, ARENA has supported 663 projects with A\$2.25 billion in funding, with a total project value of A\$9.75 billion.

Australia has had a renewable energy target (RET) since 2000. The RET aims to increase renewable energy generation in the electricity sector by incentivising its generation and

delivering an extra 33,000GWh of electricity from renewable sources every year from 2020 to 2030. The RET is split into two components: the large-scale renewable energy target (LRET) and the small-scale renewable energy scheme. The LRET seeks to encourage investment in large-scale renewable energy like solar and wind by providing a financial incentive for electricity generated from renewable sources and a market for trading renewable energy certificates. The Australian government requires electricity retailers to provide a certain proportion of their electricity from renewable sources. Under the LRET, liable entities surrender large-scale generation certificates (LGCs) to this target. Retailers which fail to submit more than 10% of their LGCs per annum are liable to pay a shortfall charge of A\$65 per certificate (Clean Energy Regulator, 2024). Retailers can carry over up to 10% of their LGC certificate obligations year on year.

4.2.1.3 State, territory and local government support for large-scale solar

State and territory government policies also played important roles in encouraging investment in large-scale solar in Australia over the past decade. The following examples provide a selection of subnational measures which contributed to the development of the large-scale solar sector in Australia. The Australian Capital Territory (ACT) launched a series of reverse auctions for clean energy from 2012 onwards, which later expanded to include storage technologies. In 2012 and 2013, the ACT Government conducted an FIT reverse auction for 40MW of large-scale solar generating capacity. The auction was highly competitive and demonstrated low delivery risks for large-scale solar (Buckman et al., 2014). Subsequent reverse auctions focused on the provision of wind and storage to remain congruent with energy transition goals (White et al., 2021). In 2017, the Victorian government established an RET, underpinned by reverse auctions. To date it has delivered 60MW of large-scale solar generation, with another 712MW under construction (Rizzetti, 2018). The Western Australian Government's Clean Energy Future Fund has provided support to utility solar projects.

Local governments have also played an important role in supporting the uptake of large-scale solar in Australia. For example, the Newcastle City Council partnered with the CEFC to help fund the Summerhill Solar Farm. The CEFC loaned A\$6.5 million to help build the A\$8 million, 5MW solar farm, built on a disused landfill and former coal mine site. The project was commissioned in 2019 and allowed Newcastle City Council to meet its 100% RET for operations. Following the 2019 bushfires, the project generated more than A\$420,000 in revenue between mid-November and the end of April 2020, almost double the original business-case forecasts of A\$250,000 a year (Vorrath, 2020). Local councils in Esperance,

the Sunshine Coast and southern Sydney have also made investments in utility solar which have supported the development of the sector.

4.2.1.4 CEFC support for large-scale solar

Australia's national green bank, the CEFC, was founded in 2012 as a complementary measure to Australia's carbon pricing mechanism. It overcomes market failures in the commercialisation phase of technology deployment, where technologies are commercially profitable but cannot secure private sector financing without public support. The CEFC was originally legislated to "invest, directly and indirectly, in clean energy technologies" (Clean Energy Finance Corporation Act, 2012). These technologies could take one of three forms: energy efficiency technologies, low-emission technologies or renewable energy technologies. At least 50% of CEFC investments were required to be in renewable energy technologies. In 2023, the CEFC's legislation broadened its investment mandate to allow it to invest to meet Australia's 2050 net zero emissions reduction target. The CEFC primarily uses concessional debt and equity finance in making its investments, but also makes use of other financial instruments such as green bonds. The CEFC was originally funded with a one-off A\$10 billion government appropriation; this was increased by A\$20.5 billion in 2023, with A\$19 billion allocated to building transmission infrastructure through the Rewiring the Nation Fund, A\$1 billion to allocated to the Household Energy Upgrades Fund and A\$500 million allocation to deliver the Powering Australia Technology Fund.

In order to understand whether the CEFC was mobilising additional private finance for large-scale solar, it is important to understand how financing in the electricity sector has traditionally operated. Most electricity generation is contracted using long-term Power Purchase Agreements (PPAs). PPAs are long-term agreements between a project company and an offtaker, where the project company makes a certain amount of electric power available daily; the offtaker, in turn, is obligated both to make a minimum purchase and to pay a fee, part of which is fixed and part variable (Gatti, 2013). They are particularly important for financing renewable energy technologies due to their higher upfront costs for capital construction compared to fossil fuel plants.

In 2015, ARENA ran a A\$100-million grant funding round, aiming to reduce the costs of delivering large-scale solar projects, confident if projects were built, retailers would offtake electricity generated due to their obligations under the RET. The CEFC partnered with ARENA offering a concessional debt product to successful proponents. ARENA provided A\$92 million in grant funding to 12 projects, while the CEFC offered A\$320 million in debt finance to eight

projects. This attracted major solar developers to Australia as well as global engineering, procurement and construction (EPC) firms. The number of projects was very important in helping the industry scale; the CEFC funded an additional 10 large-scale solar projects the following year. Through CEFC provision of concessional finance in concert with ARENA's grant finance, the cost of Australian large-scale solar fell from A\$135 per MWh in 2015 to between A\$28 and A\$68 per MWh in 2019.

4.3 Methods

4.3.1 Development of a large-scale solar database

I began by developing a comprehensive quantitative database of all Australian large-scale solar projects commissioned between 2015 and 2023, including 35 funded by the CEFC. The database was coded using data (with permission) from Australia's Clean Energy Council, comprising project name, state, latitude, longitude and estimated cost. This was supplemented to capture a range of additional descriptive variables including owner, project size (MW), commissioning (month/year), whether it included public investment (CEFC, ARENA, other), investment from foreign governments (agency), project developer (name), and offtakers (any listed PPAs, the percentage of generation offtaken and contract length), fully merchant projects and project novelty. This information was drawn from publicly available data including government websites, press releases, project development applications and project websites. The database provides insights about the evolution of the large-scale solar finance in Australia over time and the role of the CEFC in funding projects.

4.3.2 Expert interviews

Of the 65 expert interviews conducted for this dissertation, 27 were with current and former CEFC staff, project developers, co-financiers, public servants and ministerial staff between December 2021 and September 2023 (see Appendix A). Expert interviews allow for in-depth exploration of participant views (Knott et al., 2022), and provide vital insights into key factors underpinning the acceleration of large-scale solar over the period studied. In this instance I sought interviewee views on the role of the CEFC in reaching financial close on large-scale solar projects, their influence in mobilising additional private sector investment and reducing costs, and their evolving risk tolerance in the Australian large-scale solar sector. The interviews were one hour long and semi-structured with open-ended questions. Ethics approval was obtained before the interviews commenced (ANU HREC Protocol 2021/279). Consent processes included asking whether participants were happy to be identified by name or if they preferred to be anonymised at the level of organisation or position. Participation was voluntary

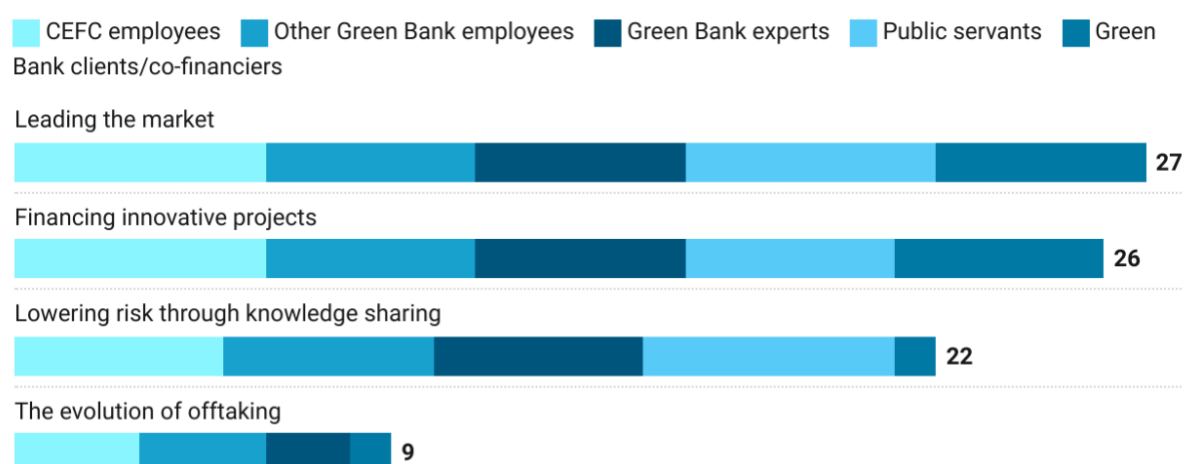
and no financial incentives were provided. Interviewees were selected using my network of colleagues (I have been a climate change policy practitioner in the Australian Government for over a decade), and snowball sampling of interview participants. Following the interviews, quoted participants were sent a draft copy of the chapter to confirm quotes were accurate or to provide further contexts and insights if needed.

4.3.3 Synthesis of database and interview data

Key trends were extracted from the database, including the evolution of project developers, owners and offtakers, the proportion of solar farms which received CEFC funding or other public support, and the increasing capacity of the solar farms over time. These trends formed the basis of discussions with expert interviewees to try and better understand the degree of causality in the CEFC scaling up Australia's large-scale solar sector.

Interview themes were identified via a qualitative content analysis. Interviews were recorded and transcribed with the permission of participants to allow for this thematic coding. The primary and secondary data was initially coded using Excel before being imported into NVIVO software and categorised according to four thematic nodes relating to investment; innovation, additionality, investment barriers and knowledge spillovers and by actor type. Within these categories key themes were identified using an iterative procedure. Four key themes emerged; leading the market, the evolution of offtaking, lowering risk through knowledge sharing and financing innovative projects. The interview counts for these themes are outlined in Table 4-2. I continued holding interviews until thematic saturation was reached (Small, 2009; Yin, 1993).

Table 4-2 Interview count of key themes by category of interview respondent

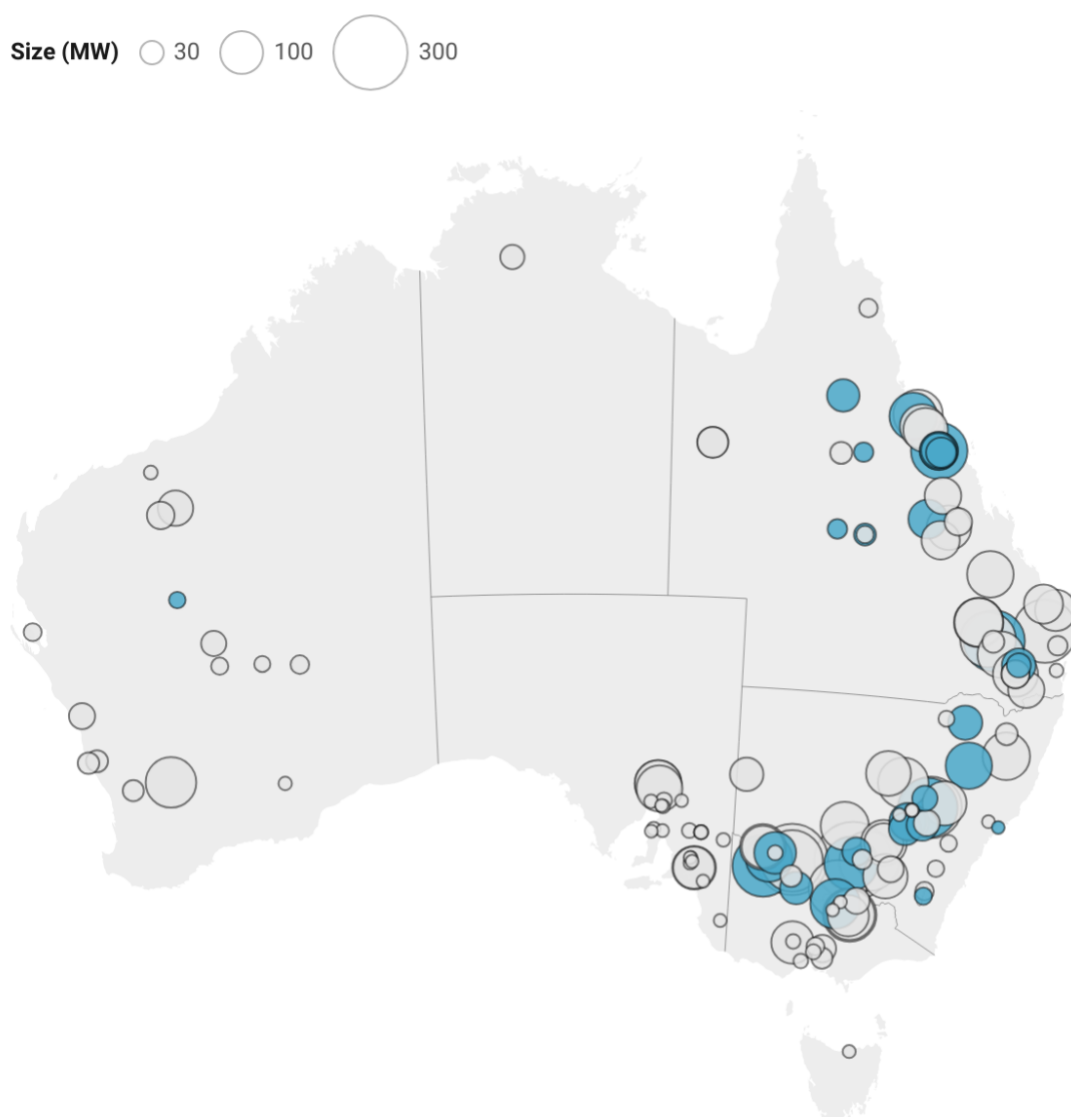


4.4 Results

This section uses the data from the quantitative database and expert interviews to answer the research question and hypotheses previously outlined. It begins with a short section providing an overview of the large-scale solar market, and follows by testing each of the research hypotheses, namely: did the types of projects the CEFC finance increase in size; did the diversity of project developers and co-financiers increase over time as the market scaled; and was the CEFC's knowledge provision a core factor in leading the development of the market.

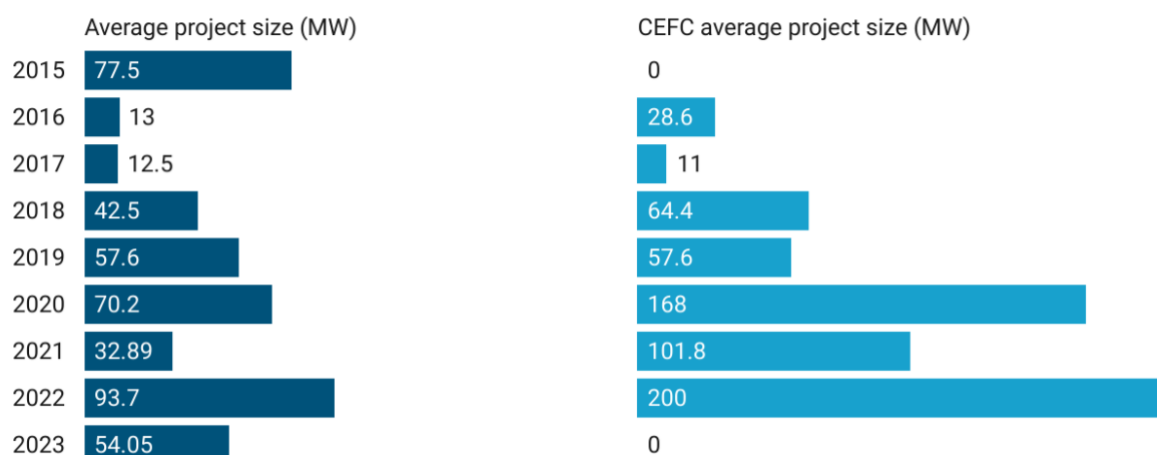
4.4.1 Development of the Australian large-scale solar sector

Overall, during the period reviewed, there are 185 utility-scale solar projects (>4.95MW) either operating or under construction in Australia (see Figure 4-1). The largest operating solar farm is the 333MW DC Darlington Point Solar farm in New South Wales, which was built by Australian developer Edify Energy. It received no government funding in its development. Its generation is partially offtaken; it has a twelve-year 150MW PPA with Delta Electricity, owner of the Vales Point coal-fired power station. The largest solar project under construction is Lightsource BP's 425MW Wellington North Solar project, also in New South Wales. The project has secured a ten-year PPA with chemical company Orica.

Figure 4-2 Australian large-scale solar projects >5MW (CEFC projects highlighted in blue)

4.4.2 Leading the market

This section seeks to answer our first research hypothesis: *Did the types of large-scale solar projects the CEFC finances increase in size, and decline in cost over time?* The quantitative data clearly illustrates that the size of CEFC projects increased over time, but more importantly, that they led the market. The average size of solar farms being commissioned has increased from 30MW in 2016 to a high of 89MW in 2022. The CEFC has consistently commissioned larger projects than the market average, ranging from an average of 38MW in 2016 to an average of 200MW in 2022 (see Chart 4-1). The CEFC did not commission any utility solar projects in 2017 or 2023. It is important to note that the CEFC only commissioned one project in 2020 and 2022 so the larger disparity between averages in this year is not necessarily representative of broader trends over time.

Chart 4-1 Average MW of large-scale solar projects, overall sector vs CEFC projects by year commissioned

Geographic analysis of NEM-connected CEFC large-scale solar projects versus other projects connected to the NEM illustrates that, on average, CEFC projects were, approximately 2 km further away to transmission lines than non-CEFC projects. While off-grid projects were excluded from the analysis, the CEFC has also funded several fringe-of-grid projects including Longreach Solar Farm, Kidston Solar Park and Barcaldine Solar Farm. Fringe-of-grid generation is characterised by reliability issues, as well as greater electrical losses, reaching 35% or above in some areas. Cost of supply is significantly higher, requiring government support or subsidisation to improve the viability of delivering this essential service (ARENA, 2018). ARENA funded a range of projects, supported by the CEFC in fringe-of-grid areas through its Regional Australia's Renewables (RAR) portfolio to help increase uptake of renewable energy projects in these areas (ARENA, 2018). This illustrates that proximity to transmission lines is not necessarily a good proxy for gauging whether the CEFC is leading the market.

Looking at the forms of government support for large-scale solar more broadly, the CEFC largely operated in the early phases of commercialisation, withdrawing its support as the sector began to scale in line with its organisational mission. One hundred and forty-six projects were commissioned between 2015 and December 2023 (see Chart 4-2). Thirty-five large-scale solar projects have received funding from the CEFC; these are summarised in [Appendix C](#). ARENA has funded a total of 23 large-scale solar projects, 15 co-funded by the CEFC. Fourteen projects received state government funding. The significance of the ARENA/CEFC large-scale solar funding round is evident in Chart 4-2, which shows their crucial role in providing support to the sector as it scaled, and their decline in project support over time as the market matured. Where projects were funded by multiple public donors, the organisation which provided the largest amount of finance is highlighted.

Chart 4-2 Average size of utility solar projects commissioned in Australia by year

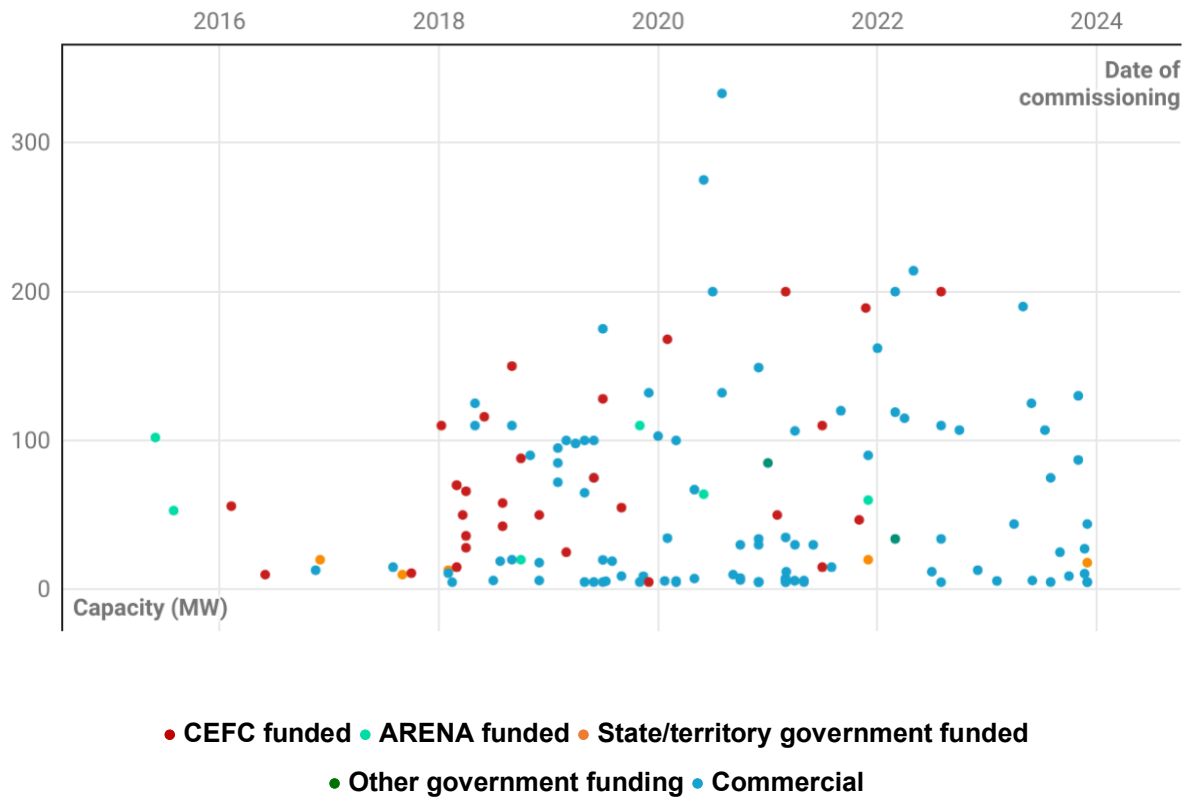
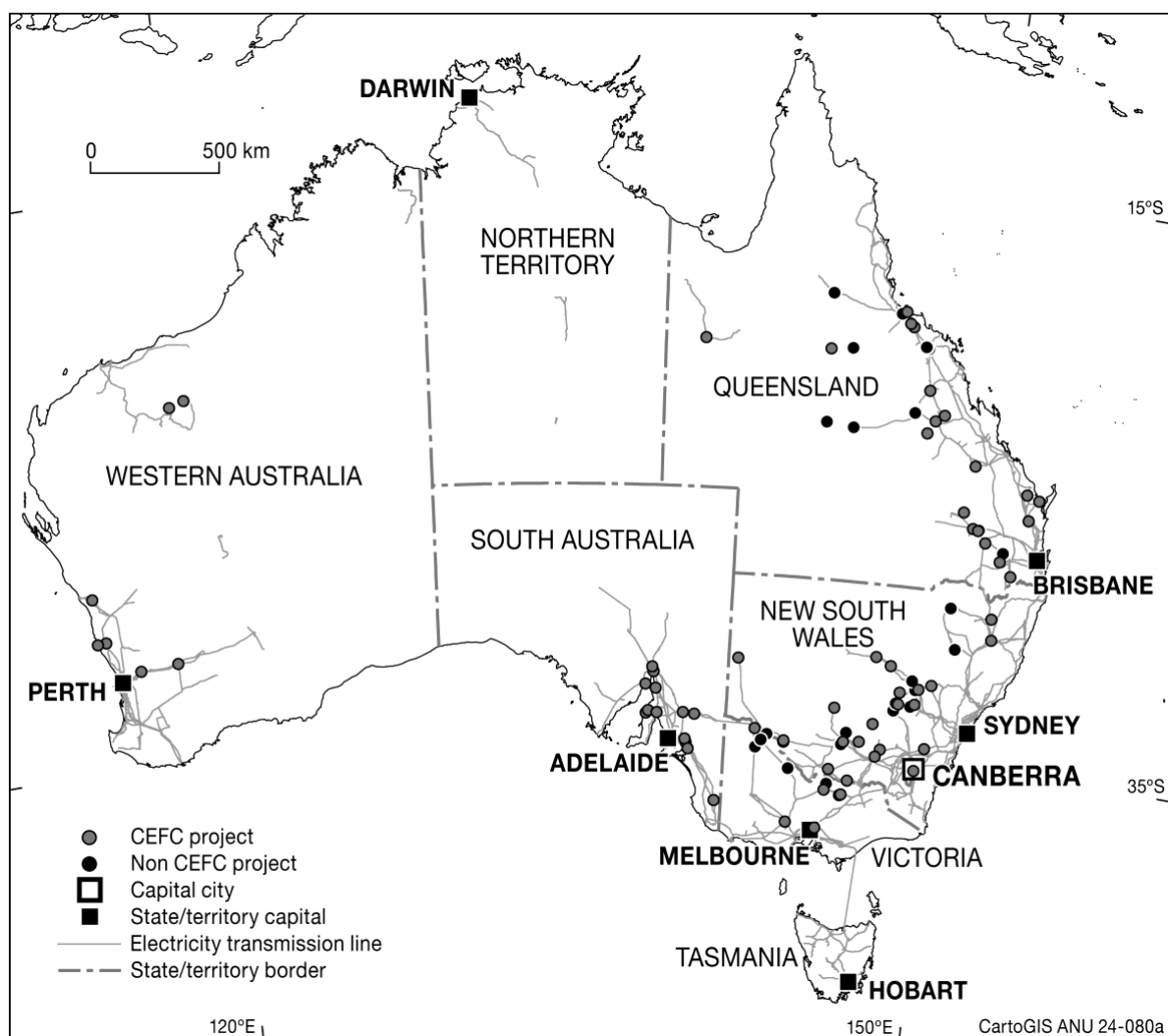
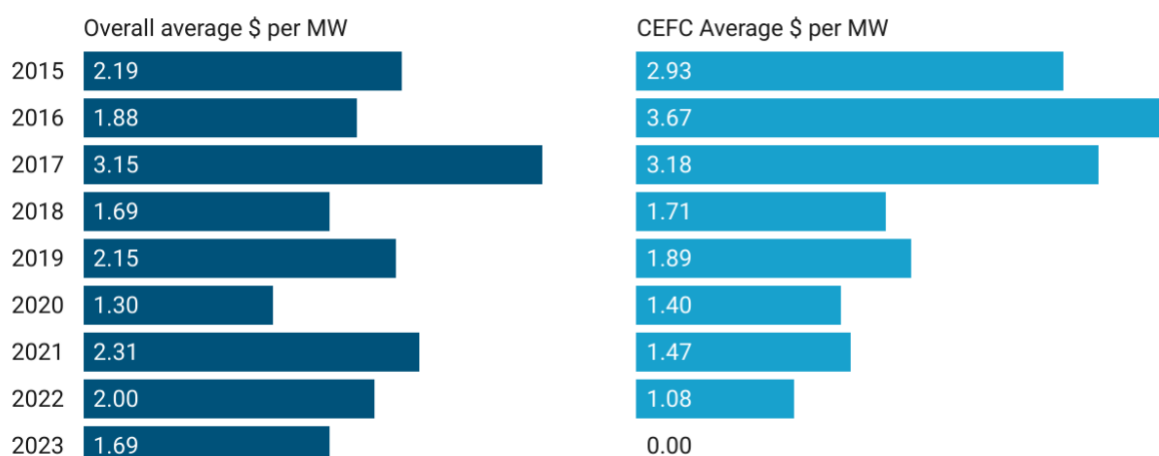


Figure 4-3 Australian large-scale solar projects >4.95MW with electricity transmission lines

The CEFC's investments in utility solar have decreased as the sector has matured, with recent investments focused on projects of 200MW and above. The largest project the CEFC has funded to date is the 300MW Walla Walla solar farm near Albury (New South Wales), although it is yet to be commissioned. The largest operating project funded by the CEFC is the Blue Grass Solar Farm, one of 50 projects supporting the Queensland Government's Renewable Energy Target (CEFC, 2022c). One quarter of the energy generated from Blue Grass Solar Farm will be offtaken by the state-owned electricity provider Stanwell Corporation.

The data shows that while the cost of large-scale solar did decline over time; these cost declines have not been linear or consistent (see Chart 4-3). From 2016 to 2020, CEFC projects were more expensive on average; however, this shifted from 2021 onwards, when CEFC projects became cheaper. However, this could be due to the larger projects the CEFC was funding and project scale reducing the overall cost. This illustrates how the CEFC is leading the market in delivering low-cost, large-scale solar, now it has reached sufficient scale.

Chart 4-3 Average capital cost (A\$) per MW of large-scale solar projects, Overall vs CEFC projects by year commissioned

4.4.3 The evolution of offtaking

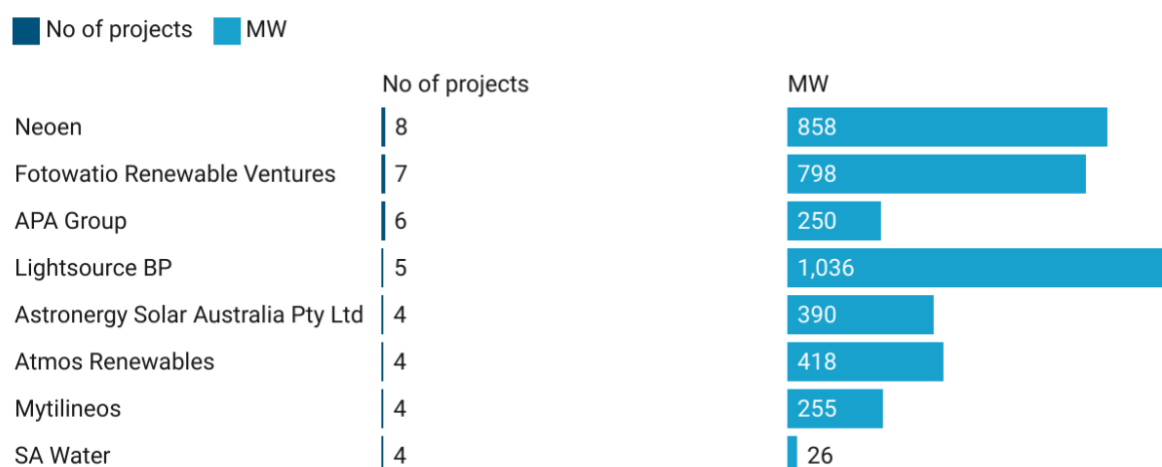
This section analyses the second key theme to emerge from the expert interviews and tests my second hypothesis, namely: *Did the diversity of project developers, co-financiers and offtakers the CEFC works with increase over time?* There were a total of 115 project developers who commissioned large-scale solar projects from 2015 to 2023. Initially, most project owners were specialised renewable energy developers and owners like Neoen, FRV and Edify Energy. Over time, a range of fossil fuel proponents like APA Group, Lightsource BP and Rio Tinto made investments, seeking to diversify their portfolios. There were also an increasing number of utilities (e.g. SA Water, Snowy Hydro) and industry facilities (e.g. SunMetals) building large-scale solar for own generation. Lightsource BP has the largest portfolio by volume, with a total of five solar farms (equating to 1,036MW) either operating or under construction over this period. It also has a further 2.5GW of utility solar projects in planning stages.

Neoen has received significantly more support from the CEFC than any other project owner, with eight large-scale solar project funded between 2015 and 2023 (see Chart 4-4). Three of these, Dubbo (25MW), Griffith (30MW) and Parkes (50MW), were funded through the large-scale solar round. The CEFC provided A\$150 million of concessional finance while ARENA provided A\$16 million in grant funding, out of a total cost of A\$340 million for the three projects (CEFC, 2017). When the CEFC Large-Scale Solar program lead was asked why Neoen was selected through the large-scale funding round she noted “we were looking for sponsors who could deliver ... with a proven background and quite detailed plans on how they would actually undertake technical/ insurance/ legal/ financial due diligence” for the project (expert interview 51, 26 September 2023). Australian project owner and developer Edify Energy has

received funding for four projects, while Wirsol and FRV received funding for three and Canadian Solar and CalEnergy Resources received funding for two projects.

Of the 185 large-scale solar farms commissioned or under development in Australia, 58% have a publicly declared PPA. As the large-scale solar sector developed, the range of PPA offtakers expanded. At first, most PPAs were signed with electricity retailers seeking to comply with RET requirements (e.g. Origin, AGL). Subnational governments were another vital group of offtakers, as they looked to shape the rate and direction of clean technology innovation and meet their own ambitious renewable energy requirements. For example, the ACT Government entered into twenty-year offtake agreements with Mugga Lane Solar Park in 2016 and Williamsdale Solar Farm Stage 1 in October 2017 as part of its reverse auctions to meet its target of 100% renewable energy by 2020. The Queensland state government entered offtake agreements for the Whitsunday and Longreach solar farms in March 2018.

Chart 4-4 Large-scale solar project developer overview



4.4.4 De-risking through knowledge sharing

The third hypothesis to be explored through the expert interviews was the role of the CEFC in de-risking investment through its technical expertise and knowledge sharing. The CEFC and ARENA played an important role in facilitating knowledge spillovers to increase developers' and financiers' understanding of the risks associated with large scale solar. As part of the large-scale solar round, they required projects to provide a range of data on the project construction, finance and operation. The findings were published in a series of seven reports known as the Generator Operator series (ARENA & CEFC, 2020). These reports provided a range of data to allow the CEFC and other financiers to better understand project risk. One key finding from these reports was that while some projects in the large-scale solar round faced

construction delays, this was due to unseasonably wet La Nina conditions and should not necessarily be factored into future projects. While the impact of this knowledge sharing is difficult to quantify, use of the reports appears widespread in the large-scale solar sector and reinforces the knowledge-sharing role of green banks (Geddes et al., 2018).

Another key finding from these reports was that revenue from adverse changes in marginal loss factors (MLFs) was lower than that originally assumed by developers during project development (ARENA & CEFC, 2020). An MLF is assigned to each load centre and generator on the NEM every year by the AEMO and represents the marginal change in loss between a connection point and the regional reference node due to an increase in load. For example, an MLF of 1.05 results in a 5% equivalent energy yield increase for a generator, while a load at that location must pay as if it consumed 5% extra energy. Between 2017 and 2020 there was a significant decline in the MLF of the large-scale solar round projects, which had an impact on revenues, as most projects had assumed there would not be any long-term changes (ARENA & CEFC, 2020, p. 13). The ARENA and CEFC analysis of MLFs on project revenue allowed prospective developers to better understand risks. Indeed, the CEFC used this data to assess its investment pipeline more accurately (expert interview 51, 26 September 2023).

4.4.5 Financing innovative projects

The final key theme to emerge from the interviews was the role of the CEFC in financing innovative projects. Of interest here is the slight disparity between the interviews and the quantitative data. Expert interviewees at the CEFC and other banks downplayed the role of green banks in financing first-of-a-kind technology deployments and emphasised that their role in innovation was primarily financial; developing new forms of investment structures whose transaction costs were too high for commercial banks.

The quantitative data shows that around half of CEFC projects were first-of-a-kind in some way. Of the 35 projects funded by the CEFC, 18 were identified as having some form of project novelty, versus 17 which did not (see Chart 4-5). Forms of project novelty roughly fell into one of three categories: technological novelty, financial novelty or scale/site geography novelty. Seven projects were identified as being technologically novel. The CEFC's first investment, the 56MW Moree Solar Farm, was the first large-scale solar farm in Australia to use single axis tracking technology. The 110MW Gunnedah and 189MW Suntop solar farms introduced novel bifacial solar panels, which generate energy from solar irradiation reflected off the ground to the underside of the solar panels. The 25MW Oakey Solar Farm Stage 1 incorporated AEMO forecasting technology to enhance grid stability. Five projects were identified as being

financially innovative. These included the 116MW Ross River Solar Farm, which was the CEFC's first large-scale solar equity investment, and the 80MW Fulham and 44MW Perry Bridge Solar farms, which were novelly structured as joint ventures. Finally, six projects were identified as being novel in terms of scale or their site geography. These included the 43MW Colinsville Solar Farm, built on the site of a decommissioned coal-fired power station, and the 150MW Coleambally Solar Farm and 200MW Kiamal Solar Farm Stage 1, the largest solar farms in New South Wales and Victoria respectively when they were announced.

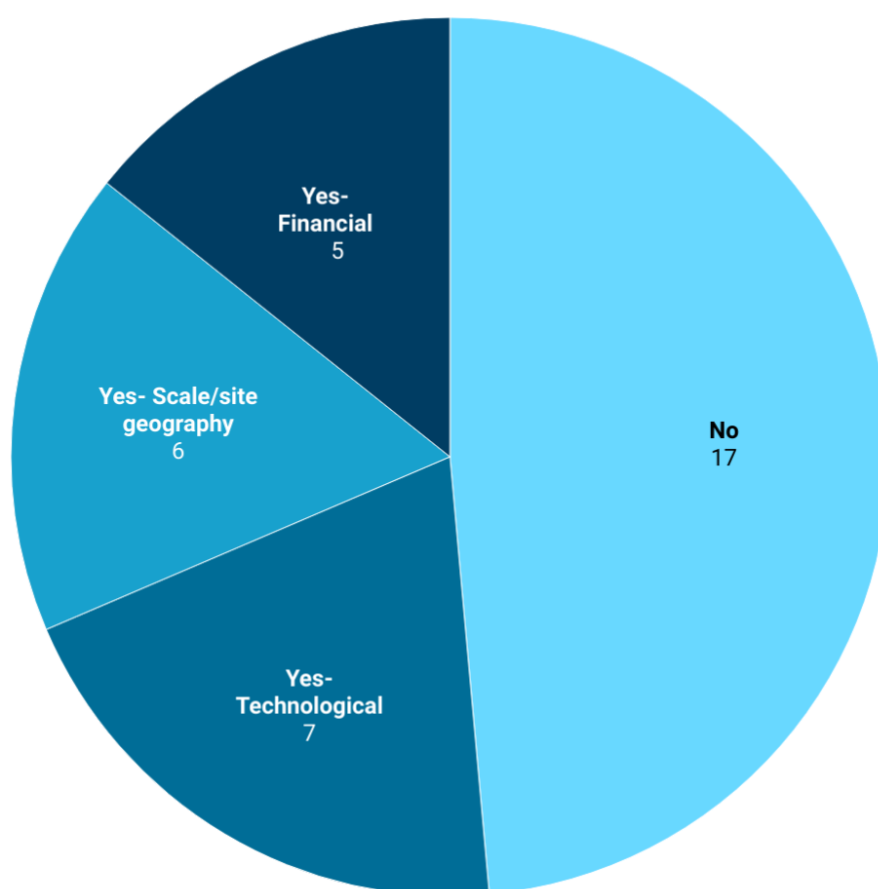
The highest-profile geographically novel project the CEFC has funded was in 2015, when it provided A\$15 million in concessional finance to the 15MW Sandfire Resources DeGrussa Copper-Gold mine in Western Australia, alongside A\$20.9 million provided by ARENA for a solar and battery project. Together, this funding covered nearly the entirety of the A\$40 million project, which was owned by Neoen (CEFC, 2024). The project was designed to provide up to one fifth of the electricity to the remote off-grid DeGrussa Copper-Gold mine, 900 kilometres north-east of Perth. The initial offtake agreement with Sandfire was for 5.5 years, when the mine was due to close, however this was extended to October 2022. The project was a trailblazer for hybrid energy projects at remote sites: Rio Tinto, BHP and Fortescue have all subsequently commissioned renewable energy and storage projects at remote mine sites (Ker, 2024), but it is unclear to what, if any, degree these investment decisions were influenced by the DeGrussa project. The DeGrussa project was strongly criticised in the Australian press as a waste of public money, illustrating the challenges for green banks in funding innovative projects when the risk tolerance for loss of public money is very low. While the CEFC's funding was repaid, ARENA's grant funding was disbursed.

4.5 Discussion

Both the data and expert interviews suggest the CEFC played a role in helping shape the rate and direction of clean technology innovation in Australia (Mazzucato & Penna, 2016). Several interviewees suggested the CEFC assisted the private sector to increase their risk appetite for funding large-scale solar projects in Australia. CEFC large-scale projects were consistently larger than other projects funded over this period (see Chart 4-3). When questioned about the role of the CEFC, A senior CEFC manager noted that "the crucial point for the CEFC was to be willing to finance a position that the banks see as risky for now but not so risky that they are not willing to follow in relatively short order" (Expert Interview 7, 17 February 2022). This was supported by one CEFC client who noted "having a commitment there just I suppose gives those investment committees the confidence that we're not necessarily going out on a limb" (Expert interview 15, 30 June 2022).

Chart 4-5 CEFC large-scale solar project novelty

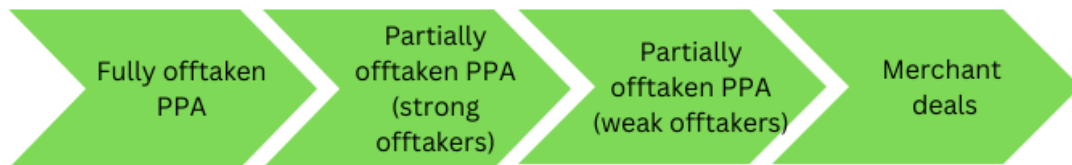
■ No
 ■ Yes- Technological
 ■ Yes- Scale/site geography
 ■ Yes- Financial



The expert interviews illustrate the important role of green bank finance in shaping financial, as well as technological, innovation. Gallagher et al. (2012) outline the phases of technology development through research, development, demonstration, market formation and diffusion. But a key finding to emerge from the interviews was the role of green bankers in shaping financial innovation in stages. As one green banker observed “we started by being willing to finance projects with good power offtake agreements where the banks were still hesitant” (Expert Interview 7, 17 February 2022). The CEFC then moved to financing partially contracted assets with strong offtakers, followed by partially contracted projects with weaker offtakers. Following these steps, the market was in a position for the CEFC to finance fully merchant projects. The CEFC was also financially innovative when it came to engineering, procurement and construction (EPC) contract structures for large-scale solar. While commercial banks were unwilling to finance EPC contracts split into components, the CEFC was willing to bank split contracts, where different companies deliver different parts of the project. Green banks played

an important role in helping to catalyse various stages of the financial innovation chain for large-scale solar projects (see Figure 4-2).

Figure 4-4 The financial innovation chain for large-scale solar projects in Australia



The CEFC was also acknowledged to play an important leadership role within the financial sector (Geddes et al., 2018). The due diligence the CEFC was required to undertake meant that “finance committees breathed a sigh of relief” (Expert interview 15, 30 June 2022) when the CEFC was involved in funding projects, as their legislative requirements required them to undertake due diligence to a higher standard than required by the private sector. While the due diligence costs of the CEFC were higher, the organisation benefited from its information arbitrage relative to the private sector: as former CEO of the CEFC noted, “You have an information arbitrage the other banks don’t have because you’re so close to policymakers” (expert interview 33, 25 November 2022). The CEFC used this arbitrage to “make better investment decisions and encourage[d] others to follow” (expert interview 33, 25 September 2022). This was not unique to the CEFC, with other green bankers confirming that they utilised this information arbitrage to their advantage. For example, Sarah Davidson from the New York Green Bank noted “if we don’t know about a new technology, there is a whole division at NYSERDA which probably does” (expert interview 18, 9 June 2022).

The CEFC played an important role in lowering transaction costs associated with financial products. Often commercial banks would not feel comfortable investing in new forms of clean energy technologies because the deals required new forms of financial structures, which they decried as too labour-intensive and time consuming. As one CEFC banker noted, commercial banks “are in the business of taking as low a risk as possible” (expert interview 51, 22 September 2023). She noted for those bankers the imperative was the volume of deals they closed in order to meet their targets and “they’re not necessarily incentivised to be innovative ... I guess we try to do a bit of that financial innovation to see how do we push them a little bit” (expert interview 51, 22 September 2023). This is a clear example of the CEFC absorbing transaction costs the private sector was unwilling to bear. In this instance, the costs

were both creating bespoke financial structures for large-scale solar projects and understanding the risks financing large-scale solar projects in the Australian market.

The retailer obligations under the RET were an important factor in creating demand for the offtake of the projects funded by the CEFC and ARENA in their large-scale solar round (expert interview 28, 26 September 2023). At the Commonwealth level, the RET was a vital instrument for providing demand for renewable energy. Its shortfall provisions for generators were what underpinned the CEFC's investment strategy for the large-scale solar round, with one CEFC staff member in the large-scale solar finance team noting their hypothesis was: "build it and they will contract" (expert interview 51, 22 September 2023). Signing PPAs with large-scale solar projects was less expensive than paying RET shortfall charges. The data also clearly illustrated the important role played by subnational governments in facilitating investment in large-scale solar, particularly when the Commonwealth lacked ambition and investment certainty. The expert interviews, along with the quantitative data, illustrate that the development of the large-scale solar sector was not the result of the CEFC alone, and many other public policies and institutions played important roles in its development.

In some instances, public policy has slowed down the approval process for large-scale solar projects. Large-scale solar projects in the Northern Territory have languished, with three 10MW solar farms sitting idle for three years after construction due to concerns about their impact on grid stability by the Northern Territory utility Power and Water Corporation. The developer of two of the farms, Italian firm ENI described the delays as "onerous, unprecedented and indefensible" (Parkinson, 2023). There are also concerns about delays in commissioning at the Commonwealth level (Clapin & Longden, 2024) and the impact of MLF changes on large-scale solar profitability.

Recent years have illustrated the continued importance for public financial support for the large-scale solar sector. The collapse of Australian engineering firm RCR Tomlinson in 2018 resulted from write-downs in the value of its large-scale solar projects. Global events have made the development of renewable energy more complex. The Covid-19 pandemic saw a range of supply chain shortages. The increasing popularity of green industrial policy has meant there is more competition for skilled workers who can develop and finance large-scale renewable energy projects. Several expert interviewees cited skills shortages as an increasing challenge for the Australian renewables industry.

4.6 Conclusion

The cost of Australian large-scale solar fell from A\$135 per MWh in 2015 to between A\$28 and \$68 per MWh in 2019. Part of this decline can be attributed to the CEFC, which invested in a range of technologically, financially and geographically novel projects and played important roles in de-risking investments through its knowledge-sharing and transparency measures through the large-scale solar round it financed with ARENA in 2016 and beyond. However, these declines also resulted from a range of other factors. Internationally, this included significant cost declines for solar PV over the period studied. Domestically, this included the RET, which provided strong demand for renewable energy offtake, various subnational policy measures and procurement, which supported renewable energy, and the depth in Australia's large, liquid capital market, which has increasingly seen a range of corporations, utilities and universities building and/or offtaking generation from large-scale solar facilities. This was demonstrated through my development of a database of Australian large-scale solar projects which combined geographic, technological and financial data to illustrate the role of public finance in not only shaping the rate and direction of clean energy technology innovation but shaping the rate and direction of financial sector innovation. In the case of the CEFC, they helped to shift private sector risk appetite towards large-scale solar, over time. They also had an important leadership role in the financial sector, sharing expertise, such as innovative financial term sheets, with private sector colleagues. The CEFC also helped to lower transaction costs for large-scale solar by developing innovative financing structures which shifted over time, remaining ahead of the market until it reached a point where public grant finance was no longer needed and the market had sufficient scale that commercial banks were comfortable financing merchant projects. This study has important implications for the deployment of other forms of clean energy technology in Australia, but also insights for the development of large-scale solar in nascent markets in other countries.

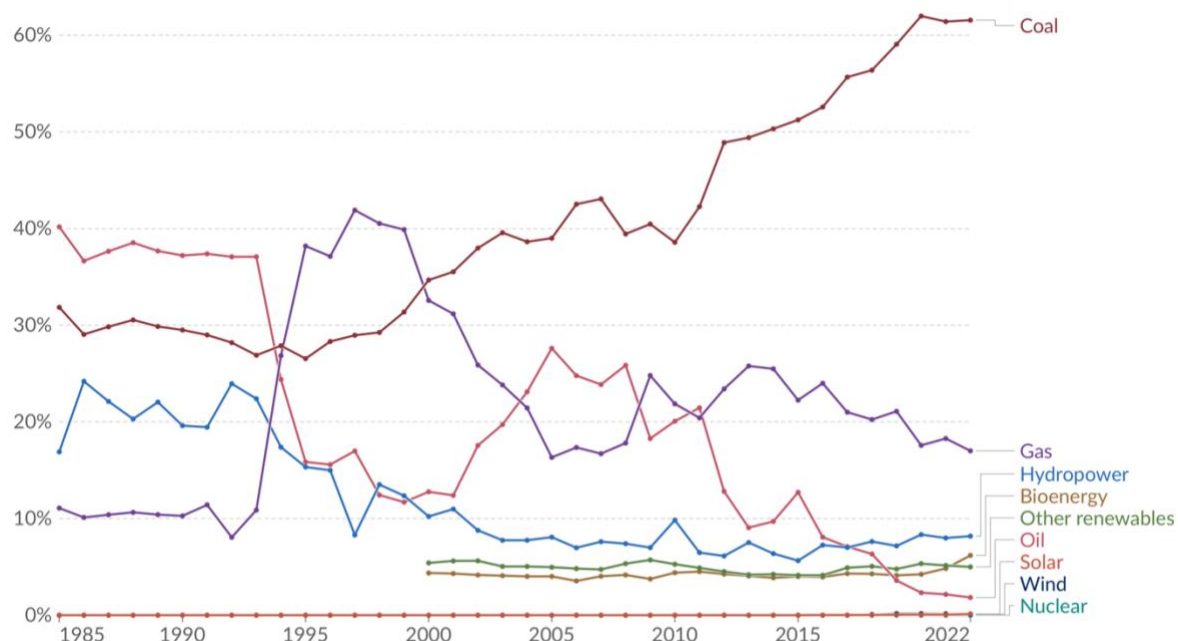
Chapter 5 Exploring the viability of an Indonesian green bank

Delivering on climate justice in Indonesia is a complex issue: one emmeshed in longer narratives of power, economic development and resource extraction. This chapter explores how climate finance could flow through more just institutions and mechanisms, specifically whether establishing an Indonesian green bank is feasible. Green banks are a new form of public financial institution which seek to catalyse climate change investment by de-risking and mobilising additional private sector finance. In this chapter, I explore how existing green bank models could be adapted to enhance climate justice in an Indonesian context. A qualitative case study approach is adopted, combining expert interviews with a systematic literature review. Existing barriers to climate finance investment in Indonesia are identified, then information is elicited on three options for creating an Indonesian green bank; either through establishing a new entity, increasing climate finance to Indonesia's development finance institution (PT Sarana Multi Infrastruktur), or increasing climate finance to the Indonesia Investment Authority. I find Indonesia's PT Sarana Multi Infrastruktur has many parallels to existing green banks and is well suited to scaling up green bank functions with additional financial and technical support.

5.1 Introduction

As noted in previous chapters, transitioning the global economy to net zero emissions in line with Paris Agreement goals requires massive increases in public and private investment (Kreibiehl et al., 2022). Southeast Asia accounts for 6 per cent of global GDP, 4 per cent of energy demand but only 2 per cent of global clean energy investment at present (IEA, 2024c). Energy demand in Southeast Asia has increased on average by around 3% a year over the past two decades (IEA, 2022). Financing climate change mitigation and adaptation in Asia is critical to the success of the net zero transition (Diaz-Rainey et al., 2023). Indonesia's nationally determined contribution (NDC) estimates US\$285 billion of investment is needed to meet its enhanced 2030 climate target (Republic of Indonesia, 2021). At present, Indonesia's investment transition to net zero emissions is off track. The Indonesian Ministry of Mineral and Energy Resources estimates there is a US\$13 billion per year investment gap for renewable energy capacity installation aligned with a net zero transition (Larasati & Mafira, 2023b).

Indonesia's decarbonisation is critical to the success of the Paris Agreement, but navigating the economic development path to high-income country status while reducing emissions poses huge political challenges (World Bank, 2023). Globally, it is the sixth largest greenhouse gas emitter, with annual emissions of 1,845 Mt CO₂-e in 2019 (Republic of Indonesia, 2019). It is the world's second largest coal exporter: 80% of its coal is exported, with the remainder fuelling over 50% of domestic electricity generation (World Bank, 2023). In Indonesia, coal "serves as a vital means to earn foreign exchange to finance other development needs" (Gao et al., 2021, p. 126). This explains to some degree why Indonesia, with its plentiful coal reserves, has been slow to invest in renewable energy, but the core reason is the significant political power vested in the Indonesian coal industry. Solar comprised only 0.13% of the electricity sector in 2022; wind comprised 0.11% (see Chart 5-1). Despite this, Indonesia has committed to ambitious action on climate change: its NDC commits to an unconditional 31.9% reduction in emissions against business-as-usual projections by 2030, and up to a 43.2% reduction conditional on climate finance support (Republic of Indonesia, 2021).

Chart 5-1 Share of Indonesian electricity generation by source, 1985–2022

Sources: Ember, (2022, 2023); Energy Institute, (2022).

Indonesia will experience significant physical and economic impacts from climate change. Heat stress is expected to cause the loss of almost 4 million full-time equivalent positions in Indonesia by 2030. It is estimated that the cost of these and other climate-related impacts will reach 1.24% of GDP by 2030 (Kompas et al., 2018). Indonesia also faces transition climate change risks, which threaten its financial stability and development progress.

The Paris Agreement ensures that climate finance will flow from developed to developing countries to accelerate their transition to net zero emissions. Developing countries are more exposed to physical climate change impacts and climate change risks, but bear little to no historical responsibility for emissions. The UNFCCC failed to deliver on its 2020 goal of raising US\$100 million per year in climate finance (Timperley, 2021), increasing the cost and risks faced by many countries in the Global South, including Indonesia, in transitioning to net zero emissions. While the UNFCCC definition of climate finance is very broad,¹ climate finance governance and economic geography literatures have illustrated how the UNFCCC has prioritised neoliberal, market-based, financial management of decarbonisation rather than environmental command and control approaches in climate finance provided to date (Bracking

¹ Local, national, or transnational financing – drawn from public, private and alternative sources of financing – that seeks to support mitigation and adaptation actions that will address climate change (UNFCCC, 2022).

& Leffel, 2021; Cipler & Roberts, 2017). Existing climate finance provision is polycentric and fragmented (Biermann et al., 2009; Skovgaard et al., 2023).

Underpinning these approaches to climate finance is the neoclassical economic orthodoxy that market-based approaches are the most efficient way to reduce emissions. Within economics and political economy literatures there have been important challenges posed to this orthodoxy. Firstly, there are a range of externalities and non-price barriers which make the political economy of implementing effective market mechanisms to reduce emissions challenging (Cullenward & Victor, 2020; Gillingham & Sweeney, 2010). Market-based approaches have struggled to overcome a range of barriers to financing low carbon investments, particularly in developing markets (Granoff et al., 2016; Polzin, 2017). Secondly, entrenched power dynamics often stymie attempts to create effective markets and institutions to try and achieve climate change goals (Bracking, 2015; Chelminski, 2022; Geddes et al., 2020; Peterson & Downie, 2023). There is a demonstrated role for developed countries to correct many forms of market failures by using public finance to mobilise private finance; shaping and co-creating markets to influence both the rate and direction of clean energy technology innovation in the net zero transition (Mazzucato, 2011; Mazzucato & Penna, 2016; Mazzucato & Semieniuk, 2018; Polzin et al., 2019; Steffen & Schmidt, 2019). Whether this approach can be applied to developing countries is far more contentious (Chang, 2002).

Rapidly accelerating the deployment of climate finance is integral to ensuring Indonesia has a transition to net zero emissions. There is a need for new forms of public financial institutions which help to accelerate investment in clean energy technologies. Green banks are a relatively new form of public financial institution, which seek to accelerate the investment transition to net zero emissions by mobilising additional domestic private sector clean technology investments which would otherwise not occur (Geddes et al., 2018; Schub, 2015). Green banks are perceived to create value beyond their financial roles, including through their investments in disadvantaged communities, though to date this value creation has not been fully captured (Lyons & White, 2023). Efforts to formalise the role of green banks in helping address social inequalities and ensuring a just transition are increasing; for example green bank funding under the Biden administration's Inflation Reduction Act allocated US\$7 billion in funding for disadvantaged communities in the United States (US EPA, 2023).

Green banks focus their operations on two areas: finance provision and capacity building. On finance provision, green banks work with domestic capital providers to de-risk investment. This is primarily achieved through the green bank undertaking specialist due diligence to develop a superior understanding of technology and/or financial risks than their private sector

counterparts. For example, it may be the first time a technology has been deployed in a national jurisdiction but there are examples of it being successfully commercialised overseas. Or there may be a need to develop a new application of a financial instrument to get a project approved. In both instances the transaction costs associated with understanding and managing these risks are too expensive for the private sector, and the projects would not proceed without green bank involvement.

To date, green banks have largely operated in mature, liquid financial markets with strong legal, institutional and regulatory frameworks (OECD, 2015). Research to date has not yet determined the viability of the green bank model in developing country markets. This poses an interesting avenue for research, as green banks have traditionally been framed as institutions which help to shape and co-create markets (Mazzucato & Penna, 2016). This chapter explores how feasible it is to bridge the gap between entrepreneurial states and developmental states to create an entrepreneurial development state (Pacheco Pardo & Klingler-Vidra, 2019). It explores notions of the entrepreneurial state (Mazzucato, 2011), and their applicability to developmental states (Chang, 2002; Naqvi et al., 2018; Woo, 2023).

This chapter expands literature on climate finance provision in Indonesia and green banks by exploring if the green bank model could be adapted to accelerate climate finance flows in Indonesia. It contributes to theoretical development in the space of climate finance and green banks in three ways. Firstly, it builds on the existing literature on green banks, by providing the first (to my knowledge) case study analysis of the feasibility of the green bank model in overcoming barriers to clean energy investment in Indonesia. Secondly, it identifies six key forms of investment barriers to scaling up climate finance in Indonesia through the systematic literature review, namely: governance, political, finance, access, skills and coordination. Finally, it extends the analysis of Geddes et al. (2018), by arguing in addition to their capital provision, de-risking, educational, signalling and early mover roles, green banks could play a role in enhancing climate justice in Indonesia's net zero transition.

The rest of the chapter is structured as follows. The methods section outlines the research design employed through the literature review, interviews, and data analysis. The results and discussion section provide a comparative analysis of the key themes and data to emerge from the systematic literature review and interviews.

5.2 Methods

This study adopts a two-stage, qualitative approach, which combines a systematic literature review with expert interviews. A more detailed outline of the research design is outlined in the following sections.

5.2.1 Systematic literature review

Literature reviews “are an important tool for obtaining and appraising evidence in a reliable, transparent and objective way” (Haddaway & Pullin, 2014, p. 179). They are an established methodology in climate change literatures (Kivimaa et al., 2017; Peñasco et al., 2021; Polzin, 2017; Polzin et al., 2019). The emerging policy relevance of the research questions meant supplementary expert interviews offered deeper insights into the current state of climate finance and climate justice in Indonesia. Stechemesser and Guenther's (2012) systematic review framework forms the basis of my method for this chapter. They apply a four-step framework, based on Fink (1998) and Tranfield et al. (2003)). Step one consists of selecting research questions, the literature database and notable grey literature sources, and defining search terms. In the second step, practical review criteria are applied to screen the resulting literature for relevance. In the third step, methodological review criteria are developed and applied. Lastly, findings are synthesised.

I sought to answer two research questions through my literature review. First: *What are the key barriers to financing clean energy technology investments in Indonesia?*, which explores present impediments to Indonesia's net zero transition. The focus on clean energy technologies reflects the mitigation-focused investment priorities of most established green banks; this chapter does not consider adaptation finance or land sector investment although it acknowledges their significance for Indonesia's net zero transition. Secondly, I ask: *What are the potential benefits and limitations of green banks in developing country contexts with heavy state ownership?*, which builds upon literature exploring the roles of green banks. In seeking to answer these questions I hope to provide insights into why existing power and political structures have made it difficult to scale up climate finance for clean energy technology investments in Indonesia and to provide policymakers with an understanding of the challenges in adapting the green bank model for developing markets.

To identify relevant studies for stage two, I used the electronic database Scopus which captures over 90 million records from 7,000 publishers (Elsevier, 2024). It captures over 99% of records from Web of Science (Singh et al., 2021). Three search strings relating to climate finance and just transitions (see Box 5-1) were used; 56 documents were found.

Box 5-1 Scopus search strings used in systematic literature review

```
(TITLE-ABS-KEY ("climate finance") AND TITLE-ABS-KEY (Indonesi*) AND PUBYEAR > 2015
```

```
(TITLE-ABS-KEY ("just transition") AND TITLE-ABS-KEY (Indonesi*) AND PUBYEAR > 2015
```

```
(TITLE-ABS-KEY ("climate justice") AND TITLE-ABS-KEY (Indonesi*) AND PUBYEAR > 2015
```

Source: Author's summary

In the second stage, I applied a range of screening criteria to the Scopus search results. Firstly, it was limited to documents from 2016 onwards to reflect the importance of the Paris Agreement (reached in December 2015) on climate change investment. Journal rankings were not used for exclusion purposes because this review aims to give a comprehensive overview of original research. When these criteria were applied, we ended up with a database of 52 records. I then screened the abstracts of each of these articles to remove duplicate records and determine their relevance to the research questions; 27 studies remained. The search terms were not exhaustive in capturing all climate finance and climate justice literature relevant to Indonesia and excluded the emerging green bank literature. A further 13 studies were included to address these limitations based on reverse snowball sampling and sourcing grey literature from key institutions and non-government organisation. This resulted in a total database of 40 studies. The final literature database is available online (Lyons, 2024). In stage three a review protocol [Appendix B](#) was developed to undertake the content analysis of the publications. This built upon the bibliographic content captured by Scopus (Lyons, 2024) to capture the purpose of the study, the barriers to accelerating climate finance and enhancing climate justice in Indonesia. I coded the literature and developed a database of key information extracted from research articles including the method (qualitative/quantitative/mixed etc.), research question/s, original contributions, and thematic scope (key conclusions, regional scope). This was an iterative process with shifting institutional classifications based on the systematic review and expert interviews. Step four of the systematic review, 'synthesising findings', is discussed in the next section.

5.2.2 Expert interviews

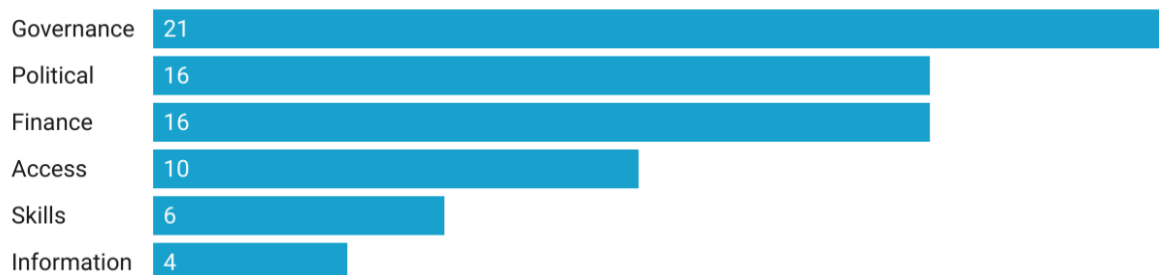
Of the 65 expert interviews conducted for this dissertation, 32 were with current and former green bank staff, Indonesian public servants, development partners and NGO researchers

between December 2021 and April 2024 (a list of participants is available in Table 1-3). I also conducted a number of off-the-record interviews to allow for input from experts who wished to offer candid insights. Ethics approval was obtained before the interviews commenced (ANU HREC Protocol 2021/279). In this instance, I sought interviewee perspectives on how existing green banks operate, whether the existing institutional model could be adapted for Indonesia, the current state of climate finance provision in Indonesia and barriers to investment in the net zero transition. Interviewee views provide useful insights into differing perspectives between categories of interview participants. The interviews were one hour long and semi-structured, with open-ended questions. Consent processes included asking whether participants preferred to be identified by name or anonymised by sector, organisation or position. No financial incentives were provided, and participation was entirely voluntary. Interviewees were selected using my network of colleagues (I have been a climate change policy practitioner in the Australian Government for over a decade), by attending the Indonesian Ministry of Finance's annual conference in December 2023 where I was an invited speaker, and snowball sampling of interview participants. Following the interviews, quoted participants were sent a draft copy of the chapter to ensure accuracy of quotes. I continued holding interviews until thematic saturation was reached (Yin, 1993).

5.2.3 Synthesis of document and interview data

Document and interview themes were identified via a qualitative content analysis. Interviews were recorded and transcribed, with the permission of participants, to allow for this thematic coding. The primary and secondary data were coded using Excel then imported into NVIVO software and categorised. A range of investment barriers were detailed in the systematic literature review (see Chart 5-2). These were iteratively grouped into seven categories: political (including power vested in state-owned enterprises [SOEs] and corruption), finance (volume and types available), access (to capital or land), skills and capacity constraints, information barriers and technology barriers. The low count for technology barriers reflects the fact that review articles focused on the deployment of commercialised technologies like solar and onshore wind.

Chart 5-2 Count of barriers to financing clean energy technology investments in Indonesia from systematic literature review



Source: Author's summary

These barriers were further explored in the expert interviews to understand whether additional categories of barriers were present and how they were evolving over time.

Three possible models for establishing an Indonesian green bank emerged from this mixed methods analysis: establishing a new national Indonesian green bank, building on the existing green bank type functions undertaken by Indonesia's existing development finance institution Persero, or accelerating green infrastructure investments by the Indonesia Investment Authority (IIA). These investment barriers and green bank models are discussed in further detail in the results and discussion sections.

5.3 Results

5.3.1 Barriers to accelerating climate finance investment in Indonesia

This section explores the first research question: what barriers exist to financing clean energy investment in Indonesia by drawing on our systematic review and views expressed by interviewees. I identified three categories of barriers to investment; domestic barriers, international impediments and skills/capacity constraints.

State-owned utility Perusahaan Listrik Negara (PLN) controls electricity transmission and distribution in Indonesia and was widely identified as a **political barrier** to private sector investment in clean energy technologies. Over the past decade PLN has rapidly expanded electricity supply, signing a range of PPAs with private corporations operating coal-fired power plants (Resosudarmo et al., 2023). Indonesia's Domestic Market Obligation requires coal producers to sell a minimum amount of their output to PLN at a rate capped at US\$70/ton, a rate well below recent market prices. This abundance of cheap coal has been a significant contributor to Indonesia's existing electricity grid oversupply (World Bank, 2023). Along with existing electricity and fuel subsidies this has favoured an expansion of fossil fuel electricity generation. Several expert interviewees noted that PLN was hesitant to support renewable

energy projects or off grid projects and was focused on maintaining its sectoral dominance while exercising a degree of bureaucratic inertia when it came to the net zero transition. The power vested in PLN is a challenge to accelerating clean energy deployment in Indonesia. But PLN will play a vital role in Indonesia's net zero transition and electricity reform must occur as a broader project of social change (Dubash & Williams, 2006).

A range of **governance barriers** are impeding clean technology investment in Indonesia. Ensuring demand for new renewable energy offtake requires decreasing support for bilateral fossil fuel investments and scaling up policy support for renewable energy (Edianto et al., 2022; Kong & Gallagher, 2021). Indonesia can also learn from Vietnam's experiences in scaling up solar and onshore wind, which illustrated that domestic motivations were key demand drivers along with high FITs for solar PV (Do et al., 2020). Grid infrastructure planning capabilities should be developed early to maximise the potential for expanding the use of these technologies (Do et al., 2021).

The complex regulatory environment in Indonesia also impedes private sector investment in clean energy technologies. Improving regulatory and financing frameworks would help Indonesia reduce the costs of clean energy projects. For example, the levelised cost of energy of solar PV in Indonesia could be around 40% lower if its investment and financing risks were comparable to advanced economies (IEA, 2022). Financing small-scale energy projects in Indonesia, especially off-grid projects, is particularly challenging. SMEs struggle to obtain finance for small-scale renewable energy projects as price caps for renewable energy generation make smaller projects unviable. This is an important energy justice issue in Indonesia, where its geography means that "regional disparities are a core policy focus for Indonesia" (expert interview 65, 18 April 2024). International climate finance is very focused at the project level, which means most private climate finance currently flows to commercially viable large-scale projects (Anantharajah & Setyowati, 2022). Ensuring the distributive justice aspects of the net zero transition do not exacerbate existing regional inequalities in Indonesia will be a critical component of a just transition (Setyowati, 2021).

Existing local content requirements increase the cost of capital for renewable energy projects, as they set a minimum threshold for local content for materials and services used in renewable energy generation. While the goal of these local requirements is to build local manufacturing capability, in the case of the solar panel industry, it has resulted in panels that are more expensive and of lower quality than those on the international market. One anonymous interviewee noted that Indonesia's state-owned electricity provider PLN was notorious for ensuring it had control over tender outcomes for new renewable energy capacity, even if they

were being funded by international donors. This was cited as a significant security concern, and one reason such projects often ground to a halt before they had begun.

Even leaving aside local content provisions, Indonesia faces a range of **financial barriers** to investment, including high upfront costs, poor understanding of project development and technical risks. Corruption was also cited as a concern, with one interviewee noting that “there’s a number of cabinet members who have direct interests in coal companies” (expert interview 45, 19 July 2023). This speaks to the complexities of undertaking ambitious environmental economic reforms where corruption is present (Tacconi & Williams, 2020). A range of **information barriers** and coordination issues were also identified. For example, one multilateral development bank staffer noted: “We don’t have adequate data to have confidence in our project pipeline in Indonesia” (expert interview 64, 7 December 2023). The regime complexity (Keohane & Victor, 2011) in terms of data ownership across the Indonesia public service was one factor which contributed to this barrier, with different agencies owning different parts of critical investment data. Another factor was that “by all accounts PLN is a very closed shop with its data” (expert interview 45, 19 July 2023).

While Indonesia has signalled it intends to move away from fossil fuels through its commitment to “Global Coal to Clean Power Transition Statement” at COP26, demand signals regarding the phase-out of fossil fuels have been mixed. Presidential Regulation No. 112/2022 legally restricts the construction of new coal-fired power stations connected to the grid; however, there are significant exemptions. Projects which were already approved, off-grid or deemed of national significance are exempt. Indonesia has plans to add 20GW of off-grid captive coal over the next decade (Mafira, 2023). Ironically much of this new coal power may be used to operate new manufacturing facilities for clean energy technologies, such as lithium battery factories. This perverse outcome highlights the complexities and trade-offs in managing climate change outcomes alongside other policy goals like economic security and development. The Just Energy Transition Partnership (JETP) has struggled so far to compel private financiers to pay for the phase-out of existing coal-fired power stations. From a political economy perspective, several interviewees remarked it was far more palatable politically to fund new renewable energy projects than decommission existing fossil fuel plants.

The impact of Russia’s invasion of Ukraine has had complex flow-on effects for Indonesia’s domestic transition to net zero emissions (World Bank, 2023). While it has increased global coal prices, exacerbating energy costs and supply chain issues worldwide, it has also made the task of eliminating Indonesian energy subsidies and increasing market competition far more complex. It has also made the political economy of introducing a carbon price more

difficult. But efforts to establish an emissions trading system in Indonesia are progressing, with the first phase of its baseline and credit scheme commencing in February 2023, covering 99 coal-fired power stations with a capacity of more than 100MW, equivalent to 81% of the electricity sector (Resosudarmo et al., 2023). There are plans to expand the scheme in 2025 and 2028 to cover oil and gas-fired power plants, as well as coal-fired power plants that are not grid connected. Many interviewees cited the importance of setting broad price signals in Indonesia's domestic economy. Despite this, one expert noted that "there is no grappling yet with the societal implications of the transition writ large" (expert interview 65, 18 April 2024).

There are a range of international impediments to increasing climate finance flows into Indonesia, principally **access barriers**. Firstly, while a wide variety of international financial organisations provide climate finance to Indonesia, including multilateral development banks, development finance agencies and export credit agencies, all of these institutions have different processes and requirements for accessing this finance (Anantharajah & Setyowati, 2022). This complexity was cited as a barrier to accessing international climate finance by several interviewees. Secondly, many of these international climate finance organisations used financial intermediaries to assist in project development and implementation. These intermediaries were usually Western consultants, paid large fees which were deducted from project funding, further reducing the level of climate finance received by Indonesia. Significant reform of existing methods for accessing international finance are needed.

International climate finance is largely provided as market-rate loans. While their terms are far more favourable than those offered by domestic commercial banks due to lower costs of capital, there is an urgent need for more concessional and grant-based financing (Bhattacharya et al., 2023). There is a need for institutions which take the capacity building model of existing international financial institutions and apply it to Indonesia's domestic banking sector to help them better understand the risks of fossil fuel investments and to assist them in de-risking clean energy investments. It illustrates how developed countries are using existing climate finance power structures to further entrench global inequality between developed and developing countries (Gabor & Sylla, 2023).

One expert interviewee noted that the fiduciary requirements of institutional investors in developed countries were not compatible with foreign renewable energy investments in developing countries like Indonesia (expert interview 48, 4 August 2023). More analysis is needed to determine how those barriers could be reduced or eliminated.

A range of **skills barriers** are slowing Indonesia's progress to net zero emissions. While limited state capacity (Dubash & Morgan, 2012) is an important dimension of these skills barriers, skills gaps are also pervasive in the private sector. The increasingly protectionist green industrial policies in many developed countries are creating significant competition for skilled professionals with experience across a range of technology, finance and policy areas related to the net zero transition. There is a significant need to train the workers required to implement the transition. This raised a range of issues around Indonesia's current planning and coordination of the transition.

The decarbonisation of Indonesia's electricity sector requires significant planning and coordination of renewable electricity generation, transmission and storage. Similarly, the transport sector requires electric vehicle (EV) charging infrastructure planning and coordination. This needs to be achieved at the same time Indonesia progresses its economic development, which poses a huge challenge. These capacity constraints have a series of negative flow-on effects for renewable energy market development, including pricing renewables out of the market and artificially reducing the cost of electricity, which leads to less efficient market outcomes.

5.3.2 Pathways to creating an Indonesian green bank

In this section I use the expert interviews and literature review as a means of answering my second research question, *"What are the potential benefits and limitations of green banks in developing country contexts with heavy state ownership?"* In doing so, I hope to shed light on the strengths and weaknesses of three possible green bank models and their viability in the Indonesian context. While I acknowledge that other possible governance models (e.g. the JETP) or government institutions (e.g. Indonesia's environmental agency Badan Pengelola Dana Lingkungan Hidup (BPDLH)) could adopt green bank functions, the three options selected were chosen based on expert appraisal of their likelihood of success.

Before moving to any assessment of green bank models it is important to identify which of the identified barriers could potentially be addressed by an Indonesian green bank. As discussed in section 2.1 there are three broad categories of transaction costs; search, bargaining and enforcement costs (Williamson, 1985). Green banks focus on addressing search and financial access and bargaining costs rather than enforcement costs. In the case of Indonesia, a green bank would not be suited to overcoming political and governance barriers associated with PLN and the existing policy and regulatory structures. It would be able to assist in overcoming certain financial and information barriers such as the high upfront cost of renewables,

improving transparency of project data to assist the private sector in investment decisions and facilitating access to international finance. While it would assist in overcoming skills barriers to clean energy investments within the financial sector, it would not be able to address boarder skills shortages, such as key trades like electricians.

One option would be to establish a green bank as a limited liability company, owned by the Government of Indonesia. This governance structure would mirror other national green banks like Australia's CEFC or NZGIF. Existing green banks do not actually operate as banks, rather they are state-sponsored investment funds which operate as hybrid organisations at arm's length to government (Lyons & White, 2023). For example, the CEFC was legislated as a corporate Commonwealth entity, which sits within the portfolio of the Minister for Climate Change and Energy. It has an independent Board of Directors which instruct the CEO as to the strategic direction of the organisation. The CEFC was initially funded through a one-off A\$10 billion budget appropriation in 2012 (Geddes et al., 2018).

Expert interviewees highlighted a range of complexities and challenges in establishing an Indonesian Green Bank using this model. Firstly, a range of market conditions would likely inhibit the success of a standalone Indonesian green bank. Unlike Australia which has a competitive electricity market, the Indonesian market is dominated by state-owned enterprise PLN. Indonesia's current oversupply of electricity means the demand signal required to scale up renewable energy infrastructure is not present. Australia also has a more mature, liquid capital market than Indonesia (expert interview 14, 17 March 2022). Secondly, there are only a finite number of experts with the skills to make an Indonesian green bank a success and attracting and retaining these staff would be an enormous challenge at this point in the net zero transition, compared with a decade earlier when the CEFC was being established. Relatedly, the net zero transition is at a point where it is critical that Indonesia's clean technology investment scales up within the next five years and this would be very challenging to achieve for a new institution (expert interview 65, 18 April 2024). Finally, there is not a logical place for an Indonesian Green Bank to operate. Situating a green bank under the Ministry of Finance would make it a direct competitor of PT Sarana Multi Infrastruktur (PT SMI), while the Ministry of Environment and Forestry, which is the focal point for the UNFCCC, was not seen as a visible actor in terms of Indonesia's domestic transition and often at odds with other key agencies like the Ministry of Energy and Mineral Resources and the Ministry of National Development Planning (Sekarintias et al., 2023). For all these reasons, experts were cautious about establishing a Indonesian green bank.

The second option for establishing an Indonesian green bank would be to scale up the green banking functions within PT SMI. Established in 2009, PT SMI is Indonesia's development finance institute. It is an SOE which sits under the Indonesian Ministry of Finance and is mandated to catalyse infrastructure development across Indonesia in two ways; optimising the social and economic benefits of infrastructure for communities (including local governments) and supporting the development of the Sustainable Development Goals, including climate change mitigation (Global Infrastructure Hub, 2019). In 2022, PT SMI was appointed as the Country Platform Manager of the Energy Transition Mechanism (ETM) and will coordinate the national phase-out of coal-fired power plants in Indonesia. It operates under three business pillars: finance and investment, project advisory and project development. Its total cumulative project value in 2022 was IDR8.2 trillion (US\$504 million), with a leverage ratio of 5.6.

There was broad agreement among the expert interviewees that PT SMI was the institution most suited to becoming a public green bank. As an SOE itself, PT SMI is well positioned to encourage PLN to make the market reforms needed to create demand for renewable energy projects. PT SMI is the country platform manager for the Asian Development Bank's ETM, which aims to catalyse blended finance in South-East Asia. PT SMI is already acting as a quasi-green bank, building significant expertise in financing innovative transactions and working with the Indonesian domestic bank sector to replicate those investments so they become catalytic in accelerating investment in low-carbon technologies (PT SMI, 2022).

The key challenge for PT SMI will be balancing its economic development imperatives with the hefty infrastructure investment of the net zero transition. There will be some instances where these policy goals are in concert, but many instances where management of direct trade-offs will be required (Cui & Aulton, 2023; Swilling, 2011). This is evidenced by the current trend of captive coal power stations being used to power new clean energy manufacturing facilities off-grid in Indonesia. For PT SMI to succeed as Indonesia's green bank, it will need to be transparent and open about those potential trade-offs and work quickly with international development partners to ensure that such value-destroying investments are ceased or amended before they begin without sacrificing Indonesia's ambitious development goal of becoming a high-income country by 2045.

Experts also highlighted that, at present, much of PT SMI's funding comes from international climate finance sources. This includes multilateral development banks (e.g. Asian Development Bank, World Bank), multilateral funds (Climate Investment Fund) and development finance corporations (Japan Bank for International Cooperation). It is the only company in Indonesia to be a Direct Accredited Entity of the Green Climate Fund (GCF), which

enables PT SMI to apply for funding from the GCF with a maximum proposal value of US\$250 million and with a broader range of financial instruments, including grants, loans, guarantees and equity. The Indonesian Investment Authority (INA) is an investment partner. For PT SMI to successfully take on the role of a public Green Bank it would need to scale up blended finance transactions through its role as the ETM Country Platform Manager and seek to co-finance more projects leveraging domestic capital.

The final option which was raised as a possibility for housing an Indonesian green bank was adapting the mission of the Indonesian Investment Authority (INA) to include green bank functions. Established in 2021, INA is Indonesia's sovereign wealth fund. Unlike most sovereign wealth funds, which invest in overseas markets, INA was established to enhance Indonesia's domestic economic security through making investments in significant industries and drawing foreign investors to Indonesia (Lakshmi, 2024). In 2022, INA invested US\$502 million across four priority sectors: transportation and logistics, green energy and transformation, digitalisation and digital infrastructure, and healthcare services (INA, 2022). INA is establishing an EV fund that will invest across the EV value chain, covering the upstream, midstream and downstream industries, with a particular emphasis on Indonesia. It is also prioritising geothermal investments, with Indonesia having the second-highest geothermal capacity globally.

As a relatively new entity, expert interviewees did not consider INA a logical institution to house green bank capabilities in Indonesia. While INA's focus on domestic investment contrasts to most sovereign wealth funds it has a very wide investment remit (including mining oil and gas investments), in contrast to most Green Banks.

5.4 Discussion

The expert interviews and literature review identified five categories of issues related to climate finance which impede clean energy investments in Indonesia. They were near unanimous that international climate finance provision faces a range of barriers to investment, but optimistic that if the green bank model was adapted to sit within SOE PTSMI that it could help to overcome some of these barriers. These are outlined in more detail below.

Firstly, the overall **volume** of climate finance is well below what is required to keep the temperature goals of the Paris Agreement alive (Kreibiehl et al., 2022). The required global capital exists to fund the net zero transition, despite persistent narratives there is a global

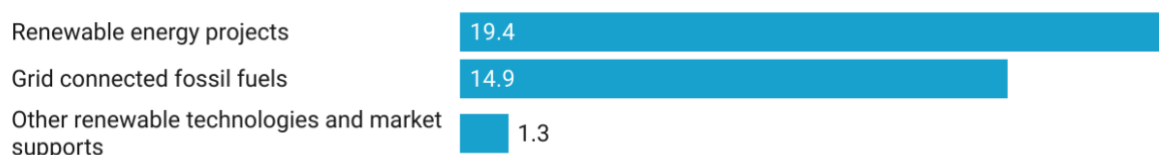
financing gap; what is most needed is the political will to redirect these global resources (Bracking, 2021).

Secondly, the **types of climate finance provided** through international financial institutions at present. The majority of international climate finance provision has been non-concessional loans financed using international capital markets. Future climate finance must consist of far greater volumes of concessional and grant-based finance than has been provided to date (Bhattacharya et al., 2023).

The large-scale project approach commonly adopted at present crowds out opportunities for small-scale renewable energy and storage projects, which will be critical to reducing structural inequalities in Indonesia's remote archipelagos (Anantharajah & Setyowati, 2022). This major project-based approach highlights another dimension critical to enhancing climate justice in Indonesia, that of project **scale**.

In addition to capturing the financial benefits of projects, existing international financial institutions funding clean technology projects in Indonesia could do more to **build capacity** of the domestic commercial banking sector, which is not currently funding projects in this sector (Larasati & Mafira, 2023a). From 2015 to 2021, the Indonesian private sector only made US\$20.77 billion of climate-aligned investments (Larasati & Mafira, 2023a). Over the same period almost US\$15 billion was invested in fossil fuels in the Indonesian power sector. Many of these investments face the prospect of becoming stranded assets (Hughes & Downie, 2023). Most of this finance was provided as loans from bilateral DFIs, which would still need to be paid even if the assets become stranded. This would exacerbate climate injustice within Indonesia by increasing public debt and placing further strain on Indonesia's development and decarbonisation efforts.

Chart 5-3 Indonesia power sector finance 2015–2021



Source: (Larasati & Mafira, 2023b)

Expert interviewees acknowledged that this was likely because domestic bankers did not understand the technological and financial risks associated with new forms of clean energy technologies. Educating the domestic banking sector to better understand technological and financial risks is a core function of green banks and there was strong interest in their potential to address these barriers, particularly among Indonesian experts. Finally, better **coordination** is desperately needed between public and private actors at all levels of governance in Indonesia.

An Indonesian green bank would be able to enhance climate justice in each of these five areas; volume, type of finance provided, scale, capacity building and coordination. Firstly, an Indonesian green bank would increase the overall volume of climate finance in Indonesia, if properly funded, through international climate finance. It would focus on crowding-in domestic investment to clean energy technology projects, and ensure domestic capital markets were more exposed to the profitable returns of the net zero transition as well as the stranded asset risks they face from their fossil fuel investments at present. Secondly, green banks primarily use concessional finance rather than the market-based rates currently used by international financial organisations, so would contribute to more just use of financial instruments in Indonesian climate finance investments rather than the market-rate loans which presently dominate. Thirdly, green banks can operate at different levels of project scale through their investments. While they do invest in large-scale renewable energy projects, they also develop financial instruments designed to aggregate many smaller-scale transactions in areas like transport or energy efficiency. These products could be targeted at particular regions to reduce inequality within Indonesia (Setyowati, 2021). Capacity building and knowledge sharing are an inherent part of the green bank model (Geddes et al., 2018). As national institutions with operational independence from government, they develop closer relationships with domestic banks than traditional international actors providing climate finance, due to their information arbitrage from proximity to national governments (expert interview 33, 22 September 2022). Sharing this knowledge and building capacity is core to their mission of mobilising additional private finance for climate change investment.

5.5 Conclusion

Indonesia faces many challenges in its net zero transition, which is off track at present. A range of domestic, international and skills barriers exist to scaling up climate finance investment for clean energy technologies in Indonesia. Domestic barriers include the market power of state-owned entity PLN, high costs of capital, regulatory barriers, information failures and high levels of public debt. International barriers include barriers to accessing finance and lack of

coordination between climate finance institutions. Skills deficits exist both domestically and internationally. Overcoming these barriers requires a range of public financial institutions and which not only deliver climate finance but also crowd in private sector investment from international and domestic capital markets. There is a need to enhance climate justice provisions of international climate finance flows to Indonesia.

This chapter has explored how to overcome certain investment barriers to accelerate climate change investment in Indonesia through an analysis of the potential benefits and limitations of green banks. Green banks seek to mobilise additional private sector investment in the net zero transition by overcoming technological, financial and site-specific barriers to investment. They offer a range of innovative financial products, particularly concessional debt structures, to finance commercial projects the private sector will not invest in due to high transaction costs. They are well placed to enhance climate justice of climate finance provision in Indonesia in terms of the volume, type and scale of finance provided. Furthermore, they play vital roles in building capacity, sharing knowledge and coordinating with domestic financial actors to crowd in investment to accelerate the net zero transition.

While it may be feasible to bridge the gap between entrepreneurial states and developmental states it will certainly not be easy and will require adapting the green bank model to suit developing country markets and institutional frameworks. This will require greater use of blended and grant finance. Of the three green bank models explored in this chapter, scaling up the green bank function of PT SMI is a more promising path for establishing an Indonesian green bank than establishing a new institution or scaling up green bank functions in INA.

Chapter 6 Exploring the viability of a Fiji green bank

Pacific Island countries (PICs) are disproportionately affected by climate change, although historically they have made a negligible contribution to global emissions. The quantum of climate finance provided to the region needs to increase rapidly. The issue of how to mobilise climate justice in the Pacific is vexed and embedded in longer narratives of dependency, power and unequal resources. Climate finance is situated in this complex history, and this chapter aims to consider ways it could flow through more just structures and mechanisms, specifically a Fiji green bank. I adopt a qualitative approach, combining expert interviews with a systematic literature review, to elicit the main barriers to increasing climate finance investment in Fiji, namely access barriers, policy and governance issues, financial barriers, skills deficits, geography/culture, data/technology gaps and political barriers. I then explore three models for finance provision: creation of a Fiji green bank, scaling up green bank functions within the Fiji Development Bank or providing additional budget support with climate conditionalities to the Fiji Government. I find green banks in their current form would not be able to operate in Fiji, but that there would be value in taking elements of their de-risking, knowledge-sharing and transparency approaches and embedding these elements within existing institutions. In the case of Fiji, scaling up these elements would be most effective within the Fiji Development Bank.

6.1 Introduction

The Paris Agreement seeks to limit the physical impacts of climate change, with the goal of keeping temperature increases to 1.5°C (and not more than 2°C) above preindustrial averages (UNFCCC, 2015). Global temperature increases are 1.1°C above preindustrial levels, and current investment levels are far short of what is needed (IPCC, 2022). There is an urgent need to accelerate public and private finance in the transition to net zero emissions (Timperley, 2021). Latest estimates suggest additional global investment of US\$4.5 trillion per year is needed to keep the 1.5°C temperature goal of the Paris Agreement in reach (IEA, 2023). Public finance has an important role to play in shaping the rate and direction of the transition to net zero emissions (Mazzucato, 2011; Mazzucato & Penna, 2016), including in developing economies (Steffen & Schmidt, 2019).

Addressing climate change is often framed as an investment problem which can be overcome by targeting financial barriers (Geddes et al., 2018; Granoff et al., 2016). There is a well-documented global climate finance gap, with the IPCC concluding financial flows are a factor of three to six times lower than levels needed by 2030 to limit warming to below 2°C (IPCC, 2022). There is sufficient global capital and liquidity to close this investment gap and the real

need is to switch investments “in type and purpose to decarbonisation pathways” (Bracking, 2021, p. 257). Latest estimates suggest an additional US\$2.4 trillion per year needs to be invested annually by 2030 in emerging markets and developing countries outside China to make necessary investments in a just energy transition, adaptation and resilience, loss and damage, and the conservation and restoration of nature (Bhattacharya et al., 2023). Of this, approximately two-thirds will be needed in developing countries. In its NDC to the UNFCCC, the Fiji Government estimates it will need an estimated US\$2.97 billion of investment between 2017 and 2030 to meet its emissions targets in the energy sector (Republic of Fiji, 2017).

Enshrined in the Paris Agreement is a commitment from developed countries to provide finance to developing countries to assist their mitigation and adaptation efforts (UNFCCC, 2015). Underscoring the climate finance provisions in the Paris Agreement is recognition, firstly, that developing countries are not responsible for the vast majority of historical emissions, and secondly, that their capacity to pay for the transition to a net zero emissions is far less than developed countries (Jakob & Steckel, 2014). PICs face a third challenge: they are among the most vulnerable in the world to climate change impacts (Samuwai, 2021). Between now and 2100, it is expected that average annual temperatures in the Pacific will rise between 1.4°C and 3.7°C, with sea level rise of an additional 120–200 cm (Fouad et al., 2021). While emissions from PICs are insignificant, accounting for ~0.0.3% of global emissions, the region is the most aid-dependent in the world (Hammersley et al., 2023). PICs need significant investment to adapt and build resilience to climate change impacts, particularly increased support for climate change adaptation, disaster risk reduction and loss and damage.

Despite efforts to scale up climate finance flows in Fiji, there has been limited success to date. While using public finance to mobilise additional private investment for the net zero transition is the source of considerable efforts elsewhere, this is unlikely to be feasible in Fiji or the PICs more broadly. Geography, immature markets, policy and regulatory frameworks make generating positive investment returns difficult in the Pacific and private actors are mostly unwilling to invest. One promising pathway is increasing the provision of “blended finance”, defined here as “using public funds to mobilise larger volumes of investment capital than would have been possible through direct official or philanthropic funding alone” (Tan, 2019, p. 303). It differs to traditional development finance seeking to foster private sector development; rather blended finance seeks to grow the overall pool of climate finance. Globally, most climate finance flows, particularly private finance, are focused on mitigation rather than adaptation (Timperley, 2021). Several studies have analysed the barriers to scaling up climate finance investment in Fiji and Pacific Islands more broadly (Anantharajah, 2019; Fouad et al., 2021; Samuwai et al., 2019), but there is an important empirical gap in the literature when it comes

to exploring more just mechanisms to accelerate the deployment of green finance in the region beyond the reform of existing institutions (ADB, 2023). This is the objective of this study: I seek to explore how the public green bank model could enhance more just provision of climate finance in Fiji and PICs.

Just provision of climate finance is complex, embedded in deeper histories of resource extraction and development. Delivering on climate justice requires consideration of distributional, procedural and restorative justice (McCauley & Heffron, 2018). Climate finance investments in developing countries are often channelled through existing development institutions. As Bracking (2021) succinctly notes,

“climate finance is managed within power structures which conditioned, and continue to do so, the political economy of development, through the institutional reproduction of economic inequality and vectors of race, coloniality and patriarchy.” (Bracking, 2021, p. 270)

The norms of international climate finance widen the disparity between rich and poor countries. Highly complex processes to access climate finance, are human resource-intensive and disadvantage small island developing states (SIDS) like Fiji, which are among the most vulnerable countries in the world to climate change impacts. Often international financial institutions operating in Fiji outsource clean energy projects to international consultants from the Global North, which hinders development of local institutional capacity. The lack of capacity for Fiji to access climate finance while it experiences worsening climate impacts illustrates this tension. One emerging solution is an increased focus on locally led adaptation (Westoby Ross et al., 2020). Defined here, locally led adaptation is climate finance investment which allows local actors to have decision-making power in planning, implementing, monitoring and evaluation of climate finance investments (WRI, 2024). Locally led adaptation is difficult to implement as it requires a redesign of traditional climate finance mechanisms. But this redesign will be critical to ensuring the net zero transition is a just transition that does not exacerbate existing fragilities of vulnerable countries.

In this chapter, I argue that green banks could offer an institutional pathway to a more just system of locally led climate finance investments for Fiji if they were adapted to consider national circumstances. As detailed in Chapter 2, green banks are financial institutions which use public funding to mobilise additional private sector investment into low-carbon, climate-resilient infrastructure. They structure investments in innovative ways to de-risk investments for the private sector (often taking on senior debt within investments). Traditionally they have provided concessional debt and equity public finance to investments which would otherwise

be unable to secure commercial finance. They operate at national and subnational levels, but there would be nothing to preclude the adoption of regional or multilateral Green Banks.

This chapter contributes to knowledge of climate finance and green banks in three ways. Firstly, it extends existing scholarship (Anantharajah, 2019; Fidali et al., 2023; Samuwai et al., 2019) on barriers to climate finance in the Pacific by exploring whether the technical and financial barriers targeted by green banks exist in Fiji. Secondly, it builds on the nascent green bank literature, building on the work of Geddes et al., (2018, 2020) and Lyons & White, (2023) to explore three potential institutional models for a Fiji green bank. It analyses whether a green bank would operate most effectively as a standalone institution, a division within the Fiji Development Bank, or through provision of additional budget support to the Fiji Government. Lastly, it makes a methodological contribution by adopting a feminist approach to the systematic literature review to explore differing perceptions of barriers to climate finance between Pacific Island lead authors compared to other authors.

The rest of the chapter is structured as follows. The methods section outlines the methodological approach undertaken through the literature review, expert interviews and data analysis. The results section provides a comparative analysis of the key themes and data to emerge from the organisational document and expert interviews. The policy implications section provides key findings for policy practitioners. Finally, the conclusion summarises the key findings and identifies opportunities for future research.

6.2 Methods

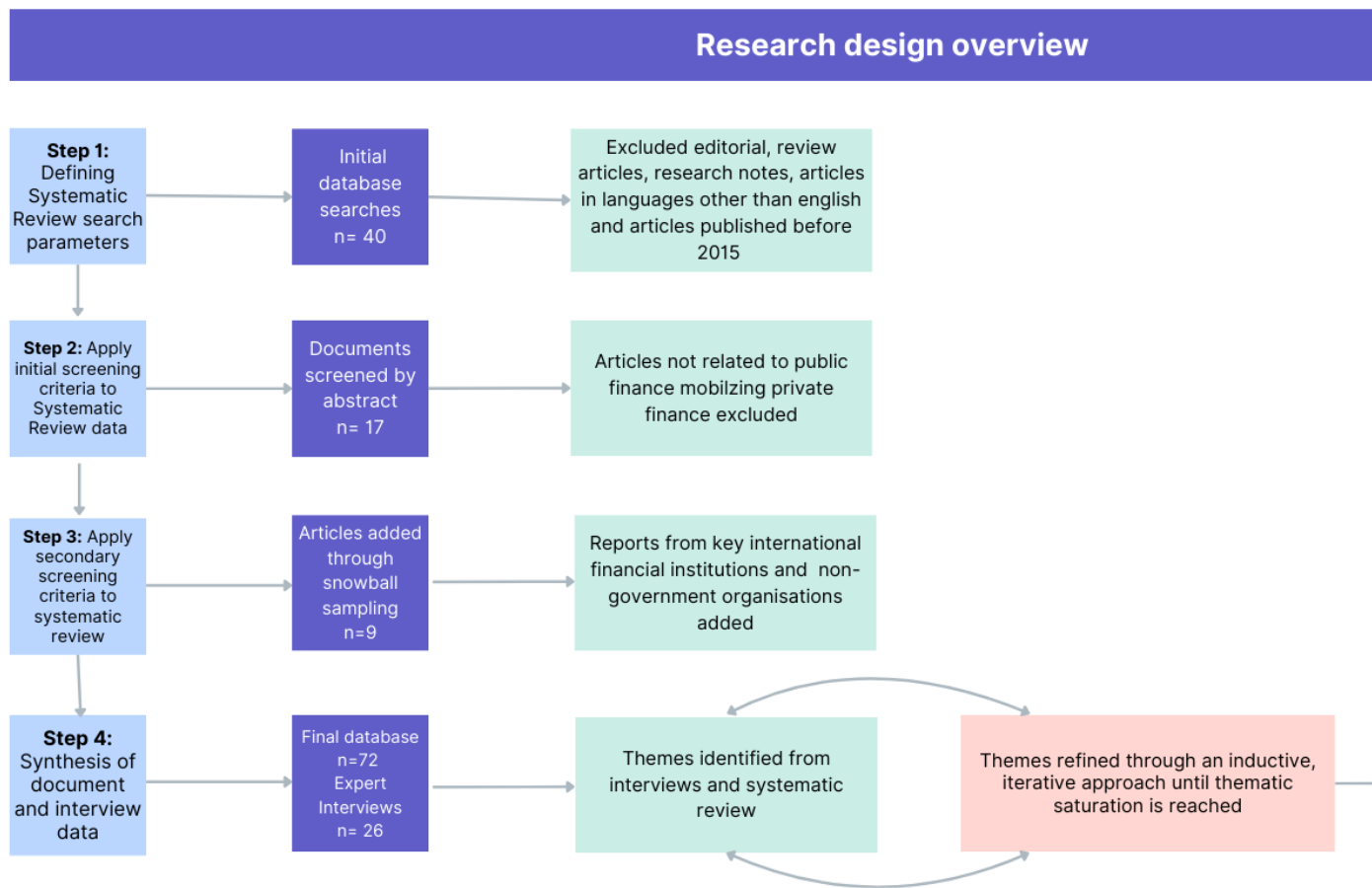
I took an inductive, qualitative case study approach with the scope of the study, considering Fiji (see section 6.2.1) while drawing implications for other PICs. I explore three options for deploying different models of green bank governance in Fiji: as a new standalone institution, as a new investment function within the Fiji Development Bank or as direct sectoral budget support contingent on embedding more climate finance advisors within the climate change divisions of the Fiji Government.

I apply feminist methodology (Ahmed, 2017) as an approach to understanding perceptions of barriers to climate finance investment. Ahmed sees citations as sources of weight and power, noting, “Citations can be feminist bricks: they are the materials through which, from which, I create our dwellings” (Ahmed, 2017, p. 16). Methodologically this can be applied to analyse how Pacific Island authors characterise investment barriers to climate finance versus other

authors. Doing so provides insights into locally led perceptions for scaling up climate finance in Fiji.

I began by undertaking a systematic literature review to understand barriers to accelerating the provision of climate finance in Fiji and PICs more broadly. I then conducted 42 expert interviews with current and former green bankers, Fiji Government officials, non-government climate finance experts and climate finance experts (more detail in section 6.2.2). The interviews explored the current state of climate finance in Fiji and the political economy of the three green bank models detailed in this chapter. Finally, I analysed the findings from these two stages using an iterative, inductive, feminist approach to explore key themes in more detail. These stages are described in the following sections and Figure 6-1 illustrates the overall process.

Figure 6-1 Overview of methodological approach



Source: Author's summary

6.2.1 Case overview

Fiji is an archipelago, consisting of more than 300 islands, with a population of 924,150 (Our World in Data, 2024). As a SIDS, Fiji is vulnerable to sea level rise, inundation and natural disasters that are exacerbated by climate change, including cyclones, flooding and drought (Samuwai et al., 2019). Fiji's annual CO₂ emissions are just over one million tonnes, negligible by global standards (GCP, 2023). While Fiji is a middle-income country, almost one-third of its population live in poverty (IRENA, 2017). Electricity access is almost universal in urban areas, but just over 80% in rural areas (Samuwai et al., 2019).

Fiji's electricity sector is primarily comprised of hydropower and imported diesel, with very limited renewable energy penetration (IRENA, 2017). There have been periodic efforts to increase competition and regulate electricity tariffs in Fiji over the past two decades with varying degrees of success (Dornan, 2014). Fiji's electricity sector is dominated by state-owned enterprise Energy Fiji Limited (EFL). EFL is majority owned (51%) by the Fiji Government, with another 44% purchased by Sevens Pacific (owned by the Japan Bank for International Cooperation and Chogoku Electric Power Company) in 2021. The remaining shares of the company were issued to domestic customers on the South Pacific Stock Exchange (ADB, 2023).

Fiji committed to reducing CO₂ emissions from the energy sector by 30% of business-as-usual emissions by 2030 and to reach close to 100% renewable energy power generation (grid-connected) by 2030, thus reducing an expected 20% of energy sector CO₂ emissions compared to a business-as-usual scenario (Republic of Fiji, 2017). Previous modelling has demonstrated that scaling up renewable energy investment in Fiji could decrease electricity generation costs (depending on the technology deployed) while enhancing energy security (Dornan & Jotzo, 2015). But overcoming barriers to new renewable energy investment and deployment in Fiji is proving challenging, as discussed further in section 6.3.1.

6.2.2 Expert interviews

Of the 65 interviews conducted for this dissertation, 39 are drawn upon in this chapter. I conducted expert interviews with Pacific climate finance experts, development bank staff, current and former green bank staff, clients and co-financiers, public servants and diplomats between December 2021 and November 2023 (a list of participants is available at Table 1-3). I sought interviewee views on the barriers to mitigation and adaptation investment in the Pacific and on the climate finance architecture in the region. The interviews were one hour long and semi-structured with open-ended questions. Ethics approval was obtained before the

interviews commenced (ANU HREC Protocol 2021/279). Consent processes included asking whether participants were happy to be identified by name or if they preferred to be anonymised at the level of organisation or position. Participation was voluntary and no financial incentives were provided. Interviewees were selected using my network of colleagues (I have been a climate change policy practitioner in the Australian Government for over a decade), and snowball sampling of interview participants. Following the interviews, quoted participants were sent a draft copy of the chapter to ensure the accuracy of quotes.

6.2.3 Systematic literature review

In undertaking a literature review for this chapter, I sought to create a comprehensive and replicable summary of the state of knowledge relating to climate finance investments in Fiji through a systematic literature review (Sovacool et al., 2018).

I undertook a four-stage process based on Stechemesser and Guenther (2012). In the first stage, I defined the research questions, namely, *What are the current barriers to climate finance investment in Fiji?*, and secondly, *Would a Fiji green bank accelerate climate finance in the region?* In seeking to answer these questions, I hope to provide insights into the state of knowledge concerning barriers to climate finance investment in Fiji, the feasibility of the green bank model and implications for other SIDS.

The electronic research database Scopus was used to identify relevant studies for stage two. Four search strings relating to climate finance, climate justice and Pacific Islands were used (see Box 6-1), which produced 40 articles. In the next stage of the review, I screened the articles for relevance and to remove duplicates; 17 articles remained. The Scopus search did not capture reports published by multilateral, bilateral or national institutions working on climate finance in Fiji or the Pacific, nor did it capture thinktank analyses. Another nine studies were added using reverse snowballing sampling and sourcing grey literature. The final literature database of 26 articles is available online (Lyons, 2024).

Box 6-2 Scopus search strings used for literature review

(TITLE-ABS-KEY ("climate finance") AND TITLE-ABS-KEY (Fiji) AND PUBYEAR > 2015

(TITLE-ABS-KEY ("climate finance") AND TITLE-ABS-KEY ("Pacific Island*") AND PUBYEAR > 2015

(TITLE-ABS-KEY ("climate justice") AND TITLE-ABS-KEY ("Pacific Island*") AND PUBYEAR > 2015

(TITLE-ABS-KEY ("climate change") AND TITLE-ABS-KEY ("Pacific Island") AND TITLE-ABS-KEY ("investment") AND PUBYEAR > 2015

Source: Author's summary

In stage three, a review protocol was developed (see [Appendix B](#)) to undertake the content analysis of the publications. This built upon the bibliographic content captured by Scopus (Lyons, 2024) to capture the purpose of the study: the barriers to accelerating climate finance and enhancing climate justice in Fiji and PICs more broadly. I coded the literature and developed a database of key information extracted from research articles including the method (qualitative/quantitative/mixed etc.), research question/s, original contributions, and thematic scope (key conclusions, regional scope) This was an iterative process, with shifting institutional classifications based on the systematic review and expert interviews. Step four of the systematic review, 'synthesising findings', is discussed in the next section.

6.2.4 Synthesis of expert interview and literature review data

Document and interview themes were identified via a qualitative content analysis. I compiled a list of each barrier identified per article through the literature review and then sought to compare these categories with barriers identified in the expert interviews. Interviews were recorded and transcribed, with the permission of participants, to allow for this thematic coding. Keyword searches were undertaken, including the words "barrier", "difficulty", "capacity", "gap" and "access". The primary and secondary data was coded using NVIVO and investment barriers were refined and grouped into key categories alongside views on different institutional models.

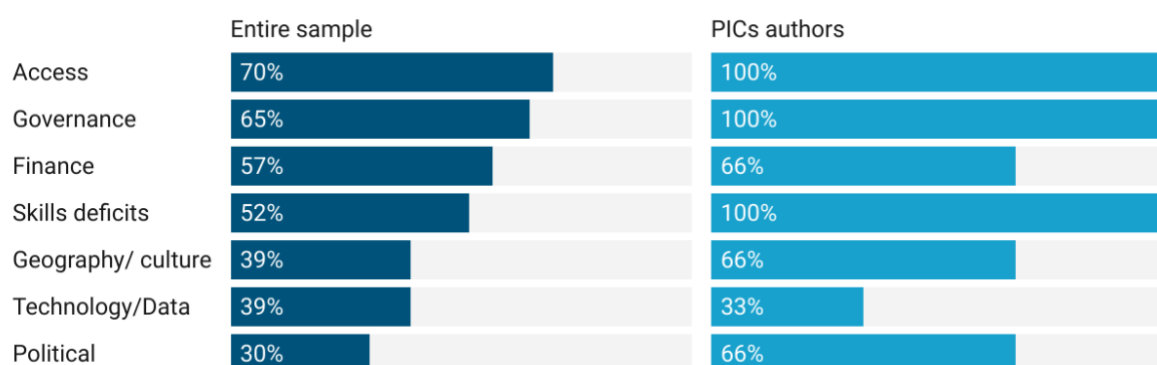
6.3 Results

6.3.1 Barriers to climate finance investment in Fiji

This section discusses my first research question, namely: *What are the current barriers to climate finance investment in Fiji?* Through the expert interviews and systematic literature review, seven key types of barriers emerged: access barriers, governance issues, finance barriers, skills deficits, geographic barriers, technology/data gaps and political barriers. A count of the number of times these barriers were recorded in the systematic literature review, comparing the full sample of authors versus PIC lead authors, is below in Chart 6-1 below.

Across all categories PIC authors identify more barriers to finance compared to the overall sample. Each of these barriers is discussed in more detail in the following subsections.

Chart 6-1 Count of barriers to scaling up climate finance in Fiji from systematic literature review, entire sample versus Pacific Island country (PIC) authors



Source: Author's summary

6.3.1.1 Access barriers

Both the systematic literature review and expert interviews identified access to climate finance as a key barrier facing PICs, including Fiji. A recurring theme was the complexity in accessing existing forms of climate finance offered by international public financial institutions. Each institution has its own process for accessing finance and the administrative requirements of these processes are a huge disadvantage for SIDS like Fiji with their small populations, compared to larger developing countries like Indonesia. Some multilateral institutions, like the GCF, required organisations to become accredited entities before being able to access significant finance (GCF, 2021). Only five organisations have been accredited to the GCF in the Pacific (Samuwai, 2021). This lack of coordination and streamlining was cited as a significant issue in slowing the flow of climate finance to the region (Bracking, 2015; Hammersley et al., 2023).

Lack of access to capital beyond climate finance was also recognised as a key issue. At present, PICs are among the most aid-dependent countries in the world (Hammersley et al., 2023). Fiji has a very limited pool of domestic capital, and the tourism sector contributes to around 30% of GDP. Ratings agencies regard its government capacity to meet its financial obligations as vulnerable to adverse business, financial and economic conditions (S&P Global Ratings, 2024). For example, Standard and Poor's rate the Fiji Government B+ with a stable outlook. Shallow domestic capital markets make financing renewable energy projects very challenging, and Fiji is dependent on climate finance to implement its net zero transition. One

respondent noted that the only entity with access to substantial capital in Fiji was the Fiji National Provident Fund, the national superannuation fund, but their investment mandate made it difficult to invest in renewable energy or adaptation projects (expert interview 55, September 2023). Several interviewees highlighted the need to strengthen domestic capital markets, and this was highlighted as an important means of scaling up climate finance and showing international investors the commercial viability of projects.

Beyond finance, access to land for renewable energy developments was identified as another important barrier to investment in Fiji and PICs more broadly: 90% of Fijian land is iTaukei, that is, it is communally owned and governed by custom (Anantharajah, 2019). This means land cannot be transferred to developers; they must gain a lease, which is a lengthy process and discourages project development.

6.3.1.2 Governance barriers

Fiji faces a complex range of governance barriers to accelerating climate finance investment. Private sector energy investment in the electricity sector is nascent, with only one power purchase agreement having been signed by EFL to date, for a 5MW grid-connected large-scale solar plant in Dratabu, Qeleloa (ADB, 2023).

The expert interviewees also highlighted significant challenges in ensuring the right policy and regulatory settings for any green bank-style investments in Fiji. For example, as one green banker noted, if they were seeking to develop a large renewable energy project:

“I have to create the market. I have to negotiate with government for the right regulations. I have to get ability to charge the right tariffs. I have to go and convince the community to actually use the energy. I even have to create businesses for them to have productive use. It completely changes the process of doing that and private sector developers maybe just aren’t interested.” (expert interview 27, 4 August 2022)

One government official working on blended finance renewable energy investments in the Pacific was more blunt, noting: “I eat risk for breakfast” (expert interview 40, 4 January 2023).

6.3.1.3 Finance barriers

In addition to accessing finance, a broader range of financial barriers exist around climate finance investments seeking to mobilise additional private sector investment in Fiji. Firstly, funding needs for adaptation are high (UNEP, 2023), accounting for between 6.5% and 9% of GDP annually for PICs (Fouad et al., 2021), and there is a lack of bankable projects (Adhikari

& Safaee Chalkasra, 2021). Lack of patient capital for long-lived renewable energy investments was cited as another barrier (Samuwai, 2021). What became clear through the systematic literature reviews and expert interviews was that substantive policy reform and capacity building would be required before private sector investment of any kind could increase in Fiji. As one former green banker currently working the Pacific noted, “there’s a lot of pre work before green investment can be set-up I think in the Pacific” (expert interview 27, 4 August 2022).

Very limited private sector investment occurs in the Pacific, because of the high costs of capital, capacity constraints and limited liquidity (Fouad et al., 2021). The International Monetary Fund (IMF) notes that “Without additional grant-based access to climate finance, meeting the cost of climate adaptation in the PICs will be extremely challenging” (Fouad et al., 2021, p. 62). Public financial institutions are trying to increase the use of blended finance, which refers to “public funds pooled with private funds, largely under private fund management” (Bracking, 2021, p. 261). The public finance component of blended finance can take numerous forms, including concessional debt, guarantees, equity or grant finance. But to date, examples of blended finance in Fiji are very limited, with the Global Fund for Coral Reefs one notable example (SDG Fund, 2024).

Like many PICs, Fiji also faces significant currency risks, when it borrows money through international financial organisations to fund low-carbon, climate-resilient projects. This risk stems from currency mismatches where assets and liabilities are denominated in different currencies that are sensitive to the exchange rate. Currency mismatches typically occur when borrowers use overseas markets, either because there is insufficient local capital, loan terms in the local market are too short or borrowing offshore offers lower cost of capital (Hoschka, 2005). One Fijian expert noted, “I constantly ask if they can lend in local currency but only the Green Climate Fund is because of our constant pushing” (expert interview 56, 16 November 2023).

6.3.1.4 *Skills deficits*

All the expert interviewees cited skills and capacity issues as key barriers to scaling up climate finance investment in Fiji. Skills gaps exist in areas where significant new infrastructure investments need to be made, both in terms of mitigation (e.g. electricians for installing solar PV) or construction workers to build roads which can withstand storm surges. A key issue noted by interviewees was that these skills are increasingly in demand worldwide and so as

soon as new cohorts were trained in Fiji, they often migrated to countries with higher wages to better support their communities and families (expert interview 55, 10 November 2023).

Another related issue is that of capacity. While Fiji is one of the largest PICs in terms of GDP, its population is still smaller than many major cities, and it is struggling to absorb the additional strain climate change is placing on its public service, business and non-profit sector. Most staff across organisations are having to meet climate change priorities in addition to other functions of their roles which are focused on economic development or broader sustainability issues. This leaves limited time to focus on their climate work and limits their effectiveness.

Consultants are widely used in Fiji and PICs to deliver climate finance projects. This was raised as an issue by one Fijian interviewee, who noted:

“I rely on consultants to come and provide support but in the process we’ve noticed one thing; that it’s not really building the capacity in the organisation because they would come with their knowledge, I would quickly work with them and get it to approval and implementation, but most of the work is done by the consultant, not done by us. Because if I did it and they checked it, then I think I would really be building capacity.” (expert interview 56, September 2023)

This highlights how current climate finance structures do not prioritise locally led development. The IMF notes, “the speed at which capacity can be developed in the region to facilitate direct access to the GCF appears inconsistent with the speed the PICs need to adapt to climate change” (Fouad et al., 2021, p. x). Given the long-term nature of climate change, enhancing skills and capacity in Fiji will be critical to a just transition to net zero emissions.

6.3.1.5 Geographic barriers

Fiji’s geographic isolation is another barrier to accelerating climate finance investments, as it contributes significantly to its high costs of capital (Samuwai et al., 2019). As an archipelago of islands, Fiji also faces barriers to investment in securing climate finance for remote off-grid electricity projects. These face significant logistical and technical hurdles to project completion due to the weight of transporting energy infrastructure and the lack of roads and infrastructure in remote parts of Fiji (Anantharajah, 2019).

Fiji is also facing intensifying physical impacts from climate change which require an increasing proportion of its domestic budget, leaving less room for mitigation and adaptation investments. There have been an increasing number of cyclones in recent years, with Cyclone Winston in 2016 and Cyclone Yasa in 2020 causing widespread damage. Saltwater intrusion from climate

change is affecting crop yields, in some cases almost halving annual sugarcane yields (Komai, 2020).

6.3.1.6 *Technology and data barriers*

Coordination and planning issues related to skills gaps were another significant barrier to investment identified by respondents. Lack of capacity to undertake detailed future electricity demand and grid planning means private investors are unable to properly gauge risks. For example, within the Fiji Government, national emissions projections are overseen by a small team of three staff, among other responsibilities (expert interview 55, 11 November 2023). There is simply not the capacity to undertake detailed scenario planning. This would be a useful area for international cooperation: Australia, New Zealand or other like-minded donor countries could provide support to help build capacity in emissions projections and transmission planning.

6.3.1.7 *Political barriers*

Fiji can be a politically difficult place for foreign investors seeking to scale up climate change investments. For example, recent efforts from a US company to invest US\$55 million in 17MW of onshore wind turbines were stalled when a PPA issued by the Fijian Ministry of Fisheries and Forestry was revoked by the Fijian Competition and Consumer Commission due to failure to adhere to processes stipulated by Fiji's Electricity Act 2017 (Tabureguci, 2024). The fact that a government agency could sign a PPA without the necessary approvals speaks to the governance barriers which exist to scaling up climate finance for renewable energy investment in Fiji. It also highlights the complexity of navigating foreign investment processes and the high transaction costs of risk mitigation for Fijian energy investments.

The regime complexity of the climate finance system is inherently political and favours larger, middle-income countries rather than SIDS. The supply chain of climate finance is skewed in favour of the international intermediaries, which reduces the overall pool of climate finance available for work with climate-affected persons (Bracking, 2015, 2019).

Finally, the power vested in EFL also creates challenges for independent power producers seeking to scale up climate finance investment in Fiji (Anantharajah, 2019, 2021). This has similarities to the barriers presented in the previous chapter with PLN in Indonesia. Assisting reform of SOEs where possible, and circumventing remaining barriers to scale up climate finance, will be imperative to a successful transition in the Indo-Pacific.

6.3.2 Governance options for a Fiji green bank

This section seeks to answer my second research question, *Would a green bank accelerate climate finance in the region?* I seek to provide insights into whether green banks could overcome the investment barriers identified in the proceeding section in ways existing public financial institutions are not able to.

While there was strong interest in the potential of green banks to accelerate investment, there were differing views among respondents about how feasible it would be in a Pacific context. As one interviewee noted, “I’m certainly a fan of the green bank model, but for some countries leveraging existing infrastructure probably makes more sense rather than creating a whole new institution” (expert interview 8, 18 February 2022). Other green bankers were more critical, with one observing that Australia’s green bank “could work in Australia because we have very sophisticated capital markets” (expert interview 14, 17 March 2022). He argued that extending the green bank model within the region warranted careful consideration of whether a green bank was what was needed “or is it something more fundamental, is it a different part of the puzzle that needs addressing” (expert interview 14, 17 March 2022). Others were unequivocal that it is was a missing piece of the climate finance toolkit; “the need for a different kind of institution that can deliver in a focused way is so obvious ... we’ve got this tool; it’s called a green bank” (expert interview 20, 14 June 2022).

All emphasised the need for any model to account for existing barriers to accelerating deployment of climate finance and to adopt a locally led approach, with one interviewee noting “it’s all possible, but definitely local knowledge is key” (expert interview 9, 18 February 2022). Another emphasised the need for additional climate finance, stating: “what climate needs is new money, it needs primary issuance. It needs new capital” (expert interview 20, 14 June 2022). Figure 6-2 provides an overview of key types of international finance institutions in Fiji and the primary and secondary barriers to climate finance they are seeking to address. This analysis led to the development of three different potential governance models for a Fiji green bank, which are discussed in more detail below.

Figure 6-2 Institutional efforts to address barriers to climate finance investments in Fiji

6.3.2.1 Capitalise a Fiji green bank

How existing green banks could be adapted for Fiji was explored through the literature review and in the expert interviews. Most green banks exist in developed markets with significant capital and are focused on making mitigation investments. Fiji, as outlined above, faces a significant range of additional barriers and is focused on adaptation investments, which are generally not commercial. This requires a fundamental reworking of the traditional green bank model, where (as in the case of Australia and New Zealand) the government provides a significant one-off capital provision and the bank is thereafter expected to be profitable. Existing green banks also have access to highly skilled finance sectors; the banking sector in Fiji is far smaller. Nevertheless, slightly more interviewees supported the creation of a green bank-like entity in Fiji than opposed it (see Chart 6-1). Interestingly, support was stronger among climate finance experts than existing green bankers. This is likely due to the domestic focus of existing green banks with most bankers being negative or neutral about the capacity of the green bank model to be deployed in other jurisdictions.

Chart 6-2 Support for a green bank entity in the Pacific

6.3.2.2 *Green bank division within the Fiji Development Bank*

The Fiji Development Bank (FDB) was founded in 1966. The bank is an autonomous statutory body, the operations of which are controlled by a Board of Directors appointed by the Minister of Finance. It provides finance and financial advisory services to assist in the economic development of Fiji through industry sectors including agriculture and commerce. In 2021, the FDB disbursed FJ\$119 million of investments. FDB is increasingly integrating climate change adaptation and mitigation into its investment goals and was the first Pacific entity to be accredited under the GCF. However, at times achieving climate and development outcomes can be incongruous goals (Vakkuri & Johanson, 2021), and there is a need to provide more financial support to the institution if it is to play a more significant role in the provision of climate finance in Fiji.

There are a range of advantages to establishing a green bank division within the FDB compared to a standalone green bank. Firstly, it would mean that the commercial banking sector were familiar with the institution from the outset. Secondly, corporate functions are already established within the FDB. Thirdly, the FDB is already accredited to access finance from a range of existing international financial institutions, which could prove a valuable stream of co-financiers in the Pacific.

6.3.2.3 *Budget support for the Fiji Government contingent upon green bank-style public investments*

The final option would simply be to provide additional budget support to the Fiji Government to append on climate change infrastructure projects and expand public sector expertise and service provision within government. This entails donor countries making direct transfers to the Fiji Government contingent on their development of green bank-style infrastructure investments. Budget support has been used by multilateral development banks (MDBs) for decades (Bazbauers & Engel, 2021). The Australian Government has provided more than A\$580 billion in budget support to Fiji, with A\$86.6 million allocated for the 2023–24 budget year (Wise, 2024). Budget support is the most administratively simple option for donors. It would also provide the Fiji Government with the highest degree of flexibility and sovereignty in

making climate finance investments. It also includes the benefit of the public goods and knowledge spillovers associated with investments largely being captured in-house if the Fiji Government chooses to scale up the public service capability to deliver this project. However, it does come with risks depending on how the budget support is structured. For donors, there are risks around how effectively the funding is used, unless it is coupled with appropriate conditionalities. For Fiji, it is unclear whether the public service would be able to increase its workforce and attract the expertise needed to successfully implement green bank-style projects. There have been examples of MDB budget support resulting in onerous or even negative outcomes (Bazbauers & Engel, 2021). Secondment of experts from existing Green Banks and development of a skilled workforce would be a critical component of these kinds of programs.

6.4 Policy implications

From the three models outlined above it is clear there will be significant challenges associated with funding any form of green bank in Fiji. Overall, most respondents agreed that situating green bank functions within the FDB would be the optimal model for Fiji. Four key principles emerged from systematic literature review and expert interviews for enhancing climate justice through climate finance provision in Fiji, which are outlined in more detail below:

6.4.1 More grant finance is needed

Given its minimal role in contributing to global climate change, the precarious state of government finance, and escalating physical impacts from climate change, any green bank in Fiji should be funded through international climate finance, with a significant proportion of grant-based and blended financing.

A significant one-off donation could be made to a national Fiji green bank, the FDB or through sectoral (budget support) to the Fiji Government. Any Green Bank entity would need periodic funding replenishments to maintain adequate levels of available grant finance.

In addition, any money which is provided for concessional loans to Fiji on this basis should become sovereign Fiji finance, to be reinvested in green bank projects as the Fiji Government sees fit. Adopting this approach would enhance distributional climate justice for Fiji

6.4.2 Projects must be adaptation-focused

Many respondents noted the significant shortfall which currently exists in financing climate change adaptation. It is estimated an additional US\$366 billion is needed per year to

adequately finance adaptation needs (UNEP, 2023). Pacific SIDS only account for 4.6% of adaptation finance in the Asia-Pacific, channelled primarily through grants from bilateral and multilateral donors (Samuwai, 2021). Many of the interviewees highlighted the difficulty in making adaptation projects bankable, and many cast doubt on whether adaptation projects could ever be bankable for private investors, even with significant provision of blended finance. The high transaction costs associated with adaptation projects make them excellent candidates for green bank projects, even though mitigation rather than adaptation projects have been the traditional focus of public Green Banks.

6.4.3 Building skills and capacity in Fiji is critical to the success of Fiji's net zero transition

There also needs to be a significant skills component to the development of any green banking institution in Fiji to address the skills and capacity issues identified in our first research question. Part of the skills issue is ensuring that the Pacific has the requisite number of electricians, energy efficiency auditors, engineers and other occupations required for the transition. Existing international skills programs like the Australia Awards (see Box 6-3), along with partnerships with the University of the South Pacific and the Australia Pacific Training Coalition, provide a strong basis for scaling up investment in Fiji's net zero transition (Australian Government, 2024). In addition, green bankers from Australia, New Zealand and the United States could also be seconded to Fiji to assist in the development of robust organisational processes and to help build an investment pipeline.

However, interviewees noted capacity barriers were a concern with all three green bank models, particularly the establishment of a Fiji green bank. This was due to absorptive capacity constraints among Pacific workforces. As one green banker noted, "you can't create a billion-dollar institution in the Pacific because it can never invest that much just because the project demand isn't big enough" (expert interview 27, 4 August 2022).

Box 6-3 Scaling up climate skills support in Fiji

The Australia Awards is an educational program which has been operated by the Australian Government's Department of Foreign Affairs and Trade since the 1950s. It provides university and skills training for young people around the Indo-Pacific region. The Australia Awards already has a range of short-term programs targeted at climate change. However, there is the opportunity to simultaneously expand and refine this offering to address the significant skills shortages, particularly in PICs.

One such model would be for the Australia Pacific Training Coalition to work with a clean energy skills accreditor, like Australia's Clean Energy Council, to offer skills in energy efficiency, solar or wind project development. Another option would be to work with Australian universities to develop a "Green bank degree" which would provide basics in finance and accounting, along with an understanding of mitigation and adaptation technologies, risk management and ESG. These could be offered to Fiji Australia Award recipients on the proviso that they were required to spend at least as long in a Fiji green bank entity as they term of their scholarship (as is the case with other Australian Government funded scholarships like the Sir Roland Wilson scholarship), ensuring a high quality of institutional capacity and limiting the "Pacific brain drain".

Source: Author's summary

6.4.4 Easier access to finance is critical to building local capacity

Both the systematic review and expert interviews reinforced the need for more locally led climate finance provision. The existing climate finance architecture in the region is complex (Keohane & Victor, 2011). This regime complexity means there are a myriad of mechanisms to increase climate finance operate at multilateral, bilateral, national and subnational levels; however, coordination and cooperation between these mechanisms is often limited (see Figure 6-3). The small populations of PICs mean they have less absorptive capacity to access climate finance than other low and middle-income countries. Transaction costs associated with accessing climate finance can be significant (Samuwai, 2021). Lastly, there are significant legal, planning and skills barriers to investment which need to be addressed. All these barriers make private sector investors hesitant to invest in climate finance projects in the Pacific, primarily because they result in a lack of bankable projects.

Figure 6-3 Selected examples of multilateral, bilateral and NGO/private sector/philanthropic climate finance provision in Fiji

MULTILATERAL CLIMATE FINANCE		
MULTILATERAL FUNDS	MULTILATERAL BANKS	OTHER UN AGENCIES
PRF	WORLD BANK	UNDP
GCF	ABD	UNEP
GEF	AIIB	FAO
BILATERAL CLIMATE FINANCE		
DEVELOPMENT FINANCE INSTITUTIONS	OFFICIAL DEVELOPMENT ASSISTANCE	EXPORT CREDIT AGENCIES
KFW	DFAT	EFA (AIFFP)
AFD	DIFD	USEXIM
DBSA	NZAP	CHINA EXIM
NGO/PRIVATE SECTOR/ PHILANTHROPIC		
CAPACITY BUILDING	INNOVATIVE/ BLENDED FINANCE	PHILANTHROPY
RMI- CFAN	CPI- THE LAB	GATES FOUNDATION
PFAN	PIDG	ROCKEFELLAR FOUNDATION
CLIMATEWORKS	IF-CAP	BLOOMBERG

Several experts highlighted the need to provide targeted technical assistance to PICs to map the energy infrastructure and data requirements of the net zero transition. Previous work has illustrated that electrification projects provided through climate finance have significantly underestimated the electricity demand for rural villages (Anantharajah, 2021). For example, in one rural island where the primary industry was night fishing the level of electrification did not allow for the use of freezers so the fisherman were not able to freeze and sell their catch to local hotels for higher profit margins. Instead, they were reliant on sales to intermediaries on the wharves.

6.5 Conclusion

Fiji is among the most aid-dependent countries in the world and is also highly vulnerable to climate change impacts. There is a significant gap in the provision of climate finance for Fiji, particularly adaptation finance. Mobilising private finance for climate in Fiji is hugely challenging even if it is highly concessional or packaged as blended finance. While locally led development is often posited as a solution to climate change, within the academic literature there have been limited methodologies which provide a locally led approach. The novel methodology developed in this chapter, underpinned by feminist standpoint theory and comparative analysis of Pacific Island expert views compared to international experts, provides a new approach to consider locally led priorities for more just provision of climate finance. Through a systematic literature review and 39 expert interviews with current and former green bankers, government officials and climate finance experts, I identified climate justice issues within seven key barriers to mobilising additional private sector investment, namely access issues, governance and policy hurdles, finance barriers, skills and capacity challenges, technology and data gaps, challenging national circumstances, and political barriers. In this chapter, I have argued there is a need for new, more just forms of climate finance and that green banks provide a promising pathway for building capacity for more locally led climate finance provision in Fiji. Of the three governance options identified, the FDB presents the best option for embedding Green Bank functions in Fiji.

Chapter 7 Does the Indo-Pacific need a multilateral green bank?

This chapter is adapted from a research report released in October 2024 by the Lowy Institute for International Policy and co-authored with Roland Rajah and Grace Stanhope.

Seventy years ago at Bretton Woods, leading thinkers gathered to design an international financial architecture capable of building a better world. But the current global geopolitical landscape has evolved far beyond the postwar period. Intensifying climate change, stalling poverty reduction, economic insecurity, high levels of public debt, rising costs of living and great power rivalry are all contributing to a more uncertain, fragmented world. The work of the IMF, World Bank and other public financial institutions has never been more important, or more difficult. Yet the financial institutions borne from Bretton Woods were not designed to simultaneously solve these modern challenges.

Once again there is an opportunity to reshape the international financial architecture to create a more secure, sustainable and resilient world. Calls for reform, particularly among the MDBs, are growing louder as global investments to deliver global public goods, including climate and development goals, continue to fall well short of what is required (Bhattacharya et al., 2023; IEA, 2023). China's Belt and Road Initiative (BRI) has sought to fill part of the financing void, but has so far overpromised and underdelivered (Dayant & Stanhope, 2024), while increasing the public debt burden of many of the most vulnerable countries across the Indo-Pacific (Cooray, 2023; Dayant & Duke, 2024; Duke, 2024). Like-minded allies are yet to provide additional finance to offer a credible alternative to BRI infrastructure finance.

In this chapter, I argue part of the solution to closing the global financing gap for climate change and development is capitalising a new kind of multilateral bank in the Indo-Pacific. My proposed Indo-Pacific Green Bank (IPGB) would be fundamentally different to the existing architecture in three ways. Firstly, it is designed to fill a multilateral economic security governance gap, setting it apart from other development, climate or trade-focused public institutions in the region. The bank would support the diversification of net zero supply chains, (including the critical minerals required for EV production) to dilute Chinese dominance of these sectors. Secondly, the bank would seek to multilateralise industry policy among like-minded Indo-Pacific partners, to maximise public and private goods through the net zero transition. This is necessary to meet net zero goals as quickly as possible. It would require the bank to take the different approach to existing institutions, which create markets through economic and institutional reforms in recipient countries alongside provision of key infrastructure projects. Instead, it would seek to finance net zero infrastructure at scale to catalyse new industries and

markets. This would require an initial focus on mitigation projects which are bankable, in contrast to the majority of adaptation projects. Finally, it would embed knowledge-sharing frameworks from green banks and set new transparency benchmarks compared to existing public financial institutions. This would help to create a more nuanced understanding of sectoral risks and help to lower costs of capital across the region.

In this chapter, I argue there is an opportunity to create a new kind of multilateral green bank in the Indo-Pacific. The bank would set new benchmarks for transparency and knowledge sharing, and most importantly, would strengthen multilateralism and enhance economic security in the Indo-Pacific among like-minded partners.

7.1 Enhancing economic security through multilateral finance

There is a well-documented financing gap which lies at the heart of delivering a range of global public goods, including climate change and development outcomes. Latest estimates suggest additional global investment of US\$4.5 trillion per year is needed to transition to a net zero energy system, alleviate energy poverty and keep the 1.5°C temperature goal of the Paris Agreement in reach (IEA, 2023). Emerging markets and developing countries outside of China are estimated to need an additional US\$1.8 trillion of investment a year by 2030 for climate and nature-related investments, with a further US\$1.2 trillion for other sustainable development priorities such as in health and education (Bhattacharya et al., 2023). The provision of climate finance from developed to developing countries will be crucial to the success of the net zero transition. Adequate climate finance provision is also vital to the legitimacy of the Global North, which failed to meet the US\$100 billion per year climate finance goal set in Copenhagen by 2020². Similarly, international development finance plays a critical role in increasing investment beyond what can be delivered by developing country governments and their capital markets.

One oft-positing pathway to closing this financing gap is to use public finance to mobilise additional private finance for global public goods. A range of public green banks have been very successful at doing this for climate change mitigation at the national level; Australia's Clean Energy Finance Corporation (CEFC), the world's largest and longest-running green bank, has invested A\$12.7 billion over its lifetime to mobilise A\$36.1 billion of private sector investment. But to date, the market-creating and shaping roles of green banks have been limited in developing countries in South-East Asia or Africa, whose decarbonisation is crucial to a successful net zero transition. The establishment of the African Green bank Initiative at

² While climate finance accounting frameworks are debated, the OECD calculates this goal was met in 2022.

COP27 is an important first step in seeking to broaden the role of green banks to key developing markets (African Development Bank, 2024).

While global capital exists to close this financing gap, there has been a persistent failure to reallocate this capital as needed (OECD, 2017a). This challenge is made complex by high levels of public debt in nearly all countries following the Covid-19 pandemic. The political economy of increasing aid budgets and development finance is challenging for donors, while the needs of recipient countries are genuine and increasing.

Further, in recent years, state actors have become increasingly nationalistic; focused on enhancing economic security and domestic resilience to global supply and demand shocks. Economic security is a nebulous term. Traditionally, it has described the use of economic instruments by states to exercise power (Baldwin, 1997, 2020), through carrots, sticks (Mitchell, 2023) or “weaponized interdependence” (Farrell & Newman, 2019). In this chapter, I am focused on how multilateral frameworks could implement economic security measures to enhance state resilience to economic and geopolitical shocks (Roberts, 2023). In doing so, I agree with the view that national interests are underpinned by security, prosperity and social cohesion (de Brouwer, 2021) and argue multilateral institutions must increase efforts to achieve global public goods.

Industrial policy is undergoing a global resurgence as countries seek to capture new markets emerging from the net zero transition while competing with the domestic subsidies offered through the US Inflation Reduction Act, China’s Made in China 2025 initiative, the EU Net-Zero Industry Act and others. The rise of industrial policy is a demonstration that governments are willing to divert additional expenditure towards achieving economic security. But the additional investment generated through green industry policies is at risk of being offset by an increasingly fragmented global trade system, beset with tariffs and other punitive measures. Since 2020, almost four times as many harmful trade policy interventions than liberalising measures have been introduced globally (Global Trade Alert, 2024).

Within Western democracies, China’s dominance of critical mineral and clean energy supply chains is viewed as a threat to economic security. China dominates mid and downstream global EV battery supply chains (IEA, 2024b) and has a monopoly over the processing of many rare earth elements. For these states, diversification of Chinese clean energy and critical mineral supply chains is vital to building resilience to supply shocks and safeguarding their long-term economic security. Conversely, economic security concerns in many developing countries are often human-centred (Nesadurai, 2005) and focused on how they can enhance

energy security (Seah & Huda, 2024) and stimulate economic growth through the creation of new domestic manufacturing industries to meet their development goals.

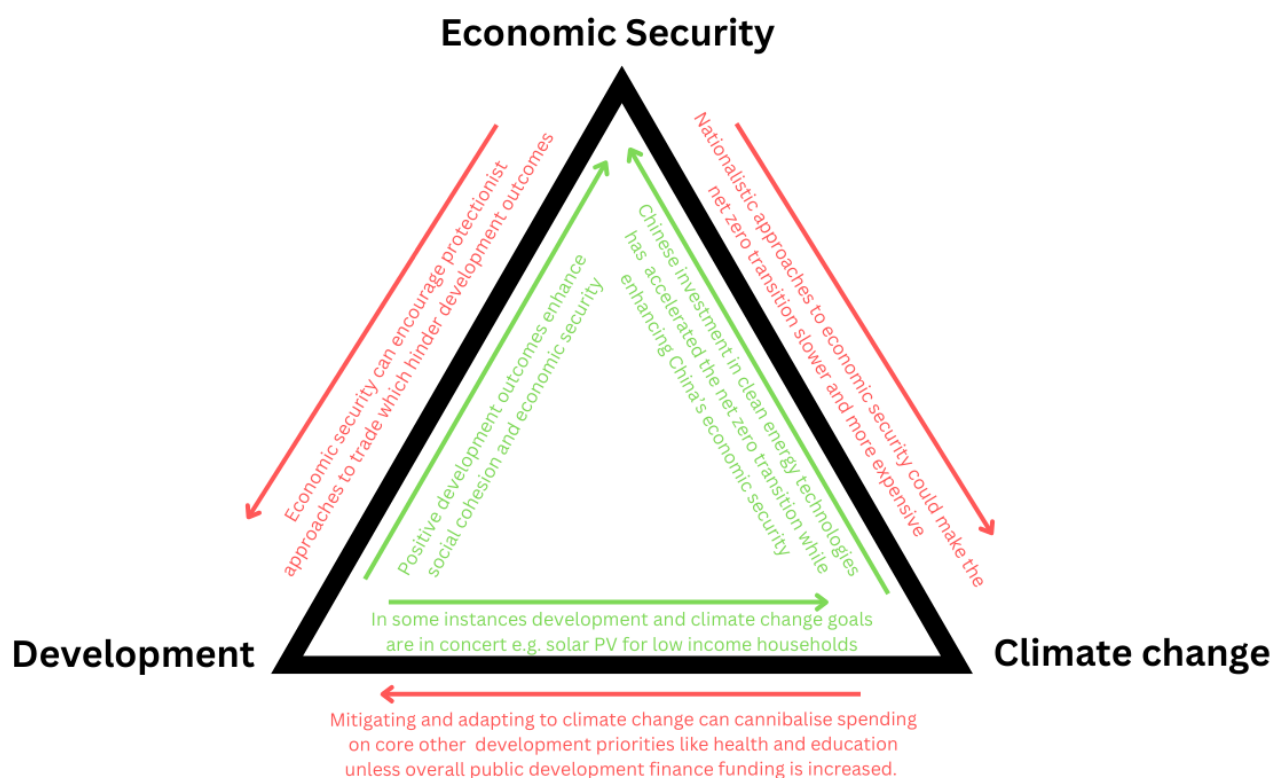
At present, policy debates are mostly focused on advancing economic security at a national level, using bilateral or domestic mechanisms, with (at best) a zero-sum mentality. Adopting a multilateral economic security approach is preferable to relying on great power competition to build these sectors in a way which exacerbates structural disadvantage for poor countries. But economic security also needs to be enhanced at the multilateral level and elevated beyond national security to a shared or transnational goal, akin to development or climate change, to facilitate more effective and efficient coordination and mobilisation of collective resources.

This requires solutions which appeal to both developed and developing countries in the region. It also requires an investment focus which sits outside the “high fence” of national security industries (Sullivan, 2023). Investments focused on achieving climate and development goals provide adequate scope for deepening regional relationships while meeting these requirements.

The expansion and diversification of net zero and critical mineral supply chains provides a pathway to enhancing multilateral economic security in the Indo-Pacific. But existing international financial institutions are not designed to operate at the nexus between economic security, climate and development. And nor should they; they have other important functions. But there is a need for a new kind of multilateral financial institution which creates complementarities between economic security, climate and development goals in the Indo-Pacific rather than trading off between these objectives (see Figure 7-1).

In this chapter, I seek to answer the following research question: *Is there a need for a new multilateral bank in the Indo-Pacific?*

Figure 7-1 Complementarities and trade-offs between economic security, climate and development



Source: Author's summary

The following section discusses the current state of public finance provision in the Indo-Pacific, and the opportunities to enhance the international financial architecture in the region.

7.2 The public finance landscape in the Indo-Pacific

Indo-Pacific countries³ are home to over 2.5 billion people and account for 40% of global GDP and 28% of global goods trade (USTR, 2023). The region is expected to grow to almost 3 billion people by 2050. This growth will underpin large increases in energy demand, which will be a significant challenge to manage, especially for developing countries that need to decarbonise their existing fossil fuel energy supply while adding new capacity. No country has ever transitioned to high-income status while reducing emissions (World Bank, 2023). Yet, the voices of developing countries in the Indo-Pacific are under-represented in key multilateral financial institutions in the region.

³ While there are varying definitions of the Indo-Pacific encompassing the countries bordering on the Indian and Pacific oceans, in this paper we conceive the Indo-Pacific as stretching from South Asia through South-East Asia and the Pacific to the United States.

At present, financing the net zero transition is off track across the Indo-Pacific. Renewable energy installations in South-East Asia are languishing, with electricity capacity growth forecast to be 63.1GW over the next five years, well below the estimated 229GW of new wind and solar required in the region to keep the net zero target underpinning the Paris Agreement alive (Setyawati, 2023). Pacific Island countries, on the front lines of climate change, are unable to secure the adequate climate finance. Even the United States, with trillions of dollars of capital flowing from the Inflation Reduction Act, is not on track to meet its 2030 emissions reduction target (Larsen et al., 2023).

Accelerating investments in net zero industries is highly complex and countries face a range of barriers (Granoff et al., 2016). Infrastructure investments are generally challenging to fund because they are illiquid assets, they are expensive and they deliver public goods, which the private sector is reluctant to pay for. Delivering infrastructure projects in developing countries adds more layers of complexity, due to high levels of public debt, poor credit ratings, exchange rate risks, governance issues (including difficult business environments, corruption and unstable political environments), legal and regulatory barriers (detering or blocking private investment or preventing economic cost recovery) and the low capacity of developing countries to offer adequate financial returns for investment. The existing development banking architecture was created to offer both financial and technical assistance to overcome these barriers.

But net zero industries face a range of additional barriers compared to other public infrastructure or development investments (Gillingham & Sweeney, 2010). These barriers include high upfront costs (for renewable energy technologies like solar and wind), information barriers, unpriced negative externalities, lack of political will to reform SOEs, and issues with existing technology lock-in. They also require high levels of innovation funding and transparency around energy supply and demand requirements. In short, they require both public finance and specialist clean energy technical support to accelerate investment. This goes some way to explain why institutions traditionally focused on development outcomes, such as the MDBs and development finance institutions (DFIs), have struggled to scale up their climate change investments.

Skills and capacity issues are also increasingly important barriers to deploying climate change finance(Martinez- Fernandez et al., 2010). Ensuring equitable knowledge spillovers and technology transfer, along with investments in skills and capacity building, must be a far larger focus of climate and development finance in the region.

The following sections illustrate how the existing public finance landscape does not provide the scale of climate and development finance required, or address economic security in a coordinated, coherent manner.

7.2.1 Multilateral development banks

At the heart of the international financial architecture in the Indo-Pacific are the largest MDBs, namely the World Bank, Asian Development Bank (ADB) and Asian Infrastructure Investment Bank (AIIB). Core to their success is their cost-effective model for delivering development outcomes. This efficiency stems from two key features of MDBs: their preferred creditor treatment (Humphrey, 2015; Perraudin et al., 2016), which allows them to borrow more cheaply from international capital markets than other financial institutions, and their investment model of leveraging relatively modest volumes of paid-in capital, guaranteed by larger volumes of callable capital (Humphrey, 2024), into large-scale lending via international capital markets. For example, with US\$19.2 billion of paid-in capital, the World Bank has been able to provide more than US\$750 billion in loans over its lifetime (Léautier, 2023). MDB provision of concessional finance, alongside their capacity building, policy advice and project preparation support, is vital to ensure continued development progress in low and middle-income countries.

Despite these strengths, MDBs are facing increasing calls for reform. While the MDB model has been efficient and effective, MDBs have struggled with unrealistic expectations of scaling their climate finance provision from billions to trillions of dollars per year in the years following the Paris Agreement. At present they only mobilise US\$0.6 of private capital for every dollar of MDB investment (Summers & Singh, 2023). The MDB model, underpinned by developing the economic structures and institutions to support market creation supplemented with infrastructure project finance, is highly unlikely to scale clean energy industries in the timeframes required to limit the worst physical impacts of climate change. Further, borrowing countries with fragile institutional capacity are burdened by bureaucratic processes, and at times excessive conditionality measures, especially on loans.

The most obvious avenue for MDB reform, a substantial general capital increase, is highly fraught due to geopolitical concerns held by the current major shareholders – the United States and Europe – over the voting influence that a capital increase would offer China at major MDBs (Morris et al., 2021). Other MDB reform options include greater use of callable capital and/or guarantees, issuance of a hybrid capital non-voting asset class, deployment of an originate-to-share model, incorporation of vulnerability into funding eligibility criteria, and introduction of

climate resilient debt clauses (explained in more detail in Appendix D). None of these options will deliver the step change in funding required.

Developing countries have long held concerns with the governance of many MDBs, heavily concentrated in wealthier countries and enforcing a power imbalance where they are under-represented. For example, India accounts for a mere 3% of voting power in the International Bank for Reconstruction and Development (World Bank, 2024). MDBs have also faced scrutiny in relation to the proportion of funding awarded to Western project teams and Chinese construction consortiums, both of which decrease the proportion of funding for locally led development.

Enhancing transparency to provide the private sector with a more nuanced understanding of market pricing drivers and individual components of investment risk is critical to increasing MDB climate finance investments. MDB efforts to enhance transparency through the Global Emerging Markets risk database have been progressing slowly (Mathiasen, 2023). This speaks to a broader issue of bureaucratic inertia within the largest MDBs. Finally, it is important to note that increased MDB spending on climate and energy projects will incur trade-offs within other crucial development areas, such as health or education, without more effective screening and evaluation of investments and/or a capital increase, a cause of significant concern for existing MDBs.

Overall, transformative reform of MDB funding, governance or transparency seems unlikely to solve climate and development funding challenges in the Indo-Pacific, or indeed globally. Newer institutions, including AIIB and the New Development Bank, have largely conformed to the World Bank template, replicating its challenges as much as its successes.

7.2.2 Export credit agencies

Export credit agencies (ECAs) are increasingly influential public financial actors in the Indo-Pacific. They are opaque institutions, which provide limited public information on their transactions, that are primarily focused on advancing trade interests through their investments. ECAs are traditionally national bodies, most often in advanced industrialised economies, which provide public financial support in the form of loan guarantees, insurance, or direct financing to mobilise additional private sector investment (Peterson & Downie, 2023). There are over 100 ECAs worldwide, and they mostly operate bilaterally (USEXIM, 2021). At their best, they provide a foundational link between domestic economic outcomes and foreign development outcomes, including enhancing economic security through supply chain management.

China, Japan, Korea, the United States and Australia all use their ECAs to provide something adjacent to development finance, especially for infrastructure finance in middle-income countries (Peterson & Downie, 2023; Shishlov et al., 2021). In recent years, Australia has provided A\$6 billion to its ECA, Export Finance Australia, for infrastructure financing facilities in the Pacific and South-East Asia, with a strong climate and development focus but very limited transparency of project outcomes (Grenville, 2024; Keen, 2023). ECA-backed deals tend to be large-scale infrastructure projects with long-term completion timetables that are central to the importing government's development agenda. ECAs are trade-focused and can facilitate vital access to capital in developing markets, especially where banking and financial systems are nascent. While private investors can tend to be cautious of SOEs due to perceptions of inefficiency and corruption, ECAs as publicly owned institutions are particularly well-equipped to use SOEs and leverage government-to-government links to reduce risk.

ECAs have been criticised for contributing to developing country debt burdens and facilitating the diversion of aid budgets to donor country trade and finance purposes (ADB, 2020). They have played a key role in financing fossil fuel assets following the Paris Agreement and increasing developing country stranded asset risks (Hughes & Downie, 2023; Shishlov et al., 2021).

Global governance of ECAs is limited, based on an informal agreement between a club of OECD countries (OECD, 2023). The OECD Arrangement dictates repayment terms, premium rates and interest rates, seeking to provide a framework for the orderly use of officially supported export credits to avoid a "race to the bottom" whereby states subsidise their own export credits to improve the competitiveness of their exporters. However, given its highly irregular form and exclusive membership, large providers of export credits – most notably China – operate outside the OECD Arrangement, weakening the incentives for its own members to abide by its non-binding rules (Hopewell, 2020). Attempts to integrate China into the OECD Arrangement have been unsuccessful, and an International Working Group has made no meaningful progress towards establishing a more formal, inclusive and transparent global governance regime for ECAs.

7.2.3 Green banks

A range of public green banks operate nationally or sub-nationally in the Indo-Pacific seeking to mobilise additional private finance for clean energy investments. These include national green banks like the CEFC and NZGIF and subnational banks like NYGB and MCGB. India's Tata Cleantech capital is an example of a hybrid national green bank in a developing country

market (Green Bank Network, 2018). Their narrow investment remit has allowed them to target net zero investment barriers successfully. They are effective at mobilising additional private finance for climate change where other public financial institutions like MDBs have struggled, particularly for energy efficiency investments. For example, the CEFC has committed A\$3.53 billion for energy efficiency measures from 2015 to 2022 (CEFC, 2015, 2022a). Existing green banks also provide lessons about how to scale investment in new renewable energy industries.

However, green banks are still a nascent form of institution and mostly operate in advanced, liquid financial markets, with virtually no use of grant finance. They face significant additional challenges in achieving their goals in developing countries, unless they greatly scale up their project preparation and capacity building functions. In the Pacific, they would struggle to operate, with a lack of bankable projects (expert interviews 25, 27, 39, 46). While green banks do not operate multilaterally, there would be benefits in taking their best elements, that is, their focused investment remit, catalytic investment function, transparency and knowledge-sharing obligations, and embedding them in a multilateral bank.

7.2.4 Other public finance provision in the Indo-Pacific

A range of other international financial institutions provide climate and development finance in the Indo-Pacific. The most important of these, the Green Climate Fund, plays a key role in the provision of adaptation and grant finance, but it has been beset with governance issues since its inception and has struggled to deploy finance rapidly (Bracking, 2015; Hammersley et al., 2023). DFIs are also active, but, like ECAs, have been criticised for their lack of global governance weak transparency (Tan, 2019) and provision of finance for fossil fuel projects following the Paris Agreement (Edianto et al., 2022).

Finally, the Indo-Pacific also has a range of ad hoc climate and development finance measures which sit outside formal institutions. The Just Energy Transition Partnerships signed with Indonesia (\$US20 billion) and Vietnam (\$US15.5 billion) seek to use a mix of government and private finance to reduce these countries' dependency on coal and scale up renewable energy investment. The Private Infrastructure Development Group administers the Indo-Pacific Economic Forum (IPEF) Catalytic Capital Fund, which aims to foster several billion in private sector investment. The G7's Partnership for Global Infrastructure and Investment has made some clean energy investments in the Indo-Pacific. The Quad – the diplomatic and security partnership between Australia, the United States, Japan and India – is increasingly focused on the provision of global public goods, including climate and development outcomes. There are

a range of other minilateral initiatives canvassing climate and development outcomes in the pursuit of enhancing regional security (Australia/Japan/United States, Japan/United States/Philippines). But none of these initiatives are Indo-Pacific focused, operate at the multilateral level or operate at the scale needed. They are also failing to build the institutional capability needed to accelerate the transition throughout the region.

Overall, the Indo-Pacific lacks the necessary finance, technical support and broader institutional capability needed to meet climate and development goals. Piecemeal initiatives are not working to scale investment; countries need to think bigger. MDBs have the most economically efficient model for mobilising concessional capital, but they need to enhance transparency around project risks and make finance provision contingent on knowledge sharing as some green banks have done.

7.3 Creating a multilateral bank for the Indo-Pacific

The existing international financial architecture is not adequately resourced to close the climate and development finance gap in the Indo-Pacific. Ambitious institutional reform of MDBs is unlikely in the current geopolitical environment. ECAs lack adequate global governance and have historically been the most recalcitrant of financial actors to embrace the net zero transition. Green banks are nascent and lack the necessary scale of bilateral or multilateral institutions. There is a global governance gap when it comes to enhancing economic security at the multilateral level in the Indo-Pacific (see Figure 7-2). The path forward is envisaging a modern Indo-Pacific Green Bank (IPGB) which builds complementarities between economic security, climate and development through its investments.

Figure 7-2 The multilateral economic security governance gap

Source: Author's summary

There are a range of existing fora which could accommodate a multilateral bank in the Indo-Pacific including IPEF, the Quad and the Association of South-East Asian Nations (ASEAN). A United States-led initiative with 14 members,⁴ IPEF is designed to support fair and resilient trade, to diversify and secure key supply chains, and to support broader economic development and decarbonisation aims. In contrast, the Quad began as a regional security dialogue between the United States, Japan, India, and Australia in 2004. It is increasingly directing its attention to providing civilian public goods and services in the Indo-Pacific, including for climate change. Lastly ASEAN draws together ten⁵ South-East Asian countries and seeks to promote economic integration in the region.

IPEF would have several advantages over the Quad or ASEAN in capitalising an IPGB. Firstly, IPEF encompasses a broader group of countries within the Indo-Pacific than other fora, including great powers (the United States), rising powers (India, Indonesia), middle powers

⁴ Australia, Brunei Darussalam, Fiji, India, Indonesia, Japan, Malaysia, New Zealand, the Philippines, Republic of Korea, Singapore, Thailand, the United States and Vietnam.

⁵ Brunei Darussalam, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam.

(Australia) and small island states (Fiji, with the possibility of other PICs joining). This broad regional membership would allow wealthier countries to provide the capital base for investments, while developing countries would provide the lion's share of bankable projects. A Quad bank would continue the tradition of multilateral banks established mostly by, and for, the Global North. An ASEAN bank would exclude the United States, Japan, India and Australia, which are key donor countries in the region. These countries also have significant expertise in scaling up clean energy technologies and critical minerals industries.

Progress in IPEF has been modest to date, as developing countries have little positive incentive to meet America's "high standard" ambitions when better market access to the United States is not on the table. An IPEF bank could provide the positive incentive at the scale the framework needs. However, US Presidential candidate Trump has indicated that if re-elected he would likely withdraw the United States from the framework. While an IPEF bank focused on enhancing economic security could be compatible with Trump's foreign policy aims, consideration of where an IPGB is situated in the current architecture warrants further analysis through an expert review.

Establishing an Indo-Pacific Green Bank (IPGB) would enhance economic security in the Indo-Pacific in several ways. Firstly, it would provide an avenue to multilateralise the development of new supply chains for critical minerals and the net zero transition, containing the sourcing and production of sensitive materials within a trusted group of economies without indulging protectionist or nationalist sentiments. This could build on existing work by the IPEF Supply Chain Council (DFAT, 2024). It would also do so in a way which respects and recognises the differing economic security objectives of Indo-Pacific countries. Secondly, it would provide a more transparent development finance alternative to the BRI for Indo-Pacific countries, providing market signals and incentives to improve accountability and transparency practices in lending. China's subsidised state-owned firms are often among the top beneficiaries when it comes to winning MDB procurement contracts, raising competition and human rights concerns. IPGB could provide the incentives needed to lift labour standards and encourage diversity of providers in MDB procurement systems. Supply chains supported by the bank could, where appropriate, be expanded beyond the Indo-Pacific to access further finance and knowledge capabilities from like-minded countries outside the immediate region, like European Union governments.

IPGB would work alongside, rather than compete with, existing MDBs such as the World Bank and ADB which operate in the region. The projects it seeks to fund are in nascent sectors and

it would be targeting investment gaps in areas like renewable energy, energy efficiency and transmission, where the scale required leaves much scope for new institutions. It would seek to share knowledge and cooperate with the MDBs wherever possible but would have a narrower investment mandate and a greater degree of agility than existing institutions. As a new form of institution, designing the governance of IPGB warrants careful consideration. Some of the key considerations include its mission, operations and governance, discussed in more detail below.

7.3.1 Mission

IPGB would have a different mission to existing institutions, focused on enhancing economic security and regional multilateralism among like-minded partners, while advancing climate change and development goals through its investments. While there are often tensions between economic security, climate and development outcomes, IPGB would invest where these three goals are complementary, and require investments to meet minimum standards across all three objectives. For example, if a critical mineral processing facility was powered by a new coal-fired power station, the bank would not fund its operation. Through this distinct mission IPGB would target different projects and co-financiers to existing public financial institutions in the region. Knowledge sharing to de-risk new technologies and develop innovative applications of financial instruments would also be core to the bank's mission.

7.3.2 Governance

Establishing IPGB offers an opportunity to create more just governance structures that give donor and recipient member countries greater ownership of the bank. The review would need to consider optimal governance structures to maximise the independence of bank management in investment decision-making, while also adopting robust risk management and knowledge-sharing practices. The voting right allocations of members would need to be carefully considered and balanced.

7.3.2.1 Membership

Embedding IPGB within an existing multilateral framework could present a variety of benefits, including organisational economies of scale, established dialogue channels and institutional knowledge. Additional members would need to be considered on a case-by-case basis. Ideally, IPGB would adopt a similar approach to the AIIB and New Development Bank (NDB) and operate primarily in the Indo-Pacific but invest more broadly, for example in Africa or SIDS beyond PICs.

Prospective members from beyond the Indo-Pacific should be encouraged to provide capital injections and contribute meaningfully to the knowledge-sharing pillar.

7.3.2.2 *Leadership*

IPGB's institutional legitimacy would also benefit from a deliberate rejection of existing leadership arrangements in the international financial architecture, most notably the practice of the World Bank and the IMF of appointing an American and a Western European as President and Managing Director respectively. Instead, the bank should appoint its leadership team through a transparent, merit-based process. The expert review should consider whether a rotating presidency/chairpersonship is appropriate, or indeed whether an open tender for an exceptionally high-performing executive should fulfil that role with no obligations to represent any shareholder.

Careful thought should be given to the question of whether to have a resident or non-resident Board of Directors. The newer MDBs (NDB and AIIB) have opted for non-resident boards in recognition of the frustration with the inefficiencies of resident boards of shareholder government representatives. A non-resident board would be cheaper and less likely to become entrenched in day-to-day management. However, non-resident boards may present risks to accountability and transparency, and some key creditor shareholder governments would be likely to insist on a resident board. A resident board would have the ability to have more frequent in-depth discussions about the trade-offs and complementarities around economic security, climate and development goals.

Appointments to the Board of Directors should be strictly professionalised, beyond the status quo in the legacy MDBs, with formal position descriptions requiring specific expertise in relevant sectors (Prizzon et al., 2022).

The Board of Directors' responsibilities should be clearly defined, especially if it is resident, to avoid it becoming involved in operational concerns instead of high-level strategic challenges.

7.3.2.3 *Capitalisation*

The capitalisation of IPGB warrants detailed consideration of three key areas: the quantum of finance; development of its capital adequacy framework; and the structure of the donor and recipient bases.

The AIIB and the NDB were both capitalised with US\$100 billion. However, only US\$10 billion of NDB capital was paid-in capital. Capital adequacy frameworks are used by MDBs to uphold their credit ratings and manage risk. The development of IPGB's capital adequacy framework would need to consider how the bank could maximise its balance sheet and leverage, while maintaining its AAA credit rating status to ensure least-cost borrowing. More important is recognition that the net zero transition will require grant and concessional finance, so IPGB would need to adopt a hybrid model where it is capitalised, but periodically seeks donor replenishment for the grant portion of its funding.

Capitalisation of any new multilateral institution would be a complex political sell in the current environment of high public debt and cost of living pressures. Donor countries would need to develop and prosecute a strong case illustrating the economic benefits of enhancing economic security and domestic resilience to supply chain shocks through the bank. Recent policy initiatives like the US Inflation Reduction Act prove that there is political will to spend big on economic security measures; we argue simply that it should be delivered multilaterally. It is critical that the bank results in additional investment from donor countries, and that it does not eat into existing aid and climate budgets.

The expert review should consider the merits of developed donor countries borrowing from the bank, as occurs in some MDBs like the European Investment Bank. This would make the political economy of joining the bank easier for donor countries. It would also have tangible benefits in terms of knowledge sharing. Rather than competing with existing Green banks or domestic state investment banks in those countries, IPGB could act as a co-financier with these institutions, increasing its volume of non-concessional loans. This would provide vital finance for net zero investments while facilitating knowledge transfers between Green banks and IPGB, which would help it catalyse the investment transition throughout the region. The expert review might arrive at a proportional target for the markets of the bank's investment, such as an 80/20 split between developing and developed economies.

7.3.3 Operational considerations

Establishing an IPGB offers an opportunity to create more just governance structures which give donor and recipient member countries greater ownership of the bank. Existing MDB governance structures, underpinned by articles of agreement, offer a logical starting point. The review would need to consider optimal governance structures to maximise the independence of bank management in investment decision-making, while also adopting robust risk

management and knowledge-sharing practices. The voting right allocations of members would need to be carefully considered and balanced.

7.3.3.1 Headquarters

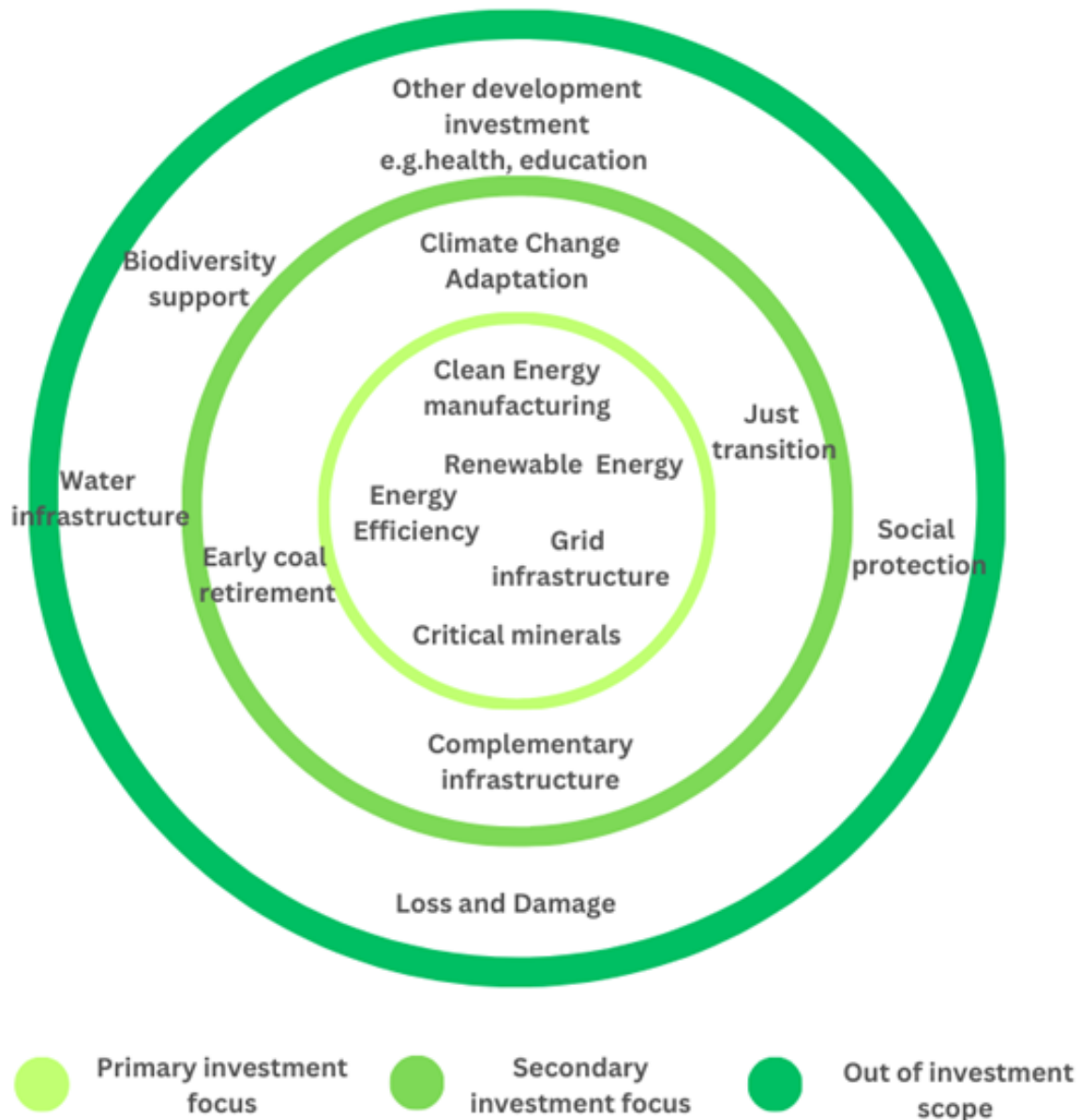
IPGB should be headquartered in an Indo-Pacific country, and there may be benefits from diverging from the practice of locating headquarters in the biggest shareholder country. Proximity to innovation and leadership in private sector finance and clean technology should be a priority when deciding headquarter location, as a deliberate enabler of the bank's knowledge-sharing pillar.

7.3.3.2 Investment mandate

In considering the investment mandate, the expert review should consider key issues around finance provision including the benchmark rate of return, risk approach and whether limits should apply to certain financial instruments.

IPGB's investment mandate should focus on activities which enhance economic security, climate and development. Its primary remit should encompass clean energy manufacturing, renewable energy, grid infrastructure, energy efficiency and critical mineral manufacturing (see Figure 7-3). This would strike a balance between the focused mandates of Green banks and the greater economies of scale and diversification of MDBs. The bank's mission also provides scope for investing in climate change adaptation, complementary infrastructure, early coal retirement and just transition, which would help to diversify bank investments and allow it to develop greater economies of scale. But these activities would rely more heavily on grants and concessional finance and their inclusion would need to be carefully considered by the expert review. It would make sense for broader economic development support for water, health, education, social protection and biodiversity, and for funding for loss and damage, to be out of scope initially.

Figure 7-3 Indo-Pacific Green Bank's possible investment focus



Source: Author's summary

Capitalisation of any new multilateral institution would be a complex political sell in the current cost of living crises. Donor countries would need to develop and prosecute a strong case illustrating the economic benefits of enhancing economic security and domestic resilience to supply chain shocks through the bank. It is critical that funding the bank sees additional investment from donor countries, rather than eating into existing aid and climate budgets.

7.3.3.3 *Finance provision*

IPGB should utilise a range of financial instruments including loans, equity, green bonds and guarantees. The appropriate use of these instruments should be considered in further depth by the expert review.

Grant finance and blended finance structures should be used in markets where concessional loans are not sufficient to make projects viable. Philanthropic funding is underutilised as a source of grant funding for blended finance structures, and there are significant opportunities to direct this capital more strategically throughout the region.

Lending in local currency should be used to reduce the risk of foreign exchange volatility exposure to both public and private borrowers and contribute to the deepening of domestic capital markets in emerging markets and developing economies (EMDEs). The bank would need to mitigate currency risks by balancing its portfolio in any one country with both foreign and local lending to avoid potential incentives for borrowers to reduce the real value of their debt by stoking inflation. In larger emerging markets, the bank could seek to work with domestic banking institutions in borrowing countries, while in PICs the bank should absorb the currency risk as part of its de-risking processes.

The bank could use sovereign finance in several ways. Policy-based loans to governments (i.e. budget support) at the central or subnational levels could be provided aimed at encouraging key enabling reforms that in turn unlock more bankable projects that can be supported by the bank and other financiers, including the private sector. The bank could also work through government budgets in ways that help to share costs and further de-risk investments, for example lending through a central government to a sovereign wealth fund or to recapitalise SOEs. Alternatively, direct sovereign lending could be provided for a small portion of bank loans (e.g. ~5%) for low and middle-income bank members, to ensure recipient country involvement from project commitment to completion and to maximise the knowledge-sharing benefits from projects for domestic governments.

IPGB should also have the capacity to enter financing agreements with SOEs. The majority of EMDEs in the Indo-Pacific have electricity sectors dominated by SOEs and there is a need for a public financial institution which can work more effectively with these actors to catalyse decarbonisation. SOEs' proximity to government can enable them to implement policy rapidly, and though the perception of inefficiencies can increase financing costs for SOEs, the implicit safety net of government rescue in the event of financial distress places downward pressure

on financing costs. Working with SOEs could actively reduce political risk for the bank by providing another level of assurance that the bank's activities are in line with the central government's agenda. SOEs play a unique role in the political economy of the region and will be essential to the development of secure and robust clean energy supply chains. This would require the bank to develop the institutional capacity to monitor and oversee investments closely and would provide significant benefit to private co-investors.

Finally the bank should seek to use non-sovereign lending wherever possible, particularly to crowd-in private sector investment in the manner of Green banks. In donor country projects the bank could work with existing green banks to help fill the capital stack in challenging finance areas like transmission. In EMDEs it could also seek to provide non-sovereign finance to help de-risk and finance critical mineral supply chains and clean energy manufacturing. PICs have very limited opportunities for non-sovereign funding and this should be recognised through greater proportion of grant and highly concessional financing. The exact parameters around non-sovereign lending would need to be considered carefully by the expert review.

7.3.3.4 Procurement

Procurement processes could be modelled on existing MDBs, which allow non-members to compete for contracts in the event they cannot be fulfilled by member states, but not on worse terms or where it creates excessive economic security risks. This would allow non-member states like the European Union, China or South American countries to fill nodes in supply chains in the short-term while IPGB members developed these capabilities. While Chinese involvement as a supplier would be a controversial and sensitive issue in some quarters, it is vital as the lowest-cost producer of clean energy technologies. China also has overcapacity in many sectors; the bank could purchase excess quantities of goods like solar panels cheaply to accelerate deployment of commercial technologies across the region. IPGB would need to tread a narrow path between drawing on China's dominant position as a climate change manufacturer and imposing appropriate safeguards with their involvement in the institution.

7.3.3.5 Knowledge sharing

IPGB could set a new standard among MDBs for transparency and knowledge sharing, drawing on the experience of national clean technology institutions like ARPA-E in the United States and ARENA and the CEFC in Australia. The bank could mandate knowledge sharing for finance recipients and develop a more nuanced understanding of sectoral investment risks in clean technology and critical mineral investments than credit ratings agencies, to allow it to invest with a greater risk appetite than existing MDBs or ECAs. If IPGB were to invest in

developing this technical expertise among its staff, the resulting information arbitrage it would provide would allow it to function like a multilateral Green Bank, accelerating domestic capital investment in recipient countries which have been significantly underinvesting in the net zero transition to date. IPGB could also collect, analyse and share knowledge and information relating to clean energy and critical mineral technology risks, including supply chain and credit rating risks, with domestic finance sectors in recipient member countries.

The bank should be a leader in disclosing disaggregated but anonymised project-level investment data, including private capital mobilisation, refinancing and defaults. This practice would protect commercial-in-confidence sensitivities but engender investment confidence by publishing both financial and technical insights from projects. The analysis and information shared by Australia's CEFC and ARENA after their large-scale solar funding round (see Box 7-1) could provide a basis for such products (ARENA & CEFC, 2020).

Box 7-1 Scaling up large-scale solar: Australia vs Zambia

In 2015, the large-scale solar sector was nascent in Australia and investors were unwilling to finance projects that were commercially viable. ARENA ran an A\$100 million grant funding round, aiming to reduce the costs of delivering large-scale solar projects, confident if projects were built, retailers would offtake electricity generated due to their obligations under Australia's Renewable Energy Target. Australia's national Green Bank, the CEFC, partnered with ARENA offering a concessional debt product to successful proponents. ARENA provided A\$92 million in grant funding to 12 projects, while the CEFC offered A\$320 million in debt finance to eight of the projects. This attracted major solar developers to Australia as well as global engineering, procurement and construction (EPC) firms. The number of projects was very important in helping the industry scale; the CEFC funded an additional 10 large-scale solar projects the following year.

Successful proponents were obliged to share knowledge, insights and data from their projects. Key insights generated through the projects included connection delays and cost overruns based on incorrect assumptions by project developers and EPC contractors, delays caused by poor weather due to La Niña, and lower operational revenue than projected. This data increased the transparency around a range of project finance risks and operation and allowed investors to more accurately gauge the viability of large-scale solar projects in Australia.

The cost of large-scale solar fell from A\$135 per MWh in 2015 to between A\$28 and A\$69 in 2019 (ARENA & CEFC, 2020). The support of ARENA and the CEFC helped large-scale solar become cheaper than new-build coal or gas in Australia and today grant finance is no longer required for large-scale solar projects.

The Australian experience of developing a large-scale solar sector stands in contrast to the more complex task of the World Bank to catalyse private sector investment in large-scale solar in developing countries. In 2015, the World Bank launched its “Scaling Solar” project, through the International Finance Corporation, seeking to bring together expertise from across the World Bank Group and provide project preparation, technical assistance, concessional finance, guarantees and risk insurance to projects. The first large-scale solar auction under the program, held in Zambia in 2015, saw the government issue a contract for two 50MW tenders. Seven companies submitted final bids in the auction, which saw record low prices of US6c per KWh. The two winning bidder consortiums were international developers with a strong track record of delivering projects (both also operate in Australia). However, the auction did not catalyse additional investment in Zambia’s solar market as the ARENA/CEFC funding round did. One of the primary reasons for this was that the advertised auction price did not reflect a range of implicit and explicit subsidies being provided to the Zambian projects. Most importantly, it did not reflect the pivotal role of concessional finance from DFIs in lowering the cost of capital. The demand for offtake was not nearly as strong in Zambia as in Australia. This meant only two projects were funded rather than 12, and did not allow for economies of scale to develop among the local EPC sector in Zambia. The lack of transparency around true costs of pricing for Zambian solar stymied further private sector investment in large-scale solar in the region. Ultimately, this meant the Scaling Solar program failed in its goal of significantly lowering the costs of capital for large-scale solar in developing countries.

7.3.3.6 *Grant-based technical and innovation fund*

IPGB should incorporate a grant-based technical assistance fund, which would be used to provide technical support to design and implement key policy reforms, work with local partners (governments, SOEs, domestic financial institutions, private firms) to adopt new technologies and innovative approaches, introduce higher ESG standards, undertake knowledge work and carry out project preparation activities to ensure a pipeline of quality projects. The facility could draw on the sector-specific plans developed by the IPEF Supply Chain Council and

member countries to develop node-to-node supply chain projects across the Indo-Pacific in the medium to long term (see Box 7-2).

Box 7-2 Mapping potential electric vehicle manufacturing capability across Indo-Pacific countries

Globally, the IEA projects (based on existing policies) that half of all cars sold in 2035 will be EVs (IEA, 2024d). This requires an elemental reconfiguration of existing vehicle supply chains, one which has sparked fierce competition among state actors seeking to capture a share of this highly profitable future industry.

EV production can be divided into upstream mining of critical minerals and midstream and downstream battery and automotive manufacturing processes. EVs rely on a range of critical minerals in their batteries, which typically contain lithium, cobalt, manganese, nickel and graphite. Many Indo-Pacific countries have established industries in at least one component of the EV supply chain (see below). This illustrates the potential for an Indo-Pacific bank to catalyse the development of node-to-node manufacturing capabilities across a range of critical mineral and clean energy technologies. There could also be opportunities to develop Indo-Pacific Grand Challenges, addressing specific research challenges with university partners in Indo-Pacific countries. IPGB could be the institutional focal point for liaison and knowledge sharing among these centres.

EV critical mineral and clean energy manufacturing potential in the Indo-Pacific

	UPSTREAM- CRITICAL MINERALS MINING					MIDSTREAM/DOWNSTREAM- CLEAN ENERGY MANUFACTURING				
	LITHIUM	COBALT	MANGANESE	NICKEL	GRAPHITE	MATERIALS PROCESSING	CELL MANUFACTURING	BATTERY ASSEMBLY	EV MANUFACTURING	EV NETWORK DEVELOPMENT
AUSTRALIA	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	EMERGING	EMERGING	UNLIKELY	UNLIKELY	UNLIKELY	EMERGING
BRUNEI DARUSSALAM	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY
FIJI	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY
INDIA	UNLIKELY	UNLIKELY	ESTABLISHED	UNLIKELY	EMERGING	ESTABLISHED	ESTABLISHED	EMERGING	ESTABLISHED	EMERGING
INDONESIA	UNLIKELY	ESTABLISHED	EMERGING	ESTABLISHED	UNLIKELY	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	EMERGING
JAPAN	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	EMERGING
MALAYSIA	UNLIKELY	UNLIKELY	ESTABLISHED	UNLIKELY	UNLIKELY	ESTABLISHED	EMERGING	EMERGING	EMERGING	UNLIKELY
NEW ZEALAND	EMERGING	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	EMERGING
PHILIPPINES	UNLIKELY	ESTABLISHED	UNLIKELY	ESTABLISHED	UNLIKELY	ESTABLISHED	EMERGING	EMERGING	UNLIKELY	UNLIKELY
REPUBLIC OF KOREA	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED
SINGAPORE	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	EMERGING	EMERGING	ESTABLISHED	ESTABLISHED
UNITED STATES	EMERGING	EMERGING	UNLIKELY	UNLIKELY	UNLIKELY	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED
THAILAND	EMERGING	UNLIKELY	EMERGING	EMERGING	UNLIKELY	EMERGING	ESTABLISHED	ESTABLISHED	ESTABLISHED	EMERGING
VIETNAM	UNLIKELY	UNLIKELY	UNLIKELY	ESTABLISHED	EMERGING	ESTABLISHED	ESTABLISHED	ESTABLISHED	ESTABLISHED	EMERGING

ESTABLISHED EMERGING UNLIKELY

Source: Author's summary

IPGB could also include a grant-based Grand Challenge funding approach to encourage collaborative research, development and deployment cooperation among members. It could announce specific research initiatives (such as an EV manufacturing research hub), which could be periodically funded by donor countries with one-off grant funding rounds like the ARENA large-scale solar round. Universities and non-government institutions in member countries could bid to host the Grand Challenges, which would coordinate research and knowledge sharing on the selected topics among IPGB members. This would ensure the “small yard, high fence” approach being adopted by some countries did not apply to net zero industries, where research collaboration will be critical to delivering global climate and development goals.

7.3.3.7 Evaluation of impact

IPGB could set global benchmarks for transparency and accountability of its investments. It could develop best practice processes and new metrics for screening and evaluating

investments to ensure complementarity between the economic security, climate and development goals of the bank and overall investment impact. The bank would not invest where complementary outcomes were not possible, for example where economic security comes into conflict with the other policy aims of decarbonisation and development. It would match the institutional independence of the World Bank's Independent Evaluation Group while pioneering new forms of evaluation methodologies that allow decision-makers to better manage complexity and risk, especially related to economic security, which remains less well defined than climate or traditional development objectives and lacks key evaluation metrics. It could also seek to enhance transparency around how the bank captures value for the institution, its donors and its recipients.

7.4 Policy implications and conclusion

The original Bretton Woods Agreement showed that bold reforms of the international financial architecture are possible if political will exists to support them. Seventy years on from Bretton Woods, there is once again a need for bold thinking to ensure multilateral financial governance is fit for purpose.

This analysis has illustrated that there is a multilateral governance gap when it comes to enhancing economic security in the Indo-Pacific. Accelerating investment in net zero and critical mineral supply chains throughout the region provides a pathway to enhancing economic security and meeting climate and development goals. Most crucially, the political economy of IPGB is such that it could receive broad support and buy-in across Indo-Pacific countries on both sides of the political spectrum.

I recommend establishing an expert review to develop an implementation plan for an Indo-Pacific Green Bank (IPGB). The review should be led by a multidisciplinary team of experts, including leading clean energy investment experts, drawn from Indo-Pacific countries and supported by a small secretariat. The expert panel should be gender-balanced and representative of the bank's prospective constituency in its foregrounding of representatives from developing countries. While the views and experiences of officials from existing MDBs will be essential, for this institution to be ambitious, innovative and effective in mobilising private finance, the perspectives of those external to the traditional international finance architecture will be even more critical.

The expert review should work closely and consult deeply with not only the existing MDBs, but also the newer "disruptors", especially the NDB and the AIIB as well as emerging borrower-led

MDBs. Given that IPGB would be a valuable addition to, rather than a replacement of, the parallel finance institutions, its establishment should be informed by the ongoing MDB reform process.

The review could be commissioned by an ambitious member government, a plurilateral grouping or an existing dialogue. The expert review would develop and recommend a proposed governance structure for an Indo-Pacific multilateral bank.

Agreeing to an expert review to assess the prospect of an IPGB would signal Indo-Pacific countries' commitment to closing the climate finance gap and advancing the development goals of its members and the Indo-Pacific region more broadly. This would send a significant signal about their ambition for the post-2020 climate finance goal, due to be agreed at COP29 in Azerbaijan in November 2024.

Leading the establishment of IPGB would be a significant economic and foreign policy legacy for its founding governments. Most importantly, IPGB would strengthen multilateralism and enhance economic security while advancing climate and development goals. In short, it would support a more secure and resilient Indo-Pacific.

Chapter 8 Conclusion

This dissertation explored an important question to ensuring a successful net zero transition; *What are the current and potential roles of public financial institutions, particularly green banks, in mobilising additional private finance to accelerate the net zero transition?* The hypothesis long held by policymakers that public finance can mobilise additional private finance for climate change deserves further academic scrutiny as it has failed to significantly close the climate finance gap since it was posited over a decade ago (World Bank, 2015). Green Banks are an excellent institutional choice for studying this hypothesis, as it underpins their organisational missions. However, as the dissertation illustrates, they require a range of market and governance conditions to maximise their impact. To date, they have been most effective in developed country capital markets with deep liquidity, strong institutions, policy certainty and robust legal frameworks. The empirical findings in this study provide a deeper understanding of the roles of current green banks and a conceptual analysis of their potential application in developing country markets and at different governance levels. It contributes to recent debates in economics and public management literatures about the roles of states in shaping and co-creating markets. It illustrates that, while green banks are an important tool, they cannot mobilise additional private finance in isolation and need to be part of a broader suite of climate policy measures in markets with strong demand for renewable energy offtake. In developing countries, where market failures are pervasive and SOEs dominate, the potential impact of green banks is more limited, but they remain a useful tool for facilitating knowledge sharing and transparency around climate finance investments. This dissertation will be of interest to climate finance scholars, institutional political economists and policymakers.

8.1 Contributions to existing literature

The original contributions of this dissertation can be divided into three components: empirical, conceptual and methodological.

The dissertation makes empirical contributions adding to qualitative and quantitative knowledge regarding the roles of public financial institutions, particularly public green banks, in mobilising additional private finance for the net zero transition. It illustrates that green banks are an important new form of public financial institution (Chapter 2), distinct from other forms of state investment banks, and that their knowledge-sharing and transparency functions have lessons to help other public financial institutions mobilise additional private finance for the net zero transition.

It makes a number of contributions to existing literature. First, it provides the first cross-case comparison of public green banks at different governance levels illustrates that green banks are perceived to have an important role in creating public value through their investments and (Chapter 3). It also has implications for the development of large-scale solar in other jurisdictions (Chapter 4), and potentially for the development of new clean energy markets such as offshore wind, green hydrogen and geothermal.

Secondly, it illustrates green banks could enhance a just transition if their institutional model was effectively adapted for developing country markets. Green banks could play an important role in building institutional capacity and increasing transparency around project risks for net zero investments in Indonesia and Fiji (Chapters 5 and 6). Finally, the green banks model could be multilateralised to address an international governance gap related to the economic security of clean energy supply chains (Chapter 7). It could play a role in encouraging other forms of public financial institutions to increase transparency and knowledge sharing around the costs of capital and implicit subsidies being provided for clean energy investments in developing markets at present to help more effectively de-risk private sector investments.

The development of the quantitative database of 177 large-scale solar projects is another important empirical contribution from this dissertation. Mapping the offtake agreements for these projects, combined with the expert interviews, revealed that while the CEFC did play a role in shaping the development of the large-scale solar market in Australia, there were other important catalysts in the development of the industry. Internationally, this included significant cost declines for solar PV over the period studied. Domestically, this included the RET, which provided strong demand for renewable energy offtake, various subnational policy measures and procurement, which supported renewable energy, and the depth in Australia's large, liquid capital market, which has increasingly seen a range of corporations, utilities and universities seeking to build large-scale solar.

Finally, Chapters 5 and 6 begin filling an empirical research gap on how the public green Bank model might feasibly be adapted for different developing country markets. Chapter 5 focuses on Indonesia, illustrating how public Green Banks could play a role in enhancing climate justice for Indonesia's net zero transition through provision of international climate finance for Indonesia's domestic capital markets. It demonstrated the complex range of political, financial, access, skills, information and technology barriers which are preventing investment in Indonesia's net zero transition to date. Indonesia's DFI PT SMI was found to be a promising pathway to scaling up green banking investments in Indonesia. Chapter 6 explored whether there could be a role for a public green bank in Fiji. While shallow capital markets, aid

dependency, isolated geography and low institutional capacity mean existing green bank models would not be viable, the expert interviews and systematic literature review demonstrated that, like Indonesia, there was a need for new forms of climate finance provision that enhanced climate justice beyond the mere provision of additional capital to consider the need for more grant finance, diversity in the scale of project funding, support for local skills development and easier access to international climate finance. While experts did not see a significant role for private finance in Fiji's net zero transition, interviewees were supportive of green banking functions being scaled up within the Fiji Development Bank, with significant financial and capacity building support from donor countries.

Conceptually, Chapter 7 made an important contribution by considering what other forms of public institutions, particularly MDBs, could learn from green banks as they seek to scale up climate finance to meet Paris Agreement goals. Chapter 7 considers how the Green Bank model could be operationalised to enhance energy security in the Indo-Pacific while progressing climate and development goals through the creation of an Indo-Pacific Green Bank. It recognises that climate finance investment is, to some degree, undergoing a shift from a traditional neoclassical economic paradigm, focused on ensuring positive returns on investment to maximise the economic efficiency of markets, to a new paradigm focused on economic security. This new paradigm is focused on building resilience to Chinese dominance of clean energy supply chains, enhancing domestic energy security or capturing a share of the value from new clean energy industries to help meet development goals, depending on the country actor. This paradigm shift provides a unique opportunity to create a new form of multilateral bank in the Indo-Pacific, which could reduce the climate and development finance funding gap while enhancing multilateralism and economic security in the region.

The developing country case studies in Chapters 5 and 6 illustrate the limited application of neoclassical theories of market creation based on economic efficiency, because in both cases, there are so many different forms of market failures that competitive electricity markets do not exist. While the green bank model helps to overcome some of these risks and barriers by absorbing certain transaction costs, these case studies illustrate the broader market reforms which need to take place in both countries. In both cases, the green bank model would need to be significantly adapted to feasibly mobilise additional private sector finance as they have in developed country markets. Provision of significant additional new climate finance, much of it grant-based and concessional, will be critical to both countries being able to successfully transition to net zero emissions.

The neoclassical approach to value creation adopted by green banks and many other public financial institutions making climate finance investments focused on financial returns on investment was successful in facilitating investment by the four green banks profiled in Chapter 3, but does not capture the many other forms of public value these green banks are perceived to create. This speaks to the more complex trade-offs in value creation and destruction which need to be considered in more detail through the net zero transition.

Finally, this dissertation made a small methodological contribution in Chapter 6 by using feminism as a methodological basis for operationalising locally led development.

8.2 Insights for policymakers

The dissertation offered a range of important insights for policymakers. Chapters 2 and 3 illustrated that green banks are an important new form of institutional actor because they help to overcome barriers to investment in instances where transaction costs around technology or financial structures prevent commercial actors from investing in commercially viable, profitable net zero projects.

Chapters 4, 5 and 6 illustrated that while green banks do play an important role in mobilising additional private finance for the transition, they will not be able to create or shape markets in developing jurisdictions which lack the depth of Australia's capital markets and actors willing to subsidise early market development. This means additional public finance, much of it grant-based or highly concessional loans, is urgently required in those markets to encourage the broader policy reforms required to create market demand and to enhance transparency and knowledge-sharing capabilities, so private investors can more adequately assess investment risks in those jurisdictions.

Chapter 7 illustrated that existing international financial institutions in the Indo-Pacific will not be able to meet climate finance needs in the region. Ambitious institutional reform is unlikely due to geopolitical tensions. Existing institutional governance does not consider economic security adequately at the multilateral level; this provides an opportunity to create a multilateral bank with like-minded partners in the Indo-Pacific which enhances economic security while making progress towards climate and development goals. An Indo-Pacific Green Bank is one pathway which could help to close the climate finance gap in the region.

8.3 Further research

This dissertation identified a range of important avenues for further research. Firstly, the role of finance in clean energy innovation remains understudied conceptually. More quantitative research is needed on clean technology market development, particularly financial innovation.

New forms of metrics are needed to gauge the catalytic value of public investments in the net zero transition. The current focus on capital deployment and private sector leverage ratios fails to capture the catalytic impact of investments like the CEFC's low-income energy efficiency apartments, which illustrates the feasibility and profitability of building energy efficient apartments in Australia. There is also a need to develop metrics to capture the value trade-offs of investments more effectively. For example, EV manufacturing facilities powered by captive coal in Indonesia illustrate how clean technology investments can produce significant environmental harm. Investors need to understand and manage these trade-offs more effectively.

Research which helps to increase the transparency of climate finance reporting would be beneficial to get a more accurate picture of global climate finance flows. ECAs and DFIs need enhanced global governance to increase transparency around their investments. Better data on climate finance provision from Global South actors is also vital.

As Utzon found while attempting to design the Sydney Opera House, final outcomes often bear little reality to the original vision. As the path to the net zero continues to narrow, the challenge to keep climate change within planetary boundaries grows greater. Finance alone cannot solve the climate crisis, but it has a critical role to play, along with sound policy, institutional capability, skills development and, the most elusive factor to date, political will.

Appendix A- expert interviewees

Interview no	Organisation	Job title	Chr 2	Chr 3	Ch4	Ch5	Chr 6
1	Department of Industry, Science and Resources	Director, CEFC team			✓		
2	ARENA	Head of Investment			✓		
3	ARENA	Director, Business Development and Transactions			✓		
4	Department of Industry, Science and Resources	Assistant Secretary		✓	✓		
5	CEFC	Chief Clean Futures Officer	✓	✓	✓		✓
6	CEFC	Head of Portfolio Management	✓	✓	✓	✓	✓
7	CEFC	Executive Director, Investment Team	✓	✓	✓	✓	✓
8	CEFC	Head of Risk and Compliance	✓	✓	✓	✓	✓
9	CEFC	Head of Government and Stakeholder Relations	✓	✓	✓	✓	✓
10	Department of Infrastructure, Transport, Regional Development, Communications and the Arts	Former Director, CEFC Team		✓	✓		✓
11	Climate Change Authority	Chief Executive Officer		✓	✓	✓	✓
12	Department of Industry, Science and Resources	Assistant Secretary	✓	✓			✓

13	Australian Government Solicitor	Senior Advisor, Minister for Climate Change and Energy Efficiency		✓	✓	✓	✓
14	Australian Energy Market Commission infrastr	Commissioner		✓	✓	✓	
15	EB/Investa	Head of ESG	✓	✓	✓		
16	Department of Climate Change, Environment, Energy and Water	Senior Policy Officer					✓
17	Department of Climate Change, Environment, Energy and Water	Assistant Director Indo-Pacific Carbon Offset scheme					
18	NYGB	Director, Strategy, Impact, Investor relations	✓	✓	✓		✓
19	NYGB	Vice President	✓	✓	✓		✓
20	NZGIF	CEO	✓	✓	✓	✓	✓
21	Department of Climate Change, Environment, Energy and Water	Director, Indo-Pacific Carbon Offset scheme	✓	✓			✓
22	Department of Foreign Affairs and Trade	Assistant Director, Green Economy					
23	Adamantem	Director, Responsible Investing	✓	✓	✓		
24	World Bank	Senior Climate Change Specialist	✓			✓	

25	Ecotone, United Kingdom Green Investment Bank	Managing Director, Head of Strategy		✓	✓	✓	✓
26	Australia Institute/DFAT	Head of Climate Change and Energy programs/GCF Secretariat Assistant Director					
27	United Kingdom Green Investment Bank	Managing Director		✓	✓	✓	✓
28	Department of Climate Change, Environment, Energy and Water	First Assistant Secretary, International Climate Change and Energy Innovation		✓	✓	✓	✓
29	GCF	Managing Director	✓			✓	✓
30	Department of Climate Change, Environment, Energy and Water/ World Bank	Assistant Secretary	✓			✓	✓
31	Australian Sustainable Finance Institute	Head of Policy	✓			✓	✓
32	Department of Foreign Affairs and Trade	Assistant Director	✓				✓
33	CEFC	CEO	✓	✓	✓	✓	✓
34	GCF	Head of Policy and Strategy	✓			✓	✓
35	NYGB	Managing Director	✓	✓	✓		✓
36	Rocky Mountain Institute	Manager, Green Investment Bank Initiative			✓	✓	✓

37	MCOB	Chief investment Officer	✓	✓	✓		✓
38	Neoen	Head of Project Finance	✓	✓	✓		
39	GCF/DC Green Bank	Board member, DC Green Bank					✓
40	Department of Foreign Affairs and Trade	Director	✓	✓		✓	✓
41	MCOB	Associate Director, Commercial and Industrial		✓			
42	Department of Foreign Affairs and Trade	Former Director, Climate Finance team	✓	✓			✓
43	Forbright Bank	Head of ESG		✓			
44	MCOB	Director of Commercial Business		✓			✓
45	Australian Embassy Indonesia	Counsellor	✓				
46	Department of Foreign Affairs and Trade	Director				✓	
47	Department of Foreign Affairs and Trade	Chief investment Officer	✓			✓	✓
48	Australian Embassy Indonesia	Minister Counsellor and Senior Treasury representative				✓	
49	Climateworks	Country lead, Indonesia				✓	

50	Climate Policy Initiative Indonesia	Director				✓	
51	CEFC	Executive Director, Rewiring the Nation			✓	✓	✓
52	Rocky Mountain Institute	Pacific Regional CFAN Manager	✓				✓
53	Fiji Government	Climate Adaptation Officer, Office of the Prime Minister	✓				✓
54	Department of Foreign Affairs and Trade	First Secretary (Climate Change)					✓
55	Fiji Government	Senior Climate Change Officer, Office of the Prime Minister					✓
56	Fiji Development Bank	Manager, Climate & Eco Finance	✓				✓
57	PFAN	Regional Coordinator, Pacific Islands					✓
58	Department of Foreign Affairs and Trade	Director, Financing instruments and Debt	✓				✓
59	Indonesian government	Ministerial advisor				✓	
60	Indonesian government	Head of macroeconomic and financial market research department				✓	
61	Indonesian government	Senior economist	✓			✓	
62	Indonesian government	Economist				✓	
63	Indonesian government	Division head				✓	

64	World Bank	Senior energy economist	✓			✓	
65	Australian Embassy Indonesia	Counsellor, Economic governance and infrastructure				✓	

Appendix B- review protocols

Chapter 2 example literature review protocol

Protocol Scope	Parameters	Example article Geddes, Schmidt, and Steffen (2018)
Method	Qualitative /Quantitative/mixed Modelling, statistical analysis, interviews, ethnography, literature review etc.	Qualitative case study design based on 56 interviews.
Research Question	What are the research questions?	What is the role of SIBs in addressing the barriers faced by low- carbon project developers in sourcing finance?
Original contribution	What is the original contribution of the article?	Defines five roles the roles SIBs take to successfully address barriers to finance; capital provision, de-risking, educational, signalling, first or early mover roles.
PFI/ private finance	What PFIs are profiled? Are they trying to mobilise private finance for climate change investments?	State investment banks
Mission	What is the overall mission of the PFI being profiled?	The paper argues SIBs can play a key role in closing the climate finance gap and leveraging additional private investment.
Financial instruments	What form of financial instruments are being used?	Concessional loans, equity, guarantees, insurance, bonds

Chapter 5 example literature review protocol

Scope – Anantharajah, K., & Setyowati, A. B. (2022). Beyond Promises: Realities of Climate Finance Justice and Energy Transitions in Asia and the Pacific. <i>Energy Research & Social Science</i>, 89. https://doi.org/10.1016/j.erss.2022.102550		
Method	Qualitative/quantitative/mixed modelling, statistical analysis, interviews, ethnography, literature review etc.	The paper is qualitative, informed by empirical data drawn from multi-sited ethnographies from local to national scale in Fiji and in Indonesia.
Research question	What is/are the research question/s?	To what extent are climate finance's premises retaining validity in the Global South? Secondly, what forms of (in)justices are enlivened through the operation of climate finance in the Global South?
Original contribution	What is the original contribution of the article?	The article makes empirical and theoretical contributions. Empirically, through sustained fieldwork in both Fiji and Indonesia, the study contributes grounded empirics to a region where the effects of climate finance remain understudied. Theoretically, the article aims to contribute to the emerging literature on climate justice finance through a bottom-up approach in investigating the deployment of climate finance in

		the Global South, particularly with regards to renewable energy development.
Thematic scope	What is the article's relevance to investment barriers in Indonesia and/or the potential role of public green banks?	The article suggests that climate finance flows primarily to the most bankable, lowest risk, highest return, and often the largest scale projects. Moreover, the prioritisation of large-scale projects tends to result in preference for on-grid as opposed to off-grid renewable infrastructures, the reinforcement of technological preferences of powerful stakeholders, and the exclusion of smaller projects and developers.
Climate Justice	How can climate justice be enhanced in Indonesia?	The article concludes that to ensure the social justice outcomes of climate finance, climate funds need to develop mechanisms to mitigate the multi-scalar exclusions experienced in developing countries, particularly in the Asia Pacific region.
Regional scope	What region is being studied?	Indonesia/ Fiji

Chapter 6 example literature review protocol

Scope – Governing Climate Finance in Fiji: Barriers, Complexity and Interconnectedness, by Kirsty Anantharajah		
Method	Qualitative/quantitative/mixed modelling, statistical analysis, interviews, ethnography, literature review etc.	Qualitative study based on three months of fieldwork in Fiji, 40 interviews and Talanoa dialogues with a range of stakeholders. This was complemented by a review of policy reports, existing academic literature, roadmaps and briefs
Research question	What is/are the research question/s?	What are the barriers to mobilising, investing and absorbing climate finance, and reaping subsequent climate outcomes in Fiji?
Original contribution	What is the original contribution of the article?	The production of grounded theory which enables “an in-depth and rich understanding of the context that governors in Fiji must navigate”.
Thematic scope	What is the article’s relevance to investment barriers in the Pacific and/or the potential role of public green banks?	Four layers of barriers to investment were identified by the article. Firstly, policy and regulatory barriers. Secondly, underlying conditions that stymie the financing, development and sustainability of projects. Thirdly, barriers stemming from international donors. Fourth,

		aspects of Fiji's national and cultural circumstances.
Authorship	Are authors from Pacific Island countries?	Yes or No
Regional scope	What region is being studied?	Fiji

Appendix C- CEFC large-scale solar projects

Project name	Capacity (MW)	CEFC funding (AUD\$, millions)	Operational	Year of CEFC funding
Walla Walla Solar Farm	300	100	Not commissioned	2023
Blue Grass Solar Farm	200	37	01-Aug-22	2022
Kiamal Solar Farm - Stage 1	200	51.2**	01-Mar-21	2019
Suntop Solar Farm	189	74.4*	23-Nov-21	2021
Daydream Solar Farm	168	89.9^	01-Feb-20	2020
Coleambally Solar Farm	150	29.6	01-Sep-18	2018
Numurkah Solar Farm	128	56.2	01-Jul-19	2019
Ross River Solar Farm	116	20.2	01-Jun-18	2017
Wemen Solar Farm	110	110	09-Jan-18	2018
Gunnedah Solar Farm	110	74.4*	01-Jul-21	2021
Bannerton Solar Park	88	98	01-Oct-18	2018
Fulham Solar Farm	80	N/A	Not commissioned	2023
Clermont Solar Farm	75	90	01-Jun-19	2018
Hamilton Solar Farm	70	78.1~	01-Mar-18	2017
Whitsunday Solar Farm	70	78.1~	01-Mar-18	2017
Parkes Solar Farm	66	79.5	01-Apr-18	2017

Hayman Solar Farm	58	89.9^	01-Aug-18	2020
Moree Solar Farm	56	46	09-Feb-16	2013
Oakey Solar Farm - Stage 2	55	54.3	01-Sep-19	2018
Kidston Solar Project - Stage 1	50	4.1	01-Dec-18	2018
Gannawarra Solar Farm - Stage 1	50	78.1~	21-Mar-18	2017
Jemalong Solar Farm	50	N/A	01-Feb-21	2020
Manildra Solar Farm	46.7	50	01-Nov-21	2019
Perry Bridge Solar Farm	44	N/A (joint venture)	Not commissioned	2022
Collinsville Solar Farm	42.5	60	01-Aug-18	2017
Gilgandra solar farm	40	57.6	Not commissioned	2019
Griffith Solar Farm	36	40.8	01-Apr-18	2017
Dubbo Solar Hub (South Keswick and Narromine)	28	28.4	01-Apr-18	2017
Oakey Solar Farm - Stage 1	25	19.4	01-Mar-19	2017
Barcaldine Remote Community Solar Farm - Stage 1	20	20	01-Dec-16	2016
Longreach Solar Farm	15	13.5	01-Mar-18	2017
Kennedy Energy Park	15	93.6	01-Jul-21	2018

Appendices

Williamsdale Solar Farm - Stage 1	11	N/A	01-Oct-17	2017
DeGrussa Solar Project	10	15	01-Jun-16	2016
Summerhill Solar Farm	5	6.5	01-Dec-19	2019

Appendix D- Options for MDB reform

While the paid-in capital model of MDBs has proven extremely effective in mobilising large amounts of finance from international capital markets, in recent years MDBs have faced increasing scrutiny for failing to use the full potential of their balance sheets, particularly in relation to **callable capital**. Callable capital is capital subscribed to by shareholders that has not been paid-in but may be called if an MDB cannot meet its bond and guarantee obligations. No MDB has ever requested its callable capital, and there is confusion about its value and how it would function as a financial instrument. But there are calls to expand financial innovation around callable capital and to increase the credit allocated to it (Léautier, 2023).

A **hybrid capital class** provides an alternative to shareholder capital from governments, and provides an opportunity for philanthropic, private and institutional investors to invest in MDB missions for safe, moderate returns and sustainable development goal impact credibility – without voting rights. So far, only the African Development Bank has issued a hybrid class, at 100% equity value, but the World Bank intends to debut its own version this year (2024). The volume of hybrid capital is unlikely to exceed 30% of shareholder capital at any one institution, so its transformative potential at any real scale is constrained.

An **originate-to-share** (or originate-to-distribute/transfer) structure could also alleviate pressure on inadequate capital holdings, by shifting mature, well-performing investments to the private sector. This model could be the most direct route to creating credible sustainable development goal asset classes at scale, with the ability to diversify across EMDEs to minimise risk and maximise attraction for large-scale investors. The emphasis on sharing rather than selling could allow MDBs to retain supervision, including responsibility for ESG standards and performance monitoring, of the asset, providing further assurance to private investors. While deployment of this model could free up capital lending space, there are concerns that deployment of debt aggregation vehicles will require large-scale market reforms and could degrade MDB legitimacy in borrowing markets. The G20 expert panel on MDB reform noted that there is no guarantee any freed-up capital would be used for additional lending in countries concerned. Additionally, this model could entrench perverse incentives for MDBs to focus on deal origination in low-risk, high-performance markets, unintentionally limiting their activities in lower-income countries.

Other reform options for the MDBs focus less on capital adequacy and more on allocative efficiency. For very low-income and climate-vulnerable countries, especially SIDS, MDBs are

considering the integration of some kind of vulnerability measure into eligibility criteria, as well as debt clauses pausing interest repayments in the event of climate disasters.

The introduction of a **vulnerability measure** could expand the list of states eligible for concessional windows, by including higher-income SIDS, without increasing the pool of funding in those windows, thereby potentially reducing the amount of concessional funding available to the lowest-income climate-vulnerable states.

Climate resilient debt clauses would similarly be likely to benefit higher-income countries, as the lowest-income SIDS receive only grant financing from MDBs. Both of these reform options are therefore marginal rather than systematic and seem more likely to benefit wealthier SIDS.

References

- Acemoglu, D., Johnson, S., & Robinson, J. A. (2005). Institutions as a Fundamental Cause of Long-run Growth. In *Handbook of economic growth: Vol. 1A*.
<https://economics.mit.edu/sites/default/files/publications/institutions-as-the-fundamental-cause-of-long-run-.pdf>
- Acemoglu, D., & Robinson, J. A. (2013). *Why nations fail*. Profile Books.
- ADB. (2020). *The Case for Regional Cooperation in Trade and Investment Finance for Asia* (ADB Briefs 134). ADB. <https://www.adb.org/publications/regional-cooperation-trade-investment-finance-asia>
- ADB. (2023). *Finding Balance 2023: Benchmarking Performance and Building Climate Resilience in Pacific State-Owned Enterprises* (Fiji, Kiribati, Marshall Islands, Palau, Papua New Guinea, Samoa, Solomon Islands, Tonga, Vanuatu). Asian Development Bank.
<https://www.adb.org/publications/finding-balance-2023>
- Adhikari, B., & Safaee Chalkasra, L. S. (2021). Mobilizing private sector investment for climate action: Enhancing ambition and scaling up implementation. In *Journal of Sustainable Finance & Investment*. Routledge Journals, Taylor & Francis Ltd.
<https://doi.org/10.1080/20430795.2021.1917929>
- African Development Bank. (2024, April 17). *African Green Banks Initiative* [Text]. African Development Bank Group; African Development Bank Group.
<https://www.afdb.org/en/topics-and-sectors/initiatives-and-partnerships/african-green-banks-initiative>
- Aguila, N., & Wullweber, J. (2024). Legitimising Green Monetary Policies: Market Liberalism, Layered Central Banking, and the ECB's ongoing discursive shift from environmental risks to price stability. *Journal of European Public Policy*. Scopus.
<https://doi.org/10.1080/13501763.2024.2317969>
- Ahmed, S. (2017). *Living a feminist life*. Duke University Press; JSTOR.
<https://doi.org/10.2307/j.ctv11g9836>
- Alford, J., & O'Flynn, J. (2009). Making Sense of Public Value: Concepts, Critiques and Emergent Meanings. *International Journal of Public Administration*, 32(3–4), 171–191.
<https://doi.org/10.1080/01900690902732731>
- Anantharajah, K. (2019). Governing Climate Finance in Fiji: Barriers, Complexity and Interconnectedness. *Sustainability*, 11(12), 3414. <https://doi.org/10.3390/su11123414>

- Anantharajah, K. (2021). "But our lights were still on": Decolonizing energy futures emerging from climate finance regulation in Fiji. *Energy Research & Social Science*, 72, 101847. <https://doi.org/10.1016/j.erss.2020.101847>
- Anantharajah, K., & Setyowati, A. B. (2022). Beyond Promises: Realities of Climate Finance Justice and Energy Transitions in Asia and the Pacific. *Energy Research & Social Science*, 89. <https://doi.org/10.1016/j.erss.2022.102550>
- APVI. (2024, September 3). *Solar PV maps and tools*. Australian PV Institute. <https://pv-map.apvi.org.au>
- ARENA. (2018). *Lessons from the fringes: Australian fringe-of-grid projects in ARENA's portfolio*. <https://arena.gov.au/assets/2019/06/lessons-from-the-fringes-australian-off-grid-projects-arena-portfolio.pdf>
- ARENA. (2024). *Our purpose*. <https://arena.gov.au/about/>
- ARENA, & CEFC. (2020). *Insights from the first wave of large-scale solar projects in Australia*. <https://www.cefc.com.au/media/vzcfmyfv/insights-from-the-first-wave-of-large-scale-solar-projects-in-australia.pdf>
- Arrow, K. (1969). *The Organization of Economic Activity: Issues Pertinent to the Choice of Market versus Non-market Allocation*. Joint Economic Committee of Congress. <https://msuweb.montclair.edu/~lebel/p/sc643intpolecon/arrownonmktactivity1969.pdf>
- Australian Government. (2024). *Pacific regional – education*. <https://www.dfat.gov.au/geo/pacific/development-assistance/education>
- Baldwin, D. A. (1997). The Concept of Security. *Review of International Studies*, 23, 5–26.
- Baldwin, D. A. (2020). *Economic statecraft: New edition*. Princeton University Press.
- Bator, F. (1958). Anatomy of Market Failure. *The Quarterly Journal of Economics*, 72(3), 351–379. <https://doi.org/10.2307/1882231>
- Battilana, J., & Lee, M. (2014). Advancing Research on Hybrid Organizing – Insights from the Study of Social Enterprises. *The Academy of Management Annals*, 8(1), 397–441. <https://doi.org/10.1080/19416520.2014.893615>
- Bazbauers, A. R., & Engel, S. (2021). *The Global Architecture of Multilateral Development Banks: A System of Debt or Development?* Routledge. <https://doi.org/10.4324/9781003007128>
- Benington, J. (2011). From private choice to public value. In J. Benington, J. and M. Moore (Eds.), *Public value: Theory and Practice* (pp. 31-51.). Macmillan Education UK.

- Bhattacharya, A., Songwe, V., Soubeyran, E., & Stern, N. (2023). *A climate finance framework: Decisive action to deliver on the Paris Agreement – Summary*. Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.
- Bhattacharyya, R. (2022). Green finance for Energy Transition, Climate Action and Sustainable Development: Overview of concepts, applications, implementation and challenges. *Green Finance*, 4(1), Article GF-04-01-001. <https://doi.org/10.3934/GF.2022001>
- Biermann, F., Pattberg, P., van Asselt, H., & Zelli, F. (2009). The Fragmentation of Global Governance Architectures: A Framework for Analysis. *Global Environmental Politics*, 9(4), 14–40. <https://doi.org/10.1162/glep.2009.9.4.14>
- BIS. (2014, October 13). *BIS member central banks*. https://www.bis.org/about/member_cb.htm
- Blackmon, P. (2016). OECD Export Credit Agencies: Supplementing Short-Term Export Credit Insurance During the 2008 Financial Crisis. *International Trade Journal*, 30(4), 295–318.
- Bodnar, P., Ott, C., Edwards, R., Hoch, S., McGlynn, E. F., & Wagner, G. (2018). Underwriting 1.5°C: Competitive approaches to financing accelerated climate change mitigation. *Climate Policy*, 18(3), 368–382. Scopus. <https://doi.org/10.1080/14693062.2017.1389687>
- Böhringer, C., Cuntz, A., Harhoff, D., & Asane-Otoo, E. (2017). The impact of the German feed-in tariff scheme on innovation: Evidence based on patent filings in renewable energy technologies. *Energy Economics*, 67, 545–553. <https://doi.org/10.1016/j.eneco.2017.09.001>
- Bose, S. (2021). Adaptation Finance: A Review of Financial Instruments to Facilitate Climate Resilience. In R. C. Brears (Ed.), *The palgrave handbook of climate resilient societies*. Springer International Publishing.
- Bracking, S. (2015). The Anti-Politics of Climate Finance: The Creation and Performativity of the Green Climate Fund: The Anti-Politics of Climate Finance. *Antipode*, 47(2), 281–302. <https://doi.org/10.1111/anti.12123>
- Bracking, S. (2019). Financialisation, Climate Finance, and the Calculative Challenges of Managing Environmental Change. *Antipode*, 51(3), 709–729. <https://doi.org/10.1111/anti.12510>

- Bracking, S. (2021). Climate finance and the promise of fake solutions to climate change. In S. Böhm & S. Sullivan (Eds.), *Negotiating Climate Change in Crisis* (pp. 255–276). Open Book Publishers.
- Bracking, S., & Leffel, B. (2021). Climate Finance Governance: Fit for Purpose? *WIREs Climate Change*, 12(4). <https://doi.org/10.1002/wcc.709>
- Brandsen, T., & Karré, P. M. (2011). Hybrid Organizations: No Cause for Concern? *International Journal of Public Administration*, 34. <https://doi.org/10.1080/01900692.2011.605090>
- Buckman, G., Sibley, J., & Bourne, R. (2014). The large-scale solar feed-in tariff reverse auction in the Australian Capital Territory, Australia. *Energy Policy*, 72, 14–22. <https://doi.org/10.1016/j.enpol.2014.04.007>
- Carney, M. (2015, September 29). *Breaking the tragedy of the horizon—Climate change and financial stability*. Speech given at Lloyd’s of London, London.
- Carney, M. (2021). *Value(s): Building a better world for all*. Hachette Book Group.
- Case-Ruchala, D. (2024). An old, novel idea: Introducing G-Pub, an original dataset of public bank formation. *Review of International Political Economy*, 31(4), 1271–1297. <https://doi.org/10.1080/09692290.2023.2281647>
- CEFC. (2015). *Clean Energy Finance Corporation Annual Report 2014–15* (p. 234). Clean Energy Finance Corporation.
- CEFC. (2017, February 1). *CEFC accelerates large-scale solar construction in New South Wales with \$150 million investment*. <https://www.cefc.com.au/media/media-release/cefc-accelerates-large-scale-solar-construction-in-new-south-wales-with-150-million-investment/>
- CEFC. (2020, May). *Clean energy and community housing*. Clean Energy Finance Corporation. https://www.cefc.com.au/media/2vqg5rly/cefc_investmentinsights_communityhousing.pdf
- CEFC. (2022a). *2022-23 Corporate Plan*. https://www.cefc.com.au/media/nazlh3hc/cefc_2022-23_corporateplan.pdf
- CEFC. (2022b). *Annual Report 2021-22. A decade leading Australia’s energy transition*. Clean Energy Finance Corporation. <https://www.cefc.com.au/media/fq2prayo/cefc-annual-report-2021-22.pdf>
- CEFC. (2022c). *Blue Grass Solar Farm officially opens*. <https://www.cefc.com.au/media/media-release/blue-grass-solar-farm-officially-opens/>

- CEFC. (2024, February 1). *Remote WA mine pioneers solar and storage potential—Clean Energy Finance Corporation*. <https://www.cefc.com.au/case-studies/remote-wa-mine-pioneers-solar-and-storage-potential/>
- Chang, H.-J. (2002). *Kicking away the ladder*. Anthem Press.
<https://anthempres.com/kicking-away-the-ladder-pb>
- Chang, H.-J. (2011). Institutions and Economic Development: Theory, Policy and History. *Journal of Institutional Economics*, 7(4), 473–498.
<https://doi.org/10.1017/S1744137410000378>
- Chelminski, K. (2022). Climate Finance Effectiveness: A Comparative Analysis of Geothermal Development in Indonesia and the Philippines. *Journal of Environment and Development*, 31(2), 139–167. Scopus. <https://doi.org/10.1177/10704965211070034>
- Ciplet, D., & Roberts, J. T. (2017). Climate Change and the Transition to Neoliberal Environmental Governance. *Global Environmental Change*, 46, 148–156.
<https://doi.org/10.1016/j.gloenvcha.2017.09.003>
- Clapin, L., & Longden, T. (2024). Waiting to generate: An analysis of onshore wind and solar PV project development lead-times in Australia. *Energy Economics*, 131, 107337.
<https://doi.org/10.1016/j.eneco.2024.107337>
- Clean Energy Finance Corporation Act, Pub. L. No. Act No. 104 of 2012 (2012).
<https://www.legislation.gov.au/Series/C2012A00104>
- Clean Energy Regulator. (2024, March 21). *Certificate shortfall*.
<https://cer.gov.au/schemes/renewable-energy-target/renewable-energy-target-liability-and-exemptions/certificate-0>
- Coase, R. H. (1937). The Nature of the Firm. *Economica*, 4(16), 386–405.
<https://doi.org/10.1111/j.1468-0335.1937.tb00002.x>
- Coase, R. H. (1960). The Problem of Social Cost. *The Journal of Law & Economics*, 3, 1–44. JSTOR.
- Coase, R. H. (1991, December 9). *The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 1991*. <https://www.nobelprize.org/prizes/economic-sciences/1991/coase/lecture/>
- Coffey, B. (2021). Environmental Challenges for Public Value Theory and Practice. *International Journal of Public Administration*, 44(10), 818–825.
<https://doi.org/10.1080/01900692.2021.1928187>

- Coghill, K. (2021). Existential Public Value. *International Journal of Public Administration*, 44(10), 845–856. <https://doi.org/10.1080/01900692.2021.1875234>
- Colvin, R. M., & Jotzo, F. (2021). Australian Voters' Attitudes to Climate Action and their Social-political Determinants. *PLOS ONE*, 16(3), e0248268. <https://doi.org/10.1371/journal.pone.0248268>
- Commonwealth of Australia. (2022). *Australia's 8th National Communication on Climate Change* (p. 409). Australian Government Department of Climate Change, Energy, the Environment and Water. https://unfccc.int/sites/default/files/resource/NatComm8%20Biennial%20Statement_2022_v8%2021%20Dec.pdf
- Cooray, M. (2023, May 2). What price will Laos need to pay to be saved, and will China pay it? *The Interpreter*. <https://www.lowyinstitute.org/the-interpreter/what-price-will-laos-need-pay-be-saved-will-china-pay-it>
- Cui, T., & Aulton, K. (2023). Conceptualizing the Elements of Value in Public Services: Insights from Practitioners. *Public Management Review*, 1–23. <https://doi.org/10.1080/14719037.2023.2226676>
- Cullenward, D., & Victor, D. G. (2020). *Making climate policy work*. Polity.
- Darbi, W. (2012). Of Mission and Vision Statements and Their Potential Impact on Employee Behavior and Attitudes: The Case of A Public But Profit-Oriented Tertiary Institution. *International Journal of Business & Social Science*, 3, 95–109.
- Das, R., Jain, K. K., & Mishra, S. K. (2018). Archival research: A neglected method in organization studies. *Benchmarking: An International Journal*, 25(1), 138–155. <https://doi.org/10.1108/BIJ-08-2016-0123>
- Dayant, A., & Duke, R. (2024, February 6). A new China loan threatens Vanuatu's debt outlook. *The Interpreter*. <https://www.lowyinstitute.org/the-interpreter/new-china-loan-threatens-vanuatu-s-debt-outlook>
- Dayant, A., & Stanhope, G. (2024). *Mind the gap: Ambition versus delivery in China's BRI megaprojects in Southeast Asia*. Lowy Institute. <https://interactives.lowyinstitute.org/features/mind-the-gap-chinas-bri-southeast-asia/>
- de Brouwer, G. (2021). *Bringing prosperity, security and social wellbeing together in the national interest in a messy world* (East Asian Bureau of Economic Research ABER Working Paper 21/11/2021). Australian National University. <https://eaber.org/wp->

content/uploads/2021/11/Chapter-2-Brouwer-Gordon-GordonProsperity-security-and-social-wellbeing.pdf

De Jonge, A. (2017). Perspectives on the emerging role of the Asian Infrastructure Investment Bank. *International Affairs*, 93(5), 1061–1084. <https://doi.org/10.1093/ia/iix156>

DFAT. (2024). *IPEF Supply Chain Agreement | Australian Government Department of Foreign Affairs and Trade*. <https://www.dfat.gov.au/trade/organisations/wto-g20-oecd-apec/indo-pacific-economic-framework/ipef-supply-chain-agreement>

Diaz-Rainey, I., Corfee-Morlot, J., Volz, U., & Caldecott, B. (2023). Green Finance in Asia: Challenges, Policies and Avenues for Research. *Climate Policy*, 23(1), 1–10. Scopus. <https://doi.org/10.1080/14693062.2023.2168359>

Diaz-Rainey, I., Robertson, B., & Wilson, C. (2017). Stranded research? Leading finance journals are silent on climate change. *Climatic Change*, 143(1–2), 243–260. <https://doi.org/10.1007/s10584-017-1985-1>

Diaz-Rainey, I., & Sise, G. (2018). *Green energy finance in Australia and New Zealand* (840; ADBI Working Paper Series). ADB.

Dibley, A. C. (2021). Why Does Leviathan Innovate? The Law and Economics of Technological Change at State-Owned Electric Utilities [J.S.D., Stanford University]. In *ProQuest Dissertations and Theses* (2581334521). Stanford Digital Repository. <https://purl.stanford.edu/ww428zp8348>

Dikau, S., & Volz, U. (2021). Out of the window? Green monetary policy in China: Window guidance and the promotion of sustainable lending and investment. In *CLIMATE POLICY*. TAYLOR & FRANCIS LTD. <https://doi.org/10.1080/14693062.2021.2012122>

Do, T. N., Burke, P. J., Baldwin, K. G. H., & Nguyen, C. T. (2020). Underlying drivers and barriers for solar photovoltaics diffusion: The case of Vietnam. *Energy Policy*, 144, 111561. <https://doi.org/10.1016/j.enpol.2020.111561>

Do, T. N., Burke, P. J., Nguyen, H. N., Overland, I., Suryadi, B., Swandaru, A., & Yurnaidi, Z. (2021). Vietnam's solar and wind power success: Policy implications for the other ASEAN countries. *Energy for Sustainable Development*, 65, 1–11. <https://doi.org/10.1016/j.esd.2021.09.002>

Dobrotkova, Z., Surana, K., & Audinet, P. (2018). The price of solar energy: Comparing competitive auctions for utility-scale solar PV in developing countries. *Energy Policy*, 118, 133–148. <https://doi.org/10.1016/j.enpol.2018.03.036>

- Dornan, M. (2014). Reform despite politics? The political economy of power sector reform in Fiji, 1996–2013. *Energy Policy*, 67, 703–712. <https://doi.org/10.1016/j.enpol.2013.11.070>
- Dornan, M., & Jotzo, F. (2015). Renewable technologies and risk mitigation in small island developing states: Fiji's electricity sector. *Renewable and Sustainable Energy Reviews*, 48, 35–48. <https://doi.org/10.1016/j.rser.2015.03.059>
- Dubash, N. K. (2021). Varieties of climate governance: The emergence and functioning of climate institutions. *Environmental Politics*, 30(sup1), 1–25. <https://doi.org/10.1080/09644016.2021.1979775>
- Dubash, N. K., & Florini, A. (2011). Mapping global energy governance. *Global Policy*, 2(SUPPL.1), 6–18. <https://doi.org/10.1111/j.1758-5899.2011.00119.x>
- Dubash, N. K., & Morgan, B. (2012). Understanding the rise of the regulatory state of the South*. *Regulation & Governance*, 6(3), 261–281. <https://doi.org/10.1111/j.1748-5991.2012.01146.x>
- Dubash, N. K., & Williams, J. H. (2006). The Political Economy of Electricity Liberalization. In *Transforming Power*. Routledge.
- Dudau, A., Glennon, R., & Verschuere, B. (2019). Following the yellow brick road? (Dis)enchantment with co-design, co-production and value co-creation in public services. *Public Management Review*, 21(11), 1577–1594. <https://doi.org/10.1080/14719037.2019.1653604>
- Duke, R. (2024, February 6). Tonga walks a tightrope on its Chinese debts. *The Interpreter*. <https://www.lowyinstitute.org/the-interpreter/tonga-walks-tightrope-its-chinese-debts>
- Edianto, A., Trencher, G., & Matsubae, K. (2022). Why do some countries receive more international financing for coal-fired power plants than renewables? Influencing factors in 23 countries. *Energy for Sustainable Development*, 66, 177–188. <https://doi.org/10.1016/j.esd.2021.12.004>
- Egli, F., Polzin, F., Sanders, M., Schmidt, T., Serebriakova, A., & Steffen, B. (2022). Financing the energy transition: Four insights and avenues for future research. *Environmental Research Letters*, 17(5), 051003. <https://doi.org/10.1088/1748-9326/ac6ada>
- Egli, F., Steffen, B., & Schmidt, T. S. (2018). A dynamic analysis of financing conditions for renewable energy technologies. *Nature Energy*, 3(12), Article 12. <https://doi.org/10.1038/s41560-018-0277-y>

- Elsevier. (2024). *Scopus*. Scopus.
https://assets.ctfassets.net/o78em1y1w4i4/28v2L8eQgAGxOnnvZlqJWh/7947feb83982b078ec1d70c297055c34/ELSV_15617_Scopus_Fact_Sheet_Update_WEB.pdf
- Ember. (2022). *European Electricity Review 2022* [Dataset]. <https://ember-climate.org/insights/research/european-electricity-review-2022/>
- Ember. (2023). *Yearly electricity data* [Dataset]. <https://ember-climate.org/data-catalogue/yearly-electricity-data/>
- Emery, T. (2023). *Solar Can't Scale in the Dark*. Energy for Growth Hub.
<https://energyforgrowth.org/article/solar-cant-scale-in-the-dark-why-lessons-about-subsidies-and-transparency-from-ifcs-scaling-solar-zambia-can-reignite-progress-toward-deploying-clean-energy/>
- Energy Institute. (2022). *Statistical Review of World Energy* [Dataset].
<https://www.energyinst.org/statistical-review/resources-and-data-downloads>
- Fankhauser, S., & Jotzo, F. (2018). Economic growth and development with low-carbon energy. *WIREs Climate Change*, 9(1), e495. <https://doi.org/10.1002/wcc.495>
- Farrell, H., & Newman, A. L. (2019). Weaponized Interdependence: How Global Economic Networks Shape State Coercion. *International Security*, 44(1), 42–79.
https://doi.org/10.1162/isec_a_00351
- Ferguson, P. (2015). The green economy agenda: Business as usual or transformational discourse? *Environmental Politics*, 24(1), 17–37.
<https://doi.org/10.1080/09644016.2014.919748>
- Fidali, K., Toamua, O., Aquillah, H., Lomaloma, S., Mauriasi, P. R., Nasiu, S., Vunisea, A., & Mangubhai, S. (2023). Can civil society and faith-based organisations in Fiji, Samoa and the Solomon Islands access climate finance? *Development Policy Review*, n/a(n/a), e12728.
<https://doi.org/10.1111/dpr.12728>
- Fink, A. (1998). *Conducting research literature reviews*. SAGE publishing.
<https://us.sagepub.com/en-us/nam/conducting-research-literature-reviews/book259191>
- Fouad, M., Novta, N., Preston, G., Schneider, T., & Weerathunga, S. (2021). *Unlocking Access to Climate Finance for Pacific Island Countries*. IMF.
- Frate, C. A., & Brannstrom, C. (2017). Stakeholder subjectivities regarding barriers and drivers to the introduction of utility-scale solar photovoltaic power in Brazil. *Energy Policy*, 111, 346–352. <https://doi.org/10.1016/j.enpol.2017.09.048>

- Gabor, D., & Sylla, N. S. (2023). Derisking Developmentalism: A Tale of Green Hydrogen. *Development and Change*, 54(5), 1169–1196. <https://doi.org/10.1111/dech.12779>
- Gale, F., P. (2019). *The Political Economy of Sustainability*. Edward Elgar. <https://www.e-elgar.com/shop/gbp/the-political-economy-of-sustainability-9781785368004.html>
- Gallagher, K. S., Grübler, A., Kuhl, L., Nemet, G., & Wilson, C. (2012). The Energy Technology Innovation System. *Annual Review of Environment and Resources*, 37(1), 137–162. <https://doi.org/10.1146/annurev-environ-060311-133915>
- Gao, X., Davidson, M., Busby, J., Shearer, C., & Eisenman, J. (2021). The Challenges of Coal Phaseout: Coal Plant Development and Foreign Finance in Indonesia and Vietnam: Global Environmental Politics. *Global Environmental Politics*, 21(4), 110–133. https://doi.org/10.1162/glep_a_00630
- Gatti, S. (2013). Chapter 3—Project Characteristics, Risk Analysis, and Risk Management. In S. Gatti (Ed.), *Project Finance in Theory and Practice (Second Edition)* (pp. 43–75). Academic Press. <https://doi.org/10.1016/B978-0-12-391946-5.00003-7>
- GCF. (2021, February 18). *About GCF* [Text]. Green Climate Fund. <https://www.greenclimate.fund/about>
- GCP. (2023). *State of the carbon cycle: An annual update of the global carbon budget*. Global Carbon Budget; Global Carbon Project (GCP). <https://globalcarbonbudget.org/>
- Geddes, A., Schmid, N., Schmidt, T. S., & Steffen, B. (2020). The politics of climate finance: Consensus and partisanship in designing green state investment banks in the United Kingdom and Australia. *Energy Research and Social Science*, 69. <https://doi.org/10.1016/j.erss.2020.101583>
- Geddes, A., Schmidt, T. S., & Steffen, B. (2018). The multiple roles of state investment banks in low-carbon energy finance: An analysis of Australia, the UK and Germany. *Energy Policy*, 115(August 2017), 158–170. <https://doi.org/10.1016/j.enpol.2018.01.009>
- Gillingham, K., & Sweeney, J. (2010). *Market Failure and the Structure of Externalities (To be included in: Harnessing Renewable Energy, A. Jorge Padilla and Richard Schmalensee, eds)*. 1–32.
- Global Infrastructure Hub. (2019). *Guidance Note on National Infrastructure Banks & Similar Financing Facilities*. Global Infrastructure Hub. https://cdn.gihub.org/umbraco/media/2621/gih-national_infrastructure_banks_-full_report-web.pdf

- Global Trade Alert. (2024, October 1). *Global dynamics- total number of implemented interventions since November 2008*.
https://www.globaltradealert.org/global_dynamics/area_all/year-from_2020/day-to_0911
- Goodhart, C. a. E. (2011). The changing role of central banks. *Financial History Review*, 18(2), 135–154. <https://doi.org/10.1017/S0968565011000096>
- Granoff, I., Hogarth, J. R., & Miller, A. (2016). Nested barriers to low-carbon infrastructure investment. *Nature Climate Change*, 6(12), Article 12. <https://doi.org/10.1038/nclimate3142>
- Green Bank Network. (2018). *Green Banks Year in Review 2018*. Natural Resources Defense Council. <https://www.nrdc.org/sites/default/files/green-banks-year-in-review-2018.pdf>
- Grenville, S. (2024, April 26). *Australia's comparative advantage in climate transition*. Lowy Interpreter. <https://www.lowyinstitute.org/the-interpreter/australia-s-comparative-advantage-climate-transition>
- Griffith-Jones, S. (2020). National Development Finance in Middle-Income Countries: The Role of National Development Banks. In J. A. Alonso & J. A. Ocampo (Eds.), *Trapped in the Middle?: Developmental Challenges for Middle-Income Countries* (p. 0). Oxford University Press. <https://doi.org/10.1093/oso/9780198852773.003.0011>
- Grubb, M. (2004). Technology Innovation and Climate Change Policy: An overview of issues and options. *Jeio Economic Studies*, 41, 103–132.
- Grubb, M., Drummond, P., Poncia, A., McDowall, W., Popp, D., Samadi, S., Penasco, C., Gillingham, K. T., Smulders, S., Glachant, M., Hassall, G., Mizuno, E., Rubin, E. S., Dechezleprêtre, A., & Pavan, G. (2021). Induced innovation in energy technologies and systems: A review of evidence and potential implications for CO2 mitigation. *Environmental Research Letters*, 16(4), 043007–043007. <https://doi.org/10.1088/1748-9326/ABDE07>
- Gunningham, N. (2020a). A quiet revolution: Central banks, financial regulators, and climate finance. *Sustainability (Switzerland)*, 12(22), 1–22. Scopus. <https://doi.org/10.3390/su12229596>
- Gunningham, N. (2020b). Financing a low-carbon revolution. *Bulletin of the Atomic Scientists*, 76(5), 228–232. Scopus. <https://doi.org/10.1080/00963402.2020.1806573>
- Haddaway, N. R., & Pullin, A. S. (2014). The Policy Role of Systematic Reviews: Past, Present and Future. *Springer Science Reviews*, 2(1), 179–183. <https://doi.org/10.1007/s40362-014-0023-1>

- Hammersley, G., Pill, M., & Rajah, R. (2023). *Revitalising the Green Climate Fund*. Lowy Institute. <https://www.lowyinstitute.org/publications/revitalising-green-climate-fund>
- Hartley, J., Alford, J., Knies, E., & Douglas, S. (2017). Towards an empirical research agenda for public value theory. *Public Management Review*, 19(5), 670–685. <https://doi.org/10.1080/14719037.2016.1192166>
- Hidalgo-Oñate, D., Fuertes-Fuertes, I., & Cabedo, J. D. (2023). Climate-related prudential regulation tools in the context of sustainable and responsible investment: A systematic review. *Climate Policy*, 23(6), 704–721. Scopus. <https://doi.org/10.1080/14693062.2023.2179587>
- Hopewell, K. (2017). When market fundamentalism and industrial policy collide: The Tea Party and the US Export–Import Bank. *Review of International Political Economy*, 24(4), 569–598. <https://doi.org/10.1080/09692290.2017.1316297>
- Hopewell, K. (2019). How Rising Powers Create Governance Gaps: The Case of Export Credit and the Environment. *Global Environmental Politics*, 19(1). https://doi.org/doi:10.1162/glep_a_00490
- Hopewell, K. (Ed.). (2020). Beyond the WTO: Erosion of the Export Credit Arrangement. In *Clash of Powers: US-China Rivalry in Global Trade Governance* (pp. 133–160). Cambridge University Press. <https://doi.org/10.1017/9781108877015.005>
- Horwitz, A. V. (1990). *The Logic of Social Control*. Springer Science & Business Media.
- Hoschka, T. C. (2005). *Local Currency Financing—The Next Frontier for MDBs?* <https://www.adb.org/publications/local-currency-financing-next-frontier-mdbs>
- Hughes, L., & Downie, C. (2023). Bilateral finance organizations and stranded asset risk in coal: The case of Japan. *Climate Policy*, 23(1), 41–56. <https://doi.org/10.1080/14693062.2021.1975622>
- Humphrey, C. (2015). *Are Credit Rating Agencies Limiting the Operational Capacity of Multilateral Development Banks?* https://scholar.google.com/scholar_lookup?title=Are%20credit%20rating%20agencies%20limiting%20the%20operational%20capacity%20of%20multilateral%20development%20banks&publication_year=2015&author=C.%20Humphrey
- Humphrey, C. (2022). *Financing the Future: Multilateral Development Banks in the Changing World Order of the 21st Century*. (First Edition). Oxford University Press.

- Humphrey, C. (2024). *The legal underpinnings of MDB callable capital*. ODI.
https://media.odi.org/documents/ODI_The_legal_underpinnings_of_MDB_callable_capital_v3.pdf
- IEA. (2021). *Net Zero by 2050 – Analysis*. International Energy Agency.
<https://www.iea.org/reports/net-zero-by-2050>
- IEA. (2022). *Southeast Asia Energy Outlook 2022 – Analysis*. IEA.
<https://www.iea.org/reports/southeast-asia-energy-outlook-2022>
- IEA. (2023). *Net Zero Roadmap: A Global Pathway to Keep the 1.5 °C Goal in Reach 2023 Update*. International Energy Agency. https://iea.blob.core.windows.net/assets/4d93d947-c78a-47a9-b223-603e6c3fc7d8/NetZeroRoadmap_AGlobalPathwaytoKeepthe1.5CGoalinReach-2023Update.pdf
- IEA. (2024a). *CO2 Emissions in 2023*. International Energy Agency.
<https://www.iea.org/reports/co2-emissions-in-2023/executive-summary>
- IEA. (2024b). *Global Critical Minerals Outlook*. International Energy Agency.
<https://www.iea.org/reports/global-critical-minerals-outlook-2024>
- IEA. (2024c). *World Energy Investment 2024 – Analysis*. International Energy Agency.
<https://www.iea.org/reports/world-energy-investment-2024/china#>
- IEA. (2024d) *Global EV Outlook 2024 – Analysis*. International Energy Agency.
<https://www.iea.org/reports/global-ev-outlook-2024>
- INA. (2022). *Annual Report 2022*. Indonesia Investment Authority.
<https://www.ina.go.id/annual-report/annual-report-2022-en>
- IPCC. (2022). *Climate Change 2022 Mitigation of Climate Change Summary for Policymakers*. Intergovernmental Panel on Climate Change.
https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SPM.pdf
- IRENA. (2017). *Renewables Readiness Assessment Fiji*. International Renewable Energy Agency. <https://www.irena.org/publications/2015/Jul/Renewables-Readiness-Assessment-Fiji>
- Jakob, M., & Steckel, J. C. (2014). How climate change mitigation could harm development in poor countries. *WIREs Climate Change*. <https://doi.org/10.1002/wcc.260>
- Jevons, W. S. (1871). *The Theory of Political Economy*. Palgrave Classics in Economics.
<https://doi.org/10.1057/9781137374158>

- Johanson, J.-E., & Vakkuri, J. (2017). *Governing Hybrid Organisations: Exploring Diversity of Institutional Life* (1st ed.). Routledge. <https://doi.org/10.4324/9781315622293>
- Jotzo, F. (2012). Australia's carbon price. *Nature Climate Change*, 2(7), 475–476. <https://doi.org/10.1038/nclimate1607>
- Jotzo, F., Jordan, T., & Fabian, N. (2012). Policy Uncertainty about Australia's Carbon Price: Expert Survey Results and Implications for Investment. *Australian Economic Review*, 45(4), 395–409. <https://doi.org/10.1111/j.1467-8462.2012.00709.x>
- Kavvadia, H. (2021). The European Investment Bank's 'quantum leap' to become the world's first international climate bank. *Politics and Governance*, 9(2), 185–195. Scopus. <https://doi.org/10.17645/pag.v9i2.3921>
- Keen, M. (2023, October 31). Infrastructure for influence: Pacific Islands building spree. *Lowy Interpreter*. <https://www.lowyinstitute.org/the-interpreter/infrastructure-influence-pacific-islands-building-sprees>
- Keohane, R. O., & Victor, D. G. (2011). The regime complex for climate change. *Perspectives on Politics*, 9(1), 7–23. <https://doi.org/10.1017/S1537592710004068>
- Ker, P. (2024, January 1). How a big new solar farm became a stranded asset. *Australian Financial Review*. <https://www.afr.com/companies/energy/how-a-big-new-solar-farm-became-a-stranded-asset-20231219-p5eshb>
- Kern, F., & Howlett, M. (2009). Implementing transition management as policy reforms: A case study of the Dutch energy sector. *Policy Sciences*, 42(4), 391–408. <https://doi.org/10.1007/s11077-009-9099-x>
- Kivimaa, P., Hildén, M., Huitema, D., Jordan, A., & Newig, J. (2017). Experiments in climate governance – A systematic review of research on energy and built environment transitions. *Journal of Cleaner Production*, 169, 17–29. <https://doi.org/10.1016/j.jclepro.2017.01.027>
- Klasen, A., Wanjiru, R., Henderson, J., & Phillips, J. (2022). Export finance and the green transition. *Global Policy*, 13, 710–720. <https://doi.org/10.1111/1758-5899.13121>
- Knott, E., Rao, A. H., Summers, K., & Teeger, C. (2022). Interviews in the social sciences. *Nature Reviews Methods Primers*, 2(1), Article 1. <https://doi.org/10.1038/s43586-022-00150-6>
- Kolko, J. (2024, April 16). *The economic research policymakers actually need*. <https://www.slowboring.com/p/the-economic-research-policymakers>

- Komai, M. (2020, December 16). Saltwater intrusion damages sugar cane farms and decreases cane production in Fiji. *Pasifika Environews*.
<https://pasifika.news/2020/12/saltwater-intrusion-damages-sugar-cane-farms-and-decreases-cane-production-in-fiji/>
- Kompas, T., Pham, V. H., & Tuong, N. C. (2018). The Effects of Climate Change on GDP by Country and the Global Economic Gains From Complying With the Paris Climate Accord. *Earth's Future*, 6(8), 1153–1173. <https://doi.org/10.1029/2018EF000922>
- Kong, B., & Gallagher, K. P. (2021). THE GLOBALIZATION OF CHINA'S COAL INDUSTRY: THE ROLE OF DEVELOPMENT BANKS. In *JOURNAL OF EAST ASIAN STUDIES* (Vol. 21, Issue 2, pp. 219–235). CAMBRIDGE UNIV PRESS. <https://doi.org/10.1017/jea.2021.16>
- Kreibiehl, S., Yong Jung, T., Battiston, S., Carvajal, P. E., Clapp, C., Dasgupta, D., Dube, N., Jachnik, R., Morita, N., Samargandi, N., & Williams, M. (2022). *Investment and finance in IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*. IPCC.
- Krupa, J., & Harvey, L. D. D. (2017). Renewable electricity finance in the United States: A state-of-the-art review. *Energy*, 135, 913–929. <https://doi.org/10.1016/j.energy.2017.05.190>
- Lakshmi, A. A. (2024, April 21). Indonesia's Sovereign Wealth Fund Eyes Green Energy Transition in \$1bn Investment Plan. *Financial Times*. <https://www.ft.com/content/451cfcfc-cbee-42c8-a1bf-8b174805c55d>
- Laplane, A., & Mazzucato, M. (2020). Socializing the risks and rewards of public investments: Economic, policy, and legal issues. *Research Policy*, 49, 100008–100008. <https://doi.org/10.1016/j.repolx.2020.100008>
- Larasati, L. K., & Mafira, T. (2023a). *Climate-Aligned Investments in Indonesia's Financial Sector*. CPI. <https://www.climatepolicyinitiative.org/publication/climate-aligned-investments-in-indonesias-financial-sector/>
- Larasati, L. K., & Mafira, T. (2023b). *The Net Zero Alignment of Indonesia's Power Sector Finance*. CPI. <https://www.climatepolicyinitiative.org/publication/the-net-zero-alignment-of-indonesias-power-sector-finance/#:~:text=CPI's%20most%20recent%20tracking%20of,meet%20Indonesia's%20NZE%2060%20scenario.>
- Larsen, J., King, B., van Brummen, A., & Kolus, H. (2023, February 9). *US Decarbonization Priorities in the Wake of the Inflation Reduction Act – Rhodium Group*. Rhodium Group.

<https://rhg.com/research/us-decarbonization-priorities-in-the-wake-of-the-inflation-reduction-act/>

Lawrence, M., Homer-Dixon, T., Janzwood, S., Rockstöm, J., Renn, O., & Donges, J. F. (2024). Global polycrisis: The causal mechanisms of crisis entanglement. *Global Sustainability*, 7, e6. Cambridge Core. <https://doi.org/10.1017/sus.2024.1>

Lazonick, W., & Mazzucato, M. (2013). The risk-reward nexus in the innovation-inequality relationship: Who takes the risks? Who gets the rewards? *Industrial and Corporate Change*, 22(4), 1093–1128. <https://doi.org/10.1093/icc/dtt019>

Léautier, F. (2023). *Boosting MDBs' investing capacity: An Independent Review of Multilateral Development Banks' Capital Adequacy Frameworks*. G20. https://www.dt.mef.gov.it/export/sites/sitodt/modules/documenti_it/news/news/CAF-Review-Report.pdf

Lepak, D. P., Smith, K. G., & Taylor, M. S. (2007). Value Creation and Value Capture: A Multilevel Perspective. *Academy of Management Review*, 32(1), 180–194. <https://doi.org/10.5465/amr.2007.23464011>

Li, B. (2023, February 27). *Scaling up Climate Finance for Emerging Markets and Developing Economies*. Speech by Deputy Managing Director Bo Li at EIB Group Forum 2023. <https://www.imf.org/en/News/Articles/2023/02/28/sp022823-scaling-up-climate-finance-for-emerging-markets-and-developing-economies>

Liao, J. C. (2021). The Club-based Climate Regime and OECD Negotiations on Restricting Coal-fired Power Export Finance. *Global Policy*, 12(1). <https://onlinelibrary.wiley.com/doi/10.1111/1758-5899.12894>

Littell, J. H., Corcoran, J., & Pillai, V. (2008). *Systematic Reviews and Meta-Analysis*. Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780195326543.001.0001>

Lyons, C., (2024), “Systematic reviews for Banking on Paris: the roles of public green banks in the net zero transition”, Mendeley Data, V1, doi: 10.17632/kms7s366nc.1

Lyons, M., & White, L. V. (2023). How Green Banks can create multiple types of value in the transition to net zero emissions. *Australian Journal of Public Administration*. <https://doi.org/10.1111/1467-8500.12623>

Macfarlane, L., & Mazzucato, M. (2018). *State investment banks and patient finance: An international comparison*. UCL. <https://www.ucl.ac.uk/bartlett/public-purpose/publications/2018/feb/state-investment-banks-and-patient-finance-international-comparison>

- Mafira, T. (2023, November 7). Indonesia's Just Energy Transition Partnership is a Glass Half Full. *Indonesia's Just Energy Transition Partnership Is a Glass Half Full*. <https://www.lowyinstitute.org/the-interpreter/indonesia-s-just-energy-transition-partnership-glass-half-full>
- Marois, T. (2021). *Public Banks: Decarbonisation, Definancialisation and Democratisation*. Cambridge University Press. <https://doi.org/10.1017/9781108989381>
- Marshall, A. (1890). *Principles of Economics* (8th ed.). Macmillan and Co.
- Martinez- Fernandez, C., Hinojosa, C., & Miranda, G. (2010). *Greening Jobs and Skills: Labour Market Implications of Addressing Climate Change* (OECD Local Economic and Employment Development (LEED) Working Papers 2010/02; OECD Local Economic and Employment Development (LEED) Working Papers, Vol. 2010/02). OECD. <https://doi.org/10.1787/5kmbjgl8sd0r-en>
- Mathiasen, K. (2023, August 3). Mining for GEMs. *Center for Global Development*. <https://mdbreformaccelerator.cgdev.org/mining-for-gems/>
- Mazzucato, M. (2011). *The Entrepreneurial State*. Penguin.
- Mazzucato, M. (2018). *The value of everything: Making and taking in the global economy*. Penguin.
- Mazzucato, M. (2019). *The value of everything: Making and taking in the global economy*. Penguin.
- Mazzucato, M., & Penna, C. C. R. (2016). Beyond market failures: The market creating and shaping roles of state investment banks. *Journal of Economic Policy Reform*, 19(4), 305–326. <https://doi.org/10.1080/17487870.2016.1216416>
- Mazzucato, M., & Ryan-Collins, J. (2022). Putting value creation back into “public value”: From market-fixing to market-shaping. *Journal of Economic Policy Reform*, 25(4), 345–360. <https://doi.org/10.1080/17487870.2022.2053537>
- Mazzucato, M., & Semieniuk, G. (2018). Financing renewable energy: Who is financing what and why it matters. *Technological Forecasting and Social Change*, 127, 8–22. <https://doi.org/10.1016/j.techfore.2017.05.021>
- McCauley, D., & Heffron, R. (2018). Just transition: Integrating climate, energy and environmental justice. *Energy Policy*, 119, 1–7. <https://doi.org/10.1016/j.enpol.2018.04.014>
- MCGB. (2022). *2022 Annual Report*. Montgomery County Green Bank. <https://mcgreenbank.org/wp-content/uploads/2023/02/Annual-Report-FY22-FINAL.pdf>

- Meckling, J., Aldy, J. E., Kotchen, M. J., Carley, S., Esty, D. C., Raymond, P. A., Tonkonogy, B., Harper, C., Sawyer, G., & Sweatman, J. (2022). Busting the myths around public investment in clean energy. *Nature Energy*, 7(7), Article 7. <https://doi.org/10.1038/s41560-022-01081-y>
- Michaelowa, A., & Jotzo, F. (2005). Transaction costs, institutional rigidities and the size of the clean development mechanism. *Energy Policy*, 33(4), 511–523. <https://doi.org/10.1016/j.enpol.2003.08.016>
- Mitchell, H. (2023). *A Modern Economic Statecraft Framework* (SSRN Scholarly Paper 4548008). <https://doi.org/10.2139/ssrn.4548008>
- Monnin, P., Feyertag, J., Robins, N., & Wollenweber, A. (2024). *Aligning sovereign bond markets with the net zero transition: The role of central banks*. LSE.
- Moore, M. H. (1995). *Creating public value: Strategic management in government*. Harvard University Press.
- Morris, S., Rockafellow, R., & Rose, S. (2021). *Mapping China's Participation in Multilateral Development Institutions and Funds*. Centre for Global Development.
- Naqvi, N., Henow, A., & Chang, H.-J. (2018). Kicking away the financial ladder? German development banking under economic globalisation. *Review of International Political Economy*, 25(5), 672–698. <https://doi.org/10.1080/09692290.2018.1480515>
- Nesadurai, H. (2005). *Conceptualising Economic Security in an Era of Globalisation: What Does the East Asian Experience Reveal?*
- New York State Climate Leadership and Community Protection Act, S6599, NY State Senate Bill (2013). <https://www.nysenate.gov/legislation/bills/2019/S6599>
- North, D. C. (1990). *Institutions, Institutional Change and Economic Performance*. Cambridge University Press; Cambridge Core. <https://doi.org/10.1017/CBO9780511808678>
- Nussbaum, M., & Sen, A. (Eds.). (1993). *The Quality of Life*. Oxford University Press. <https://doi.org/10.1093/0198287976.001.0001>
- NYGB. (2020). *NYGB Transaction Profile Q4 2020 Agbotic, Inc.* NYGB. <https://greenbank.ny.gov/-/media/Project/Greenbank/Files/NYGB-Transaction-Profile-Agbotic.pdf>
- NYGB. (2021, August 2). *NY Green Bank Announces Completion Of First Private Capital Raise And Largest By A Green Bank In The U.S.* NYSERDA.

<https://www.nyserda.ny.gov/About/Newsroom/2021-Announcements/2021-08-02-NY-Green-Bank-Private-Capital-Raise-Fund-Largest>

NYGB. (2022). *2021-22 Impact Report*. New York Green Bank.

<https://greenbank.ny.gov/Resources/Impact-Report>

NZGIF. (2019). *NZGIF Statement of Intent 2019-2023*.

<https://nzgif.co.nz/assets/Files/B.36+NZGIF+Statement+of+Intent+20192023.pdf>

NZGIF. (2022). *New Zealand Green Investment Finance Annual Report 2021-2022*. NZGIF.

OECD. (2015). *Green Investment Banks*. OECD.

OECD. (2017a). *Investing in Climate, Investing in Growth*. <https://www.oecd-ilibrary.org/content/publication/9789264273528-en>

OECD. (2017b). *Investing in Climate, Investing in Growth A Synthesis*. OECD.

<https://www.oecd.org/env/cc/g20-climate/synthesis-investing-in-climate-investing-in-growth.pdf>

OECD. (2023s). *Arrangement on officially supported Export Credits*.

[https://one.oecd.org/document/TAD/PG\(2023\)7/en/pdf](https://one.oecd.org/document/TAD/PG(2023)7/en/pdf)

OECD. (2024). *Climate Finance and the USD 100 billion goal*. OECD.

<https://www.oecd.org/en/topics/sub-issues/climate-finance-and-the-usd-100-billion-goal.html>

Office of Legislative Oversight. (2021). *Economic Impact Statement* (44–21).

<https://www.montgomerycountymd.gov/OLO/Resources/Files/eis/2021/EIS-Bill44-21.pdf>

O'Flynn, J. (2021). Where to for Public Value? Taking Stock and Moving On. *International Journal of Public Administration*, 44(10), 867–877.

<https://doi.org/10.1080/01900692.2021.1884696>

O'Manique, C., Tucker, B., & DeAngelis, K. (2022). *At a Crossroads: Assessing G20 And MDB International Energy Finance Ahead of Stop Funding Fossils Pledge Deadline*. Oil Change International. <https://www.oilchange.org/publications/g20-at-a-crossroads/>

Osborne, S. P., Powell, M., Cui, T., & Strokosch, K. (2022). Value Creation in the Public Service Ecosystem: An Integrative Framework. *Public Administration Review*, 82(4), 634–645. <https://doi.org/10.1111/puar.13474>

Our World in Data. (2024, July 12). *Population*. Our World in Data.

<https://ourworldindata.org/grapher/population-unwpp?tab=chart&country=FJI>

Pacheco Pardo, R., & Klingler-Vidra, R. (2019). The Entrepreneurial Developmental State: What is the Perceived Impact of South Korea's Creative Economy Action Plan on

- Entrepreneurial Activity? *Asian Studies Review*, 43(2), 313–331.
<https://doi.org/10.1080/10357823.2019.1589418>
- Parkinson, G. (2023, April 26). *NT solar farms still sitting idle after three years, now a consultant has been called in*. Renew Economy. <https://reneweconomy.com.au/nt-solar-farms-still-sitting-idle-after-three-years-now-a-consultant-has-been-called-in/>
- Peñasco, C., Anadón, L. D., & Verdolini, E. (2021). Systematic review of the outcomes and trade-offs of ten types of decarbonization policy instruments. *Nature Climate Change*, 11(3), 257–265. <https://doi.org/10.1038/s41558-020-00971-x>
- Perraudin, W., Powell, A., & Yang, P. (2016). Multilateral Development Bank Ratings and Preferred Creditor Status. *IDB Publications*. <https://doi.org/10.18235/0011741>
- Perry, J. L., & Rainey, H. G. (1988). The Public-Private Distinction in Organization Theory: A Critique and Research Strategy. *Academy of Management Review*, 13(2), 182–201.
<https://doi.org/10.5465/amr.1988.4306858>
- Peters, E. J. (2018). Bankable Savings: Analyzing New York’s Green Bank. *Stanford Environmental Law Journal*, 33, 13.
- Peterson, M., & Downie, C. (2023). The international political economy of export credit agencies and the energy transition. *Review of International Political Economy*. Scopus.
<https://doi.org/10.1080/09692290.2023.2272845>
- Polanyi, K. (1957). *The Great Transformation*. Beacon Press.
<https://books.google.com.au/books?id=848GAQAAIAAJ>
- Polzer, T., Meyer, R. E., Höllerer, M. A., & Seiwald, J. (2016). Institutional Hybridity in Public Sector Reform: Replacement, Blending, or Layering of Administrative Paradigms. In J. Gehman, M. Lounsbury, & R. Greenwood (Eds.), *Research in the Sociology of Organizations* (Vol. 48, pp. 69–99). Emerald Group Publishing Limited. <https://doi.org/10.1108/S0733-558X201600048B003>
- Polzin, F. (2017). Mobilizing private finance for low-carbon innovation – A systematic review of barriers and solutions. *Renewable and Sustainable Energy Reviews*, 77, 525–535.
<https://doi.org/10.1016/j.rser.2017.04.007>
- Polzin, F., Egli, F., Steffen, B., & Schmidt, T. S. (2019). How do policies mobilize private finance for renewable energy?—A systematic review with an investor perspective. *Applied Energy*, 236, 1249–1268. <https://doi.org/10.1016/j.apenergy.2018.11.098>

- Porta, L., Lopez-De-Silanes, F., & Shleifer, A. (2002). Government Ownership of Banks. *The Journal of Finance*, 57(1), 265–301. <https://doi.org/10.1111/1540-6261.00422>
- Prizzon, A., Josten, M., & Gyuzalyan, H. (2022). *Country perspectives on multilateral development banks*. ODI.
- PT SMI. (2022). *Annual Report PT SMI 2022*. PT SMI.
<https://ptsmi.co.id/cfind/source/files/annual-report/annual-report-pt-smi-2022.pdf>
- Rahman, S., Moral, I. H., Hassan, M., Hossain, G. S., Perveen, R., Rahman, S., Moral, I. H., Hassan, M., Hossain, G. S., & Perveen, R. (2022). A systematic review of green finance in the banking industry: Perspectives from a developing country. *Green Finance*, 4(3), Article GF-04-03-017. <https://doi.org/10.3934/GF.2022017>
- Republic of Fiji. (2017). *NDC Implementation Roadmap 2017–2030*. Ministry of Economy.
- Republic of Indonesia. (2019). *Indonesia- Third Biennial Update Report*.
<https://unfccc.int/documents/403577>
- Republic of Indonesia. (2021). *Updated Nationally Determined Contribution*.
- Resosudarmo, B. P., Rezki, J. F., & Effendi, Y. (2023). Prospects of Energy Transition in Indonesia. *Bulletin of Indonesian Economic Studies*, 59(2), 149–177. Scopus.
<https://doi.org/10.1080/00074918.2023.2238336>
- Rizzetti, D. (2018, April 30). *Victoria’s Renewable Energy Target: What is a reverse auction and how does it work?* Environment Victoria.
<https://environmentvictoria.org.au/2018/04/30/victoria-edge-clean-energy-revolution/>
- Robbins, L. (1945). The Scarcity Definition of Economics. *An Essay on the Nature and Significance of Economic Science*, 12–15.
- Roberts, A. (2023). Risk, Reward, and Resilience Framework: Integrative Policy Making in a Complex World. *Journal of International Economic Law*, 26(2), 233–265.
<https://doi.org/10.1093/jiel/jgad009>
- Robiou du Pont, Y., Jeffery, M. L., Gütschow, J., Rogelj, J., Christoff, P., & Meinshausen, M. (2017). Equitable mitigation to achieve the Paris Agreement goals. *Nature Climate Change*, 7(1), Article 1. <https://doi.org/10.1038/nclimate3186>
- Rodrik, D., Subramanian, A., & Trebbi, F. (2004). Institutions Rule: The Primacy of Institutions over Geography and Integration in Economic Development. *Journal of Economic Growth*, 9(2), 131–165.

- Rose, P., & Samuel, W. (2013). The Role of the Eastern Caribbean Central Bank. In *The Eastern Caribbean Economic and Currency Union: Macroeconomics and financial systems*. (pp. 381–404). International Monetary Fund.
- Samuelson, P. A. (1954). The Pure Theory of Public Expenditure. *The Review of Economics and Statistics*, 36(4), 387–387. <https://doi.org/10.2307/1925895>
- Samuwai, J. (2021). *Understanding the Climate Finance Landscape and How to Scale It Up in Pacific Small Island Developing States* (ESCAP WORKING PAPER SERIES). United Nations ESCAP. <https://www.unescap.org/kp/2021/understanding-climate-finance-landscape-and-how-scale-it-pacific-small-island-developing>
- Samuwai, J., Jeremy, M. H., & Michalena, E. (2019). Thinking Outside the Box: Deepening Private Sector Investments in Fiji's Nationally Determined Contributions through Scenario Analysis. *Sustainability*, 11(15), 4162. <https://doi.org/10.3390/su11154161>
- Sartzetakis, E. S. (2021). Green bonds as an instrument to finance low carbon transition. In *ECONOMIC CHANGE AND RESTRUCTURING* (Vol. 54, Issues 3, SI, pp. 755–779). SPRINGER. <https://doi.org/10.1007/s10644-020-09266-9>
- Sarzynski, A., Larrieu, J., & Shrimali, G. (2012). The impact of state financial incentives on market deployment of solar technology. *Energy Policy*, 46, 550–557. <https://doi.org/10.1016/j.enpol.2012.04.032>
- Schmit, M., Gheeraert -Thierry, L., & Warny, D.-C. (2011). *Public Financial Institutions in Europe*.
- Schub, J. (2015). Green Banks: Growing Clean Energy Markets by Leveraging Private Investment with Public Financing. *The Journal of Structured Finance*, 21(3), 26–35. <https://doi.org/10.3905/jsf.2015.21.3.026>
- SDG Fund. (2024). *The Blended Finance Approach of the Global Fund for Coral Reefs in Fiji*. Joint SDG Fund'. <https://jointsdgfund.org/article/blended-finance-approach-global-fund-coral-reefs-fiji>
- Seah, S., & Huda, M. S. (2024). *“Enhancing ASEAN’s Role in Critical Mineral Supply Chains” by Sharon Seah and Mirza Sadaqat Huda* (Vol. 3). ISEAS Yusof Ishak Institute. <https://www.iseas.edu.sg/articles-commentaries/trends-in-southeast-asia/enhancing-aseans-role-in-critical-mineral-supply-chains-by-sharon-seah-and-mirza-sadaqat-huda/>
- Seibel, W. (2015). Studying Hybrids: Sectors and Mechanisms. *Organization Studies*, 36(6), 697–712. <https://doi.org/10.1177/0170840615580005>

- Sekaringtias, A., Verrier, B., & Cronin, J. (2023). Untangling the Socio-political Knots: A Systems View on Indonesia's Inclusive Energy Transitions. *Energy Research & Social Science*, 95, 102911. <https://doi.org/10.1016/j.erss.2022.102911>
- Setyawati, D. (2023). *Beyond tripling: Keeping ASEAN's solar & wind momentum*. Ember. <https://ember-climate.org/app/uploads/2023/11/Report-Beyond-Tripling-ASEAN.pdf>
- Setyowati, A. B. (2021). Mitigating Inequality with Emissions? Exploring Energy Justice and Financing Transitions to Low Carbon Energy in Indonesia. *Energy Research and Social Science*, 71. Scopus. <https://doi.org/10.1016/j.erss.2020.101817>
- Shishlov, I., Censkowsky, P., & Darouich, L. (2021). *Aligning Export Credit Agencies with the Paris Agreement*. Perspectives Climate Research.
- Shittu, E., & Weigelt, C. (2022). Accessibility in sustainability transitions: U.S. electric utilities' deployment of solar. *Energy Policy*, 165, 112942. <https://doi.org/10.1016/j.enpol.2022.112942>
- Siderius, K. (2023). An unexpected climate activist: Central banks and the politics of the climate-neutral economy. *Journal of European Public Policy*, 30(8), 1588–1608. <https://doi.org/10.1080/13501763.2022.2093948>
- Simshauser, P., & Gilmore, J. (2022). Climate change policy discontinuity & Australia's 2016–2021 renewable investment supercycle. *Energy Policy*, 160, 112648. <https://doi.org/10.1016/j.enpol.2021.112648>
- Singh, V. K., Singh, P., Karmakar, M., Leta, J., & Mayr, P. (2021). The journal coverage of Web of Science, Scopus and Dimensions: A comparative analysis. *Scientometrics*, 126(6), 5113–5142. <https://doi.org/10.1007/s11192-021-03948-5>
- Skelcher, C., & Smith, S. R. (2015). Theorizing Hybridity: Institutional logics, complex organisations and actor identifies: the case of nonprofits. *Public Administration*, 93(2), 433–448. <https://doi.org/10.1111/padm.12105>
- Skovgaard, J., Adams, K. M., Dupuy, K., Dzebo, A., Funder, M., Fejerskov, A. M., & Shawoo, Z. (2023). Multilateral Climate Finance Coordination: Politics and Depoliticization in Practice. *Global Environmental Politics*, 23(2), 125–147. Scopus. https://doi.org/10.1162/glep_a_00703
- Small, M. L. (2009). 'How many cases do I need?': On science and the logic of case selection in field-based research. *Ethnography*, 10(1), 5–38. <https://doi.org/10.1177/1466138108099586>

Sovacool, B. K., Axsen, J., & Sorrell, S. (2018). Promoting novelty, rigor, and style in energy social science: Towards codes of practice for appropriate methods and research design. *Energy Research & Social Science*, 45, 12–42. <https://doi.org/10.1016/j.erss.2018.07.007>

S&P Global Ratings. (2024). *Intro to Credit Ratings*.
<https://www.spglobal.com/ratings/en/about/intro-to-credit-ratings>

Stechemesser, K., & Guenther, E. (2012). Carbon accounting: A systematic literature review. *Journal of Cleaner Production*, 36, 17–38. <https://doi.org/10.1016/j.jclepro.2012.02.021>

Steffen, B. (2021). A comparative analysis of green financial policy output in OECD countries. *Environmental Research Letters*, 16(7). Scopus. <https://doi.org/10.1088/1748-9326/ac0c43>

Steffen, B., & Schmidt, T. S. (2019). A quantitative analysis of 10 multilateral development banks' investment in conventional and renewable power-generation technologies from 2006 to 2015. *Nature Energy*, 4(1), Article 1. <https://doi.org/10.1038/s41560-018-0280-3>

Stern, N. (2006). *Stern Review on the Economics of Climate Change*.

Stilwell, F. J. B. (2002). *Political economy: the contest of economic ideas* / Frank Stilwell. South Melbourne, Vic.: Oxford University Press.

Sullivan, J. (2023, April 27). *Remarks by National Security Advisor Jake Sullivan on Renewing American Economic Leadership at the Brookings Institution* [Speech].
<https://www.whitehouse.gov/briefing-room/speeches-remarks/2023/04/27/remarks-by-national-security-advisor-jake-sullivan-on-renewing-american-economic-leadership-at-the-brookings-institution/>

Summers, L., & Singh, N. K. (2023). *Strengthening Multilateral Development Banks: The Triple Agenda. Report of the Independent Experts Group*. G20.
https://www.cgdev.org/sites/default/files/The_Triple_Agenda_G20-IEG_Report_Volume1_2023.pdf

Sun, B., & Sankar, A. (2022). The changing effectiveness of financial incentives: Theory and evidence from residential solar rebate programs in California. *Energy Policy*, 162, 112804. <https://doi.org/10.1016/j.enpol.2022.112804>

Swilling, M. (2011). Greening Public Value: The Sustainability Challenge. In J. Benington & M. H. Moore (Eds.), *Public Value* (pp. 89–111). Macmillan Education UK.

Tabureguci, D. (2024, April 11). Inside Story | Mystery of the wind turbine PPAs. *Fiji Times*.
<https://www.fijitimes.com.fj/inside-story-mystery-of-the-wind-turbine-ppas/>

- Tacconi, L., & Williams, D. A. (2020). Corruption and Anti-Corruption in Environmental and Resource Management. *Annual Review of Environment and Resources*, 45(Volume 45, 2020), 305–329. <https://doi.org/10.1146/annurev-environ-012320-083949>
- Tan, C. (2019). Creative cocktails or toxic brews? Blended finance and the regulatory framework for sustainable development. In *The concept of sustainability and its application in international trade, investment and finance* (pp. 300–330). Edward Elgar Publishing Ltd.; Scopus. <https://doi.org/10.4337/9781788971041.00023>
- Thiemann, M., Büttner, T., & Kessler, O. (2023). Beyond market neutrality? Central banks and the problem of climate change. *Finance and Society*, 9(1), 14–34. Scopus. <https://doi.org/10.2218/FINSOC.8090>
- Thynne, I. (2011). Ownership as an instrument of policy and understanding in the public sphere: Trends and research agenda. *Policy Studies*, 32(3), 183–197. <https://doi.org/10.1080/01442872.2011.561685>
- Tienhaara, K. (2014). Varieties of green capitalism: Economy and environment in the wake of the global financial crisis. *Environmental Politics*, 23(2), 187–204. <https://doi.org/10.1080/09644016.2013.821828>
- Timperley, J. (2021). The broken \$100-billion promise of climate finance—And how to fix it. *Nature*, 598(7881), 400–402. <https://doi.org/10.1038/d41586-021-02846-3>
- Tooze, A. (2022, October 28). Welcome to the world of the polycrisis. *Financial Times*. <https://www.ft.com/content/498398e7-11b1-494b-9cd3-6d669dc3de33>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a Methodology for Developing Evidence-Informed Management Knowledge by Means of Systematic Review. *British Journal of Management*, 14(3), 207–222. <https://doi.org/10.1111/1467-8551.00375>
- Traxler, A. A., & Greiling, D. (2018). Sustainable public value reporting of electric utilities. *Baltic Journal of Management*, 14(1), 103–121. <https://doi.org/10.1108/BJM-10-2017-0337>
- UNEP. (2023). *Adaptation Gap Report 2023 | UNEP - UN Environment Programme*. <https://www.unep.org/resources/adaptation-gap-report-2023>
- UNFCCC. (2015). *Paris Agreement*. United Nations Framework Convention on Climate Change. https://unfccc.int/sites/default/files/english_paris_agreement.pdf
- UNFCCC. (2022). *Introduction to Climate Finance | UNFCCC*. <https://unfccc.int/topics/introduction-to-climate-finance>
- UNFCCC. (2023). *Technical dialogue of the first global stocktake*.

- Ürge-Vorsatz, D., Tirado-Herrero, S., Dubash, N., & Lecocq, F. (2014). Measuring the Co-Benefits of Climate Change Mitigation. *Annual Review of Environment and Resources*, 39, 549–582. <https://doi.org/10.1146/annurev-environ-031312-125456>
- US EPA. (2023, February 1). *Greenhouse Gas Reduction Fund* [Collections and Lists]. <https://www.epa.gov/greenhouse-gas-reduction-fund>
- USEXIM. (2021). *Report to the U.S. Congress on Global Export Credit Competition*. Export-Import Bank of the United States. https://img.exim.gov/s3fs-public/reports/competitiveness_reports/2020/EXIM_2020_CompetitivenessReport_Web-Ready_Single%20pages.pdf
- USTR. (2023). *Indo-Pacific Economic Framework for Prosperity (IPEF)*. Office of the United States Trade Representative. <https://ustr.gov/trade-agreements/agreements-under-negotiation/indo-pacific-economic-framework-prosperity-ipef>
- Vakkuri, J., & Johanson, J.-E. (2021). *Hybrid governance, organisations and society: Value creation perspectives*. Routledge.
- van Geet, M. T., Lenferink, S., & Leendertse, W. (2019). Policy design dynamics: Fitting goals and instruments in transport infrastructure planning in the Netherlands. *Policy Design and Practice*, 2(4), 324–358. <https://doi.org/10.1080/25741292.2019.1678232>
- Victor, D. G., Lumkowsky, M., & Dannenberg, A. (2022). Determining the credibility of commitments in international climate policy. *Nature Climate Change*, 12(9), Article 9. <https://doi.org/10.1038/s41558-022-01454-x>
- Vorrath, S. (2020, June 30). *Coal mine turned solar farm powers through bushfires, earns Newcastle council \$420k*. One Step Off The Grid. <https://onestepoffthegrid.com.au/coal-mine-turned-solar-farm-powers-through-bushfires-earns-newcastle-council-420k/>
- Waidelich, P., & Steffen, B. (2024). Renewable energy financing by state investment banks: Evidence from OECD countries. *Energy Economics*, 132, 107455. <https://doi.org/10.1016/j.eneco.2024.107455>
- Wamsley, G. L., & Zald, M. N. (1973). The Political Economy of Public Organizations. *Public Administration Review*, 33(1), 62–73. <https://doi.org/10.2307/974786>
- Westoby Ross, McNamara, K. E., Kumar, R., & Nunn, P. D. (2020). From community-based to locally led adaptation: Evidence from Vanuatu. *Ambio*, 49(9), 1466–1473. ProQuest One Academic; Social Science Premium Collection. <https://doi.org/10.1007/s13280-019-01294-8>

- White, L. V., Hughes, L., Lyons, C., & Peng, Y. (2021). Iterating localisation policies in support of energy transition: The case of the Australian Capital Territory. *Energy Policy*, 158, 112568–112568. <https://doi.org/10.1016/J.ENPOL.2021.112568>
- Whitney, Grbusic, T., Meisel, J., Becerra Cid, A., Sims, D., & Bodnar, P. (2020). *State of Green Banks 2020*. Rocky Mountain Institute. <https://rmi.org/insight/state-of-green-banks-2020/>
- Wilkinson, M. (2020). *The Carbon Club*. Allen and Unwin.
- Williamson, O. E. (1987). *The economic institutions of capitalism : firms, markets, relational contracting*. Free Press.
- Williamson, O. E. (2000). The new institutional economics: Taking stock, looking ahead. *Journal of Economic Literature*, 38(3), 595–613.
- Wise, J. (2024, July 30). Australia gives \$87m for budget support. *The Fiji Times*. <https://www.fijitimes.com.fj/australia-gives-87m-for-budget-support/>
- Woo, M. (2023). The Developmental State. In J. Han, R. Pacheco Pardo, & Y. Cho (Eds.), *The Oxford Handbook of South Korean Politics* (p. 0). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780192894045.013.7>
- World Bank. (2015). *From billions to trillions: MDB contributions to financing for development*. World Bank Group. <http://documents.worldbank.org/curated/en/602761467999349576/From-billions-to-trillions-MDB-contributions-to-financing-for-development>
- World Bank. (2023). *Indonesia Country Climate and Development Report*. World Bank.
- World Bank. (2024). *Voting Powers* [Text/HTML]. World Bank. <https://www.worldbank.org/en/about/leadership/votingpowers>
- World Economic Forum. (2023). *The Global Risks Report 2023 18th Edition*. https://www3.weforum.org/docs/WEF_Global_Risks_Report_2023.pdf
- WRI. (2024). *Locally Led Climate Adaptation*. World Resources Institute. <https://publications.wri.org/r3284134a>
- Yin, R. (1993). *Applications of case study research*. SAGE Publications.
- Zhang, A. H., Sirin, S. M., Fan, C., & Bu, M. (2022). An analysis of the factors driving utility-scale solar PV investments in China: How effective was the feed-in tariff policy? *Energy Policy*, 167, 113044. <https://doi.org/10.1016/j.enpol.2022.113044>