

# Financing the Net Zero Transition *Ideas for Australia*



THE UNIVERSITY OF  
SYDNEY



We recognise and pay respect to the Elders and communities – past and present – of the lands that the University of Sydney's campuses stand on. For thousands of years, they have shared and exchanged knowledges across innumerable generations for the benefit of all.

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# Preface

The University of Sydney launched the Net Zero Institute in 2024, building on the foundations of the Net Zero Initiative established in 2022. The Institute represents a flagship multidisciplinary effort to accelerate innovation across research, development, commercialisation and the responsible deployment of cutting-edge technologies and solutions, supporting the global transition to net zero emissions.

## The NZI is a bold call to action.

- **Accelerate Progress:** Driving faster progress towards net zero emissions through cutting-edge research and its translation. Our focus is reducing demand, eliminating emissions, removing greenhouse gases and understanding climate risks – supported by rigorous evaluation from multidisciplinary and cross-sector teams.
- **Foster Innovation:** Nurturing a dynamic, socially conscious entrepreneurial culture across the University and among our students. Together we share experience, spark innovation and engage with our communities.
- **Shape the Future:** Sharing best practice and creating lasting impact across governance, finance, policy and legislation to influence the nation’s trajectory for generations to come.

- **Build a Skilled Workforce:** Building capability to meet Australia’s workforce needs and strengthen national competitiveness.

The NZI focuses on four core themes: reducing demand, achieving zero emissions in energy and industry, removing greenhouse gases, and understanding climate change risks. These themes bring together initiatives designed to support the transition to net zero emissions. By working with diverse partners across economic sectors, the NZI highlights pioneering research and development and helps translate innovative ideas from laboratory concepts into real-world solutions.



# Published by the Net Zero Institute

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As Managing Editor, I would like to especially acknowledge Professor Steven Maguire, **Deputy Dean (Research)** at the University of Sydney Business School, whose vision and support were central to the development of this white paper. His dedication to research excellence significantly shaped the scope and impact of this work.

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# Foreword

Dear Friends and Colleagues,

At a time of geopolitical flux, with conflicts on multiple fronts and the net zero transition seemingly under political pressure, it has never been more critical to stay the course in our collective efforts to decarbonise the planet. The restructuring of global supply chains, the redrawing of defence and trade alliances, rising sovereign protectionism and the growing impacts of climate change present Australia with serious risks, but also unprecedented opportunity. Complexity surrounds us. The choices we make now, and the boldness with which we make them, will likely shape our next century.

Many barriers remain. Alongside the usual inertia and resistance to change, we must contend with vested interests seeking to undermine the net zero transition through increasingly organised campaigns of negative messaging and climate denialism. Preserving positive public sentiment and maintaining urgency around accelerated decarbonisation has never been more important. Mobilising the capital needed to fund emissions reduction, unlock technological innovation and build the infrastructure required for the net zero transformation is economically rational, socially equitable and urgently necessary.

Australia occupies a unique and sometimes challenging position as it navigates this evolving global landscape. Our opportunity to play a pivotal role in the net zero transition rests on our comparative advantages as a nation. Adam Smith, often described as the “father of modern capitalism”, referred to these advantages as a country’s “factor endowment”. In Australia, this includes abundant reserves of critical minerals, vast renewable energy potential, large areas of land, skilled workers, and established industrial precincts and export hubs located where many of these resources intersect. These precincts also sit close to major trading partners, many of whom would welcome the opportunity to deploy the same advantages.

“Mobilising the capital needed to fund emissions reduction, unlock technological innovation and build the infrastructure required for the net zero transformation is economically rational, socially equitable and urgently necessary.”

Realising this generational opportunity will require a collaborative, multidisciplinary effort across science, engineering, chemistry, digital innovation and intelligence, finance and public policy. Combined with the capabilities of our world-leading universities and research institutions, a strong history of enterprise and innovation, and a national willingness to “have a go”, these advantages position Australia to grasp the opportunity the net zero transition presents.

The manufacturing of equipment such as solar PV and battery storage modules – technologies fundamental to decarbonising the global energy system – illustrates what collaboration across these fields can achieve. Australia has the resources and capability not only to deliver its own transition but also to build the green export industries of the future. This comparative advantage should not be squandered. It represents a new chapter in the story of the “lucky country”.

This important work by the Net Zero Institute, *Financing the Net Zero Transition: Ideas for Australia*, offers timely and thoughtful insights into this generational opportunity and explores ways to mobilise the significant capital required. Access to capital is not the primary obstacle. Despite our relatively small population, Australia holds the fourth-largest retirement savings pool in the world through its superannuation system. Nor is expertise lacking. Our educational, financial, political and community institutions are highly capable and globally respected.

Australia is therefore uniquely positioned. We have the capital and the talent. Let us take heed of the insights and provocations offered by the contributors to this work and seize this moment for Australia.

**David Scaysbrook**  
USYD Alumnus  
Co-Founder and Managing Partner, Quinbrook



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# The Opportunities of the Transition

Australia has committed to achieving net zero by 2050. The question is no longer why we must invest in the transition, but how.

## Introduction

The transition to net zero is no longer a distant goal. It is already reshaping how economies invest, build infrastructure and manage risk. While much has been written about why we must finance the transition, the critical question is how we do it and what we can mobilise.

Like all major shifts in human history, achieving net zero represents the greatest economic and social opportunity of our generation. Just as past innovations reshaped industries and societies, today's climate solutions can redefine how we use resources, create value and live in a world with reduced emissions, renewable energy and habitable ecosystems. The transition will bring challenges. But progress begins when individuals or organisations demonstrate better ways to manage resources and inspire others to follow. The decisions and investments we make today will shape the net zero legacy we leave for 2050 and beyond, and Australia is uniquely positioned to seize this opportunity.

Australia is rich in renewable resources such as sunlight, wind and land, supported by world-class research and development. Yet we fall short in funding the transition at the scale required. This paradox can become an opportunity. Australia has the capital, resources and research capability to lead, but must reframe green investment to turn these assets into action.

This paper presents ideas for Australia to turn financial intent into action. It explores practical ways to accelerate the transition through research, collaboration and innovation. The case studies that follow highlight how these ideas are already being tested and applied in practice. It focuses on three areas, beginning with rethinking Australia's traditional investment approaches and how to accelerate research and development for climate solutions. This includes drawing on the largely untapped \$4.2 trillion held in Australia's superannuation system for green investment – the world's fourth-largest retirement savings pool.

Transport is another critical area. The transition must extend beyond passenger cars to include electric buses, trucks and bikes, creating systems that are sustainable, accessible and well integrated. Evidence-based research and co-design involving government, industry and communities will support smarter infrastructure planning and faster adoption.

Australia can also learn from its neighbours. Indonesia's decarbonisation journey highlights both the challenges and opportunities of balancing energy demand, investment and social equity in emerging economies. These lessons reinforce the need to align research, finance and governance to create a transition pathway that is fair, scalable and resilient.

Australia has committed to achieving net zero by 2050. The question is no longer why we must invest in the transition, but how.

By shifting from intention to action, we can focus on what is possible now and build the path to a net zero future.



## *Case Study*

“The question is not whether superannuation capital can support the net zero transition, but how quickly new investment pathways can be developed.”

### Unlocking Australia’s Green Capital with Superannuation

*By Dr Danielle Kent and Dr Cara Vansteenkiste*

Australia’s superannuation system, now worth around \$4.2 trillion and the fourth largest in the world, continues to grow rapidly. This pool of capital could be transformative for the country’s climate transition, yet it remains largely untapped for large-scale green investment.

One key barrier is the limited supply of investable opportunities in Australia that meet the scale, de-risking and measurability requirements of superannuation funds. These funds operate under regulatory pressure, short-term planning horizons and resource constraints that make long-term commitments to net zero infrastructure more difficult.

Sovereign wealth funds could play a powerful role. By deploying capital strategically, they can crowd in private investors, including super funds, helping to de-risk early-stage projects and create viable investment pipelines.

Researchers Danielle Kent and Cara Vansteenkiste from the University of Sydney Business School are tackling this challenge directly. They are working to co-design investment tools, market structures, behavioural nudges and governance strategies that could unlock green capital at scale. Their research emphasises collaboration between academia, industry and government to ensure solutions are both practical and ambitious.

Globally, Norway’s sovereign wealth fund (NBIM) offers a useful comparison. The world’s largest sovereign wealth fund has integrated climate risk assessment into its portfolio management and actively engages companies on their net zero strategies. By setting clear expectations on emissions reductions and excluding lagging companies, NBIM has redirected capital towards firms leading the energy transition. In doing so, it has helped normalise climate risk as a core financial risk – an approach Australia could adopt.

For Australia, the question is not whether superannuation capital can support the net zero transition, but how quickly new investment pathways can be developed. Researchers like Kent and Vansteenkiste are helping reimagine how these funds can be mobilised, ensuring Australia’s superannuation system becomes a driver of sustainability rather than a bystander.



Image: Dr Danielle Kent (L) and Dr Cara Vansteenkiste (R)

# Rethinking Timeframes

Evidence suggests the world is unlikely to reach net zero by 2050, highlighting the need to reconsider current timeframes.

In the 2025 edition of the World Energy Outlook,<sup>1</sup> the International Energy Agency (IEA) stated:

“...the links between energy and politics have always been close, but when we look at the energy world in recent decades, there is no other time when energy security tensions have applied to so many fuels and technologies at once. [...] Governments are contending with a formidable array of potential threats, vulnerabilities, dependencies and uncertainties... We also highlight, once again, two critical areas where the world is clearly falling short: universal energy access and climate change. And we highlight once again that, far from limiting global warming to 1.5 °C or well below 2 °C, we are currently heading towards outcomes in the range of 2.5–3 °C, with severe implications for lives and livelihoods around the world.”

A similar picture emerges in the IEA’s assessment of technologies for the clean energy transition. While clean energy deployment accelerated rapidly and momentum towards a clean energy economy is growing, many components are still not on track globally.

A closer look at several sectors illustrates the scale of the challenge.

In its 15th edition of *Eye on the Market*,<sup>2</sup> J.P. Morgan examined sustainable aviation fuel (SAF). SAF derived from biological sources – such as organic waste, biomass, sugars and cooking oil – remains scarce, accounting for just 0.3% of global aviation fuel use, and is more expensive than kerosene. There are concerns that large-scale SAF production from biological sources may not reduce emissions once full lifecycle impacts are considered. This has increased interest in synthetic SAF produced using green hydrogen and CO<sub>2</sub> captured from the atmosphere. While fully synthetic SAF can be produced with no embodied emissions, its manufacturing process

requires roughly three times the energy content of the fuel itself. It also depends heavily on direct air capture technology, which remains at an early stage of development.

The same report notes that despite global spending of around \$9 trillion over the past decade on wind, solar, electric vehicles, energy storage, electrified heat and power grids, the renewable transition remains gradual. The share of renewables in final energy consumption is increasing slowly, at around 0.3% to 0.6% per year.

McKinsey & Company has also highlighted the physical challenges of reaching net zero emissions.<sup>3</sup> One major issue is managing the variability of renewable energy sources, which McKinsey classifies as a “Level 3” challenge. This classification reflects gaps in technological performance and complex system interdependencies, indicating that the transition remains in its early stages.

As the share of variable renewable energy (VRE) generation – such as solar and wind – increases, power system output becomes more variable. There will be periods when generation exceeds demand and others when it falls short.

Germany provides a useful example. By 2050, VRE is expected to account for around 90% of its power generation. Even so, there could still be about 75 days each year when VRE generation supplies less than 75% of demand.

Addressing this variability will require additional flexibility on the supply side, including energy storage, backup gas-fired plants and stronger grid interconnections. These flexibility solutions may need to expand two to seven times faster than global power demand over the next 30 years. However, scaling these solutions faces significant

barriers. Some energy storage technologies depend on constrained inputs, and market design mechanisms for backup generation remain underdeveloped. Critically, technologies needed to provide seasonal flexibility – such as long-duration energy storage and hydrogen-based generation – would need to scale by hundreds of times by 2050, starting from a very small base.

Climate Action Tracker<sup>4</sup> summarises current trends in its chart of emission pathways to 2100 (Figure 1). Two points stand out. First, all current trajectories indicate that emissions will remain well above zero by 2050 and, in most cases, still above zero in 2100. The earliest plausible pathway to net zero is around 2080, along a 1.5°C-compatible trajectory that is already out of reach given the gap this decade.

Second, current policies, targets and actions suggest global temperatures are likely to rise between 2°C and 3°C above pre-industrial levels by 2100.

As illustrated in Figure 2, one reason for this shortfall is that current and projected spending on the net zero transition is significantly below the level required. McKinsey & Company estimates that \$9.2 trillion annually – plus an additional \$3.5 trillion beyond business as usual – would be needed if the world is to decarbonise by 2050.



Achieving net zero by 2050 is an ambitious goal and represents the greatest social and economic challenge, and opportunity, of our generation. Even reaching net zero by 2100 will require the development and deployment of new technologies and the capital needed to scale them. It will also require investment in adaptation measures to better protect communities from the impacts of a changing climate.

The financial sector sits at the centre of this transition. While much of the investment must come from private capital, uncertainty and the evolving nature of climate risks present significant challenges for the sector.

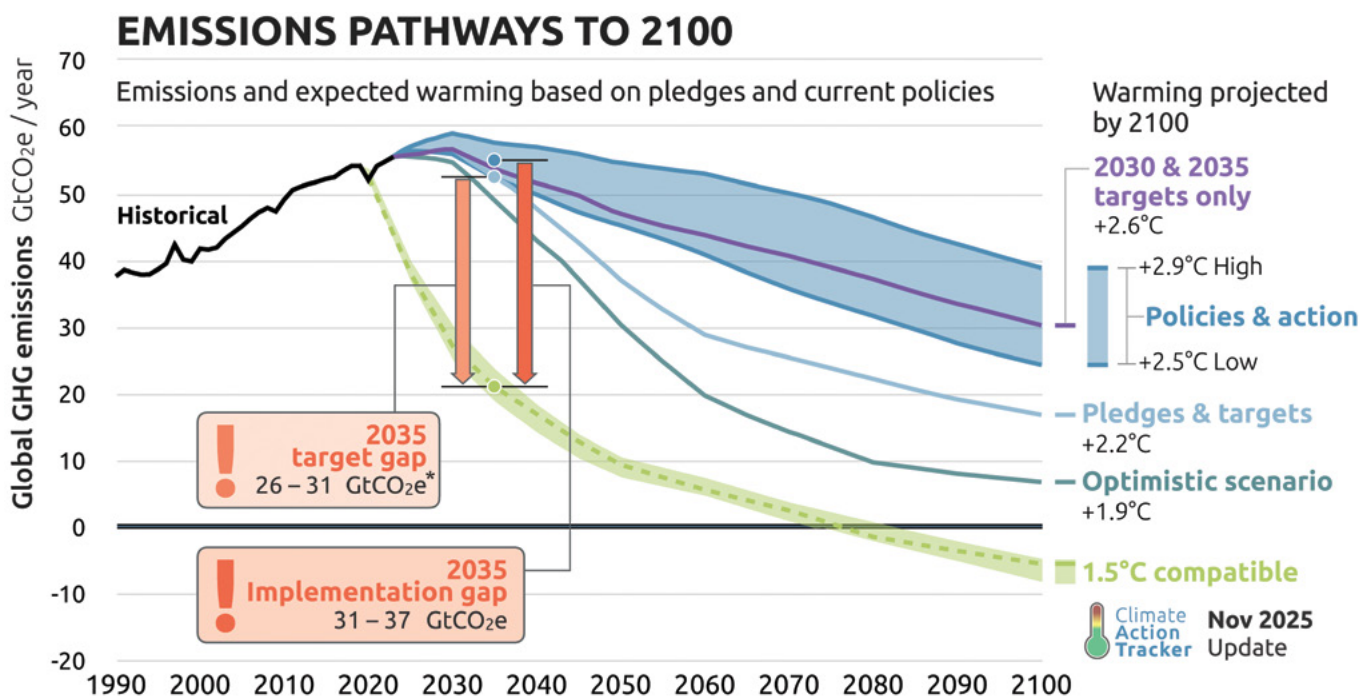


Figure 1: Emission pathways to 2100<sup>4</sup>

## Global low-carbon tech capital expenditure

USD billion

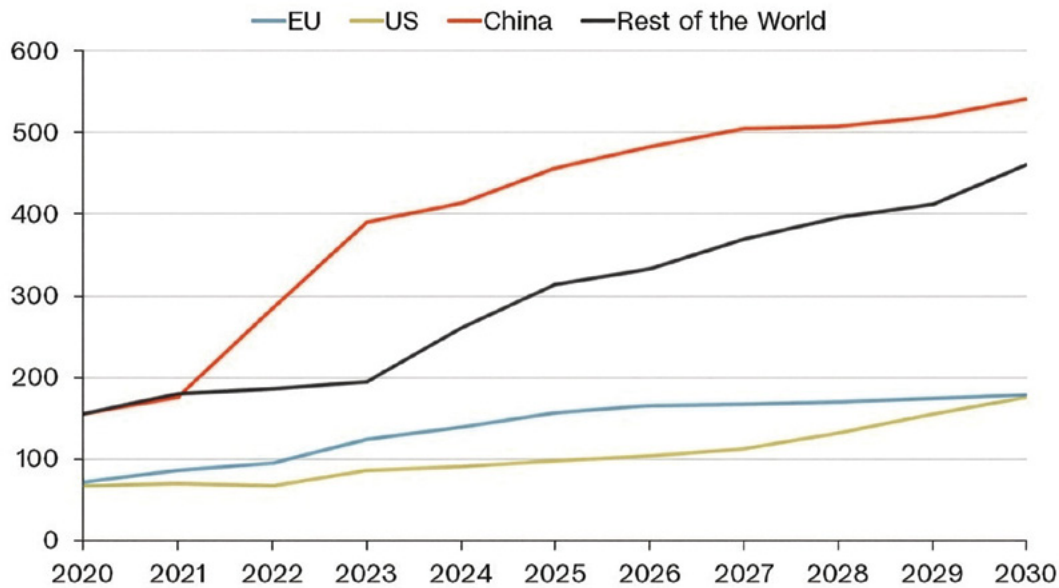


Figure 2: Expenditure on the net zero transition is falling behind.<sup>5</sup>  
Includes spending on renewables, CCUS, hydrogen, batteries and nuclear.

## Case Study

### Australia's Climate Economy – Evaluating Emerging Strategies for Decarbonisation and Resilience

By Associate Professor Gareth Bryant and Associate Professor Sophie Webber

Associate Professor Gareth Bryant, a political economist, and Dr Sophie Webber from the School of Geosciences are leading research into how Australia is shaping a new “climate economy”. Their project examines how climate pressures and social responses are being integrated across the energy, transport and water sectors, and how governance, finance and policy tools are being reconfigured to deliver both economic and environmental outcomes.<sup>6</sup>

The project aims to develop a practical toolkit to improve hybrid policies and institutions, alongside strategies to support policymakers, industry and investors in designing Australia's climate economy in line with national and international net zero commitments. Bryant, also a member of the University's Policy Lab, has examined the

“Future Made in Australia” agenda and its interaction with challenges such as critical minerals. This work highlights where government investment and industry capability can align to unlock sustainable growth.

Projects like this generate new knowledge and expertise while influencing policy development. Their findings are communicated through scholarly publications and shared through stakeholder workshops, research websites, interactive tools and think tanks. Importantly, they provide a roadmap for companies and investors to align with Australia's emissions reduction goals, reduce operational risks and position themselves at the forefront of the low-carbon transition.

By demonstrating how evidence-based strategies can turn environmental and resource challenges into investable opportunities, this research shows how policy and business can collaborate to accelerate the net zero transition. For investors, policymakers and industry leaders, it offers a credible foundation for decision-making that strengthens climate resilience, delivers commercial returns and supports social inclusion.

## Case Study

### The Singapore Green Finance Centre

The Singapore Green Finance Centre (SGFC) plays a pivotal role in advancing the region's green finance ecosystem by fostering collaboration across research, policy and industry. Drawing on the combined expertise of Imperial College London and Singapore Management University (SMU), SGFC delivers applied research to support Asia's transition to a low-carbon, nature-positive and resilient economy.

SGFC's work focuses on three core pillars: applied research, education and industry engagement. Its projects include supporting companies to adopt the Impact Weighted Accounts Framework, which helps organisations measure and value the environmental and social impacts of their operations – an essential step toward credible green investment and net zero alignment. SGFC also examines how to finance the regional energy transition, a critical component of global decarbonisation.

Key barriers identified include limited local climate data and a shortage of skilled professionals in sustainable finance. Much of the existing data originates in the Global North and has limited relevance for Asia's local conditions. To address this, SGFC partners with regional think tanks and organisations, including the Impact Institute, to validate and adapt global impact datasets for Asian companies, improving data accuracy and confidence in investment decisions.

Recognising the urgent need for talent, SGFC has co-developed an undergraduate Sustainable Finance Track at SMU, established a MOOC (Massive Online Open Course) on sustainability and sustainable finance, and curated professional courses accredited by the Institute of Banking and Finance Singapore (IBF). These initiatives have trained thousands of students and professionals.

SGFC also collaborates with the Monetary Authority of Singapore (MAS) and leading financial institutions to align research with industry needs. Recent initiatives include an ESG mapping guidebook for SMEs in Singapore's energy and chemicals sector, helping them begin their sustainability reporting journey.

Looking ahead, SGFC highlights significant opportunities for data-driven research, policy collaboration and international cooperation, including between Singapore and Australia under the Green Economy Agreement (GEA). Joint efforts to build region-specific data frameworks and harmonised standards can improve transparency, reduce investment risk and accelerate private capital flows into the region's net zero transition.



Fireside Chat on Powering Climate Action with Clean Energy Transition: Innovative Green Finance – August 2025, Singapore.

From left to right: Professor Winston Chow (SMU, Intergovernmental Panel on Climate Change), SRSO Damilola Ogunbiyi (Sustainable Energy for All (SEforALL)), SMU Chairman Piyush Gupta, Dr Rajiv Lall (SMU, SGFC)

# Financing the Transition

In a paper examining how to finance the transition, Deloitte describes the energy transition as the replacement of fossil-based production with more expensive green alternative technologies.<sup>8</sup> Deloitte estimates that the transition will require between \$5 trillion and \$7 trillion in annual investment, while current investment remains below \$2 trillion per year. High capital costs and the risks associated with green projects make financing difficult. De-risking projects by addressing financial, technological and policy risks is therefore critical to making them bankable. Overcoming these challenges will allow the private sector to provide the capital needed for the transition.

The World Economic Forum (WEF) has proposed a seven-point plan to get the transition back on track.<sup>9</sup> The plan focuses on allocating spending efficiently, redesigning physical and energy systems, and navigating risks and opportunities. It includes allocating spending wisely to reduce the costs of existing and new low-emissions technologies, redesigning our energy systems to better align with low-emissions objectives, and competing for the opportunities created by the transition.

The WEF analysis begins with the use of lower-cost solutions to reduce emissions. It highlights that about one-third of global emissions could be reduced through measures costing less than \$20 per tonne of emissions abated. Examples include improving energy efficiency, reducing methane emissions from fossil fuel extraction and halting deforestation. Even these relatively low-cost measures would still require around \$380 billion in annual investment. The Climate Change Authority reached a similar conclusion in its sector pathways report,<sup>10</sup> noting that “working to reduce emissions now, using existing technologies, is far more efficient and effective than waiting and hoping that larger breakthroughs will do all the work.”

Significant capital will be required to deploy existing technologies and develop new zero-emission alternatives. Public funding and conventional loans alone will not be



sufficient. Innovative financial mechanisms are needed to direct capital where it is most required. The scale of investment exceeds public sector capacity, making private sector participation essential.

However, several barriers may limit these investments. Many technologies remain relatively new, making it difficult for investors to assess their commercial viability and risks. Some existing technologies also require long-term investment horizons that may be less attractive to private investors.

Recognising these challenges is an important step toward identifying solutions for financing the net zero transition. The WEF suggests that new asset classes may be needed, including industrial venture capital funds, growth infrastructure funds and “brown-to-green” transition funds. Expanding blended finance, which combines public and private capital, could also help attract investment by

reducing risks for private investors. Further development of appropriate financial models will be required.

Financial barriers are also compounded by physical constraints or “bottlenecks”. The transition to net zero will require large supplies of minerals, manufactured goods, land, infrastructure and skilled labour to build and operate new energy systems. Bottlenecks can limit access to these inputs, often due to long development timelines. For example, establishing a new mine can take five to fifteen years. The concentration of mineral resources and manufacturing capacity in a small number of countries, as well as shortages of specialised skills, adds further complexity. Addressing these constraints will require time, capital and adjustments to global supply chains as countries respond to shifting geopolitical and national security priorities.

Private investors therefore play a critical role in accelerating the transition to sustainable energy systems. Their participation provides capital, encourages innovation and supports the development of resilient energy systems.

Several aspects of private sector involvement are particularly important.

Private investors, including institutional investors such as pension funds and sovereign wealth funds, can provide

the capital needed to scale clean energy projects. Their investments help bridge the funding gap that public financing alone cannot cover.<sup>13</sup>

Through blended finance structures, private investors can collaborate with multilateral development banks and development finance institutions to reduce project risk. This makes clean energy investments more attractive and commercially viable. Blended finance combines development finance and philanthropic funding with private investment to support projects that may not otherwise meet purely commercial criteria. Institutions often use concessional funding to offset specific investment risks. Investors with long-term horizons, such as sovereign wealth funds and large public pension funds, are particularly well positioned to support the energy transition.

Private investors also play an important role in supporting early-stage technologies and higher-risk projects.<sup>14</sup> Their participation helps drive innovation and bring new clean energy solutions to market.

Without this innovation and investment, the transition could place significant pressure on societies and economies.

## Case Study

### Response of the Asian Development Bank

The Asian Development Bank (ADB) is a key partner in supporting the Asia-Pacific's transition to a net zero future. The midterm review of Strategy 2030 reaffirmed climate action as one of ADB's five strategic priorities. ADB has committed to providing at least \$100 billion in cumulative climate finance between 2019 and 2030 and aims for at least 50% of its annual committed financing to support climate action by 2030.

ADB's assistance to its developing member countries is demand-driven and may focus on analytical and capacity-building support, policy development, sector planning or investment, depending on each country's priorities.

The Country Partnership Strategy (CPS) provides the framework for ADB's engagement with each developing member country. It is the primary platform for designing operational programs that deliver development outcomes at the country level, guided by both national development strategies and ADB's corporate priorities.

Through this process, ADB uses climate diagnostics and strategic engagement to help governments align development priorities with climate commitments, identify opportunities for climate action and shape multi-year investment programs. These priorities are implemented through ongoing programming cycles that identify specific projects and initiatives.

ADB also provides targeted technical assistance through programs such as NDC Advance. This includes support for preparing Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs), mapping decarbonisation pathways, assessing climate finance landscapes and conducting sector diagnostics. These activities strengthen decision-making capacity and inform investment planning.

ADB's approach combines policy reform with capital mobilisation. It uses policy-based lending, project finance and blended concessional resources to de-risk early-stage investments and attract private capital. Regional initiatives such as FAST-P and partnerships with ASEAN and RCEP support cross-border energy cooperation, trade facilitation and broader climate integration.

To strengthen financial systems, ADB works with central banks, regulators and financial institutions to integrate

climate risk assessments, align taxonomies and adopt disclosure standards, including those developed by the ISSB, ASEAN and GFANZ. These efforts improve transparency and support credible transition finance markets. At the same time, ADB uses blended finance, guarantees and sustainability-linked lending to channel investment into low-carbon projects and resilient supply chains.

Recognising barriers such as limited risk mitigation tools, weak coordination and data gaps, ADB combines capacity building, policy dialogue and financial innovation to improve project readiness and market confidence. Through the FAST-P partnership with GEAPP and the Monetary Authority of Singapore, ADB is helping scale blended finance solutions that accelerate clean energy deployment and support Asia's transition to low-carbon, climate-resilient development. ADB's Fiscal Resilience and Public Financial Management Initiative also supports governments to strengthen climate-responsive budgeting, integrate climate and disaster risks into fiscal planning and improve public investment management, laying the institutional foundations for climate finance at scale.

Looking ahead, ADB will continue to support collaboration among industry, research and policy actors to harmonise standards, unlock capital and accelerate progress towards a sustainable net zero economy.



## Case Study

### Carbon Markets, Tokenisation and the Enterprise Data Challenge

By Dr Luke Deer

There is a growing opportunity for companies to demonstrate credible progress towards net zero by making carbon offsets transparent and verifiable. Luke Deer, a researcher and contributor to Sydney Business Insights at the University of Sydney Business School, is leading research into this challenge. His work includes collaboration with Meeco, a digital identity and data infrastructure company, on the white paper *Carbon Markets, Tokenization and the Enterprise Data Challenge*,<sup>7</sup> which examines how tokenised carbon credits can improve the traceability and integrity of corporate offset programs.

As part of this work, Meeco developed Trustury, a visualisation tool that allows users to see the full lifecycle and provenance of individual carbon credits

on the blockchain. This makes sustainability claims more measurable and verifiable. The research shows how combining data infrastructure, blockchain and tokenisation can improve ESG reporting, strengthen trust with investors and customers, and support compliance with emerging regulations. A pilot of Trustury demonstrated the ability to track hundreds of carbon credits from purchase through to retirement, providing companies with reliable data to support transparency and reporting.

This work highlights the value of co-design and collaboration between academic researchers, private companies and technology providers. By working together, stakeholders can develop new approaches for carbon markets, improve transparency and build more credible net zero programs. Engaging with this research enables companies and policymakers to test new strategies, refine their approaches and translate sustainability commitments into measurable outcomes that accelerate the transition to net zero.

## Case Study

### Considering the Modern Slavery–Climate Change Nexus in Achieving Net Zero

By Assoc. Prof. Martijn Boersma

Industries central to the clean energy transition – including mining for renewable technologies, biofuel production and other resource-intensive sectors – face elevated risks of modern slavery. Associate Professor Martijn Boersma from the Discipline of Work and Organisational Studies at the University of Sydney Business School is researching the link between modern slavery and climate change<sup>12</sup>. His work explores practical pathways for businesses and policymakers to address this “dual crisis” as Australia moves toward net zero.

Boersma’s research highlights that sectors such as mining for renewable technologies and biofuel production are particularly exposed to modern slavery risks in certain countries that mine, refine and manufacture the equipment we are reliant on for the transition. At the

same time, these industries are essential to Australia’s clean energy transition because of our technological and manufacturing dependencies. His findings show that companies must integrate human rights protections into their climate strategies to ensure decarbonisation efforts do not create unintended social harm.

Drawing on evidence-based insights, the research guides businesses in aligning net zero commitments with ethical practices. For policymakers, it provides a framework to strengthen regulation, reporting and oversight, reducing both reputational and operational risks while advancing climate goals.

The study also demonstrates how research can support co-designed strategies between companies, governments and civil society. Addressing social and environmental challenges together will help ensure Australia’s transition to net zero is both sustainable and just.



## *Case Study*

### Integrated Strategic Evaluation Work for Retrofitting a Sydney CBD Heritage Building

*Dr Niranjika Wijesooriya and Mitra Khalili*

In Sydney's CBD, a heritage-listed building has become the focus of research into how Australia can accelerate the net zero transition by retrofitting existing building stock. Rapid urbanisation is projected to double global floor area by 2050, placing increasing pressure on energy and emissions targets. Meeting this challenge will require a dual approach: designing new net zero buildings while urgently upgrading existing stock to meet evolving energy and emissions performance standards. The Property Council of Australia (2023) warns that up to 40% of the nation's commercial buildings may require substantial upgrades – or risk becoming “stranded” – by 2030, with the potential value of stranded assets exceeding AUD \$100 billion.

Dr Niranjika Wijesooriya and Mitra Khalili are addressing this challenge through an integrated strategic valuation framework that links financial metrics with environmental outcomes<sup>11</sup>. In this context, retrofitting involves more than installing energy-efficient technologies. It requires balancing lifecycle costs, return on investment and

broader benefits such as occupant comfort, tenant satisfaction and building resilience. Real-world examples show that financial optimisation can support transition pathways, helping overcome resistance to change while opening new opportunities for sustainable construction practices.

The research team piloted this framework on the Sydney CBD heritage building, using parametric modelling to simulate building performance and assess financial implications across different net zero transition pathways. The results showed that targeted retrofit strategies can significantly reduce operating costs, improve tenant satisfaction and enhance long-term asset value, while ensuring compliance with tightening regulatory standards.

Embedding this type of valuation approach into industry practice can help shift the perception of retrofits from costly obligations to opportunities for value creation. The research demonstrates how economic, environmental and social outcomes can be aligned through evidence-based decision-making, supporting emissions reduction in the building sector while protecting asset value and future resilience.



## What This All Means

Five key conclusions emerge that help guide thinking about financing and managing the transition, as well as how the University of Sydney and the Business School can contribute:

1. The transition will be costly and complex.
2. It will likely take longer than many expect, particularly as temperatures continue to rise and the need for adaptation grows.
3. Increased short-term spending alone will not solve the problem, as some technologies required for the transition are not yet fully developed.
4. Existing financial models struggle to support the long-term, uncertain investments required.
5. The scale of resources required for the net zero transition exceeds what governments alone can provide.

Taken together, these conclusions point to the need for more time to develop low- and zero-emission technologies, secure long-term funding and support financial investment that accelerates innovation. They also highlight broader challenges, including supply chain constraints and workforce readiness. Addressing these issues will require stronger mobilisation of private capital to support research, development and deployment of solutions that enable a just and equitable transition to net zero.

The next section examines the broader social, environmental and economic pressures that call for faster and more effective research and development. History shows what is possible when urgency drives innovation.

The space race accelerated scientific and technological progress. Global health crises have pushed medical research to deliver life-saving solutions in record time. Past energy shocks have also led to breakthroughs in renewable energy. Today, climate change, geopolitical shifts and social pressures create a similar moment. By strengthening research, development and collaboration, the net zero transition can transform today's challenges into tomorrow's solutions.

# It's Time to Accelerate R&D

The net zero transition will require the same urgency, funding and collaboration that have driven innovation during past global challenges.

## Research During a Time of Global Challenges

History shows that during periods of global challenge, research and development accelerate when three conditions align: clear and urgent goals, substantial resources and funding, and a call for collaboration and action across stakeholders.

In 1903, Orville Wright flew 120 feet (37 m) in 12 seconds in an aircraft he and his brother designed. Recorded in a famous photograph, it was the first controlled, heavier-than-air flight. Aircraft technology advanced steadily over the next 25 years, but this progress was modest compared with the rapid developments that followed during the five years of massive R&D investment prompted by the Second World War. Two examples stand out: the B-29 heavy bomber with its computer-controlled guns, and the ME262 jet fighter.

Innovation is not driven by war alone. Consider Boeing and two major challenges it tackled.<sup>20</sup> One was bringing commercial aviation into the jet age with the Boeing 707 in 1958.<sup>21</sup> The other was reducing the cost of air travel with the development of the Boeing 747.<sup>22</sup>

These advances in aircraft technology resulted from a combination of defence-driven needs and private sector ambition, with companies recognising the commercial opportunities.

Today's net zero challenge is no different. Governments worldwide are setting targets to reduce emissions and achieve net zero by 2050. Businesses and institutions are dedicating resources to research and development, while global networks share ideas and solutions. For private investors, the opportunity must be commercially viable, with risks clearly understood. Both funding and sustained R&D are essential to achieving net zero by 2050.



## Case Study

### Evidence-based Tools for Zero Emissions Transport

By Professor David A Hensher AM

Australia has set measurable net zero goals for transport: by 2030, half of all new cars sold are expected to be electric, supported by \$1.1 billion in investment in renewable fuels for transport. While ambitious, these targets present complex challenges. Electric vehicles (EVs) raise questions about cost, charging infrastructure and how they integrate into broader transport systems.

This is where research and expertise are essential. Professor David Hensher AM, Founding Director of the Institute of Transport and Logistics Studies at the University of Sydney, is one of Australia's leading transport experts and a trusted adviser to government and industry.<sup>15</sup> With more than 750 published papers and global recognition, his work focuses on how transport systems can transition to clean energy in ways that are both effective and sustainable.

Hensher's research examines EVs, buses and trucks, with a focus on integrating new technologies into smarter transport systems. In his paper *Transitioning to Net Zero Emissions Needs a New Supply Chain Partnership*, he argues that governments, manufacturers and energy providers must share the risks of the transition so no single actor carries the burden.<sup>16</sup> In another paper, *The Greening of the Passenger Car Might Not Deliver Such Positive Sustainability News*, he warns that EVs alone

will not solve the problem.<sup>17</sup> Policies supporting public transport, car-sharing and reduced car ownership are also needed to deliver meaningful emissions reductions. His work also highlights the "rebound effect", where efficiency gains from EVs can be offset if people drive more.<sup>18</sup>

These insights matter because EV adoption carries hidden risks – from environmental costs in production to unequal access and increased travel demand. With the right tools, however, these risks can be managed. Hensher's work provides evidence-based models, forecasts and decision-making tools that help governments and industry plan more effectively.

One example is a forecasting tool developed with colleagues Wei and Balbontin for BusNSW. The model helps bus operators plan the transition from diesel fleets to zero-emission fleets<sup>19</sup> by estimating emissions reductions, energy use and long-term costs, giving investment decision-makers greater confidence.

Achieving Australia's transport targets will require more than adopting new technologies. It will require the evidence, strategy and foresight provided by experts such as Professor Hensher. By connecting research with practical solutions, his work helps governments and industry navigate the complex path toward net zero transport.



# The Time is Now

Global examples show that when capital, research and policy align, the transition accelerates. Australia now has the opportunity to do the same.

Momentum toward net zero emissions is already building, and the time to act is now. Around the world, governments and institutions are using new financing models to unlock investable climate projects.

Norway's sovereign wealth fund, valued at nearly \$1.9 trillion, provides a prominent example. The fund has shifted capital away from fossil fuels and toward renewable energy, climate technology and sustainable industries. It also encourages investee companies to set net zero targets and transition plans that address Scope 1, 2 and 3 emissions. For example, the Brookfield Global Transition Fund received a \$1.5 billion investment from Norges Bank Investment Management to expand clean energy for carbon-intensive industries.

In Australia, the CSIRO's Missions program is taking a similar approach by pooling national resources to tackle major challenges such as low-emissions technologies, clean hydrogen and climate adaptation through coordinated research and industry partnerships. Meanwhile, Canada, is doubling down on its ambition to dramatically reduce emissions and expand energy exports, and the European Union's Green Deal is reshaping energy, transport and industry through coordinated regulation and funding.

Indonesia is also stepping up through a \$20 billion Just Energy Transition Partnership with global partners to reduce coal dependence and expand renewable energy at scale.

These examples highlight a clear lesson: when countries align capital, research and collaboration, progress accelerates. For Australia, with its abundant renewable resources, world-class research institutions and significant private capital – including superannuation funds – there is an opportunity not only to follow but to lead. Acting decisively now can ensure that today's investments generate innovation, jobs and sustainable growth for 2050 and beyond.

Together, these insights show how rigorous research and practical evidence can guide governments and industry in shaping more sustainable behaviours, technologies and investment pathways. However, as Australia moves from research to implementation at scale, well-designed initiatives must be supported by coherent national policy. Without alignment, even the most innovative ideas and evidence-based interventions struggle to reach their full potential.

This challenge is explored in the following case study, which shows how conflicting policy settings can impede progress and why stronger coordination is essential for an effective net zero transition.

In the next section, we examine three aspects of the transition from an Australian perspective. First, we consider how the financial sector can support the development of new zero-emission technologies. Australia has abundant renewable resources and relatively low domestic energy demand. Identifying technically and commercially viable options for exporting renewable energy could help reduce reliance on fossil fuel exports. Second, we examine how Australia's large superannuation pool could support the transition. Finally, we explore policy options for encouraging the electrification of light vehicle transport.

## Case Study

### Decarbonising Indonesia by 2060

By Mira Sari and Dr Gordon Weiss

Indonesia has committed to reaching net zero emissions by 2060 or earlier, but achieving this goal will require major changes in the country's electricity and transport sectors. Postgraduate sustainability student Mira Sari's research examined two key questions: how Indonesia can decarbonise these sectors by 2060, and what the estimated costs of doing so would be.

Supervised by Dr Gordon Weiss and supported by the Net Zero Institute, the study applied two analytical frameworks – the World Economic Forum's Energy Transition Index and the Avoid-Shift-Improve model – to evaluate potential transition pathways. Using qualitative and quantitative methods, including data analysis, literature review and scenario modelling, the research developed a roadmap for the Indonesian government.

The roadmap outlines the policy, technology and investment actions needed to decarbonise electricity

and transport, along with estimates of the associated costs. While the transition requires significant upfront investment, the findings show substantial long-term benefits, including reduced reliance on imported fuels, improved air quality and economic growth through renewable energy and clean transport industries. Drawing on global and local case studies, the research also highlights the importance of governance reforms and international financing partnerships to accelerate progress and reduce risks.

The project demonstrates the value of postgraduate research supported by expert academic supervision and the Net Zero Institute. It provides evidence-based insights to guide governments, industry leaders and policymakers – offering a practical roadmap for Indonesia's net zero ambitions while contributing to the broader global discussion on how emerging economies can achieve their climate goals.



## Case Study

### Using Research to Support Sustainable Travel Choices

By Professor John Nelson, Dr Camila Balbontin, Professor David A Hensher AM, Professor Matthew J. Beck

Reducing Scope 3 emissions from travel and transport is a major challenge for organisations, including companies and universities. Staff, students and visitors often default to driving, contributing to congestion, higher costs and increased carbon emissions. With the right data and insights, however, organisations can make more informed decisions and encourage sustainable options such as public transport, cycling and shared mobility.

Professor John Nelson, Chair in Public Transport, and colleagues at the Institute of Transport and Logistics Studies at the University of Sydney lead research on how behavioural science, surveys and real-world data can influence travel choices. Their work shows how organisations can reduce car use, align with net zero targets and support broader government transport strategies.

In the co-designed research *Transportation in a Net Zero World: Transitioning Towards Low Carbon Public Transport* (UK Energy Research Centre), Nelson, Hastings and Logan examine how evidence-based approaches can support the shift to low-carbon public transport. The researchers also co-authored a

comparative analysis of university sustainable travel plans and examined travel demand management initiatives in Australian education precincts.<sup>23</sup> This research highlights how universities, as large employers and destinations, can use targeted strategies to encourage more sustainable commuting patterns.

At the University of Sydney, these insights are being applied to support the institution's sustainability and net zero strategy by addressing Scope 3 emissions. Surveys and behavioural analysis are helping the University better understand how people make travel decisions, identify barriers to change and test measures that encourage shifts away from car use. The research also informs collaboration with government agencies such as Transport for NSW, ensuring campus initiatives align with broader policy and infrastructure planning.

For organisations, the lesson is clear: evidence-based research provides the foundation for more effective transport strategies. By drawing on primary data and real-world insights, decision-makers can design initiatives that reduce emissions while improving access, lowering costs and supporting sustainability goals.

The research demonstrates that with the right data, partnerships and planning, organisations can play an active role in reducing emissions while making travel more convenient and sustainable for their communities.

## Case Study

### Greater Coordination is Needed to Address Conflicting National Policy Approaches

By Professor Penelope Crossley

Conflicting national policy approaches between the energy and finance sectors,<sup>24</sup> along with poor institutional coordination and oversight,<sup>25</sup> can create significant risk and regulatory uncertainty for investors.<sup>26</sup> This makes it difficult for renewable energy developers to attract and secure the funding required for clean energy projects. As a result, projects are often delayed

or derailed, slowing overall progress toward renewable energy adoption.<sup>27</sup>

There are many examples of conflicting policies within the energy sector as governments attempt to transition to sustainable energy systems while meeting rising demand and maintaining energy security. In Indonesia, for example, the government simultaneously supports a renewable energy target of 23% of the national energy mix by 2025 while also expanding coal-fired power generation due to economic and security concerns.<sup>28</sup> This sends mixed signals to investors.

Similar tensions exist in other resource-rich countries in the region, including Australia,<sup>29</sup> China<sup>30</sup> and the Philippines,<sup>31</sup> where renewable energy legislation aimed at accelerating clean energy development sits alongside mining and oil and gas laws that support continued fossil fuel extraction. In Vietnam, generous feed-in tariffs for solar and wind energy have at times conflicted with policies prioritising coal and hydroelectric power for energy security.<sup>32</sup> These contradictions create uncertainty for investors.<sup>33</sup> While renewable projects are encouraged, the continued emphasis on fossil fuel extraction and use undermines confidence in the long-term viability of clean energy investments.

Institutional complexity can further complicate project development. Many energy and resource projects require approvals across multiple laws, ministers, departments and levels of government, both during permitting and in ongoing compliance monitoring. Where coordination is weak and responsibilities are unclear, projects can face significant delays.

In Indonesia, overlapping authority between the Ministry of Energy and Mineral Resources and regional governments<sup>34</sup> has created approval bottlenecks. In the Philippines, national renewable energy policies often

clash with local government priorities, complicating the investment landscape.<sup>35</sup> Vietnam faces similar challenges, where divided authority between the Ministry of Industry and Trade and provincial governments can lead to delays and inconsistencies in project approvals and implementation.<sup>36</sup>

These examples illustrate that without coherent policy direction and clear institutional coordination, national commitments to accelerate the clean energy transition can be undermined. Conflicting signals – between fossil fuel expansion and renewable energy promotion, and between national ambition and local regulatory practice – erode investor confidence, increase transaction costs and delay projects.

Stronger coordination across ministries, levels of government and regulatory bodies is therefore essential to provide the policy certainty and clear market signals needed to mobilise private capital at scale. Without this alignment, the region risks continued fragmentation, slower deployment of clean energy infrastructure and missed opportunities to attract the investment needed to meet net zero commitments.



# Ideas for Australia

Much has already been written about financing the net zero transition.<sup>37</sup> There is limited value in repeating global analyses that explore this challenge from an international perspective. However, one gap in the literature is a clear view of how the transition could be financed from an Australian perspective.

## How Australia Is Different

### 1. Australia needs to transition its energy exports

Australia has been a major energy exporter for several decades. Figure 3 shows the growth in coal and liquefied natural gas (LNG) exports since 1960. Most exports have gone to North Asia – particularly Japan, South Korea and China. Together, coal and LNG exports contribute around \$160 billion<sup>38</sup> to Australia’s export earnings. However, the government expects the value of primary energy exports to fall to around \$100 billion by 2030. The net zero transition must therefore recognise the importance of developing alternative energy exports based on Australia’s other natural resources.

Australia has vast renewable energy resources, with strong solar and wind potential, as illustrated in Figures 4 and 5. For example, the annual output of a 10-square-kilometre solar array in central Australia would roughly match the country’s yearly electricity demand. This suggests Australia could generate renewable electricity far beyond its domestic needs. The key challenge is identifying markets for this surplus electricity and developing viable export pathways.

Revenue from exporting renewable electricity or renewable energy products could help offset declining fossil fuel exports. Australia has explored several options. Green hydrogen was initially viewed as a promising

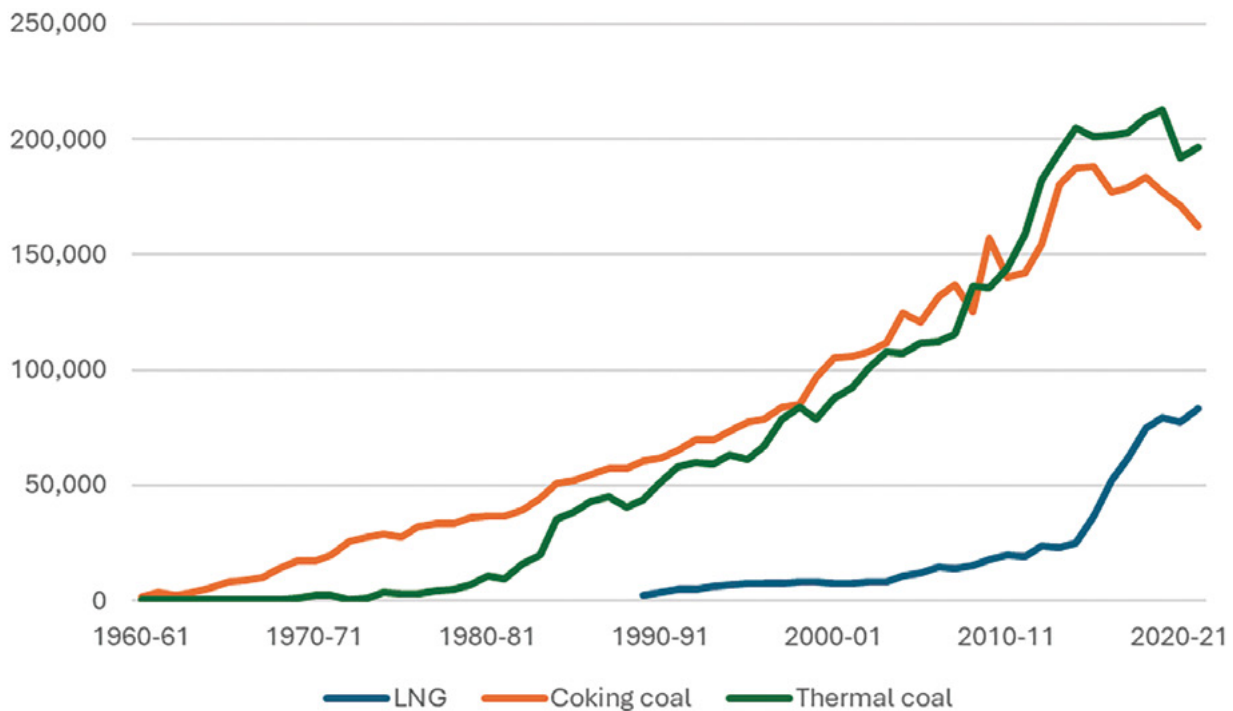


Figure 3: Australia's principal energy exports (PJ)<sup>39</sup>

export opportunity,<sup>42</sup> although progress to date has been limited.<sup>43-45</sup> Direct export of renewable electricity has also been considered. SunCable's Australia-Asia Power Link project is one example, although it too has faced funding challenges.<sup>46</sup>

To fully harness its renewable energy resources for export, Australia will need to develop new technologies for capturing, storing and transporting renewable energy. This presents an opportunity for Australia to lead in the development of these technologies.

## 2. Australia has extensive energy resources, except for the most important one

Modern economies depend heavily on oil. Ongoing geopolitical conflicts have caused a global fuel crisis, highlighting the economic and energy-security risks for countries that rely heavily on imported oil.

As shown in Figure A (Appendix), oil is the only major energy source that Australia imports. The figure also shows that most petroleum imports are used in the transport sector. This reliance on imported petroleum reduces Australia's energy security. Cheng et al. (2005)<sup>47</sup> found that trade in fuels and critical materials contributes to energy security risks, and that these risks decline in net

zero scenarios as countries reduce reliance on imported fossil fuels. The relationship between electrifying transport and improving energy security is also well documented in the literature.<sup>48</sup>

If countries such as China view electric vehicles as a way to strengthen energy security as well as reduce emissions,<sup>49-51</sup> Australia should consider the same opportunity.

## 3. Finding a home for patient capital

Australia's superannuation funds are valued at almost \$4.2 trillion and continue to grow, soon becoming the second-largest pool of retirement savings in the world.<sup>52</sup> The primary purpose of superannuation is to support retirement incomes, but within that objective there is significant potential to invest in the net zero transition.

Given the scale of Australia's superannuation system, allocating even a small portion of these funds could substantially contribute to net zero. The challenge lies in managing the risks of such investments, reinforcing the importance of improved capital allocation by super funds into existing technological solutions in the near term, and research and development into the technologies needed for Australia's energy transition in the mid to longer term.

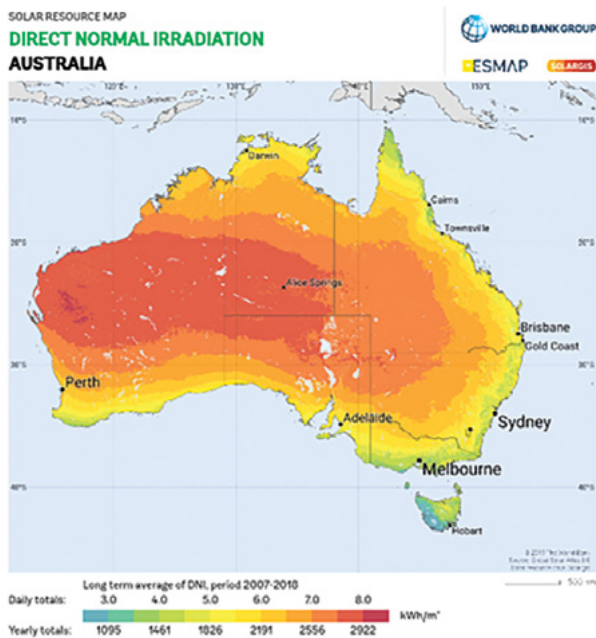


Figure 4: Australia's solar power resources<sup>40</sup>

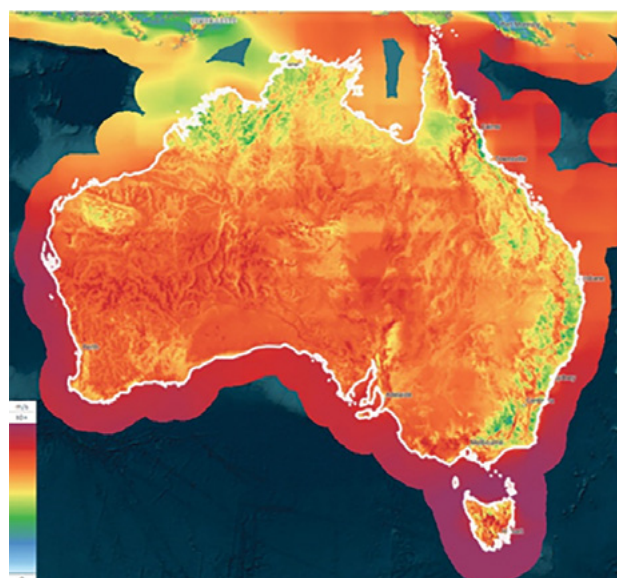


Figure 5: Australia's wind power resources<sup>41</sup>

# Why Funding New Technology Matters

Australia’s transition will depend on stronger investment in the technologies and funding pathways needed to turn renewable advantage into real-world outcomes.

As discussed earlier, Australia stands to gain more than most nations from developing affordable technologies capable of transporting renewable electricity over long distances and across oceans, whether through transmission lines or energy carriers such as hydrogen or synthetic fuels. Supporting the development of these technologies is therefore in the national interest.

A study published in *Nature* found that Australia has struggled to maintain its research performance, partly due to declining development funding.<sup>53</sup> In 2009, research and development spending accounted for 2.25% of GDP. By 2022 it had fallen to 1.68%, the lowest level in 20 years. The study also found that medical research receives the largest share of public research funding, while exporting renewable energy will depend heavily on advances in the physical sciences and engineering.

The Group of Eight (Go8) universities have reached a similar conclusion.<sup>54</sup> Their analysis notes that “Australia’s R&D intensity has been in decline for over a decade, at a time when productivity growth has been patchy and advanced economies have been investing heavily in R&D to boost their long-term prospects. The result is a growing gap between our R&D performance and that of advanced OECD economies.”

The Go8 report also compares sources of R&D expenditure in the United States and Australia (Table 1). Compared with the US, large corporations in Australia are less likely to invest in research and development than smaller organisations.

Many large Australian companies have committed to reducing emissions and reaching net zero by 2050 or earlier, often with interim targets such as emissions reductions by 2030. However, in many cases it remains unclear how these targets will be achieved, particularly if grid decarbonisation occurs more slowly than expected. This suggests that large corporations could play a greater role in the national R&D effort by supporting the development of the cost-effective technologies needed for their own decarbonisation.

Developing new financial instruments and improved risk management approaches will be important for supporting R&D investment and recognising its economic returns. A key part of this effort is understanding the broader benefits generated by innovation.

HSBC, a business partner of the NZI, is supporting the commercialisation of cost-effective decarbonisation technologies.<sup>56</sup> One example is its funding of Electric

**Table 1: R&D expenditure by business employment size<sup>55</sup>**

United States	2019	Australia	2021-22
Up to 4 persons	0.5	Up to 4 persons	8.6
5-19 persons	1.7	5-19 persons	15.4
20-249 persons	9.3	20-199 persons	31.3
250 or more persons	88.6	200 or more persons	44.7
Total	100.0	Total	100.0

Hydrogen, which is developing novel electrolyzers designed to lower the cost of green hydrogen production. HSBC also notes that around 35% of the emissions reductions required by 2050 are expected to come from technologies that are not yet commercially mature.

HSBC is also active in providing venture debt, which allows start-ups to secure additional funding without diluting founder equity, helping maintain incentives for founders to drive the success of their companies.

Developing financial instruments that support large Australian companies in building new technologies for the net zero transition would be beneficial. The Go8 report also highlights the superannuation sector as an emerging source of capital, with funds such as Hostplus investing in early-stage projects. Internationally, the United Kingdom has introduced reforms encouraging pension funds to allocate a portion of their assets to unlisted equities, including a commitment from nine major pension funds to invest 5% of their default assets in such investments by 2030.

## *Case Study*

### HSBC Response to Climate Change Efforts

HSBC has committed to becoming a net zero bank by 2050. The bank aims to provide and facilitate between US\$750 billion and US\$1 trillion in sustainable finance and investment by 2030, with strong progress already underway. By mid-2025, it had reached nearly US\$448 billion.

Supporting customers is central to HSBC's strategy. Financing customers' transition is critical to their own net zero goals and aligns with the bank's broader climate ambitions. HSBC is strengthening its customer-focused approach while leveraging a simpler business structure to operate more commercially and efficiently.

The bank has established three strategic priorities to support Corporate and Institutional Banking and Commercial Banking customers in their transition. These include becoming a leading bank for fast-growing transition ecosystems, particularly in clean power, electrification of transport, and data centres and AI; acting as a strategic transition partner to support investment and innovation across sectors and value chains; and positioning itself as a preferred bank for emerging climate technologies, from international expansion to first-of-a-kind infrastructure projects.

In Australia and New Zealand, HSBC applies this strategy through innovative financing structures such as sustainability-linked and green finance solutions. One example is the sustainable supply chain finance program

developed with The Warehouse Limited – the first of its kind in New Zealand – which rewards suppliers for environmentally and socially responsible practices.

HSBC is also playing an increasing role in financing large-scale renewable and energy storage projects. In 2025, the bank supported major battery energy storage system (BESS) projects, including AMPYR Australia's 300 MW Wellington Stage 1 facility and EnergyAustralia's 350 MW Wooreen Energy Storage System. It also supported AirTrunk's A\$16 billion sustainable financing across multiple transactions and markets, including the largest syndicated sustainability-linked loan for a data centre operator.

HSBC has identified several challenges to financing net zero investments, including grid congestion, high construction costs and the bankability of emerging technologies. Addressing these challenges will require coordinated action across government, industry and financial institutions.

Looking ahead, HSBC sees significant opportunities to support the transition across the broader ecosystem – from emerging climate technologies to heavy industry – including through blended finance structures that attract private capital. Strengthening cross-sector partnerships will be critical to accelerating Australia's transition to a resilient net zero economy.



## Case Study

### Financial Dilemmas in Racing for Net Zero in the Digital Economy

By Associate Professor Shumi Akhtar and Dr Farida Akhtar

Associate Professor Shumi Akhtar and Dr Farida Akhtar examine how the rapid growth of AI, automation and cloud computing is creating both economic opportunities and sustainability risks, particularly through electronic waste. More than 50 million metric tonnes of e-waste are generated each year, yet only a small proportion is responsibly recycled. This creates regulatory, financial and reputational challenges for companies and governments.

As reliance on AI-driven industries such as semiconductor manufacturing, data centres and consumer electronics grows, exposure to compliance costs and regulatory scrutiny is increasing. Failure to address these risks can disrupt supply chains, reduce investor confidence and limit access to sustainable finance.

Their research shows that technologies such as AI, blockchain and circular economy strategies can transform e-waste from a liability into a valuable resource. These approaches enable firms to recover critical minerals, reduce costs and strengthen investor confidence.

This work complements broader research on critical minerals and the ESG landscape in Australia. Associate Professor Akhtar at the University of Sydney and Dr Akhtar at Macquarie University are collaborating to examine how governance, transparency and stakeholder collaboration can help manage complex supply chains, attract investment and support sustainable growth.

Together, these studies demonstrate how innovation, governance and data-driven approaches can turn environmental and resource challenges – such as e-waste and critical minerals – into practical opportunities that support the net zero transition while strengthening economic outcomes.



E-Waste stack of graphics cards and motherboards in a landfill site, Germany (Image by: Nathan Cima on Unsplash)

# Reframing Investments

The scale of investment required for the net zero transition is substantial. In its 2022 study on the cost of the transition, McKinsey & Company estimated that:

“Capital spending on physical assets for energy and land-use systems in the net zero transition between 2021 and 2050 would amount to about \$275 trillion, or \$9.2 trillion per year on average, an annual increase of as much as \$3.5 trillion from today.”<sup>57</sup>

Hans Rosling, the Swedish physician and author of *Factfulness*, cautioned against interpreting large numbers without context. McKinsey therefore provided useful comparisons: the additional \$3.5 trillion annually is roughly equivalent to half of global corporate profits, one-quarter of total tax revenue, and about 7% of household spending (based on 2020 figures). The report also suggested that investment would be front-loaded, starting at 6.8% of global GDP in 2022, rising to around 8.8% between 2026 and 2030, before declining thereafter.

In practice, global investment has not yet reached these levels. For example, in Canada (an interesting country to consider with regards to its parallels with Australia’s economy) there are ongoing tensions between decarbonisation goals, requiring massive new investment into carbon management technologies, and the aspiration to expand energy exports.<sup>58</sup> While significant, this still falls well short of the global spending levels required.

Australia has also taken steps to accelerate investment. The Australian Government has released its national climate risk assessment, adaptation plans and emissions reduction targets for 2035.<sup>59</sup> It has also announced funding for renewable energy fuels (\$1.1 billion), electric vehicle infrastructure (\$40 million), clean energy and renewable electricity supported by gas and battery storage (\$2 billion), and a \$5 billion fund to support transformation in resource and heavy industries.

Australia’s emissions reduction targets align with international frameworks such as the Kyoto Protocol and the Paris Agreement. However, these emerged during a period of strong globalisation and multilateral cooperation. That context is changing, with geopolitical

tensions reshaping global trade and energy systems. Recent developments illustrate this shift. In April 2025, the United States introduced sweeping tariffs on imports.<sup>61</sup> Although the long-term consequences remain uncertain, the move triggered responses from major trading partners. China, for example, imposed export restrictions on rare earth elements – materials critical for renewable energy technologies, electronics and defence systems.<sup>62</sup>

These developments are contributing to a shift toward “onshoring” or “friend-shoring” supply chains, driven by national security concerns. While this may strengthen resilience, it can also reduce economic efficiency, increase costs and create supply constraints.

At the same time, international development institutions are reassessing their priorities. A recent report noted internal discussions at the World Bank emphasising that the institution’s core mission remains development and poverty reduction, even as climate change increasingly shapes global economic conditions.<sup>63</sup>

Meanwhile, many of the world’s largest emitters have yet to take sufficiently decisive action. As shown in Table 2, some countries have set limited emissions reduction targets, while others have adopted ambitious goals without clear policy pathways to achieve them.

In contrast, Australia possesses significant advantages: abundant renewable energy resources, access to capital, and strong research capability. With the right policy settings and investment strategies, these strengths position Australia to play a leading role in the global net zero transition by 2050.

**Table 2: What the large emitters are doing<sup>64</sup>**

	% of global	CAT rating
China	30%	Highly insufficient
United States	11%	Insufficient*
India	8%	Highly insufficient
Russia	5%	Critically insufficient

\* Before the withdrawal of the USA from the Paris Agreement

# Unleashing the Superannuation Pool



In 2023, the Australian superannuation industry released a report outlining recommendations to increase investment in the clean energy transition.<sup>65</sup> The report noted that superannuation investors are already supporting emerging net zero industries, including through investments in publicly listed critical minerals producers, private equity in energy technology service providers, and early-stage projects in offshore wind and hydrogen. However, these investments remain small relative to the total assets managed by superannuation funds.<sup>66</sup> Funds also report difficulty identifying investment opportunities that meet their required risk and return profiles.

In an article for *The Conversation*,<sup>67</sup> Arjuna Dibley from the University of Melbourne observed that in 2021–2022 institutional investors, including superannuation funds, contributed less than 1% of global direct private climate finance – around US\$6 billion. Although many funds have expressed intentions to increase investment aligned with net zero targets, regulatory constraints can limit their ability to act on these commitments.

While most large Australian funds have pledged support for net zero and established related investment targets, they often view companies developing new technologies or operating in areas undergoing significant policy change as higher risk. This perception helps explain why emerging green technologies can struggle to attract institutional capital compared with established fossil fuel investments.

## Boosting green investment opportunities

Superannuation funds frequently report that the limited availability of green investments with suitable risk-adjusted returns is a major barrier to increasing climate-focused investments. In addition, current approaches to assessing and rewarding fund managers often emphasise short-term performance, which can discourage long-term investments.

These concerns were also highlighted in a report by the Association of Superannuation Funds of Australia (ASFA).<sup>68</sup> The report noted that achieving the transition will require significantly higher investment in low-emissions infrastructure. ASFA estimates that investment will need to be about 5% higher than the business-as-usual scenario over the next three decades, with much of the additional funding required in the near term. While investment in low-emissions assets will increase, many of these projects will replace planned investments in higher-emissions infrastructure.

## Balancing risk and return

Superannuation funds could help meet part of the capital required for the net zero transition. However, ASFA reports that an increasing share of new superannuation capital is being invested overseas, with around 60% of assets currently allocated outside Australia – a trend expected to continue.

Superannuation investments must comply with regulatory requirements and fiduciary obligations, which place strong emphasis on balancing risk and return. From the perspective of institutional investors, the “green premium” can make low-emissions assets less attractive. In this context, the green premium refers to the extent to which the expected return on low-emissions investments is lower than comparable high-emissions assets. ASFA estimates this premium at around 100 to 200 basis points, effectively increasing the cost of capital for low-emissions projects and reducing their commercial viability.

The superannuation industry therefore identifies two key barriers to deploying member funds in support of the net zero transition:

- a shortage of suitable low-emissions investment opportunities in Australia
- the green premium, which affects the commercial viability of many transition projects.

Researchers at the University of Sydney, Dr Danielle Kent and Dr Cara Vansteenkiste, are examining both issues, particularly the behavioural barriers that

influence superannuation investment decisions. Their research identifies factors such as lack of trust, regulatory uncertainty and limited product accessibility as constraints on directing capital toward the clean energy transition.

Using behavioural economics experiments with asset managers, the researchers examined how these frictions arise when investors wish to support sustainable investments but face opaque choices or unclear trade-offs. These challenges do not affect only individual investors; they also scale to institutional decision-making. Their findings show that even engaged investors can lose confidence in sustainable investment pathways when transparency, standardisation and trusted advice are lacking.

These insights suggest that expanding green investment opportunities will require more than waiting for new projects to emerge. Measures such as clearer regulatory frameworks, stronger member engagement and co-investment structures may help build investor confidence and unlock greater superannuation investment in the net zero transition.

## *Case Study*

### Optimistic Framing Increases Responsible Investment by Investment Professionals

Dr Danielle Kent and her colleagues studied how framing influences investment decisions related to the transition, including the divestment of high-emissions assets and investment in low-emissions alternatives. A key challenge in responsible investing is that these decisions often involve moral as well as financial considerations.

The study focused on investment professionals, who play a central role in asset allocation decisions. The findings

suggest that optimistic framing can increase responsible investment. If a similar effect were observed at scale, the shift could translate into approximately US\$3.6 trillion in global asset reallocations.

This research highlights opportunities to strengthen engagement in responsible investing, suggesting that communicating the urgency of carbon divestment in a more positive and opportunity-focused way may influence investment behaviour.

# Electrifying Transport

Accelerating EV uptake will depend on infrastructure, grid readiness and policies shaped by real-world behaviour.

Electrifying transport is both an emissions reduction strategy and an energy security measure for Australia. However, several barriers continue to slow electric vehicle (EV) adoption.

Research across academia, policy institutes and industry consistently identifies two main constraints: vehicle cost and charging infrastructure.<sup>69-71</sup> Studies such as Lodhia et al. (2024)<sup>69</sup> argue that more aggressive subsidies, rebates and tax concessions could accelerate uptake, potentially worth up to \$21,000 per vehicle. However, financial incentives alone may not address all the barriers to EV adoption.

## Is vehicle price still a barrier?

Affordability has historically been a major concern for consumers. Survey data from the University of Sydney's Transport Opinion Survey (TOPS) shows that while one in three Australians is considering purchasing an EV within the next five years, 44% report that they cannot currently afford one.

However, the price gap between EVs and conventional vehicles is narrowing rapidly. In late 2024, BYD released the Shark 6 plug-in hybrid ute in Australia for \$57,900,<sup>73</sup> slightly less than the price of a Toyota Hilux SR.<sup>74</sup> Other EV models are now entering the market at comparable price points to conventional vehicles.<sup>75</sup> For example, the BYD Dolphin Essential starts from around \$32,000 driveaway, similar to many small petrol vehicles.<sup>76</sup>

As EV prices fall and running costs remain lower than internal combustion vehicles, the importance of purchase price as a barrier may continue to decline.

## Expanding charging infrastructure

Charging infrastructure remains a significant constraint. A 2024 survey by Compare the Market found that lack of charging stations was the third most important barrier to EV adoption, closely linked to concerns about range.<sup>77</sup> Analysis by Lodhia et al. suggests that Australia may require up to 5,800 additional fast charging stations by 2040, at an estimated cost of around A\$1.2 billion.



Research by NZI members Andrea Pellegrini, Antonio Borriello and John Rose highlights the importance of understanding how drivers actually use charging infrastructure.<sup>78</sup> Their work identifies two types of EV users:

- **Regular** chargers, whose behaviour responds to technological improvements such as increased driving range
- **Irregular** chargers, whose charging patterns are less influenced by technology or usage

Understanding these behavioural differences can help policymakers design more effective infrastructure and policy settings.

## Managing the impact on the electricity grid

The electrification of transport will also increase demand on the electricity system. NZI researchers Mengyu Li and Manfred Lenzen modelled how EV charging could affect Australia's electricity grid.

Their analysis suggests that the existing grid could support 5–10% EV penetration under uncontrolled charging. However, with controlled charging, where vehicles

charge when electricity supply is abundant, the system could accommodate 60–70% EV penetration. Controlled charging could also reduce electricity costs by 4–6%, creating additional energy system benefits.

### **Behavioural factors also matter**

Infrastructure and price are not the only influences on EV adoption. Behavioural factors such as attitudes, perceptions and social norms can also shape purchasing decisions.

Research from the United States demonstrates that EV adoption can be influenced by political identity and social signalling.<sup>80</sup> These findings highlight how public narratives and messaging can shape consumer behaviour.

In Australia, similar dynamics may apply. Messaging focused on emissions reductions may resonate with some segments of the population, while others may respond more strongly to arguments related to energy security, fuel independence, or lower operating costs.

### **Aligning policy, incentives and behaviour**

Financial incentives remain an important policy tool. Subsidies, rebates and tax concessions can lower the upfront cost of EVs, while grants and financing

programs can support fleet transitions and charging infrastructure deployment.

International experience demonstrates the impact of well-designed incentives. Norway's tax exemptions and toll discounts have helped EVs reach 89% of new car sales in 2024, while federal and state incentives in the United States have also accelerated adoption.

Australia has begun implementing similar measures. State programs such as New South Wales' \$3,000 rebate and stamp duty exemptions, combined with investments in national charging corridors, have contributed to rising EV adoption. By April 2024, EVs accounted for 9.4% of new vehicle sales, up from 3.8% in 2022.

However, as some incentives begin to phase out, continued policy alignment will be important to maintain momentum.

Ultimately, accelerating EV adoption will require coordinated action across policy, infrastructure investment, technology development and consumer engagement. Aligning these factors with what consumers value – affordability, convenience and reliable charging – will be critical to Australia's transition to low-emissions transport.

## *Case Study*

### **How Australians Charge Their EVs**

*Dr Andrea Pellegrini and Prof. John M. Rose*

A 2024 study by Dr Andrea Pellegrini and Professor John Rose from the University of Sydney Business School examined how Australians charge their electric vehicles. Conducted with the Electric Vehicle Council, the study surveyed EV owners nationwide to understand where, when and how often they charge their vehicles – at home, at work, in retail locations and at public charging stations.

They found most charge at home, particularly among households with rooftop solar, where vehicles are often charged during the day using self-generated electricity. Workplace charging is also popular, particularly where it is provided free of charge. Supermarkets and public charging stations are used mainly for occasional top-ups rather than primary charging.

These insights are significant because they reflect real charging behaviour rather than planning assumptions. The results suggest that policies to accelerate EV adoption should prioritise home and workplace charging, including solutions such as kerbside charging for homes without garages.

Public charging infrastructure remains important, but it is unlikely to be sufficient on its own. Instead, it should complement the locations where most charging already occurs.

By drawing on real-world data, the study provides evidence to help councils, governments and businesses design more effective charging infrastructure. Aligning investment with actual charging behaviour can reduce barriers to EV ownership and support the broader transition to low-emissions transport.

## Case Study

### Using Social Impact Assessment in Transport Projects

*Dr Lara Mottee*

Transport infrastructure plays a significant role in shaping how communities live, move and work. While roads, railways and freight lines are built to serve society, they can also create social impacts that are difficult to measure. Dr Lara Mottee, a researcher at the John Grill Institute for Project Leadership, is examining how Social Impact Assessment (SIA) can be used more effectively in transport projects to capture both their benefits and their challenges.

Mottee's research highlights that defining the social area of influence for transport projects is often complex, particularly when projects span multiple regions or do not align neatly with geographic boundaries. Transport initiatives can generate intangible outcomes, including changes in travel behaviour, improved access to services and new employment opportunities.

By strengthening SIA methods for transport infrastructure, the research shows how projects can move beyond regulatory compliance to better demonstrate their social value and contribution to sustainability goals. It provides planners, project managers and policymakers with practical tools to assess and communicate the broader impacts of transport initiatives.

Participatory approaches are central to this work. SIA methods that actively engage communities allow residents to share their concerns, experiences and local knowledge, helping shape project decisions. This engagement creates opportunities for governments, investors and communities to collaborate in designing transport systems that support a net zero future.

For governments, investors and industry, these insights support more resilient and socially responsible decision-making. Effective SIA can help ensure that transport infrastructure not only moves people and goods efficiently but also delivers fair outcomes and long-term benefits for the communities it serves.

## Case Study

### Hyundai's Response to Electrifying Transport

Hyundai Motor Company Australia has outlined a strong commitment to supporting Australia's net zero transition, particularly through the decarbonisation of road, rail and maritime transport. Its primary focus locally is on road transport, advancing both electric and hydrogen fuel cell technologies to support a cleaner mobility system.

Hyundai identifies several barriers slowing Australia's transition. These include inconsistent consumer incentives across federal, state and territory governments; a lack of national coordination for DC fast-charging infrastructure for passenger and commercial vehicles; and the absence of a national strategy for kerbside or power-pole charging to support EV owners without off-street parking. Addressing these gaps will require coordinated action between government, industry and local communities.



Since 2017, Hyundai has played an active role in deploying EVs in Australia and supporting the development of industry associations. In 2023, the company introduced the Mighty EV, a compact electric truck, extending electrification into the commercial vehicle sector. Hyundai continues to work with governments, industry partners and media organisations to promote EV adoption and strengthen supporting infrastructure.

Hyundai has also been an early mover in hydrogen mobility. It introduced Australia's first hydrogen fuel cell passenger car and established the country's first permanent hydrogen refuelling station in 2014. The company is now developing a self-funded 700-bar hydrogen station capable of producing hydrogen from water using renewable energy. Hyundai has also co-founded the Australian Hydrogen Council and the Hydrogen Transport Forum and is deploying 40-tonne hydrogen fuel cell trucks with industry partners.

Looking ahead, Hyundai is collaborating with government and industry on Vehicle-to-Grid (V2G) technology, which enables EVs to return power to the electricity grid. This capability could help stabilise energy supply during peak demand while supporting the broader transition to low-emissions transport.

## Case Study

### Assessing the Willingness to Adopt Home Charging Stations for EVs

*Dr Andrea Pellegrini, Antonio Borriello and Prof. John M. Rose*

As Australia moves toward a net zero future, household charging behaviour is becoming an important factor in the adoption of electric vehicles (EVs). Research by Dr Andrea Pellegrini, Antonio Borriello and Professor John M. Rose from the Institute of Transport and Logistics Studies examined the willingness of Australian households to install home charging stations.<sup>79</sup>

The study surveyed 1,199 households in New South Wales, including residents of both standalone houses and apartment complexes. It found strong support for home charging, with apartment residents showing a clear preference for private chargers rather than shared communal facilities.

The findings highlight an important planning gap. While public charging infrastructure is expanding, most households prefer to charge their vehicles at home. Without adequate support for private charging — including kerbside solutions for apartments or homes without garages — EV adoption may be slower than expected, potentially limiting progress toward national emissions targets.

By collecting primary data on household preferences, the study provides evidence to help policymakers,



planners and businesses design EV infrastructure that reflects real user behaviour. The insights can inform kerbside planning, zoning regulations and incentive programs that support the installation of private or semi-private charging.

For businesses, the research also identifies opportunities in home charger installation, kerbside charging solutions and service models that support residential EV uptake.

Much of the current policy discussion in Australia focuses on expanding public charging networks. However, without a clear understanding of the role of private charging, these investments may not fully address how people prefer to charge their vehicles. Incorporating these findings into urban planning and infrastructure design could help governments, councils, developers and energy providers remove barriers to EV adoption and support Australia's transition to low-emissions transport.

# The Transition Starts Now

The net zero transition is not a distant goal – it is already underway. The challenge now is to translate ideas, research and financing into action. Around the world, new solutions are emerging alongside those outlined in this paper. Further research and development will be needed to understand how emerging fields intersect – including the use of artificial intelligence and blockchain in climate finance, new approaches to funding nature-based solutions at scale, and governance frameworks that help boards and investors make climate-aware decisions while managing risk.

Australia is well placed to contribute to this next phase. The country has world-class renewable energy resources, one of the largest superannuation systems in the world, and strong research capability. By connecting these strengths, Australia can play a significant role in shaping how the net zero transition is financed and implemented – both domestically and internationally.

The University of Sydney's Net Zero Institute is supporting this effort by creating platforms where research and real-world decision-making intersect. Through workshops, roundtables and forums, the Institute brings together researchers, businesses, governments and communities to explore practical solutions and share knowledge.

It has also developed a framework for understanding mechanisms, perceptions and value, helping identify where interventions and investments can be most effective. Collaboration of this kind builds the trust, evidence and investment pipelines needed to move from discussion to implementation.

## Where to from here?

Future research can further examine how digital technologies may accelerate sustainable finance, how superannuation and sovereign wealth funds could help scale climate investment, and how incentives and governance structures might strengthen trust across markets and communities.

There is also scope to expand research on transport decarbonisation, the relationship between climate action and human rights in global supply chains, and financing strategies for large-scale nature-based solutions.

The transition to net zero will require a combination of research, innovative financing, effective governance and cross-sector collaboration. With the right structures in place, Australia and its partners can transform today's challenges into practical solutions that accelerate progress toward a net zero future.

## Conclusion

For Australia, the time has come to rethink timelines and actively fund the net zero transition. Accelerating research and development will help generate practical solutions for clean energy, sustainable transport and resilient infrastructure.

This white paper highlights how research and development – led by the University of Sydney's world-class scholars – can inform policy, investment and innovation. Evidence-based approaches, from co-designed financial tools to advances in transport and energy systems, show how Australia can translate investment into tangible outcomes. Collaboration will be essential. Governments, businesses, researchers and communities must work together to

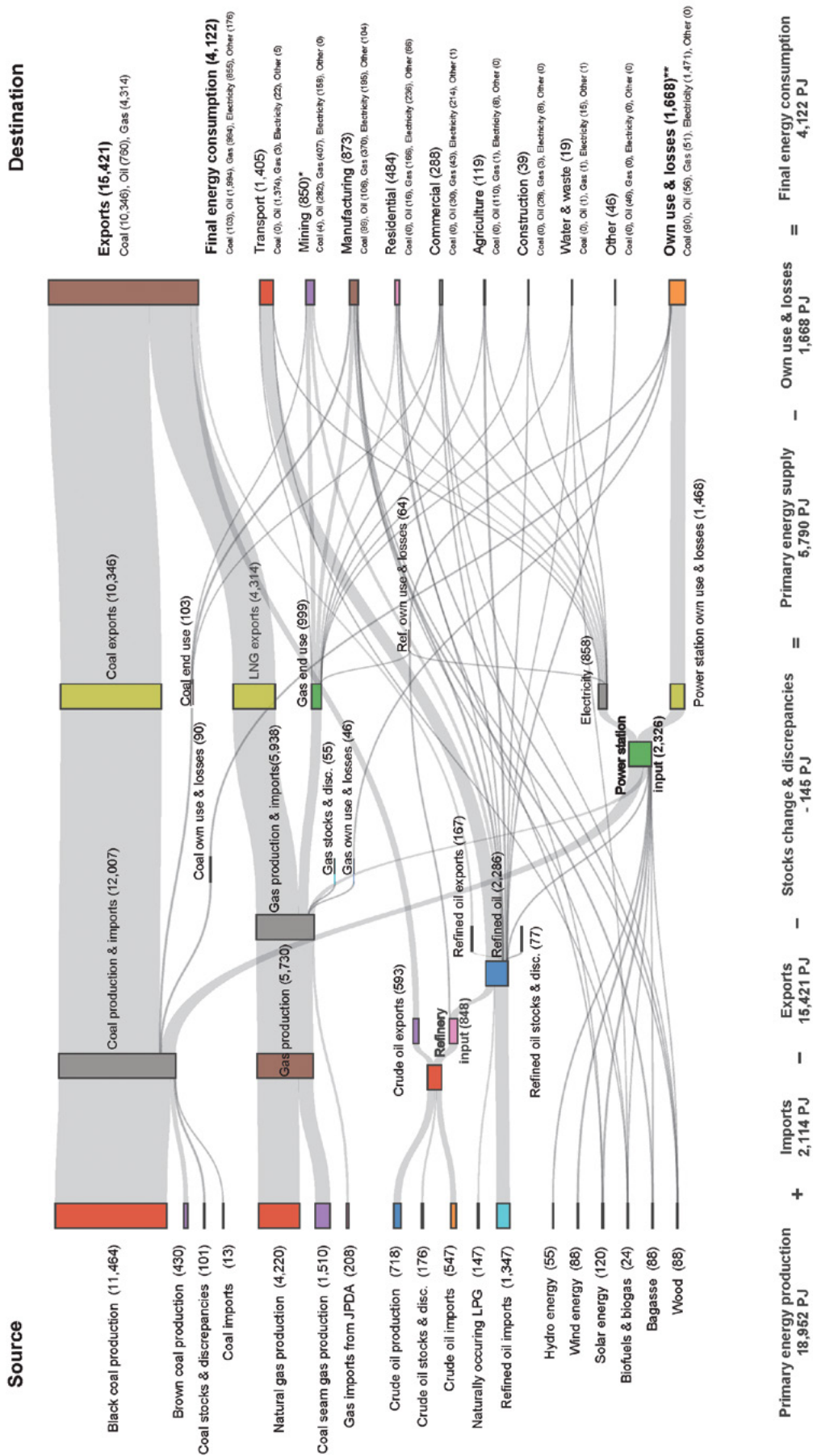
design policies, financing mechanisms and innovations that are evidence-based, scalable and effective. Sharing knowledge, testing new ideas and learning from both international and local experience can help reduce risk and accelerate progress.

The opportunity is significant. Every investment, policy decision and innovation will shape Australia's net zero future. By acting now, Australia can not only meet its targets but also demonstrate how coordinated investment can translate into real climate action. The University of Sydney's Net Zero Institute stands ready to work with partners across government, industry and the community to help turn this commitment into practical outcomes.

# Appendix

Figure A: Australia's Energy flows in 2020–21 (PJ)<sup>81</sup>

## Australian Energy Flows 2020-21 (Petajoules)



NOTES: Numbers may not add due to rounding. JPDA = Joint Petroleum Development Area. \* includes LNG plant own use of gas. \*\* Conversion plants own fuel use & losses, and transmission losses.

SOURCE: Australian Energy Statistics 2022, Table A, Table F, and Table Q

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