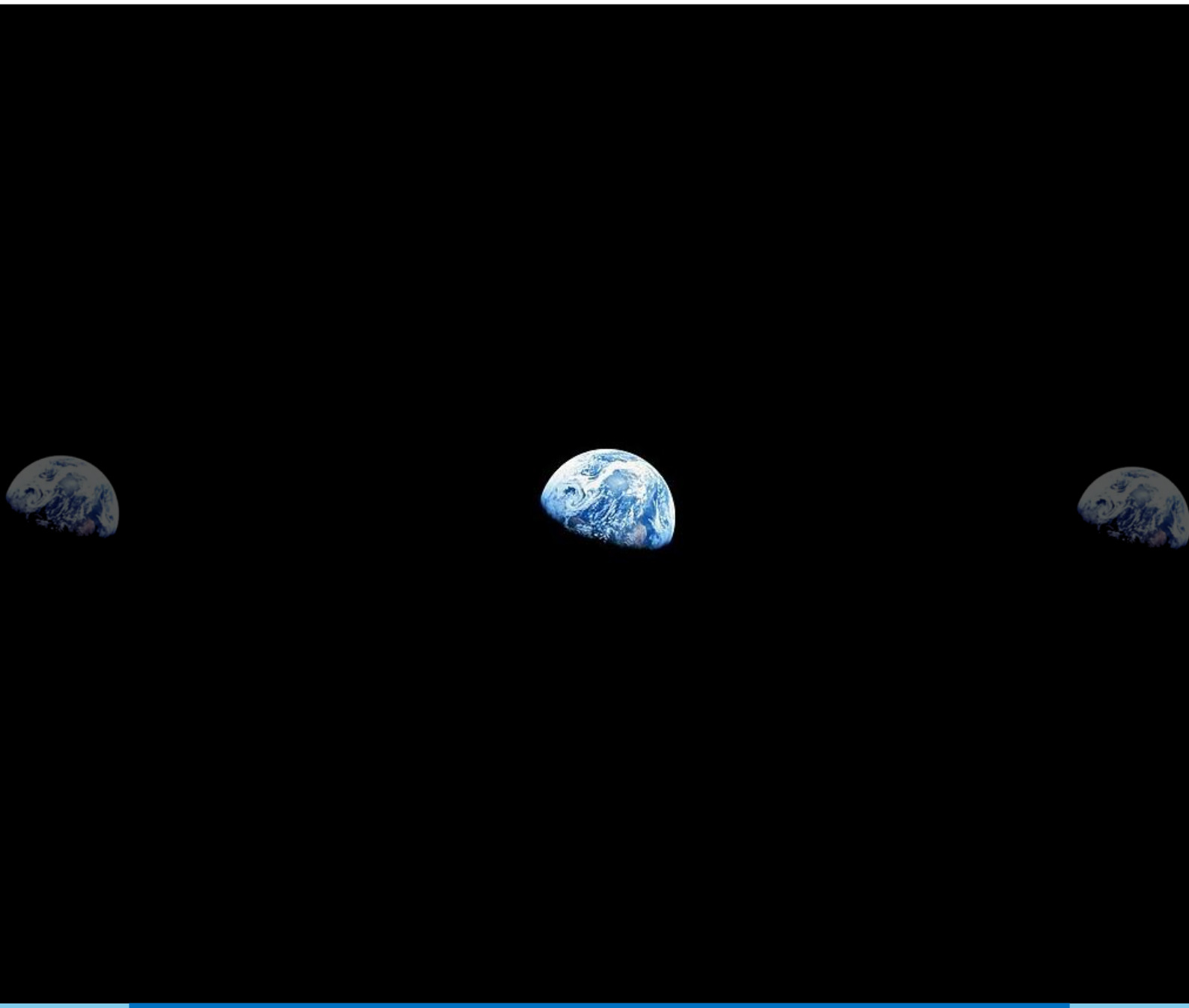
the state of policy

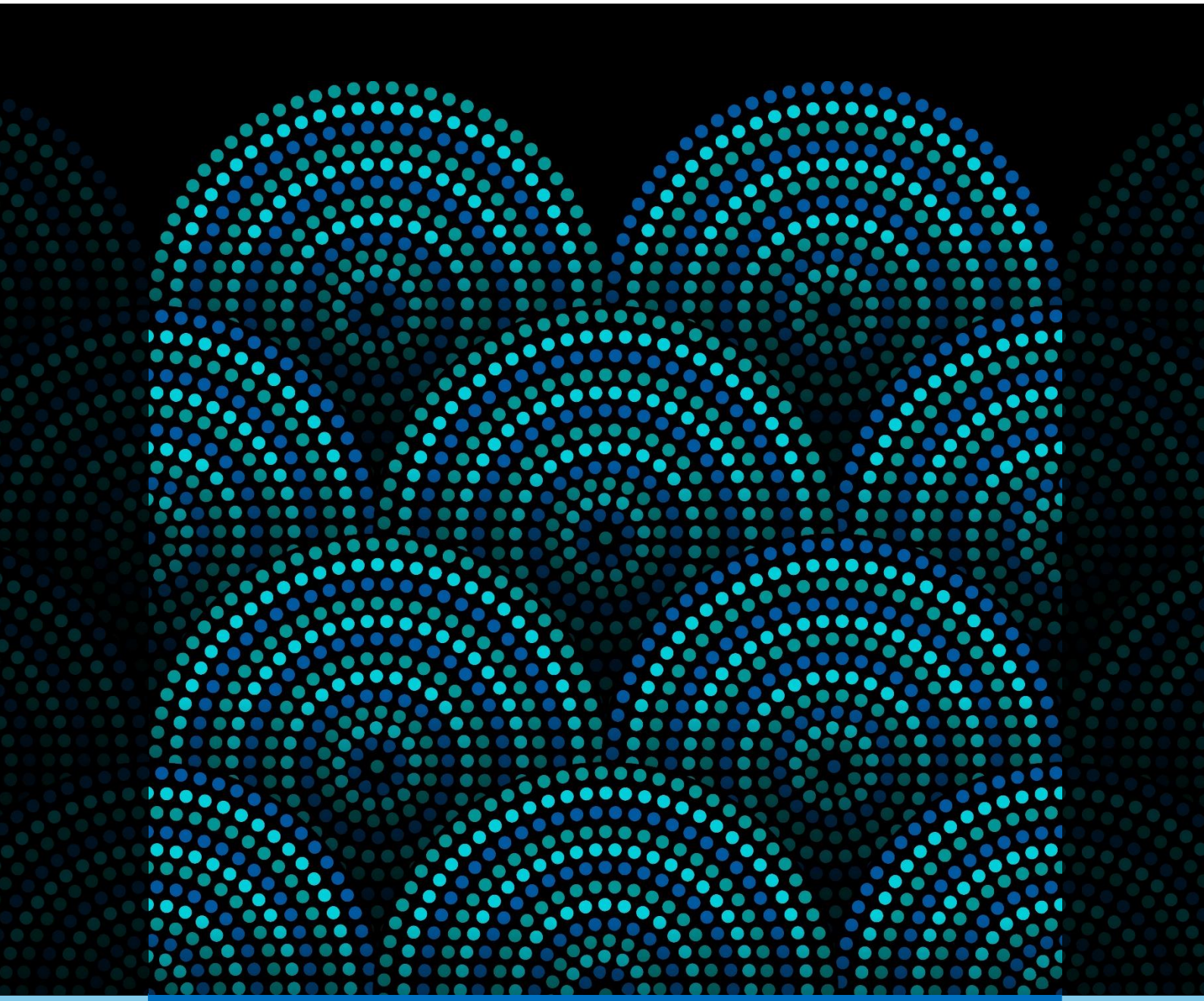
an assessment of Australia's federal government policy as it relates to environmental and sustainability issues

the climate centre



A commitment to social and environmental equity

The Climate Centre is committed to advocacy for the betterment of the environment, for reducing humanity's negative impact on the climate system, and the socio-culture damage that has been caused by human activities. By developing sustainable practices, we can move towards a future where the impact of society is to uplift all peoples and living things, and work towards a future defined by a healthy planet. We reject the cultural norms that have allowed the destruction of the environment and society to take place. We acknowledge the wisdom in us to improve our way of life, and work towards a hopeful future.



Acknowledgement of country

We acknowledge the Traditional Custodians of the lands, waters, and skies on which we work and live. We pay our respects to Elders past and present and extend that respect to all First Nations peoples.

We recognise that Aboriginal and Torres Strait Islander peoples have cared for country for tens of thousands of years — as stewards of the land, and as a part of it. Caring for the environment requires a deep spiritual connection to place, and we hope that all Australians can embrace similar principles in their lives and take inspiration from the wisdom of Indigenous knowledge and practices. In a time of climate crisis and environmental uncertainty, we acknowledge that embracing these traditions are vital to guide us toward true sustainability.

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executive summary

The State of Policy report examines Australia's policy framework from the perspective of climate, environmental and sustainability issues across five important areas of policy, including environment impact and ecosystem health, the energy transition, economic and industry impacts, public services and climate justice and geopolitics. Australia's Federal government has historically taken an approach that climate change is limited to certain areas of policy, but the reality is that climate change impacts every single aspect of our daily lives, and similarly every aspect of policy. For this reason, we encourage the Federal government to take a "climate in all policies" approach to policy development and consider where certain policy areas may need substantial reform to address this, including through the creation of entirely new Federal government policies.

In our assessment of Australian government policy, written both before, during and after the May 2025 election, we assess the impacts to our nation during a time of widespread and severe climate impact, however this impact is set to worsen dramatically into the future unless society can make sufficient change, through which policy reform and government are important parts. To date, the Federal government has acted ineffectively in addressing the root causes of many issues and typically takes a responsive rather than a pro-active approach. In some cases, it has actively worked against the national interest, as demonstrated by the recent choice to extend the North West Gas Shelf project to 2070, violating the principles of its own legislated net zero by 2050 target, and in the process alarming community groups and international stakeholders. '

The State of Policy report's comprehensiveness acknowledges the fact that Australia is being increasingly impacted by climate change, both in terms of the impact to our unique natural environment, but also socially and economically, with impacts to housing, public health and food security already being felt. Additionally, industry is not being sufficiently supported through funding, policy guidance, or stakeholder engagement, meaning that the transformative change required in many sectors cannot happen at the rate required to ensure the worst impacts of climate change are avoided. While there are many areas in which the government is doing well or performing at an acceptable level, generally it tends to only address the bare minimum and immediate needs of the nation, which in the long-term leads to worsening outcomes for all aspects of the country, especially in the face of an accelerating existential disaster. Here we outline brief recommendations for reform across the five important policy areas, each divided further by the report's chapters.

recommendations for environmental impact and ecosystem health

Terrestrial biodiversity

Provide at least $6 billion annually for conservation efforts, provide financial incentives for private land conservation, establish an independent Environment Protection Authority, strengthen environmental legislation with enforceable standards, expand and connect protected areas.

Marine biodiversity

Expand monitoring programs to address lack of understanding of species and habitats, restrict overfishing to allow stock recovery, address compliance and enforcement deficiencies of the EPBC Act, and resolve human resourcing issues which hinder effective management of protected areas.

Water resource management

Disparities in water access require renewed policy, groundwater management must focus on climate resilience and compliance. Ecosystem management needs to address climate stressors, agricultural water reform should prioritise community support and shift to proactive risk management.

Coastal erosion

Establish a national agency to integrate coastal management and uphold national standards. Increase funding for coastal defence methods, establish cooperation and collaboration amongst governments to achieve consistent adaptation efforts.

recommendations for the energy transition

Fossil fuel rebates and subsidies

Fossil fuel rebates and subsidies need to be replaced with low-carbon revenue strategies: corporate income tax reform, government co-investments, and industry levies. Effective communication and planning are needed to address the social impacts of transitioning away from fossil fuels.

Solar power

Australia should modernise its grid infrastructure and expand energy storage solutions, implement dynamic pricing and strengthened feed-in tariffs, provide incentives for battery storage, increase investments in large-scale solar projects, and promote national solar education programs.

Wind power

Ensure effective community consultation and enhance coordination among government tiers, private industry, and communities. For offshore wind: investing in development, reforming policies to provide better support, and conducting thorough research to identify additional suitable locations for offshore wind farms.

Hydropower

Continue support for Snowy 2.0 and smaller pumped hydro energy storage stations. Facilitate effective integration of hydropower into the National Electricity Market. Improve water management, and ensure compliance with the EPBC Act to safeguard ecologically significant areas.

recommendations for the energy transition

Wave energy

Research and development needs to be prioritised through long-term financial support to governments and stakeholders to alleviate financial burdens and ensure continuous investment. The EPBC and OEI Acts should be updated to streamline approvals and enhance environmental assessments.

Hydrogen

Optimise existing incentive programs, improving infrastructure for hydrogen transport, foster public-private partnerships, and continue funding for local pilot projects. The industry faces risk from the archiving of several projects due to funding shifts, but success requires consistent support.

Nuclear energy

Nuclear power could become an option for Australia's power generation in the future, particularly as technology continues to advance. However, current construction costs and timelines for implementation render it impractical for addressing Australia's immediate climate and energy generation needs.

Energy grid optimisation

Develop a comprehensive gas market system plan to improve energy security, conduct mid-cycle reviews of the ISP, adopt open-source software principles for grid modeling, differentiate between short and long-duration storage in planning, and establish a coordination office for industrial decarbonisation.

recommendations for the energy transition

Electric vehicles

Current incentives are inconsistent and limited, and the New Vehicle Efficiency Standard is weaker than desired. To enhance EV growth in Australia, the Federal government should establish a cohesive framework for incentives, support local manufacturers, and invest in charging infrastructure.

Carbon capture and storage

A national CCS framework should be established and various steps should be taken to improve CCS including: incorporate scope 3 emissions accounting into evaluation, shifting investment towards hard to abate industries, supporting direct air capture, and prioritising high-impact sequestration options.

recommendations for economic and industry impacts

Cost of living

Implement a National Food Security Policy and increase funding for food cooperatives. Continue and enhance direct monetary support for energy prices to households. Create a National Climate Insurance Framework and reforms to ensure fair access to housing insurance in high-risk areas.

recommendations for economic and industry impacts

Housing and construction

Increase NatHERS ratings for new residential buildings, enhance energy efficiency standards for commercial constructions, and boost funding for decarbonising supply chains. Enhance the NCC including resilience against natural disasters and enhancing risk maps for extreme weather.

Sustainable packaging

Mandate industry compliance with APCO's National Packaging Targets, tighten packaging regulations and incentives for extended producer responsibility, particularly for problematic materials, consider local government infrastructure needs in packaging regulations, and invest in reprocessing facilities.

Financial and insurance services

Introduce compulsory reporting and industry-specific standards, encourage innovative products and public-private partnerships, including green bonds, and carbon trading policies which require reforms for effectiveness, and introducing a carbon tax could enhance accountability.

Plant-based agriculture

A Ministry of Food should be created to handle food security; a comprehensive transformation plan should be created to enable transition towards climate-resilient agriculture; and a National Food Security Strategy should prepare for and respond to climate change threats to food security.

recommendations for public services

Public transport

Amend the NLA Act to include binding sustainability provisions, tie FFAS funding to KPIs, prioritise small-scale impactful initiatives, provide at least 5% of IIP funding to the ATF permanently. Transition to a distance-based road user charge as EV adoption rises, with rebates for low-income and regional

Public health and food security

Implement a National Food Security & Climate Framework and a National Food Plan, appoint a Minister of Food, increase sustainable farming research funding, promote crop diversification, tackle food waste, increase food relief organisation funding, adjust dietary guidelines to mitigate climate change.

Public health and heatwaves

Establish a heatwave preparedness national body, develop a National Heatwave Strategy, enhance stakeholder collaboration, better integrate health systems, recognise extreme heat as a disaster eligible for funding, improve building codes, increase green spaces and establish local cooling centres.

Natural disasters

Implement annual updates to the AGCMF, enhance operational improvements in disaster recovery funding, increase disaster preparedness spending from 3% to 30% of total disaster expenditure, establish a flood defense fund, improve flood mapping, and provide transparent monitoring of insurance premiums.

recommendations for climate justice and geopolitics

Foreign relations

Encourage collaboration across government, invest in offshore wind power infrastructure to improve energy access in Australia, the Pacific and Southeast Asia, rollback gas project extensions, re-commit to reducing fossil fuel emissions, and focus on food security.

Migration and displacement

Implement a national policy framework, expand migration pathways for international climate migrants, implement humanitarian protections for Australians facing long-term internal displacement, including buyback and relocation schemes, and enhance public awareness of the rights of displaced individuals.

Legal assistance

Increase funding for natural disaster legal assistance, streamline access to services, improve stakeholder coordination, invest in community legal education, tailor support for vulnerable populations, and consider services in the context of slow-onset impacts, such as coastal erosion and housing issues.

First Nations justice and equity

Recommendations include mandating minimum equity ownership, providing accessible financing, setting workforce participation targets, enshrining the UNDRIP into Australian law, introducing Native Title reform, and embedding clean energy policies into a framework of reconciliation and recognition.

introduction to the policy landscape

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The year 2024 marked an important moment in the global climate crisis: the first 12-month period in which Earth's average temperature reached or exceeded 1.5°C above pre-industrial levels (World Meteorological Organisation, 2025). While this does not necessarily equate to the failure of the 1.5°C target specified in the Paris climate agreement, which is calculated as the long-term average warming over decades, it demonstrates how little time we have before this threshold is likely breached. In a nation already grappling with escalating climate threats, the danger of breaching this threshold demonstrates the need for Australia to secure more ambitious climate-relevant policies. Without rapid action to decisively cut emissions, we will lose the opportunity to fulfil both the 1.5°C and 2°C climate targets and in doing so inflict irreversible damage on Australia's environment, economy and communities.

The scientific consensus, as represented in the Paris Agreement, asserts that limiting global warming to 1.5°C as a long-term average is essential for mitigating the most catastrophic effects of climate change. For a 67% chance of meeting this objective, the remaining global carbon budget from 2024 must not exceed approximately 150 Gt CO_2-equivalent (Climate Change Tracker, 2025). With global emissions currently estimated at 40 Gt per year and on an upward trajectory, the 1.5°C carbon budget is set to be exceeded in 2027 unless significant emissions reductions are undertaken. In comparison, the carbon budget for limiting warming to 2°C (with 67% likelihood) is expected to be depleted in 2046 if global emissions continue at their present rate. However, emissions could continue to rise for some time, potentially shortening these timelines, as several major countries have recently considered withdrawing from the Paris Agreement, including the United States, Indonesia and Argentina (Mariska et al., 2025).

The full impacts of climate change have historically been absorbed by the land and oceans (Cassidy, 2024). Absorbing a majority of carbon emissions has come at the expense of the health of the environment and ecosystems, which have not only experienced severe negative impacts but are also losing resilience in their ability to protect us against further warming and change (Hessen & Vandvik, 2022). Boreal forests, for example, which have typically absorbed around one third of all land-based carbon stores (Adamczyk, 2021), have experienced a sharp decline in the amount of carbon they absorb (Pan et al., 2024). Tropical forests, such as the Amazon, as well as some temperate forests, such as those in Canada, have not only decreased in the amount of carbon they can store, but have transitioned from carbon sinks to carbon sources (Pearce, 2020). Oceans have experienced long term rises in temperature (Voosen, 2023) and have absorbed so much carbon that their ability to absorb additional carbon is reducing (Müller et al., 2024).

A challenge in understanding the impacts of these systems being destabilised is that most climate models fail to fully account for this declining resilience and thus actual impacts of climate change may be more severe than anticipated (Pearce, 2020). A comprehensive understanding of the impacts of climate-human system interaction is limited in part due to the fact that the Earth sciences are chronically underfunded (Overland & Sovacool, 2020).

If all conditional NDCs (Nationally Determined Contributions) and net-zero pledges are implemented, this will likely limit warming to 1.9°C (UN Environment Programme, 2024a). However, there is a substantial and alarming difference between pledges and enacted policies, with current policy measures projected to cap warming at 3.1°C. This level of warming is highly likely to cause the triggering of climate tipping points, leading to the destabilisation of major environmental systems and contributing to further heating of the planet (Armstrong McKay et al., 2022).

Sixteen of these 'tipping points' have been identified, five of which are already likely to be crossed at current levels of warming. One of the most important and sensitive tipping points is the collapse of the Greenland and West Antarctic Ice Sheets, which collectively contain enough water to raise sea levels by at least 12 metres (Poinar et al., 2024). Even though these sources of sea level rise will more than likely take centuries to melt completely, such processes are very difficult to stop once started. This means that even though we may achieve our net-zero targets, our ability to reverse this change would be severely difficult if not impossible to prevent further melting. Permafrost thaw also poses a significant risk, with an estimated 1,700 Gt of carbon stored in the Northern Hemisphere alone (Miner et al., 2022). Even if all climate targets are met, permafrost thaw could release 220–300 Gt of CO2-equivalent this century, an amount several times yearly global emissions, which would result in even more heating (Chadburn et al., 2021). Moreover, the collapse of convection in the Labrador Sea and the loss of tropical coral reefs diminish the ocean's capacity to absorb carbon (DeGrandpre et al., 2006) and severely damage marine ecosystems, upon which at least hundreds of millions of people depend (Moberg & Folke, 1999). At 2°C of warming, more severe risks unfold, including increased risk of dieback of the Amazon Rainforest, with catastrophic consequences for both carbon storage and global climate systems (Potsdam Institute for Climate Impact Research, n.d.). If destabilized, any of the tipping points could trigger a cascade of devasting effects on climate, biodiversity and human well-being, and exacerbate the climate emergency.

Understanding climate trends and impacts

Natural levels of greenhouse gases are essential for maintaining the stable, warm conditions necessary for human life – a phenomenon known as the greenhouse effect. Levels of these gases have remained relatively stable for the past 800,000 years, and during this time carbon dioxide concentrations fluctuated cyclically between approximately 180 and 280 ppm (Siegert et al., 2020). The Holocene period, which began 11,700 years ago (Gibbard & Head, 2020), brought a period of highly stable temperatures, which is often cited as a key factor in the development of human civilisation (Steffen et al., 2011). However, since the Industrial Revolution,

humans have engaged in an array of activities that release greenhouse gases, including fossil fuel combustion, large-scale agriculture and deforestation. Over time, this has resulted in greenhouse gas concentrations far beyond natural levels – in particular carbon dioxide, which reached a concentration of 427 ppm in May 2024 (National Oceanic and Atmospheric Administration, 2024). This influx of additional greenhouse gases has produced an enhanced greenhouse effect, resulting in warming far beyond natural levels.

One important element of global warming is the rapid rate of increase in carbon dioxide concentrations, which places immense strain on environmental systems and ecosystems that cannot adapt quickly enough. Additionally, greenhouse gases typically have long atmospheric lifetimes, meaning that high levels of warming will persist even after net-zero emissions are achieved, until these gases are actively removed from the atmosphere (Palazzo Corner et al., 2023).

The rise in temperature resulting from anthropogenic greenhouse gas emissions has three principal effects. First, the increase in heat introduces the equivalent energy of four Hiroshima bombs to climate systems every second (Climate Council, 2019), destabilising the atmosphere and increasing the frequency and intensity of natural disasters. Additionally, evaporation increases at higher temperatures, exacerbating rainfall imbalances as it increases drought and drying in certain regions, while increasing rainfall elsewhere (Xiong & Yang, 2024). The third consequence comes from the accelerated melting of ice sheets and glaciers at higher temperatures, along with the thermal expansion of seawater, raising sea levels (National Aeronautics and Space Administration, 2025).

These factors produce a cycle of increasingly unstable weather and severe natural disasters. At the current level of global warming, an alarming scale of natural disasters are already unfolding. Examples from 2024 include (Van Dijk et al., 2025):

- A severe drought spanning southern Africa, which decimated maize yields and left tens of millions in need of humanitarian assistance amid food shortages.
- Heavy monsoon rains in Bangladesh, leading to the displacement of at least half a million individuals and the destruction of over one million tonnes of rice.
- An exceptionally severe hurricane season in the USA which resulted in an estimated US$500 billion in damages, the majority of which were uninsured.

In Australia, climate change is also already having devastating impacts. The Black Summer Fires of 2019–2020 burned over 18 million hectares and killed or displaced more than 3 billion individual animals (World Wildlife Fund, n.d.). The 2022 floods in Eastern Australia wreaked extensive damage, resulting in 240,000 claims to a total of $6 billion, the second largest insured event globally that year (Insurance Council of Australia, 2023). Although at present the impacts of climate change are scattered and difficult to predict, they demonstrate a trajectory of increasingly severe climate-related natural disasters. In the coming years, these events will strike harder and closer to home, threatening to reverse decades of progress and development in Australia.

Australia's position

Australia's annual emissions reached 572 million tonnes of CO2-equivalent, ranking it as the 15th highest emitter globally (European Commission, Joint Research Centre & International Energy Agency, 2024). On a per capita basis, Australia emits almost 22 tonnes per person, the highest among OECD countries and the 11th highest worldwide. However, as the world's largest exporter of coal, Australia's global influence – and in turn its responsibility, extends beyond these figures. In 2023, Australia exported 1.15 billion tonnes of CO2 emissions through coal, oil and gas, and other exports, more than two and a half times the size of our domestic emissions, totalling around 4.5% of global emissions in 2022 (Grant & Hare, 2024). Thus, how Australia manages the climate crisis and transition to net zero is critical in determining the emissions scenario that becomes reality not just for Australians, but for the entire world.

Australia has pledged to achieve net zero emissions by 2050 as part of the Paris Agreement. This target forms part of a broader framework of conditional, unconditional, and net zero commitments made by member countries, which collectively aim to limit global warming to below 2°C above pre-industrial levels. However, to avoid the worst impacts, Australia would need to reach net zero by at least 2040 if not earlier, consistent with a global effort to limit warming to a much safer long-term average of 1.5°C. Yet despite these obligations, Australia's existing policies – which correspond to a climate scenario of over 3°C of warming (Climate Action Tracker, 2024) – underscores a fundamental misalignment between climate ambitions and practical implementation. Australia has set itself an interim target of reducing emissions by 43% below 2005 levels by 2030 to keep on a steady path to net zero by 2050. Yet, the Climate Action Tracker rates this target as "insufficient" compared to both its fair share of global efforts and its modelled domestic emissions pathways (Climate Action Tracker, 2024).

When including land use change (also known as LULUCF), Australia has achieved a net emissions reduction of 28% below 2005 levels, however when excluding land use change, national emissions have only dropped by 2% (Climate Action Tracker, 2024). The improvements in the LULUCF sector were largely due to changes in the methods of projection for land sequestration and are thus unlikely to produce significant further emissions reductions. Accordingly, to fulfil national climate goals, it is imperative that other sectors assume a leading role in driving substantial emissions reductions.

Australia's current emissions strategy focuses on addressing 6 sectors (Climate Change Authority, 2024):

1. Energy and electricity
2. Transport
3. Agriculture and land
4. Resources
5. Industry and waste
6. The built environment

The importance of policy analysis

Policy analysis is an integral part of informed decision-making, especially for complex issues like climate change in which the geopolitical landscape, socio-political dynamics and public support intersect with urgent global imperatives. By systematically assessing the design, implementation, and outcomes of policies, it enables governments to optimise policy to achieve national goals with maximum efficiency.

In Australia, federal climate policy exists within a framework shaped by international agreements (including the Paris Agreement) and domestic governance structures. The federal government must coordinate with state and local governments to ensure that climate policies at all levels are consistent with the fulfilment of international obligations. Effective climate action requires alignment across these layers of governance as well as active consultation with marginalised groups to ensure equitable outcomes.

Independent bodies like the Climate Change Authority (CCA) are central to evaluating policy progress. The scope of analysis undertaken by government is often limited due to the Australian government's traditional focus on business and industry. The CCA's status as a government agency – albeit statutorily independent – render complementary assessments from third-party agencies invaluable. Such assessments can support robust, transparent decision-making and allow Australia to align its policies with domestic and international targets. As Australia faces the challenge of transitioning to net zero emissions, thorough policy analysis is essential to ensure present actions secure a sustainable future.

Australia's climate policy

The Australian Federal Government currently oversees several policies that span multiple sectors:

1. Climate Change Act: formalizes Australia's climate targets, including a 43% reduction in emissions by 2030 and net zero by 2050. The Climate Change Act also creates a framework for transparency and accountability via periodic reports (Climate Change Act 2022). The Act also establishes the Climate Change Authority, an independent advisory body that issues annual progress updates and independent reviews (Climate Change Authority Act 2011).
2. Net Zero Economy Authority: aims to facilitate investment in renewable energy and emerging technologies while prioritising a just transition for communities and workers in fossil fuel-dependent regions (Net Zero Economy Authority Act 2024).
3. Future Made in Australia: drives clean energy growth by supporting onshore energy manufacturing and building resilient supply chains to secure long-term national prosperity (Future Made in Australia Act 2024).
4. Treasury Laws Amendments: introduce tax incentives for investment in renewable energy projects and energy storage technologies, as well as fringe benefits tax exemptions for employer-provided vehicles with zero or low emissions (Treasury Laws Amendment (2024 Tax and Other Measures No. 1) Act 2024; Treasury Laws Amendment (Electric Car Discount) Act 2022).

5. Safeguard Mechanism: sets emissions reduction targets for industrial facilities that emit over 100,000 tonnes of CO_2-e annually, compelling companies to reduce their emissions or purchase carbon credits (National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015; Safeguard Mechanism (Crediting) Amendment Act 2023).

Sector: Energy and electricity

Energy and electricity are currently Australia's greatest source of emissions and contributed 153 Mt in 2021-22, 30% of total national emissions (Climate Change Authority, 2024). Coal is the primary sources of the sector's emissions, followed by natural gas. Nationally, Australia has set a target of 82% of electricity coming from renewables by 2030 (Department of Climate Change, Energy, the Environment and Water, 2025c). During the final quarter of 2024, 46% of electricity was provided by renewables (Australian Energy Market Operator, 2025). While this is a significant achievement, it will nonetheless require a monumental effort to reach 82% in the next 5 years. In order to achieve this, Australia will need to invest in renewable energy generation from wind, solar, and green hydrogen and speed up the development of energy infrastructure and related approval processes (Climate Change Authority, 2024). Simultaneously, it needs to develop the infrastructure for energy storage and buffer energy supply, including synchronised condensers, gas-fired generation, electric batteries and pumped hydropower.

The Federal Government currently adopts several policies to reduce emissions in the energy and electricity sector, including but not limited to:

1. Capacity Investment Scheme: guarantees government-backed payments and stimulates private investment to renewable energy projects and storage solutions (Electricity Infrastructure Legislation Amendment Act 2025).
2. Powering Australia: Australian Government's plan to create jobs, lower energy bills and reduce emissions by promoting investment and research and development in renewable energy (Department of Climate Change, Energy, the Environment and Water, 2024).
3. Renewable Energy Target: promotes investment in additional renewable energy generation through the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES) (Clean Energy Regulator, 2025).

Sector: Transport

The transport sector contributed to 90 Mt of domestic emissions in 2021-22 (Climate Change Authority, 2024). The primary source of emissions is cars (47%), followed by trucks and buses (21%), light commercial vehicles (17%), domestic aviation (9%) and rail (4%) (Climate Change Authority, 2021b). To reduce emissions in the transport sector, the focus has been on electrification for light electric vehicles and overhead electric rail. For heavy vehicles and aviation, the primary avenue for emissions reductions has been the development of renewable fuels while electrification technologies are still in early stages of development (Climate Change Authority, 2024).

The Federal Government has adopted several policies to reduce emissions in the transport sector, including but not limited to:

1. New Vehicle Efficiency Standard Act 2024: establishes new regulatory standards for vehicle emissions and fuel efficiency, lowering carbon dioxide emissions thresholds for new vehicles (New Vehicle Efficiency Standard Act 2024).
2. Vehicle Standards: adopts the Euro 6 emissions standards, setting emissions limits for air pollutants like nitrogen oxides, hydrocarbons and carbon monoxide (Vehicle Standard (Australian Design Rule 79/04 — Emission Control for Light Vehicles) 2011; Vehicle Standard (Australian Design Rule 80/04 – Emission Control for Heavy Vehicles) 2023).
3. Driving the Nation Fund: allocates $500 million to accelerate the transition to clean transport through investment in EV charging infrastructure, hydrogen refuelling stations and zero-emissions vehicle technologies (Department of Climate Change, Energy, the Environment and Water, 2025a)
4. National Electric Vehicle Strategy: accelerates the adoption of electric vehicles via public investment in infrastructure, including charging networks, subsidies and rebates for electric vehicle buyers and local manufacture of electric vehicles and batteries (Department of Climate Change, Energy, the Environment and Water, 2023a).

Sector: Agriculture and land

Agriculture contributed 85 Mt to domestic emissions in 2021-22 (Climate Change Authority, 2024), originating from two primary sources: methane emissions from livestock and nitrous oxides from fertilisers on crops. The main priorities for emissions reductions are feed supplements (and potentially early-stage methane vaccines) to reduce livestock emissions, in addition to enhanced fertilisers to reduce the carbon footprint of crops.

Relative to the 2005 baseline, the land subsector contributes net negative emissions, acting as a carbon store of 88 Mt per year, yet two major issues remain. Firstly, Australia needs to strengthen and coordinate legislation on deforestation, since it is the only 'developed' country on the list of global deforestation hotspots (Wilderness Society, n.d.). Additionally, soil degradation persists due to unsustainable farming practices and land clearing; this can be addressed by increased forest protection, carbon farming and improved management of manure, herds and pastures.

The Federal Government currently adopts several policies to reduce emissions in the agriculture and land sector, including but not limited to:

1. Emissions Reduction Fund: initially established as the Carbon Farming Initiative, the ERF provides tradeable Australian Carbon Credit Units to landowners for projects that store carbon or avoid emissions, including reforestation, soil carbon sequestration and methane reduction in livestock (Carbon Credits (Carbon Farming Initiative) Act 2011).

2. National Soil Strategy: encourages sustainable soil management, monitoring and research on carbon storage potential (Department of Agriculture, Fisheries and Forestry, 2021).
3. FutureFeed: markets a livestock feed supplement developed by federally-funded CSIRO that uses Asparagopsis seaweed to reduce ruminant methane emissions by at least 80% (FutureFeed, n.d.).

Sector: Industry and waste

The industry and waste sector contributed to 64 Mt of domestic emissions in 2021-22 (Climate Change Authority, 2024). The sector's emissions are highly concentrated among a small number of large industrial facilities. Emissions reductions in the industry subsector are centred around reducing emissions during manufacturing via the electrification of low temperature industrial processes and use of biofuels for high temperature industrial processes. Simultaneously, promoting a circular economy will assist by reducing the need for unnecessary manufacturing in the first instance. Finally, in the waste subsector, several practices have been proposed to reduce emissions from landfill, including by diverting organic waste and promoting the recycling of scrap metal.

The Federal Government currently adopts several policies to reduce emissions in the industry and waste sector, including but not limited to:

1. National Waste Policy Action Plan: reduces waste by promoting circular economy initiatives and setting targets for waste reduction, resource recovery, and methane emissions from landfills (Department of Climate Change, Energy, the Environment and Water, 2024a).
2. National Energy Productivity Plan (NEPP): aims to improve energy efficiency across industries, cutting energy waste in manufacturing by supporting technology upgrades, energy management strategies and innovation in industrial processes (COAG Energy Council, 2015).
3. Emissions Reduction Fund: initially established as the Carbon Farming Initiative, the ERF provides financial incentives for businesses to cut emissions through projects like improving industrial energy efficiency, waste methane capture and carbon sequestration, earning Australian Carbon Credit Units (Carbon Credits (Carbon Farming Initiative) Act 2011).

Sector: Resources

The resources sector is the second largest sources of emissions, releasing 99 Mt CO2-e in 2021-22 (Climate Change Authority, 2024). It includes mining, as well as the extraction and processing of oil and gas (including LNG production). Fugitive emissions from coal mining, oil and gas make up 46% of these and can be mitigated via fugitive abatement measures for oil and gas production, underground coal mine gas drainage, as well as carbon capture and storage. Fuel combustion and onsite electricity generation are responsible for the remaining emissions, and are addressed by electrification, off-grid renewables and storage systems, and improvements in energy efficiency.

The Federal Government currently adopts several policies to reduce emissions in the resources sector, including but not limited to:

1. Critical Minerals Strategy: promotes Australia as a leading supplier of critical minerals necessary for clean energy technologies, while upholding strict environment standards (Department of Industry, Science and Resources, 2023).
2. Powering the Regions fund: supports regional areas in their transition to cleaner energy, including financial assistance to reduce emissions in the resources sector (Australian Renewable Energy Agency, 2025; Department of Climate Change, Energy, the Environment and Water, 2023b).
3. National Greenhouse and Energy Reporting Act: mandates reporting on greenhouse gases and energy consumption, informing emissions baselines and progress monitoring under the Safeguard Mechanism (National Greenhouse and Energy Reporting Act 2007).

Sector: Built environment

Australia's housing is some of the least efficient in the world. While there is the potential to reduce emissions by 69% by 2030, it was projected that only 11% emissions reductions will be realised (ClimateWorks Australia, 2018). Direct emissions accounted for 28 Mt CO2-e in 2021-22, with an additional 77 Mt derived from electricity use (Climate Change Authority, 2024). Emissions occur primarily through stationary energy used by appliances and heating or cooling systems. Accordingly, emissions reductions policy is focused on the electrification of appliances and improving energy and thermal efficiency.

The Federal Government currently adopts several policies to reduce emissions in the built environment sector, including but not limited to:

1. Greenhouse and Energy Minimum Standards (GEMS): establishes minimum energy performance standards for a wide range of appliances, including heating and cooling systems, lighting and building materials (Greenhouse and Energy Minimum Standards Act 2012).
2. National Construction Code: sets minimum standards such as energy efficiency and thermal performance requirements for building design and construction (Australian Building Codes Board, 2022).
3. Trajectory for Low Energy Buildings: sets clear targets for improving energy and thermal efficiency in buildings through measures to align with net zero targets (Commonwealth of Australia, 2018).

Economic, social and environmental perspectives on climate policy

Australia's current strategy focuses on addressing emissions across 6 sectors and has historically framed policies from the perspective of business and industry (Climate Change Authority, 2024). However, with climate change delivering increasingly worse impacts across all areas of daily life and the environment, there is a growing recognition that government policy needs to address not only business and industry responsibility but also addressing the impacts on society and the environment.

Economic impacts of climate change

Climate change is projected to substantially reduce global economic output. If all Paris Agreements are met, global GDP is projected to decline by at least 4%, specifically due to climate-related impacts. However under the current emissions trajectory, global GDP is projected to decline by 18% specifically due to climate change (Swiss Re Group, 2021). Even by 2050, Australia is projected to endure a $6.8 trillion reduction to GDP if the renewable energy transition is delayed (Pitt, 2024). The agricultural sector is particularly vulnerable; climate change is already reducing broadacre profits by 22% and beef production by 5% (Climate Change Authority, 2021a). Risks to agriculture are especially acute in the Murray-Darling Basin, which supports 40% of Australia's agricultural production and is facing severe water shortages (Murray–Darling Basin Authority, 2024). As agricultural production is reduced, this has the potential to raise food prices and exacerbates cost of living pressures. Additionally, more frequent and intense natural disasters are expected to cause substantial economic damage, with an estimated cost of $35 billion (in 2022 dollars) by 2050 (Lefebvre & Reinhard, 2022).

The Federal Government currently adopts several policies to mitigate the economic impacts of climate change, including but not limited to:

1. National Climate Risk Assessment: this attempts to identify and evaluate the biggest climate risks facing Australia in order to inform evidence-based decision-making (Department of Climate Change, Energy, the Environment and Water, 2024b).
2. National Climate Resilience and Adaptation Strategy (NCRA): provides funding for climate-smart innovations like precision agriculture and effective irrigation and assists farmers in adapting to climate change through crop diversification, water management, and drought preparedness (DAWE, 2021).
3. National Adaptation Plan: builds on the NCRA by outlining national priorities and providing a framework for adapting to climate risks, including driving private sector investment and supporting vulnerable groups (Department of Climate Change, Energy, the Environment and Water, 2025b).
4. Water Act: established the Murray-Darling Basin Authority, instituting sustainable diversion limits and trading markets for water entitlements (Water Act 2007)
5. Future Drought Fund: allocates $100 million a year to initiatives to increase the resilience of farmers, producers and communities to drought and other climate-related impacts (Department of Agriculture, Fisheries and Forestry, 2025).

Social impacts of climate change

Increasing frequency and severity of natural disasters will cause considerable injuries and fatalities, property and infrastructure damage, as well as loss of livelihood and mass displacement. Climate change will worsen pre-existing socioeconomic disparities and inequities, disproportionately impacting vulnerable populations such as lower-income households, First Nations peoples, and rural communities (Li et al., 2024). There is also a higher chance of heat-related illnesses, flood-related and severe storm impacts, and mounting evidence that changes in

land use and changes to ecological and climate zones will result in substantial impacts to agricultural output. The social impacts will also stem from impacts on wildlife, for example pressures on different species will cause them to move outside of traditional environments, which could increase the likelihood of worldwide pandemics (Carlson et al., 2022).

The Federal Government currently adopts several policies to mitigate the social impacts of climate change, including but not limited to:

1. National Strategy for Disaster Resilience: this policy document emphasises the shared responsibility of governments, communities, businesses, and individuals in preparing for natural disasters (Council of Australian Governments, 2011).
2. Disaster Recovery Funding: specifies that the federal government must assist in providing financial support to communities impacted by natural disasters. This reduces the financial burden that these events place on states and territories by supplementing the amount of funds available to support impacted communities (Department of Home Affairs, 2018).
3. National Health and Climate Strategy: outlines a strategy to safeguard population health and well-being from climate-related impacts (Department of Health and Aged Care, 2023).

Environmental impacts of climate change

Australia is renowned for its precious natural beauty and distinctive array of wildlife, yet its biodiversity is under serious threat from climate change. Australia has one of the highest rates of species decline across OECD countries (Australian Government, 2021). The rapid pace of climate change is surpassing the adaptive capacity of species, contributing to global extinction rates 1000 times higher than the natural baseline (Vos et al., 2014). This is largely attributed to climate change-related environmental changes, which compound challenges already faced from invasive species, habitat degradation from logging, human expansion and eutrophication from agricultural runoff (Australian Government, 2021). Climate change thereby threatens irreversible ecosystem damage and collapse even if temperatures are limited to 2 degrees of warming. This is particularly evident in coral reefs, including the Great Barrier Reef, which are expected to suffer a 99% decline in coral cover (UN Environment Programme, 2024b).

The Federal Government currently adopts several policies to mitigate the environmental impacts of climate change, including but not limited to:

1. Environmental Protection and Biodiversity Conservation Act: mandates that Environmental Impact Assessments be completed for development projects impacting threatened species, protected wetlands and marine areas, and places of heritage. It also contains policies that regulate land clearing and logging (Environment Protection and Biodiversity Conservation Act 1999).
2. Australia's Strategy for Nature: serves as Australia's National Biodiversity Strategy and Action Plan, establishing ambitious national biodiversity targets with the aim to halt and reverse biodiversity loss by 2030 (Commonwealth of Australia, 2024).

3. Threatened Species Action Plan 2022-32: facilitates action and investment aimed at protecting priority species and locations. However these plans only cover approximately 6% of Australia's threatened species and ecological communities (Igini, 2024) (Department of Climate Change, Energy, the Environment and Water, 2022).
4. National Water Quality Management Strategy: sets guidelines for water equality and enacts management plans for pollutants and eutrophication (Water Quality Australia, 2018).

The State of Policy Report

The Climate Centre's State of Policy report attempts to address climate and environmentally relevant policy with a broad scope covering several issues unified under five key areas: environmental impact and ecosystem health, the energy transition and technology solutions, economic and industry impacts, public services, and climate justice and geopolitics.

This includes by analysing how the Australian federal government policies tackle issues relating to environmental impact and ecosystem health. This covers both terrestrial (land) and marine biodiversity. Given a majority of Australia's population lives along coastlines, our association with the marine and coastal environments are particularly important to our national culture and identity. Policies relating to terrestrial biodiversity are important due to Australia's unique wildlife, while the management of marine protected areas are also important due to Australia's large oceanic territory and it's recognised significance for marine biodiversity including at sites such as the Great Barrier Reef and Ningaloo (Department of Climate Change, Energy, the Environment and Water, 2025d). With shifts in climate altering the water cycle, policies for managing water resources will become increasingly important as certain areas experience increased rates of drying, while others see frequent heavy rainfall events and enhanced flooding. Strategies to address the management of water resources include controlling groundwater supplies and river systems, paying special attention to the importance of major natural water resources such as the Murray-Darling Basin or the Great Artesian Basin. Managing polluting activities such as wastewater and runoff are important to combat eutrophication issues and maintain the health and viability of riverine and estuarine ecosystems, which are critical for supporting Australia's water-focused culture. Coastal areas will also be impacted due to sea level rise, which cause erosion of the natural coastline, threatening heavily populated regions, and altering coastal ecosystems, requiring a coordinated whole of government response (Department of Climate Change, Energy, the Environment and Water, 2021).

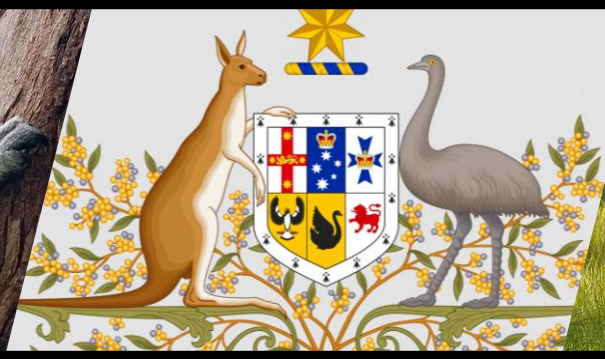
The analysis also looks at how Australian policy handles the renewable energy transition, which represents a large-scale effort to move away from heavily polluting industries. However, Australia has a long history of being a fossil fuel exporter and has hundreds of billions of dollars' worth of investment in fossil fuel projects. This has resulted in fossil fuel lobbyists influencing government policy over time, which makes diversifying away from these industries as political challenge. A cornerstone of federal government policy relates to fossil fuel subsidies and rebates which have historically given the coal, oil, and gas industries significant

financial support in spite of climate pledges (The Australia Institute 2024a). However, despite this upper hand, renewable energy technologies have seen both political, social and economic support and Australia is considered a prime area for renewable energy, particularly due to its widespread availability of solar and wind as abundant natural resources. Australia also has a long history of hydropower development, notably stemming from the post-war infrastructure project the Snowy Mountain Scheme, which is being expanded upon with Snowy 2.0. Other renewables are being developed around Australia, albeit to lesser extents, notably wave energy, which Australia has abundant supply of in southern areas, and hydrogen energy. Other energy sources and technologies such as nuclear energy and carbon capture and storage remain limited in deployment and receive comparatively less political and financial support in Australia. The massive changes required by Australia's renewable transition to infrastructure will undoubtedly require energy grid optimisation, however the scale of the problem will undoubtedly present challenges, given Australia's large geographic size and fragmented energy systems (Ernst & Young 2024).

The analysis also considers that climate change and our attempts to address its root causes are likely to have a variety of impacts to society at local, regional, and global scales. One of the most immediate impacts will be through cost of living impacts. While renewable energy and energy efficiency initiatives may ultimately result in lowering household costs, issues relating to reduced agricultural yields and global supply shocks may cause increases to household costs. Whether new technologies such as sustainable land management, drought-resistant farming techniques and circular economy principles are able to better manage some of the negative consequences of climate change is unclear. Regardless, a wide range of adaptation strategies will be required to mitigate impacts on communities, business and the environment (Department of Agriculture, Fisheries and Forestry 2023). Unless such adaptations are implemented successfully, the resilience of various areas of society and the economy to withstand climate related impacts may be impaired. This includes impacts on areas such as insurance schemes, housing, infrastructure, and public and private projects, which may all be substantially threatened by climate impacts. Mitigating these impacts will likely require improvements to climate forecasting, including early warning systems, as well as disaster preparation and recovery (The Australia Institute 2024b). Similarly, public health policies will also need to take climate related impacts into account, including things such as changes to diseases, increasingly common occurrences of heat stress, and changes to diet due to negative impacts to food security and quality. Whilst much of Australia's policy is inward focused, the government must also be mindful that as a developed and economically wealthy country, we may be better equipped to handle the wide reaching impacts of climate change, but in a geopolitical context, our neighbours may be less resilient. As a result, we must consider displacement not only internally but also across the Indo-Pacific, and what it means for our ability to manage external issues while balancing this with justice and equity considerations (Australia Strategic Policy Institute 2022).

environmental impact and ecosystem health

terrestrial biodiversity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Australia is home to a diverse range of ecosystems, ranging from tropical rainforests to arid deserts and is renowned globally for its unique biodiversity. Biodiversity, or biological diversity is the variety of plant and animal life in the world or a particular area. A biologically diverse ecosystem supports a resilient, productive and healthy environment, and is able to provide important ecological goods and services. Australia is classified as a 'megadiverse' country and supports between 7-10% of all species on Earth (DCCEEW, 2011). Millions of years of geological isolation has resulted in a high level of endemism, with many species not found anywhere else in the world. These endemic species include 87% of our mammals, 93% of reptiles and 92% of vascular plants (Chapman, 2009). In addition to direct resources (e.g. food, timber and fibres), Australia's biodiversity provides important economic benefits and are essential to sectors like tourism and agriculture. Additionally, Australia's unique flora and fauna are of cultural and spiritual significance, particularly for Aboriginal and Torres Strait Islander people (DCCEEW, 2022a). The strong interdependence of biodiversity to Australia's cultural, economic and ecological landscape highlights the importance of effective conservation efforts.

Current state of biodiversity in Australia

Biodiversity loss is a critical and impending concern on a national and global scale with global extinction rates estimated to be tens to hundreds of times higher than the natural baseline (WWF, n.d.). The World Economic Forum (2025) ranked biodiversity loss and ecosystem collapse as the second greatest risk over the coming decade and as one of the fastest accelerating risks since 2009. Australia's land-based biodiversity is facing particularly alarming rates of decline and extinction. Over one hundred Australian species have been formally recognised as extinct, with many more listed as threatened. Australia has the greatest number of mammal extinctions of any other continent (34 to date) and one of the highest rates of species extinctions in the world. This is largely driven by habitat loss and fragmentation due to land clearing, the spread of invasive species, altered fire regimes and the intensifying effects of climate change (Commonwealth of Australia, 2024).

Catastrophic events, such as the 2019-2020 bushfires, have had devastating impacts, leading to the deaths and displacement of billions of animals and the destruction of habitat (WWF-Australia, n.d.). The intensifying effects of climate change are likely to see more frequent and extreme weather events, further disrupting ecosystems and contributing to the continued decline in biodiversity unless effective action is taken to mitigate these impacts.

The role of biosecurity on biodiversity

Biosecurity controls play an important role in protecting Australia's biodiversity, primarily by preventing the introduction and spread of pests, diseases, and invasive species. In Australia, invasive species are one of the greatest threats to native flora and fauna and are considered the leading cause of extinction for native species. They have been described as posing a greater risk to biodiversity than habitat destruction or climate change with more than 80% of Australia's land-based threatened species negatively impacted by invasive species (Puri, 2024).

Notable pests and diseases currently present in Australia that threaten biodiversity include the Red Imported Fire Ant (Solenopsis invicta) (Wylie & Janssen-May 2017), the Polyphagous shot-hole borer (Euwallacea fornicatus) (DPIRD, 2025) and the Amphibian chytrid fungus (Batrachochytrium dendrobatidis) (Wildlife Health Australia, 2025). Other high-risk biosecurity threats such as Xylella (Xylella fastidiosa, a plant pathogen) (DAFF, 2025b) and Foot and Mouth Disease (a highly contagious viral disease) (DAFF, 2024) have not yet been detected in Australia but pose major risks and must be proactively managed to prevent their introduction.

Climate change is likely to exacerbate biosecurity threats, altering ecological conditions in ways that favour the spread and establishment of invasive species and pathogens and/or by causing ecosystem stress and vulnerability of native flora and fauna. For example, increased frequency and severity of extreme weather events associated with climate change may increase the spread of Red Imported Fire Ants. These ants, which are a highly invasive pest are capable of colonising bushfire-affected areas and surviving as well as spreading through flood events (Wylie & Janssen-May, 2017). The amphibian chytrid fungus is another example of a biosecurity threat and has already caused significant declines in frog populations across Australia and could spread further as climate change alters environmental conditions. This expansion may put more species at risk, contributing to the continued decline or even leading to the extinction of vulnerable amphibian species (Wildlife Health, 2025).

Invasive species cause ecological damage and also impose a significant economic burden on Australia. It is estimated to cost Australia approximately $25 billion per year, primarily through losses in agriculture and expenses associated with controlling and management outbreaks (CSIRO, 2023). The protection of Australia's biodiversity relies on a strong biosecurity framework with a focus on early detection, rapid response, and coordinated national surveillance.

Current Australian government policies

The Australian government has the responsibility to protect the environment, which is achieved through effective regulation and legislation that adequately addresses and is tailored to the challenges that are faced in the country. However, several critics and experts have described Australia's policy setting as inadequate and unambitious. Additionally, ecological data continues to show a decline in biodiversity, suggesting that current conservation policies are not effectively addressing the scale or complexity of the threats faced. This continued loss, despite conservation efforts, highlights a disparity between the intention of these policies and their real-world outcome, pointing to the need for a thorough examination of policy effectiveness. By understanding the limitations of our current policies and governance mechanisms and improving upon them, it may be possible to improve outcomes for Australia's unique biodiversity.

Australia's Strategy for Nature 2024-2030

Australia's Strategy for Nature 2024-2030 serves as the national framework guiding the efforts of government, non-government organisations and community in managing matters that affect biodiversity (Commonwealth of Australia, 2024). It was first adopted in 2019 and was last updated in 2024 after Australia signed the 2022 Kunming-Montreal Global Biodiversity Framework (GBF) (Australian Land Conservation Alliance, 2024). The Strategy sets six national targets to address environmental decline with the aim to "halt and reverse biodiversity loss by 2030". These targets are:

- Protect and conserve 30% of Australia's landmass and 30% of Australia's marine areas by 2030
- Minimise the impact of climate change on biodiversity
- Put priority degraded areas under effective restoration by 2030
- Eradicate or control invasive species in priority landscapes and further minimise their introduction by 2030
- Ensure that no new extinctions occur
- Increase Australia's circularity rate, and reduce pollution and its impacts on biodiversity by 2030

Recognising that achieving these targets will require cooperation across groups outside of government, the Strategy also identifies three 'enablers of change'. These 'enablers', or approaches, outline strategies that will be used to meet the above targets. These are:

- Mainstreaming nature into government and decision-making
- A commitment to working with First Nations peoples, acknowledging their long-standing management and custodianship of Country.
- Improving access to environmental data for businesses and industry to enable evidence-based decision making, such that they may avoid and mitigate environmental impacts.

The Strategy for Nature provides a comprehensive national framework and aligns with Australia's international commitments to biodiversity and environmental protection (Commonwealth of Australia, 2024).

Environmental Protection and Biodiversity Conservation Act 1999

The Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act 1999) is the main piece of environmental legislation, providing a legal framework for protecting and managing nationally important plants, animals and habitats (referred to in the Act as 'protected matters') (DCCEEW, 2025). The EPBC Act covers 9 protected matters, these are:

- World heritage areas
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Listed threatened species and ecological communities
- Listed migratory species (protected under international agreements)
- Commonwealth marine areas
- Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines)
- Water resources (that relate to unconventional gas development and large coal mining development)

While states and territories are generally responsible for managing land use, water, pollution control and air quality, projects that are suspected to impact any of the protected matters are required to submit a 'referral' to the Department of Climate Change, Energy, the Environment and Water (DCCEEW). These referrals are assessed by the environment minister based on suspected impacts to the protected matters. In most cases, projects that are referred to the DCCEEW include strategies to mitigate significant impacts to the protected matters. Alternatively, project approval may be conditional such as the requirement of environmental offsets (e.g. breeding or threat abatement programs, supporting research or education programs etc.).

National Reserve System

The National Reserve System (NRS) is a network of protected land within Australia. This includes reserves owned by the government (Commonwealth, state/territory, and local governments), Indigenous lands, protected areas run by non-profit organisations, and privately owned land. It aims to protect a diverse and representative range of Australian habitats, flora and fauna for long-term conservation (DCCEEW, 2025b). There are three key criteria used in establishing and assessing reserves to be included in the NRS (Fitzsimons et al., 2023). These are:

- Comprehensiveness - the NRS should include a range of ecosystems and bioregions across Australia
- Adequacy - each area should be large enough and managed adequately to ensure long term survival of the ecosystem and species it contains
- Representativeness - the protected areas should reflect the natural diversity of existing ecosystems (e.g. areas with variations in geology, vegetation and species)

As of 2024, the NRS covered 22.57% of Australia's land mass, constituting 173.5 million hectares of land (DCCEEW, 2025b). By protecting and managing the land and land use, the NRS aims to build healthy environments that support high biodiversity and are more resilient to the effects of climate change. For example, habitat threats such as weeds and feral animals are managed within protected areas to protect native flora and fauna.

A significant component of the NRS is Indigenous Protected Areas (IPAs), which includes land owned and voluntarily managed by First Nations communities (DCCEEW, 2025a). IPAs represent over 54% of the NRS and have played a large part in improving environmental resilience and protecting cultural heritage. Both the NRS and IPAs are crucial parts of Australia's Strategy for Nature's commitment to protecting 30% of landmass by 2030 (Commonwealth of Australia, 2024).

Other major programs and initiatives

The Australian Government implements several other key programs and initiatives to support its biodiversity conservation policies.

The National Landcare Program (NLP) was an Australia government initiative aimed at sustainable agricultural practices, environmental protection and natural resource management (DAFF, 2025a). The Australian Government invested more than $1 billion through to 2023 to help protect and conserve Australia's natural environment. The NLP aimed at improving soil health, water quality and increasing biodiversity within agricultural landscapes. Funding is now delivered through the Natural Heritage Trust (NHT) which has committed another $1.1 billion through to 2028 to address climate change, habitat loss and invasive species (DCCEEW, 2025d).

Conservation of private land is also considered an important aspect of Australia's biodiversity management strategy (DCCEEW, 2022b). Federal, state/territory and local governments offer financial and non-financial incentives (e.g. access to training and technical support) to encourage private landholders to engage in biodiversity conservation efforts.

These major programs and initiatives reflect a comprehensive approach to conserving biodiversity, involving a wide range of stakeholders and applying diverse strategies across both public and private lands.

Biosecurity policies

Australia's biosecurity system is managed by a series of policies and frameworks designed to manage the risks posed by exotic and established pests, weeds, and diseases to the nations environment, agriculture, human health and the economy. It encompasses the following systems (DAFF, 2024a):

- Pre-border activities - working with neighbouring countries, international bodies and importers to prevent the introduction of pests
- Border protection - includes inspections, screening, and quarantining to prevent biosecurity hazards from entering and penalties for violations
- Post-border management - monitoring for pests and disease, responding to threats and controlling spread within Australia

Key instruments in this system include the Biosecurity Act 2015, the National Biosecurity Strategy and Action Plan and the Intergovernmental Agreement on Biosecurity (IGAB). Together, they form a multi-layered approach involving federal, state/territory, local and industry stakeholders.

The Biosecurity Act 2015 is an Australian federal law designed to manage the risks of diseases and pests entering, establishing, or spreading in Australia (DAFF, 2024a). It serves to protect human, animal, and plant health and consequently the environment and economy. The Act grants significant powers to the federal government, including emergency response capabilities and outlines import conditions, risk assessments, and compliance mechanisms.

The National Biosecurity Strategy aims to provide a unified national approach to biosecurity (DAFF, 2022). The strategy outlines key goals in enhancing partnerships with domestic and international stakeholders, expanding offshore assurance and supply chain integration, investing in a skilled workforce, adopting advanced detection technologies, and increasing national preparedness for exotic pests and disease outbreaks.

The Intergovernmental Agreement on Biosecurity (IGAB) is a formal agreement between the Commonwealth, and state and territory governments (DAFF, 2024b). It aims to strengthen Australia's biosecurity system by promoting collaboration and sharing responsibility between governments in managing biosecurity risks across the country.

International frameworks

Biodiversity loss is both a national and global challenge, requiring cooperation on a global scale. As such, Australia is party to several international agreements that relate to the protection of the environment. Australia is a signatory of the United Nations Convention on Biological Diversity (CBD) (Commonwealth of Australia, 2024). This is an international treaty with the objective of conserving biodiversity, promoting the sustainable use of biodiversity and ensuring equitable sharing of the benefits arising from using genetic resources. As a signatory to the CBD, Australia adopted the Kunming-Montreal Global Biodiversity Framework (GBF) at the 15th Conference of Parties to the CBD in 2022. Australia's national targets outlined in the Strategy for Nature 2024-2030 are directly aligned with the goals and targets of the GBF. This includes the major agenda to halt and reverse biodiversity and protect at least 30% of Australia's landmass by 2030.

Other international agreements that relate to biodiversity and conservation that Australia is party to include (Commonwealth of Australia, 2024):

- UN Convention to Combat Desertification
- Ramsar Convention on Wetlands
- Sustainable Development Goals
- Convention on Migratory Species
- International Convention for the Regulation of Whaling
- UN Framework Convention on Climate Change

- Convention on International Trade in Endangered Species of Wild Fauna and Flora
- World Heritage Convention

Alignment with international frameworks demonstrates Australia's commitment to global efforts in addressing the biodiversity crisis.

Review of current policies

Australia's Strategy for Nature (2024-3030)

Australia's Strategy for Nature was first published in 2018 (Australia's Strategy for Nature 2019-2030), before the Kunming-Montreal GBF was finalised. The strategy was heavily criticised for its lack of detail regarding its objectives and lack of measurability of its actions (Australian Conservation Foundation, 2019). The Strategy for Nature has since been updated, with the most recent 2024-2030 Strategy aligning more closely with the goals of the Kunming-Montreal GBF. However, the updated Strategy has continued to receive criticism with concerns predominately about the measurability, lack of detail and effective implementation of the targets (Dielenberg, et al., 2023).

While the strategy recognises the economic value of biodiversity, there is a lack of sufficient funding to adequately deliver on the commitments outlined in the strategy. For example, the government has committed $250 million over the next five years to tackle invasive species, create new national parks and expand private and Indigenous protected areas. However, it has been estimated to require up to $11 billion annually to protect biodiversity and fulfil the Strategies commitment to protecting 30% of landmass by 2030 (30 by 30, 2024).

Environmental groups have highlighted contradictions between the government's conservation commitments in the Strategy and its actions. For example, since May 2022 the Australian Government approved 10 new coal mines or expansions, which will generate approximately 2.4 billion tonnes of greenhouse gas emissions and have direct adverse effects on threatened species and ecosystems, including the Glossy Black Cockatoo, Grey Box–Ironbark Woodland, Hunter Valley Delma, and Box–Gum Woodland (Australia Institute, 2024). The recent decision to extend the North West Shelf gas project to 2070 is another example of contradictory actions being taken by the Federal government (Hepburn, 2025).

The Biodiversity Council criticised The Strategy for lacking specific targets mapped to all GBF targets (i.e. only 6 targets in the Strategy to address 7 GBF targets) and emphasised the need to not "cherry pick" targets and implement the targets of the GBF in full (Biodiversity Council Australia, 2024).

EPBC Act 1999 Review

Independent reviews of the EPBC Act have consistently found the Act to be inefficient and ineffective at protecting matters of national importance. The second and most recent independent review of the EPBC Act, led by Professor Graeme Samuel (the Samuel review) was published in 2020, drawing on experts from various fields including industry, environmental law, agriculture and Indigenous culture. The

review analysed the implementation and operation of the EPBC Act and criticised its ineffectiveness and inability to address current or future environmental challenges in the face of climate change. The review highlights the Acts failure to prevent continued loss of natural habitats through widespread land clearing and new extinctions since the introduction of the Act.

“The EPBC Act is outdated and requires fundamental reform. It does not enable the Commonwealth to effectively fulfil its environmental management responsibilities to protect nationally important matters. The Act, and the way it is implemented, results in piecemeal decisions, which rarely work in concert with the environmental management responsibilities of the States and Territories. The Act is a barrier to holistic environmental management which, given the nature of Australia’s federation, is essential for success.” (Samuel, 2020)

The Act has been described as lacking coherent and holistic land management and protection practices. The Act has been criticised for a narrow focus on land management, and its provisions have been described as “death by a thousand cuts” — referring to the environmental damage caused by assessing developments in isolation, without accounting for their cumulative impact on habitat loss (Walsh, 2020).

The EPBC Act has also been criticised for not explicitly addressing climate change as a matter of environmental significance, despite its strong impact on biodiversity. There is ongoing debate about whether indirect climate impacts on protected matters under the EPBC Act should require assessments (Peel, 2024).

The approval process of referrals under the Act have been criticised for being inefficient, creating frustration for businesses by causing delays to new development projects. Commonwealth and state and territory environmental approval processes often overlap, creating unnecessary delays and costs (Carbon Neutral, 2024). A 2014 analysis by the former Commonwealth Department of the Environment estimated that aligning environmental approval processes between the Commonwealth and state and territory governments could save Australian businesses approximately $426 million each year (Mineral Council of Australia, 2020).

The EPBC Act has faced criticism for its prioritisation of western science over Indigenous knowledge and the culture of “tokenism and symbolism” in incorporating Indigenous knowledge (Samuel, 2020). The review also noted a lack of power for Indigenous landowners in decision making processes. For example, the Samuel review noted that land leased to the Commonwealth that is owned by Traditional Owners is ultimately controlled by the Director of National Parks.

National Reserve System and Indigenous Protected Areas

The NRS is recognised as a fundamental piece in conserving Australia's biodiversity and plays a crucial part of Australia’s Strategy for Nature’s commitment to protecting 30% of landmass by 2030 (Commonwealth of Australia, 2024).

While the NRS aims to include a comprehensive, adequate and representative range of ecosystems, it has been criticised for not adequately representing all important environments, with many habitats of threatened species not occurring within any of

the protected areas. Over one third of bioregions and ecosystems, including areas that are important for biodiversity (e.g. threatened species habitats, centres of plant diversity, important bird areas) are underrepresented in the NRS (May, 2017)

The NRS faces challenges in effectively conserving biodiversity due to fragmentation, with many reserves acting as isolated patches. This isolation makes species more vulnerable to environmental changes, particularly in smaller protected areas (Woinarski et al., 2018).

Effective conservation requires clearly defined goals, sufficient management resources, and integration with off-reserve management, which is currently lacking (Woinarski et al., 2018).

Other criticisms

A critical issue undermining the effectiveness of Australia's biodiversity and conservation efforts is the significant amount of government funding that continues to support activities that directly harm the environment. A report by the Biodiversity Council (2024) found that the Australian government spends approximately $26.3 billion per year subsidising activities that are likely to have a negative impact on the environment while investing 50 times less ($475 million per year) on activities that promote biodiversity such as species recovery and invasive species control.

In alignment with the Kunming-Montreal GBF, Australia is among 196 other countries that have agreed to eliminate subsidies for activities that are harmful to biodiversity. However, Australia's Strategy for Nature 2024-2030, the main framework to achieving the GBF targets, did not include mention of eliminating harmful subsidies (Commonwealth of Australia, 2024).

Recommendations for improvements to current policies

To effectively halt biodiversity loss and restore Australia's natural environment, reforms are required across national strategies, environmental legislation and protected area management.

General recommendations

The following recommendations address gaps in funding and engagement, issues that are consistently raised across many government policies related to biodiversity and conservation.

- Increase and secure adequate funding – Ensure long-term, sufficient funding for conservation programs, research and protected area management. The Biodiversity Council recommends Australia commits at least $6 billion per annum ongoing towards Australia's Strategy for Nature to achieve GBF targets (Biodiversity Council Australia, 2024). Recommendations for a $5 billion fund for the purchase of land of high importance for biodiversity has also been suggested (Fitzsimons et al., 2023).
- Support Indigenous-led conservation – Indigenous communities should be recognised and empowered to manage and protect their traditional lands. This includes incorporating traditional ecological knowledge through co-management arrangements that protect their cultural heritage, respect

Indigenous rights and enhance conservation outcomes (Biodiversity Council Australia, 2024; Fitzsimons et al., 2023; Samuel, 2020).

- Increase public awareness and engagement – Foster community involvement through citizen science, education campaigns, and local stewardship programs to build public understanding and support of conservation initiatives. Encouraging broader participation can strengthen conservation efforts across the country (Dielenberg et al., 2023; Samuel, 2020).

Specific recommendations for each policy

Australia's Strategy for Nature 2024-2030

- Address policy inconsistencies - Ensuring that development approvals, such as those for fossil fuel projects, are consistent with biodiversity conservation goals is essential. Australia should commit to reducing harmful subsidies (Biodiversity Council Australia, 2024).
- Provide financial incentives – financial incentives to encourage private landholders and Indigenous communities can enhance conservation outcomes. The Australian Land Conservation Alliance notes that private land conservation could contribute significantly to achieving the 30% land protection target by 2030 (ALCA, 2024).

Environment Protection and Biodiversity Conservation Act 1999

- Integrate climate change into policy design – Climate change is recognised as one of the biggest threats to biodiversity. To effectively protect nature over the long term, new and updated conservation and land management policies should explicitly address climate-related risks and impacts. By building climate adaptation and mitigation strategies into environmental laws, policies can stay effective and relevant under climate-impacted environmental conditions (Peel, 2024).
- Establish a truly independent Environment Protection Authority – the EPA would have decision-making and enforcement powers to protect the environment. The current EPBC Act lacks an independent body to enforce compliance and make decisions on matters (Samuel, 2020).
- Strengthen environmental legislation – Introduce legally enforceable National Environmental Standards that set clear rules for protecting biodiversity, heritage, water resources, and Indigenous culture, ensuring consistency across different jurisdictions (Samuel, 2020)
- Require cumulative impact assessments – Require assessments that consider both the impacts of individual projects and the cumulative effects of multiple developments within the broader regional area (Samuel, 2020).
- Strengthen protections for threatened species and habitats – Habitat loss continues to be the primary driver of species decline, yet development approvals often permit destruction of critical ecosystems. Update listing criteria, improve recovery plan implementation, and ensure that critical habitats are protected and cannot be offset through biodiversity trading schemes (Samuel, 2020).

- Improve data and monitoring – Reliable data is essential for evidence-based decision-making. Investment in scientific research, biodiversity monitoring, and data-sharing platforms will enable adaptive conservation management and improve transparency (Samuel, 2020).

National Reserve System

- Expand and connect protected areas – Increase the size and connectivity of protected areas to support viable wildlife populations and allow species to move and adapt to environmental changes. Investing more in ecological corridors and restoration projects can reduce habitat fragmentation and improve species resilience to climate change (May, 2017).

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Marine biodiversity is essential for supporting important ecological processes like nutrient cycling, creating habitats, storing carbon, and helping ecosystem resilience in marine environments (Worm et al., 2006). Maintaining healthy ecosystems, including marine ecosystems, are vital for looking after ecological needs, including but not limited to climate regulation and supporting human livelihoods through resources like food, medicine, and tourism opportunities (UNEP, 2006). Globally, marine biodiversity plays a big part in moving nutrients and keeping ocean systems productive through complex food chains. Phytoplankton are responsible for nearly half of the Earth's photosynthesis, producing oxygen and forming the base of marine food chains (Field et al., 1998). Larger animals such as whales, sharks, fish and cephalopods, help spread nutrients through the water, boosting productivity near the surface. Marine biodiversity also helps build essential habitats. Coral reefs, for example, cover less than 1% of the ocean floor but support about 25% of all marine species. Other habitats like mangroves and seagrass meadows act as nurseries for young fish, reduce coastal erosion, and help keep sediments in place, which strengthens ecosystems and makes them more stable (Alongi, 2012; Fourqurean et al., 2012). Marine ecosystems also play a key role in storing carbon and regulating the climate. Coastal areas with mangroves, seagrasses, and salt marshes can store more carbon than forests on land, making them important for fighting climate change (McLeod et al., 2011). Protecting these areas is vital for reducing carbon in the atmosphere.

Marine biodiversity in the Australian context

Australia has a wide range of plant and animal life, partly due to the fact it has been geographically isolated for a long time. Its diverse ecosystems include vast coastal and marine regions, deserts, and rainforests. There are numerous species that are unique to Australia. The economy, culture, and environment all benefit from this biodiversity, including the important industries of agriculture, fishing, and tourism (Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2022b).

Australia's marine biodiversity is known globally, particularly due to it being host to the largest coral reef system in the world, the Great Barrier Reef (GBR). However, it also contains a variety of other important marine ecosystems, including but not limited to: extensive mangrove forests, vast seagrass meadows, as well as the largest fringing coral reef in the world, the Ningaloo Reef, in Western Australia. Thousands of marine organisms exist across the many coral reef systems of Australia (De'ath et al., 2012). For animals like dugongs and turtles, seagrass beds—like those in Shark Bay, Western Australia—are crucial habitats. According to Fourqurean et al. (2012), these ecosystems also contribute to the preservation of healthy fish populations and the storage of carbon. Mangrove forests in Australia preserve coastlines, store carbon, and provide breeding grounds for fish species that are significant to the local and global economy (Alongi, 2008).

Across tropical, temperate, and even sub-Antarctic waters, Australia boasts a diverse range of marine ecosystems. Its vast coastline and offshore territories are home to a number of significant hotspots for marine biodiversity, each of which supports a diverse array of species and their own habitats. Notable instances consist of:

- The Great Barrier Reef is the world's largest coral reef system and a globally important marine area spanning over approximately 350,000 square kilometres. It supports more than 400 coral species, 1,500 fish species and 4,000 molluscs. It also provides critical habitat for threatened species like dugongs and green turtles, with Raine Island being the largest green turtle nesting site in the world (UNESCO, n.d.-a).
- The Ningaloo Reef is a 300 km long fringing reef on Western Australia's northwest coast home to many species of coral, crustaceans, molluscs, fish and whale sharks. Its biological significance is also demonstrated by its status as a UNESCO World Heritage site (Natural World Heritage Sites, n.d.).
- The Great Southern Reef is a network of kelp forests stretching along the coasts of New South Wales, Victoria, Tasmania, South Australia, and Western Australia. These reefs are globally recognised for their unique marine life, especially endemic seaweeds, invertebrates, and fish. They also support valuable fisheries like abalone and rock lobster (Bennett et al., 2016).
- The North-West Coral Reef Atolls in the Indian Ocean are a collection of distinct and remote reefs off Western Australia, including the Rowley Shoals, Scott Reef, and Seringapatam Reef. They are located along the edge of the continental shelf and represent the last surviving coral systems of an ancient barrier reef that existed along the Western Australian coast millions of years ago. They contain a high amount of marine biodiversity and because of their isolation these reefs are largely undisturbed from damaging human activities. The Rowley Shoals alone contains at least 230 coral species and 700 fish species, including many large predators such as reef sharks and groupers (Oceanographic Magazine, 2020; The Guardian, 2021). Scott Reef supports nearly 1,000 fish species and serves as a migration route for species like pygmy blue whales and green turtles (Greenpeace Australia, n.d.).
- The Offshore Island Marine Parks scattered across both the Pacific and Indian Oceans also host important marine ecosystems. Lord Howe Island and Norfolk Island, both in the Pacific Ocean, lie where tropical and

temperate waters meet, creating a unique mix of marine species, many of which are found only in this region. Lord Howe Island has the southernmost coral reef on Earth, home to over 500 fish species (DCCEEW, n.d.-a). Norfolk Island's reefs are also shaped by the East Australian Current and support diverse marine life (DCCEEW, n.d.-a).

- In the Indian Ocean, Christmas Island and the Cocos (Keeling) Islands feature coral reefs with a diversity of Indian–Pacific species. Christmas Island's reefs host almost 100 coral species and over 650 fish species, including endemic species like the Cocos angelfish (DCCEEW, n.d.-b). These waters are also visited by large marine animals such as dolphins, whale sharks, and turtles (DCCEEW, n.d.-c).

History of the Great Barrier Reef

The Great Barrier Reef (GBR) was declared a UNESCO World Heritage site in 1981 because of its outstanding universal value. This includes its rich biodiversity, vital ecological processes, and stunning natural beauty (Great Barrier Reef Marine Park Authority (GBRMPA), 2023; UNESCO, 2023). However, its status as the world's largest coral reef ecosystem, and its ability to provide support for thousands of unique marine species, as well as providing critical habitats for endangered species such as the dugong and the green turtle, have taken many hundreds of thousands of years to develop (UNESCO World Heritage Centre, n.d.; GBRMPA, 2022).

Origin and geological formation

The Great Barrier Reef has developed over hundreds of thousands of years, shaped by cycles of coral growth and extinction. The reef's geological origins date back approximately 500,000 years; however, its contemporary structure emerged approximately 6,000 to 8,000 years ago following the last Ice Age. Rising sea levels flooded coastal plains, providing substrates suitable for coral growth (Hopley, Smithers, & Parnell, 2007). Its formation has been influenced by changes in climate and sea levels throughout its history.

- Ancient Foundations: The reef sits on a continental shelf that began drifting into tropical waters about 20 million years ago. At first, cooler ocean temperatures and murky water meant coral reefs didn't grow much. Coral growth picked up around 600,000 years ago in more northern areas, once the waters became warmer and clearer (GBR Biology, n.d.-a). Early reefs formed on shallow platforms and along the edge of the shelf, which were built by both coral as well as calcareous algae. This resulted in limestone structures being created on top of older rock layers.
- Reef Cycles and Ice Ages: Since the initial formation of the reef, sea levels have fluctuated with natural climatic variation. During ice ages, sea levels dropped by up to 120 metres, exposing the seabed and killing many coral reefs. When the climate warmed and seas rose again, corals returned, growing on top of the old reef remains. This happened repeatedly, leading to multiple layers of reef growth across the region (GBR Biology, n.d.-b). This process has created a complex, layered structure under today's living reefs.
- Modern Reef Formation: The current GBR started forming after the last ice age, about 20,000 years ago, when sea levels were much lower. The sea

gradually rose, and between 9,000 and 7,000 years ago, coral started growing again on the submerged platforms. As sea levels stabilised around 6,000–7,000 years ago, corals reached the surface and formed the reef structures we see today (GBR Biology, n.d.-c). Some reefs grew upwards by 10–15 metres, while others spread outwards to form larger systems. The shape of the reef was influenced by the seafloor and ocean currents during this period.

- Environmental Influences: Several environmental factors influenced reef growth. As Australia moved northward, it came under the influence of the East Australian Current, which brought warm water and coral larvae. This helped coral thrive in northern areas (GBR Biology, n.d.-b). Weather patterns, river runoff, and ocean changes also affected coral growth, especially closer to shore. Even in the past, coral bleaching and cyclone damage have left marks on the reef's structure. Despite all these changes, coral communities repeatedly grew back, making the GBR a symbol of long-term resilience and ecological rebuilding (Webster et al., 2011).

Indigenous Australians and the reef

The Great Barrier Reef and adjacent regions have been inhabited by Indigenous Australians for more than 60,000 years. Despite changes in coastlines over time, their ties to the land and sea have remained strong. The now-submerged coastal plains were inhabited by Aboriginal people prior to the reef's current formation. As the sea rose and coral reefs developed, they adapted and included the reef in their cultural traditions (Great Barrier Reef Marine Park Authority [GBRMPA], n.d.-a).

- Cultural Significance: Around 70 Aboriginal and Torres Strait Islander groups have deep spiritual and cultural ties to the reef. Dreaming stories and songlines describe how the reef and marine animals came to be. These stories also guide how people should care for the sea and its creatures. Certain animals and reefs are considered sacred or linked to family groups, and caring for them is seen as part of identity and duty (Great Barrier Reef Marine Park Authority, 2019).
- Traditional Ecological Knowledge: Indigenous groups have passed down detailed knowledge of the reef through generations. This includes how to read weather and seasons, fish breeding patterns, and sustainable harvesting practices. They have long used methods like rotating harvest areas and observing natural signs to ensure resources were not overused (DCCEEW, n.d.).
- Modern Involvement: Despite disruptions after colonisation, many Indigenous groups are now involved in managing the reef. Through agreements like Traditional Use of Marine Resources Agreements and ranger programs, communities carry out sustainable practices like controlled hunting, protecting turtle nesting areas, and monitoring the sea. Their knowledge also helps scientists, by using oral histories to understand historical sea-level rise patterns. Today, "Two Ways" science approaches combine Indigenous knowledge with modern research to manage the reef (DCCEEW, n.d.).

Impacts after colonisation

Since European colonisation in the late 1700s, the GBR has faced increasing human pressure. The following are some key issues:

- Early Use and Shipping: After Captain Cook's voyage in 1770, shipping increased and so did damage from shipwrecks. In the 1800s, people began harvesting sea cucumbers, pearl oysters, turtles, and shells, which led to local species decline. No management systems existed at the time, and while human presence was still limited, signs of overuse had already begun by the early 1900s (GBRMPA, n.d.-a).
- Coastal Development: In the 20th century, cities like Cairns and Townsville grew rapidly. Agriculture and industry expanded, especially sugarcane farming and cattle grazing. This led to fertiliser, pesticide, and sediment runoff into the GBR lagoon, harming coral and seagrass through poor water quality. These nutrients also fed outbreaks of crown-of-thorns starfish, which eat coral and have caused major damage since the 1960s (Phys.org, 2012; GBRMPA, 2024).
- Tourism and Fishing: Millions of tourists visit the area each year, and tourism plays a significant role in the local economy. If not properly managed, though, it may result in harm, including pressure on wildlife and damage to anchors. In some places, overfishing has been a problem, but the establishment of no-fishing zones has helped mitigate these impacts. Illegal fishing and bycatch are still problems (GBRMPA, n.d.-b).
- Climate Change: The biggest modern threat to the reef is climate change. Rising sea temperatures have caused mass coral bleaching, first recorded in 1998 and now occurring more often. Major bleaching events in 2002, 2016, 2017, 2020, 2022 and 2024 have killed large parts of the reef. Bleaching happens when corals lose the algae that give them colour and energy. Without recovery time between events, coral health worsens. Warmer oceans, stronger cyclones, and ocean acidification all add stress (GBRMPA, 2024).

Current state of biodiversity in the reef

Two key criteria for assessing biodiversity in the Reef, include: the condition of habitats to support species; and, populations of species and groups of species.

Condition of reef habitats

Across different regions of the Great Barrier Reef, the condition of reef habitats is rated as poor compared to historical conditions (GBRMPA, 2024). The ecosystem health assessment is based on five main criteria: physical processes, chemical processes, ecological processes, coastal ecosystems that support the Great Barrier Reef, and outbreaks of disease, introduced species, and pests (GBRMPA, 2024). Each criterion has its own rating system and definitions, which are combined to give an overall result. Because of this, there isn't one single definition for what "poor" ecosystem health means.

Historically, the GBR had wide coral coverage and highly complex habitats that supported a rich variety of marine life and helped the reef stay strong and recover

after damage (Dietzel et al., 2020). But over recent decades, repeated stresses like coral bleaching, cyclones, and poor water quality have led to widespread loss of this variety. This is a serious issue because complex reef structures provide hiding places and feeding grounds for many species, and they are key to the reef's ability to recover from damage (Graham & Nash, 2013). Reefs in "good" condition usually have more than 30% coral cover, a wide range of species, and strong, three-dimensional structures—all of which help them resist and bounce back from stress (GBRMPA, 2019). As reef habitats become simpler, their ability to support marine life and important ecosystem services, including its utility to humanity, declines.

Recent reports show that reef condition varies across regions. Some northern reefs are showing signs of recovery after severe bleaching, but overall coral cover is still well below historical levels, mainly due to repeated bleaching caused by warming oceans (GBRMPA, 2024). Other long-term threats, like pollution from farm runoff and more frequent cyclones, are making the problem worse (Great Barrier Reef Foundation [GBRF], 2025).

Seagrass habitats have improved somewhat since 2019 and are now rated as good in many northern areas. In the south, however, seagrass beds are still badly affected, as they continue to recover from extreme weather, poor water quality and other factors (GBRMPA, 2024).

Other parts of the reef, especially deeper offshore habitats, are generally in good or very good condition. These areas are further from the coast, so they're less affected by runoff, sediment, and pollution from the land which are major causes of damage in coastal zones (GBRMPA, 2024). Offshore areas also have more stable conditions, like temperature and salinity, and face less human pressure from things like farming, tourism, and development (Brodie et al., 2012). All these factors help explain why offshore reef habitats are holding up better.

Populations of species and groups of species

The overall condition of species populations in the Great Barrier Reef (GBR) is rated as poor. This means that many species, or even whole groups, have declined significantly due to human activities and environmental pressures. These pressures are primarily habitat damage, climate change, and worsening water quality. A "good" condition would mean only some individual species have declined, but not whole groups (GBRMPA, 2024).

Historically, the GBR had strong diverse populations including, but not limited to marine turtles, dugongs, seabirds, and a variety of fish. Now, many of these species have dropped in numbers. Loggerhead and hawksbill turtle populations, for example, have fallen because of damaged habitats and climate change. Warmer sand temperatures are affecting the balance between male and female hatchlings, lowering breeding success (Jensen et al., 2018). Dugongs have also declined, especially in the south, due to the loss of seagrass beds, their main food source (GBRMPA, 2024). Seabird numbers are going down too, mainly because of less food and damaged nesting areas (GBRMPA, 2024).

On a more positive note, humpback whale numbers are recovering well, thanks to strong conservation efforts in Australia and globally (Noad et al., 2019). Some fast-

growing coral species have also increased in coverage, but overall coral diversity and the health of the reef ecosystem are still under threat from the ongoing effects of climate change and related stresses (Dietzel et al., 2020).

Main problems affecting biodiversity within the Great Barrier Reef

The primary problems affecting biodiversity in the GBR include:

1. Climate Change: Warmer ocean temperatures have led to more frequent coral bleaching, which seriously damages coral and changes the reef's structure. This affects many marine species that rely on the reef (Craik, 2017; Glyde, 2024).
2. Water Quality and Pollution: Agricultural runoff, urban wastewater, and marine debris introduce pollutants such as nutrients, pesticides, and sediments. These lead to eutrophication, harmful algal blooms, and coral death (Queensland Government, n.d.).
3. Overfishing and Illegal Fishing: Unsustainable fishing practices reduce populations of ecologically important species (e.g. herbivorous fishes like parrotfish) which sustain reef health by grazing (GBRMPA, n.d.).
4. Coastal Development and Habitat Degradation: Increasing urban and industrial activities along Queensland's coast degrade habitats and exacerbate runoff problems, significantly impacting reef health (Queensland Government, 2024).
5. Crown-of-Thorns Starfish Outbreaks: These coral-eating starfish proliferate under conditions of poor water quality and warming seas, contributing substantially to coral cover reduction.

Current government policy on protecting and improving biodiversity in the Great Barrier Reef

Australia's national and international commitments

Australia has made strong commitments both nationally and internationally to protect biodiversity, with a clear focus on the Great Barrier Reef (GBR). The reef was added to the UNESCO World Heritage List in 1981, which means Australia must protect its Outstanding Universal Value through active conservation and sustainable management (UNESCO, 2023).

As a member of the Convention on Biological Diversity (CBD), Australia has agreed to protect biodiversity, use it sustainably, and share the benefits from genetic resources fairly (CBD, 2022). To meet these commitments, Australia developed a National Biodiversity Strategy and Action Plan (NBSAP) that aligns national goals with global targets. This updated plan includes goals from the Kunming-Montreal Global Biodiversity Framework, which aims to stop biodiversity loss and restore ecosystems worldwide by 2030 (CBD, 2022). Key goals of the framework include protecting at least 30% of land and sea areas by 2030, cutting pollution, managing invasive species, and using biodiversity responsibly.

The United Nations Conference of the Parties (COP) oversees agreements like the CBD and the Paris Agreement. It leads international talks and creates frameworks

such as the Kunming-Montreal Global Biodiversity Framework, setting targets that member countries, including Australia, are expected to meet (CBD, 2022).

Australia's promises under the UNESCO World Heritage Convention and the Convention on Biological Diversity are put into action through plans like the Reef 2050 Long-Term Sustainability Plan. This plan closely follows the CBD's goals for conservation (GBRMPA, 2024).

Australia is also part of the Paris Agreement, which is vital for protecting the Great Barrier Reef from climate change impacts such as ocean warming and acidification. Under the agreement, Australia has committed to cutting greenhouse gas emissions and meeting these targets is key to keeping global warming under 1.5°C, a limit seen as critical for the survival of coral reefs (IPCC, 2018).

The Kunming-Montreal Global Biodiversity Framework, agreed at CBD COP15, strengthens global targets for protecting nature. By linking national plans like Australia's Strategy for Nature and the Reef 2050 Plan with this global framework, Australia is taking a more collaborative and focused approach to biodiversity conservation (CBD, 2022; Australian Government, 2024).

Reef management, federal laws, strategies and policies

The Great Barrier Reef (GBR) is listed as both a World Heritage Area and a National Heritage Place, which means the Australian Government must protect its Outstanding Universal Value under international and national agreements (DCCEEW, n.d.). It is jointly managed by the Australian Government and the Queensland Government. Each is responsible for different areas of the reef, and they work together to protect its biodiversity (Great Barrier Reef Marine Park Authority [GBRMPA], 2024).

At the national level, the reef is protected by the Great Barrier Reef Marine Park Act 1975. This law created the Great Barrier Reef Marine Park Authority (GBRMPA), a federal agency that manages the GBR Marine Park. GBRMPA oversees zoning plans, issues permits, and enforces rules in Commonwealth waters (beyond 3 nautical miles from the coast). Its goal is to protect the environment, biodiversity, and heritage values of the reef over the long term (GBRMPA, 2024). The Marine Park Zoning Plan (2003) divides the park into different zones, including large "no-take" zones where fishing and collecting are banned to conserve marine life. These zones are enforced by GBRMPA, often in partnership with the Queensland Government (GBRMPA, 2024).

Queensland is in charge of coastal waters (up to 3 nautical miles offshore) and the islands in the GBR region. The state has its own protected areas, including: the Great Barrier Reef Coast Marine Park (under the Marine Parks Act 2004); and numerous island National Parks (under the Nature Conservation Act 1992). These protections cover inshore reefs, estuaries, mangroves, and coastal habitats that are outside of Commonwealth waters (Queensland Government, n.d.).

The two governments work together under the Great Barrier Reef Intergovernmental Agreement (2024). This agreement supports joint

management through programs like the Joint Field Management Program, which is delivered by GBRMPA and Queensland Parks and Wildlife Service. Teams from both agencies carry out patrols, monitor reef sites, protect nesting turtles, and respond to incidents (GBRMPA, 2024).

The Environment Protection and Biodiversity Conservation Act

At the federal level, Australia's policies for protecting and managing the GBR are structured around several key legislative and strategic frameworks. One of these is the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act), that mandates environmental impact assessments for activities likely to significantly affect areas of national environmental significance, such as the GBR (Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2021). The Department of Climate Change, Energy, the Environment and Water (DCCEEW) is responsible for enforcing the EPBC Act. It works closely with GBRMPA for projects that impact the Marine Park, and can stop or change developments that might damage the reef (DCCEEW, n.d.).

Fisheries management

Managing fisheries in the GBR is also shared:

- Queensland's Department of Agriculture and Fisheries oversees fishing licences, quotas, and gear restrictions in state waters.
- GBRMPA enforces no-fishing zones and protects species in Commonwealth waters (DCCEEW, n.d.).

Together, they aim to ensure fishing is sustainable and doesn't harm endangered species. For example, species such as dugongs, turtles, and coral reef fish are protected through a mix of fishing limits and marine zoning (DCCEEW, n.d.).

In 2023, the Queensland Government announced it would phase out commercial gill-net fishing in the GBR Marine Park by 2027, under its Sustainable Fisheries Strategy 2017–2027. This aims to reduce bycatch of threatened species and help fish stocks recover. The Commonwealth supports this with funding and oversight under the EPBC Act (Queensland Government, 2017; DCCEEW, n.d.).

The Reef 2050 Long-Term Sustainability Plan

Complementing the EPBC Act, the Reef 2050 Long-Term Sustainability Plan serves as the overarching federal-state framework between the Australian and Queensland Governments. The plan was established to guide collaborative actions for managing the reef until 2050 (Great Barrier Reef Marine Park Authority [GBRMPA], 2022). The plan prioritises 5 key areas of action:

- limit the impacts of climate change;
- reduce the impacts from land-based activities;
- reduce impacts from water-based activities;
- influence the reduction of international sources of impact; and,
- protect, rehabilitate and restore (GBRMPA, 2022).

The plan is led by the federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) and Queensland's Department of

Environment and Science (DES). Oversight is provided by the Great Barrier Reef Ministerial Forum, made up of ministers from both governments. The Reef 2050 Plan sets clear goals for areas like water quality, biodiversity, ecosystem health, heritage, and community involvement. It includes specific actions with assigned responsibilities (Queensland Government, n.d.).

For example, the Australian Government is in charge of recovery plans for threatened species like turtles and dugongs, while Queensland handles marine incident responses and protection of important habitats. Many tasks are completed jointly. The plan identifies that long-term reef protection needs cooperation between governments, Traditional Owners, businesses, and communities (DCCEEW, n.d.).

Although the Reef 2050 Plan is not a law, it is tied to the Intergovernmental Agreement on the GBR, which means both governments must work together and align their actions with the plan's targets (Queensland Government, n.d.).

Reef 2050 Water Quality Improvement Plan 2017–2022

The Reef 2050 Water Quality Improvement Plan 2017–2022 provides a guide for how industry, governments, and communities can work together to improve the water quality of the GBR and water flowing into the GBR. While initially covering the period to 2022, the plan remains effective until superseded by an updated version (State of Queensland, 2018). This plan is led by the Queensland Government, with support from the Australian Government. It sets clear targets, such as reducing dissolved nitrogen by 60% and sediment by 25% (from 2009 levels) by 2025 (Queensland Government, 2018).

This plan continues over 15 years of previous collaborative efforts involving landholders, natural resource managers, industry, researchers, and conservation organisations established through earlier Reef Water Quality Protection Plans. It functions as a component of the broader Reef 2050 Long-Term Sustainability Plan, addressing diverse land-based pollution sources including agricultural, urban, industrial, and public land runoff, recognising agriculture as the major contributor (State of Queensland, 2018). Furthermore, it uniquely integrates social, cultural, and economic considerations alongside environmental objectives, highlighting the interconnected benefits of improved water quality to both reef ecosystems and local communities (State of Queensland, 2018).

The plan is run by Queensland's Department of Environment and Science (DES), through its Office of the Great Barrier Reef. The Commonwealth government supports it through funding (like the Reef Trust) and through the EPBC Act, which can assess the impact of large developments on water quality (Department of Climate Change, Energy, the Environment and Water [DCCEEW], n.d.).

To enforce the plan, Queensland introduced Reef Protection Regulations under the Environmental Protection Act 1994, which set rules for farming practices – such as limits on fertiliser use and erosion controls. Queensland agencies are responsible for monitoring compliance and helping farmers make improvements, while the federal government provides funding and checks that large-scale projects do not make water quality worse (Queensland Government, 2018; DCCEEW, n.d.).

Reef 2050 Wetlands Strategy

The Reef 2050 Wetlands Strategy is a commitment between the Australian and Queensland governments designed to guide the science, planning, coordination, and management of wetlands within the Great Barrier Reef and its catchments. It forms a component of the broader Reef 2050 Long-Term Sustainability Plan, aiming to enhance wetland ecosystems' capacity to support reef health (Queensland Government, 2023).

The strategy outlines actions to improve knowledge and understanding of wetland ecosystems, promote integrated planning, strengthen on-ground management practices, and encourage stakeholder collaboration. By prioritising wetland conservation and restoration, the strategy aims to reduce sediment and nutrient loads entering the reef, thereby contributing to improved water quality, increased biodiversity, and the greater resilience of the reef ecosystem (Queensland Government, 2023).

Marine Park Authority's Great Barrier Reef Blueprint for Resilience

The Great Barrier Reef Marine Park Authority's Blueprint for Resilience (Blueprint 2030) is a plan to help the reef cope with the impacts of climate change. It supports the goals of the Reef 2050 Long-Term Sustainability Plan and includes specific actions to adapt how the reef is managed (GBRMPA, 2024).

Blueprint 2030 sets out five main goals that together provide a clear plan for action. These goals are designed to help the reef's ecosystems survive and recover from climate-related damage, helping to protect its biodiversity for future generations (GBRMPA, 2024).

Other relevant policies

Australia's National Biodiversity Strategy and Action plan (also known as Australia's Strategy for Nature 2024–2030) provides strategic guidance aligned with the Global Biodiversity Framework (GBF), setting national biodiversity targets in 6 key areas that aim to halt and reverse biodiversity decline by addressing key factors like habitat loss, climate change, and invasive species (DCCEEW, 2024).

The National Climate Resilience and Adaptation Strategy 2021–2025 outlines federal initiatives to anticipate, manage, and adapt to climate impacts, supporting resilience-building efforts across governmental and community sectors, crucial for the GBR's adaptation to changing conditions (DCCEEW, 2024).

The Aboriginal and Torres Strait Islander Heritage Strategy for the Great Barrier Reef Marine Park outlines how the Great Barrier Reef Marine Park Authority (GBRMPA) will work with Aboriginal and Torres Strait Islander peoples to protect and strengthen Indigenous heritage in the Marine Park. The strategy sets out a clear vision, key principles, goals, and actions to help recognise, protect, and promote the cultural heritage of Indigenous communities connected to the reef (GBRMPA, 2019).

The Tourism Management Action Strategy sets out how tourism in the Great Barrier Reef will be managed to support sustainable use while protecting the reef.

It was developed with input from both targeted groups and the public, and was released in September 2021. The strategy is a joint effort between the Great Barrier Reef Marine Park Authority and the Queensland Parks and Wildlife Service. It covers both Commonwealth and State Marine Parks and will guide tourism management through to 2035 (GBRMPA, 2021).

Effectiveness of current policies and governance approaches

The health of the Great Barrier Reef has continued to worsen over the last decade. The 2024 Great Barrier Reef Outlook Report explains that extreme weather and ongoing problems like too much sediment and nutrients in the water have caused the reef's overall condition to decline since 2009. As more of the natural systems that support the Reef continue to break down, the special global value of the Reef is likely being affected (GBRMPA, 2024). As ocean health is often linked to global issues, such as ocean warming, rising sea levels and ocean acidification, many Australian government policies may find it difficult to directly tackle the root cause of reef decline. As a result, key indicators like coral cover, seagrass health, and fish populations are still in decline. However, there are many mitigating strategies that could be put in place to improve overall resilience despite the challenges imposed by global issues (GBRMPA, 2024).

Water quality

Policies to cut pollution from land, like farm runoff, are not working fast enough. Poor water quality harms coral and seagrass and leads to more outbreaks of crown-of-thorns starfish. The Reef 2050 Water Quality Plan set clear goals, such as cutting nitrogen runoff by 60% by 2025. But by 2022, only a 28% reduction had been made. Sediment runoff had only been cut by 16%, well below the 25% target (Australian Marine Conservation Society, 2022). This slow progress is mainly because farming rules were enforced too late, monitoring is limited, and land-clearing laws have loopholes. There have also been problems with coordination between federal and state governments. On top of that, current funding only covers about 28% of what's needed to meet water quality goals (WWF-Australia, 2018).

Monitoring gaps

Monitoring gaps are so extensive that many reef species may be declining without anyone noticing, because only a few well-known indicators (like coral cover) are regularly tracked. A study by Richards and Day (2018) found that although 136 reef species are globally threatened, only 23 are officially listed under Australia's laws. This means many species get no protection or recovery plans. Better use of technology like drones, satellite images, or environmental DNA could help detect changes earlier and allow faster responses (Richards & Day, 2018).

Furthermore, condition and trend information is only available for a limited number of species (Fabricius & De'ath, 2000; GBRMPA, 2014a). In fact, the population status of many large species of high conservation significance, is uncertain (Hamann & Chin, 2015). As such, discovery and mapping is still occurring for cryptic lineages (Schmidt-Roach et al., 2013); new species (e.g. Hooper & Van Soest, 2006; Miller & Downie, 2009; Sutcliffe, Hooper & Pitcher, 2010; Hunter & Cribb, 2012; Schmidt-Roach, Miller & Andreakis, 2013; Capa & Murray, 2015) and entire

habitats such as sponge gardens, mesophotic reefs, and deep water corals (e.g. Bridge & Guinotte, 2013; Bridge et al., 2012; Harris et al., 2013; McNeil et al., 2016).

A clear understanding of the reef's health and biodiversity requires access to comprehensive and up-to-date data. Without this, decision-makers are left with an incomplete picture, making it harder to respond effectively to environmental issues. These gaps in information only hinder timely action and make it difficult to determine whether current policies and programs are delivering meaningful results.

Overfishing

The Queensland Sustainable Fisheries Strategy 2017-2027 is facing challenges in meeting its targets. For example, it is unlikely to achieve its 2027 targets for the following species: red snapper, pearl perch and Spanish mackerel (Tanzer 2022). An official progress report noted that as of 2021 at least five major stocks had sustainability concerns with snapper, pearl perch, and saucer scallop in depleted status and others like Spanish mackerel in decline (Queensland Department of Agriculture and Fisheries, 2021).

The following two critical 2020 targets were not met including: to set sustainable catch limits based on achieving at least maximum sustainable yield for all Queensland fisheries (around 40-50% biomass); and to maintain all Commonwealth export approvals (Tanzer 2022). Additionally, there have been concerns raised about whether the following significant 2027 targets will be achieved: to set sustainable catch limits based on achieving maximum economic yield for all Queensland fisheries (around 60% biomass); and no Queensland fisheries are overfished (Tanzer 2022).

Addressing known problems of chronic over or destructive fishing has been too slow and often inadequate relative to the extent of the historical decline and ongoing impacts (Tanzer 2022). These shortfalls can be attributed to a combination of management issues, data and monitoring limitations, environmental and ecosystem pressures, and compliance factors (ABC News, 2021; AMCS, 2022; DAF, n.d.-a).

Effectiveness of the Reef 2050 Plan

Climate change is an ongoing and increasingly serious challenge to the outstanding universal value of the GBR, which has suffered a series of widespread coral bleaching events, occurring with increasing frequency (Carter & Thulstrup 2022).

While the Reef 2050 Plan promotes progress towards Australia's climate change mitigation commitments – such as achieving the 1.5°C Paris Agreement target, the associated plans and strategies lack clear pathways to avoid significant negative impacts to the outstanding universal value of the GBR (Carter & Thulstrup 2022).

Further, the Reef 2050 Plan lacks concrete actions to preserve the outstanding universal value of the GBR under current global temperature increase scenarios – such as mechanisms to track progress of strategic actions in addressing the impacts of climate change on the GBR (Carter & Thulstrup 2022).

Effectiveness of the EPBC Act

The EPBC Act is Australia's main environmental law. It is meant to protect places like the Great Barrier Reef, but experts say it's not doing the job – especially for activities outside the Marine Park (Samuel, 2020; DCCEEW, 2023).

One of the primary issues identified is poor enforcement. The federal environment department often uses a "cooperative" approach, focusing on voluntary compliance instead of strong oversight. As a result, many development approvals come with conditions that are not properly checked or enforced. This means protections promised on paper often don't happen in practice (Samuel, 2020).

A 2020 review by the Australian National Audit Office (ANAO) found that conditions attached to project approvals were often poorly tracked. The audit also found no conflict-of-interest register in the compliance team – a sign of wider problems in governance (ANAO, as cited in Samuel, 2020). Over 10 years, only 22 fines were issued under the EPBC Act, totalling less than $230,000 – not enough to act as a serious deterrent (DCCEEW, 2023).

This lack of action has real consequences. For example, land clearing continues in Reef catchments, causing more sediment runoff into the Reef's waters, even though the reef is already stressed by climate change (AMCS, 2019, 2023). The approval of large industrial projects like the Abbot Point coal port expansion also shows how current laws often fail to stop politically supported developments that harm the environment (WWF & AMCS, 2015).

Areas of success

Marine Park zoning, especially no-take zones, has been effective, with these areas showing higher fish numbers and healthier reefs. Also, the Field Management Program has strong compliance rates with over 90% for fishing rules (DCCEEW, n.d.). Partnerships with Traditional Owners and local communities have also delivered benefits. For example, community clean-ups and targeted programs like crown-of-thorns starfish removal have had positive local impacts. These successes show that when rules are clear, funding is strong, and communities are involved, reef protection works.

Areas of reform

Issue 1: The condition and trend of values relevant to biodiversity are relatively unknown for the majority of species in the Great Barrier Reef's monitoring program

In order to effectively manage biodiversity in the Great Barrier Reef (the GBR), it is essential to have a good understanding of the condition and trend of values relevant to biodiversity. Unfortunately, the condition and trend of values relevant to biodiversity are relatively unknown for the majority of species in the GBR (Australian Academy of Science 2023, Richards & Day 2018). This reflects the complexity and scale of the GBR's ecosystems.

The main knowledge gaps relate to:

- particular plant and animal groups including invertebrates, inshore and snubfin dolphins, sharks and rays;
- habitats including the lagoon floor, shoals, Halimeda banks and the continental slope (Australian Academy of Science 2023, Addison et al. 2015);
- various highly targeted and vulnerable marine taxa (such as sea cucumbers and giant clams) (Richards & Day 2018);
- detecting trends in long-lived sparse species (such as marine megafauna);
- some ecosystem processes and functioning (such as groundwater inflows);
- the effects of multiple or combined stressors (Australian Academy of Science 2023); and,
- understanding the impact of acidification on reef formation, genome sequencing and planktonic/larval movements.

Without understanding the areas mentioned above, it's hard to judge how well the Great Barrier Reef is being effectively managed for biodiversity. Therefore, it's recommended that the reef's monitoring program is expanded to cover these knowledge gaps.

Issue 2: Overfishing

While fishing in the GBR is commercially important, guarding against overfishing is crucial to ensure that biodiversity is maintained. However, comprehensive monitoring indicates that overfishing is occurring with: stock biomass at 25 to 30 per cent for snapper; stock biomass at approximately 20 per cent for pearl perch; significant declines in spawning aggregations for Spanish mackerel (Tanzer 2022). To address this, it is recommended that restrictions are introduced and enforced to prevent overfishing in the GBR.

Issue 3: Revising the Reef 2050 Plan

While the Reef 2050 Plan is a key overarching document addressing many of the key elements required for effective management of the GBR, it faces challenges when responding to the cumulative impacts of climate change and other stressors. The Reef 2050 Plan and its associated plans and strategies lack clear pathways to avoid significant adverse impacts from climate change on the GBR's outstanding universal value (Carter & Thulstrup 2022). To address this, it is recommended that the Reef 2050 Plan is amended to be more ambitious and require clear indicators for success and adaptive management.

Issue 4: Effectiveness of EPBC Act approvals made outside of the Marine Park

The compliance and enforcement of provisions under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) relating to approvals that are made outside of the Marine Park, are ineffective (Samuel 2020). This has significant adverse impacts on the ability to protect the GBR's outstanding universal value and can include illegal discharge or inappropriate management of coastal development activities. To address this, it is recommended that greater compliance and enforcement activities are undertaken for EPBC Act approvals made outside of the Marine Park. This includes to set up an independent compliance and enforcement agency, with real powers, strong funding, and the ability to act without political pressure (Samuel, 2020). Clear and meaningful national

environmental standards will be required to enable measurable outcomes. Regular inspections and public reporting would make it easier to check if developers are following the rules (Samuel, 2020). Stronger enforcement through higher penalties will be required. In serious cases, developers who repeatedly break the rules should face criminal charges. To make this work, governments must properly fund compliance teams and improve coordination between federal and state agencies.

Issue 5: Resourcing

While funding for biodiversity may be increasing, human resourcing remains problematic for the Reef Authority and other agencies (Australian Public Service Commission 2022), including the areas of Traditional Owner engagement and on-the-ground management. This is due to staff turnover, the loss of institutional knowledge, difficulty in filling vacant positions as well as the lack of in-house skill sets for making decisions. To address this, it is recommended that human resourcing of the Reef Authority is reviewed and remedied.

water resource management

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Water is highly important to Australian ecosystems, communities and industries, including sectors pivotal to the economy, including mining, agriculture, and tourism (Baird et al., 2021). However, water shortages are worsening due to climate change, which is causing more frequent droughts, increased rates of evaporation, and variable rainfall (Caretta et al., 2022; Steffen et al., 2018; Lawrence et al., 2022; Green & Moggridge, 2022). As a result, the management of water resources in Australia has been identified as a major national security and political issue (Steffen et al., 2018). This aligns with global concerns, where water security is becoming one of the most important global issues as its availability becomes increasingly unstable (UN 2020).

Given that Australia is a geographically broad country, it has to rely on a variety of water sources to supply communities and industries. This includes relying on surface water, groundwater, and large reservoirs (Green & Moggridge, 2022). The most important surface water source of national significance is the Murray–Darling Basin (MDB), Australia's largest and longest river system, covering one million square kilometres across New South Wales, Queensland, South Australia, Victoria, and the Australian Capital Territory (MDBA, 2024). This region is also Australia's most agriculturally productive and supports 40% of the country's farms and approximately 70% of its irrigated land (Bureau of Meteorology 2016). The Murray, Darling and Murrumbidgee rivers which make up the MDB, are Australia's longest, with the Lachlan River, Cooper Creek, and Flinders River being the other rivers of the country exceeding 1000 kilometres in length (Geoscience Australia, 2014).

The Great Artesian Basin (GAB) is arguably Australia's most important groundwater systems which is also one of the world's largest underground freshwater reserve, with a storage capacity of approximately 65 million gigalitres. It spans 1.7 million square kilometres (one-fifth of Australia) across Queensland, New South Wales, South Australia, and the Northern Territory and connects with both the MDB and the Lake Eyre Basin (Cook et al., 2022; Habermehl, 2020). It is a vital water source for agriculture, industry, and groundwater-dependent ecosystems (Habermehl, 2020; Green & Moggridge, 2022).

In terms of reservoirs, Australia is heavily reliant on over 500 major surface-water storages, thousands of small reservoirs, and more than 2 million farm dams. Developing more large-scale water storage projects is difficult given that most suitable rivers have already been dammed (Green & Moggridge, 2022). Managing small reservoirs and farm dams will become increasingly difficult in the future, as smaller reservoirs are more vulnerable to droughts and floods which will worsen with climate change – the likelihood of farm dams running dry is projected to increase by up to an additional 10% by 2050 (Malerba et al., 2022). Climate change represents a threat to water security across the globe and in Australia. Large scale stores will see steady declines, and many small scale water holders may struggle to protect their water supplies. Government policy will be pivotal for ensuring there is national coordination in protecting this valuable asset, critical for our ecosystems, community health, and the functioning of industry.

Water policies will need to be reviewed and strengthened as the climate continues to warm (Steffen et al., 2018). For example, in southern Australia, cool-season rainfall is predicted to decrease, lowering soil moisture and runoff, especially in the south-east and south-west, which further reduces water availability. Extreme droughts are also predicted to become more frequent (Steffen et al., 2018; Lawrence et al., 2022), which will be worsened by rising temperatures and evaporation rates, impacts that will further strain dam storage and groundwater recharge. These trends are expected to worsen as climate change accelerates (PC, 2024). Heavy rainfall events are projected to become more intense, increasing the risks of flash flooding, erosion, and sedimentation, placing further strain on ageing stormwater and wastewater infrastructure (Lawrence et al., 2022).

Related impacts include through wildfires, which will worsen with climate change, and pose substantial risks to water supplies by altering land cover, increasing runoff, erosion, and contamination (Caretta et al., 2022; Haque et al., 2021). Burnt soil can prevent water absorption and accelerate stormwater runoff, which carries pollutants, chemicals, and debris into waterways, degrading water quality (Haque et al., 2021). These impacts threaten drinking water, aquatic ecosystems, and socio-economic activity (Caretta et al., 2022; Robinne et al., 2021).

With profound changes to the water cycle and growing pressures on freshwater resources, Australia must efficiently manage competing water demands across communities, industries, and ecosystems (Steffen et al., 2018). Stronger policies, climate-resilient water management, and sustainable resource use will be essential to securing Australia's freshwater future.

Policy history

Water management in Australia is primarily the responsibility of state and territory governments, but the federal government has a key role in areas such as sharing water between states, protecting key environmental assets, developing interstate water markets, and managing cross-border water investments (Thompson, 2006).

By the 1980s many surface and groundwater systems were fully or over-allocated (Goesch et al., 2019). Subsequent water reforms which took place in the mid-1990s, were driven by ecological declines in rivers and wetlands, with unsustainable

irrigation practices identified as an important factor. The Council of Australian Governments (COAG) introduced the Strategic Framework on Water Reform, which recognised water policy as a cross-jurisdictional issue requiring a sustainable approach (Wheeler et al., 2024). This framework shifted water allocation arrangement from administrative allocation towards a market-based approach included measures such as cost-recovery pricing, a system of water allocations with provisions for environmental water, separation of land and water titles, and the establishment of water trading (Poddar et al., 2014).

These initiatives laid the groundwork for the Intergovernmental Agreement on the National Water Initiative (NWI) in 2004, a cornerstone policy for nationally consistent water reform in Australia. The NWI recognises the continuing national imperative to increase the productivity and efficiency of Australia's water use, the need to service rural and urban communities, and to ensure the health of river and groundwater systems by establishing clear pathways to return all systems to environmentally sustainable levels of extraction. It has committed state and territory governments to key actions: preparing water plans with environmental provisions, addressing over-allocated water systems, introducing water rights registers and water accounting standards, expanding water trading, improving water storage and delivery pricing, and managing urban water demands (COAG, 2004).

The National Water Commission (NWC) was established in 2005 and was tasked with driving the national reform agenda and overseeing the effective implementation of the NWI (Radcliffe & Page, 2020). This included through progress monitoring and reform evaluation as well as the provision of subject matter expertise on water management issues (DCCEEW, 2023).

These events took place around the time of the Millennium Drought which occurred from 1997 to 2009. This major drought event demonstrated problems with Australia’s management of water resources, indicating that significant reforms were needed to improve water resource management. This resulted in the introduction of the Water Act in 2007, which moved the government’s role from supporting state-led reforms to directly overseeing the MDB (Wheeler et al., 2024).

The Water Act introduced institutional and regulatory frameworks required to manage the MDB by focusing regulatory action on principles of economic efficiency and sustainability (ACCC, 2024). Other events that took place around the same time were: the creation of the Murray-Darling Basin Authority (MDBA), which was established in 2008; and, the implementation of the Murray-Darling Basin Plan (‘Basin Plan’) in 2012. These were aimed at ensuring that water extraction was undertaken sustainably in an attempt to restore balance between environmental, industrial, regional and urban water needs (Wheeler et al., 2024).

Despite the fact that climate change is worsening and therefore threats to water security will also exacerbate into the future, the National Water Commission (NWC), which had been instrumental in driving reforms, was dismantled in 2015 due to budget cuts. This change indicates that despite the importance of water resource management to the national interest, it is susceptible to issues with governance and bureaucracy (Radcliffe & Page, 2020). The National Water Reform Committee

(NWRC) has taken the place of the NWC, however, this committee lacks the independence and authority of the NWC to implement meaningful positive changes (PC, 2024).

Groundwater

Groundwater is an important source of freshwater in Australia for both communities and industries such as agriculture and mining, as well as groundwater-dependent ecosystems (Barnett et al., 2020). In regions with limited rainfall and infrequent recharge, it may be the only method by which land is irrigated, or the only source for drinking water (Choudhury et al., 2023; Griebler & Avramov, 2015). A majority of groundwater in Australia (approximately 70%) is used for agriculture and irrigation, with the remainder supporting mining and domestic needs (Cook et al., 2022). However, groundwater is regularly under threat from human activities. For example, the Great Artesian Basin (GAB), as Australia's largest underground aquifer is a critical supply of water for communities, agriculture, and ecosystems in four states across eastern Australia and despite its importance it is regularly threatened by human activities and lacks sufficient regulatory protections (Cook et al., 2022).

Depletion & contamination risks

A growing threat is the depletion of groundwater resources, especially in arid areas with little recharge (Cook et al., 2022). Particularly in the Murray Darling Basin (MDB), groundwater levels in the main alluvial systems have decreased by an average of 0.1 metres annually, with some regions experiencing a decline of 1 metre annually (Fu et al., 2022). Long-term drying trends will be exacerbated by a 79% decrease in recharge in western, central, and south-east Australia, according to climate projections for 2050 (Barron et al., 2011).

Groundwater contamination from industries such as agriculture and mining, as well as urban development, further threatens water security. Key risks include:

- Industrial and agricultural pollution: Pesticides, fertilisers, and wastewater disposal lower water quality (Zahoor & Mushtaq, 2023).
- Coal Seam Gas (CSG) Operations: Depressurising aquifers and raising contamination risks by extracting vast amounts of groundwater (Pearce et al., 2023).
- Hydraulic Fracturing & Mining Waste: this introduces salinity, heavy metals, and hazardous chemicals, requiring strict management (Radcliffe, 2018).
- Seawater Intrusion: Over-extraction in coastal areas causes rising salinity levels (Chandnani, 2022).

Excessive groundwater extraction has already caused declining water tables, elevated salinity, and decreased stream flows to wetlands in a large portion of Australia, including the MDB, which has resulted in substantial environmental and socioeconomic impacts (Fienen & Arshad, 2016; Shalsi et al., 2019).

Coal seam gas development

The sustainability of groundwater use in Australia is at risk due to increasing groundwater extraction brought on by coal seam gas (CSG) operations across Australia, especially in Queensland where they risk the viability of the GAB amongst other aquifers (Pearce et al., 2023). The significant water removal required for CSG production in order to release trapped gas is the cause of a multitude of risks and impacts including aquifer depressurisation, contamination risks, and drops in water tables (Robertson, 2020). Key concerns include:

- Methane Migration: Gas leakage into overlying aquifers can compromise drinking water quality, elevate greenhouse gas emissions, and create explosion risks in confined spaces (Pearce et al., 2023).
- Co-Produced Water: Large volumes of high salinity, alkalinity, and trace contaminants (heavy metals, hydrocarbons) produced by CSG extraction call for appropriate treatment and disposal to prevent ecosystem damage (Peng et al., 2022).
- Groundwater Drawdown & Streamflow Reductions: Aquifer depletion from too high extraction can lower flows into rivers and wetlands, negatively impacting groundwater-dependent ecosystems (GDEs), including Ramsar-listed wetlands (Fienen & Arshad, 2016; Shalsi et al., 2019).
- Chemical Contamination: Some known endocrine disruptors and carcinogens mix among the chemicals in hydraulic fracturing fluids. Should their control be inadequate, these chemicals could leak into surface or aquifers (Radcliffe, 2018; Pearce et al., 2023).

There have also been legal challenges in New South Wales, government interventions, moratorium proposals, and public opposition to CSG that has grown stronger over time (Dart et al., 2022). Regulatory changes notwithstanding, inconsistent application and a lack of social licence still compromise industry reputation (Salmachi et al., 2021).

Often high in salinity, alkalinity, heavy metals, and trace pollutants, CSG extraction produces co-produced water that can damage freshwater ecosystems if improperly controlled (Peng et al., 2022). Reducing environmental and health hazards requires correct treatment and disposal.

To remove pollutants, treatment choices include desalination, reverse osmosis, and chemical precipitation (Nghiem et al., 2011). Among the disposal techniques are evaporation ponds, discharge into surface water bodies, and re-injection into depleted aquifers. Beneficial reuse is preferred where feasible, with treated water used for agricultural irrigation, industrial applications, coal washing, and dust suppression (Peng et al., 2022).

However questions remain about the long-term effects of re-injection and surface discharge on groundwater quality, and there have been calls for more research to help advance treatment technologies and create sustainable reuse plans (Nghiem et al., 2011; Peng et al., 2022). Independent research is also required to evaluate groundwater connectivity, methane migration, and the total effects of extraction, especially in fault-prone areas where contamination hazards are raised (Pearce et

al., 2023; Cook et al., 2022). Closing these knowledge gaps is highly important for developing evidence-based policies to ensure groundwater sustainability.

Governance and policy gaps

With weak enforcement, regulatory exemption, and poor monitoring (Page et al., 2023; Cook et al., 2022; PC, 2017, 2022; Dart et al., 2022), Australia's groundwater management stays fractured and inconsistent across jurisdictions despite decades of reform. The mining sector remain frees from normal water entitlement systems, which reduces transparency and fair resource management, and over-extraction and rising salinity persist despite sustainability targets (PC, 2023). A weakening of environmental impact assessments and policy settings that lower responsibility include self-regulation and post-approval condition-setting (Dart et al., 2022; Pointon & Rossini, 2020). Sustainable diversion limits (SDLs) were introduced by the Murray-Darling Basin Plan (2012) and the Water Act 2007 to help to slow groundwater depletion (MDBA, 2024). But limited efficacy of enforcement rules has meant over-extraction persists.

Though inconsistent approvals and poor compliance remain issues, the 2013 EPBC Act "water trigger" amendment expanded federal oversight to major coal and gas projects (Pointon & Rossini, 2020). The EPBC Act (1999) has also struggled to regulate environmental impacts on water resources due to data deficiencies, adaptive management loopholes, and weak accountability mechanisms (APEEL, 2017; Pointon & Rossini, 2020). Post-approval condition-setting allows impact assessments and mitigation measures to be deferred until after project approval, reducing oversight and transparency (Reynolds, 2023; Dart et al., 2022). Additionally, the lack of a public merits review process for ministerial decisions further undermines regulatory accountability (Pointon & Rossini, 2020).

The mining industry continues to bypass standard water entitlement and planning frameworks under the NWI (PC, 2017, 2022). While some jurisdictions, such as the Northern Territory, have integrated extractive industries into legislative frameworks, Queensland continues to allow unlimited groundwater extraction for resource projects under separate "associated water" rules (PC, 2017, 2022; Robertson, 2020). Unlike other users, companies only require impact reports and "make good" agreements instead of standard licensing (PC, 2017). Under Queensland's Water Act 2000, for instance, the Adani coal mine was awarded a long-term associated water licence (until 2077), allowing unhindered groundwater extraction (PC, 2023). This generates an unfair playing field, burdening other water users and lowering water governance transparency (Robertson, 2020).

In Western Australia, the state government approved Alcoa's bauxite mining near Serpentine Dam, despite warnings from the Water Corporation and environmental regulators about risks to Perth's drinking water (Milne, 2024; Pin, 2025). Documents reveal concerns over sediment runoff, chemical spills, and PFAS contamination, which could render the dam unusable for years, costing $2.6 billion to restore, and negatively impact Perth's water supply, including for drinking water use (DWER, 2023; Milne, 2025).

Despite the numerous warnings and red flags, the mining activities were approved by the WA Government in December 2023 (Pin, 2025). Although the EPA started a supposedly independent review, Alcoa was ultimately given an exemption to carry on business, a move that ought to be forbidden by state law (Milne, 2024). Critics contend the changes benefit Alcoa over water security, and in doing so they compromise Perth's main water supply with potential long-term contamination even while the government claims it strengthened protections (Milne, 2024; DWER, 2023).

To stop more depletion and contamination of our water supplies, stronger environmental protections, regional extraction limits and independent monitoring are absolutely vital. Australia's groundwater resources will remain vulnerable without more strict control, enforcement, and integrated management, so endangering long-term water security and environmental sustainability.

Impacts on ecosystems

As climate change speeds up changes in the global water cycle and increases the severity of droughts, worries about water security are growing (Lawrence et al., 2022). Rising temperatures and changes in rainfall and runoff patterns pose serious risks to the health of freshwater ecosystems, which are particularly vulnerable to climate change. (Thompson et al., 2024). Human consumption, socioeconomic factors, and governmental policies all have an impact on water availability in addition to climatic conditions (Huang et al., 2021).

Through catchment runoff interception, surface water withdrawals, dam-regulated river flow, and groundwater extraction, human activities worsen ecosystem stress and water scarcity by upsetting surface-groundwater interactions (Bond et al., 2019; Thompson et al., 2024). These stresses endanger freshwater biodiversity, diminish stream flows, and deteriorate habitat and water quality (Athukoralalage et al., 2024; Bond et al., 2019).

The 1991 blue-green algal bloom, which spanned 1,000 km and reduced the diversity and abundance of native fish, was caused in part by extensive water extraction for irrigation along the Darling River (Grafton et al., 2022). A string of devastating fish kills along the lower Darling River took place in the summer of 2018–19. This resulted from upstream irrigation diversions and drought-induced blue-green algal blooms, which led to oxygen depletion (Vertessy et al., 2019). The MDB's ecosystems were also made vulnerable by the Millennium Drought (1997–2009), which demonstrated how natural and human factors combine to exacerbate water scarcity. Average annual flows fell to 2,445 GL between 2001 and 2009, which is 82% less than the average of 13,830 GL for the 20th century (Van Dijk et al., 2013). Water allocations prioritised high-security users, like water utilities and irrigators of high-value crops, while lower-security users and river ecosystems suffered the most (CSIRO, 2010; Van Dijk et al., 2013). This decline was largely caused by over-extraction (Van Dijk et al., 2013; MDB Royal Commission, 2019).

During the Millennium Drought, decreased streamflow had detrimental effects on the environment. Long-term low flows caused widespread dieback in floodplain forests, eutrophication, elevated salinity, and deteriorating ecological health (Bond

et al., 2019; Mosley et al., 2023; Van Dijk et al., 2013). Long-term ecosystem resilience was weakened by the decline in fish, waterbird, and aquatic plant populations (Grafton et al., 2022; Van Dijk et al., 2013).

The MDB's ecosystems continue to deteriorate even when there is no drought. An indicator of the health of the basin is the Coorong estuary, a Ramsar-listed site at the MDB's terminus (Brookes et al., 2023). Significant degradation has occurred in this ecosystem, as evidenced by algal blooms, macroinvertebrate losses, hyper-salinity, and decreases in the numbers of waterbirds and aquatic plants (Mosley et al., 2023; MDB Royal Commission, 2019).

Within a certain range, certain ecosystems might be able to tolerate declining conditions and even recover when conditions improve. However, unsustainable water extraction practices and ongoing environmental degradation can force ecosystems into drier states from which recovery might be difficult if not impossible (Grafton et al., 2022). Long-term water scarcity raises the possibility of ecological collapse by endangering the stability, structure, and function of freshwater ecosystems (Bond et al., 2019).

Agriculture and water

The agricultural sector is a major contributor to Australia's economy, with the industry forecasted to reach AUD 88.4 billion by 2024–25 (ABARES, 2024). With 70% of agricultural output exported, Australia plays a crucial role in global food security (ABARES, 2024). Agriculture is also Australia's largest water consumer, accounting for 73% of total water use—equivalent to 5.7 million megalitres allocated to irrigated agriculture in 2020–21 (ABS, 2022). The Murray–Darling Basin (MDB) is the country's most productive agricultural region, containing 60% of Australia's irrigated land and using 62% of total irrigation water in 2020–21 (ABS, 2022). It supports 40% of Australia's farming land and generates approximately $30 billion annually, underscoring its economic and agricultural significance (MDBA, 2024).

However, the sector faces multiple, often conflicting challenges—the need to increase productivity and profitability while reducing its environmental and water use footprint (Maraseni et al., 2021). These challenges are further exacerbated by climate change, which disrupts rainfall patterns and water availability, alongside government policies on water management and climate adaptation (Coles & Camkin, 2023; Shemer et al., 2023; Maraseni et al., 2021). Droughts and evaporative losses are becoming more frequent, driven by record-breaking temperatures. The 2016–2019 drought, one of the hottest and driest on record, saw national rainfall drop to 277.6 mm in 2019—40% below average (Bureau of Meteorology, 2020). These conditions severely impacted irrigated agriculture, particularly in the MDB, where large portions of the basin were drought-declared, leading to reduced water allocations and sharp declines in agricultural production (Coles & Camkin, 2023).

Water markets in agriculture

The NWI introduced a market-based system for water management, shifting away from administrative allocation to an economic approach that allows water trading—where water can be bought and sold independently of land ownership (PC, 2024; Poddar et al., 2014). This has transformed water into a valuable asset, with

entitlements in the southern MDB now valued at over $26 billion (PC, 2020). The water market has enabled water use to align with market opportunities, encouraging on-farm efficiency improvements—such as adopting irrigation methods that use less water for similar outputs—freeing up water for other agricultural and environmental purposes (PC, 2020). However, while the water market has been effective in improving economic efficiency, concerns remain about whether market-driven mechanisms alone can balance social equity and ecological sustainability (Poddar et al., 2014).

There are substantial concerns about the broader social and economic impacts of water trading, particularly for third parties and local communities. While structural adjustment in Basin communities has largely been driven by broader economic and industry trends, water purchases have added further pressure, especially in rural and remote irrigation-dependent regions (PC, 2024; Wheeler et al., 2024).

When water is traded out of certain areas, it can concentrate withdrawals in regions traditionally engaged in low-value agriculture, increasing the risk of stranded assets, economic decline, and social dislocation (Poddar et al., 2014). The end result of this is not only threatening the viability of irrigation but also negatively impacting other industries. These broader scale impacts have the potential to devastate communities that rely on the Murray-Darling system if not properly managed (PC, 2024).

Irrigation efficiencies

Many irrigation areas experience a "rebound effect," where efficiency upgrades intended to save water instead increase consumption and demand (Grafton & Wheeler, 2018; Richter et al., 2017). Water saved through efficient technologies is often reused to expand irrigated land, grow water-intensive crops, or intensify production, sometimes leading to higher total water consumption at the basin scale (Grafton & Wheeler, 2018; Koech & Langat, 2018). This increased consumption can reduce recoverable return flows, including groundwater recharge and river flows, ultimately worsening water scarcity (Richter et al., 2017; Wheeler et al., 2020; Owens et al., 2022). Despite over $12 billion invested in reducing agricultural water use through buybacks and efficiency measures, water scarcity remains a major issue in many parts of the MDB (Bond et al., 2019; Grafton & Wheeler, 2018).

Lobbying efforts from irrigators have influenced government subsidies for rebuilding or reconfiguring irrigation systems resulting in policies that only benefit certain groups rather than resulting in policies that result in tangible water savings (Alexandra & Rickards, 2021). There have also been similar concerns regarding the effectiveness of entitlement buybacks and efficiency measures, and the risk of large-scale government investments in irrigation upgrades resulting in minimal water savings is well-established (Grafton & Wheeler, 2018). The Commonwealth's funding is unlikely to result in significant improvements to irrigation system outcomes in the absence of clear governance procedures and strict enforcement (Alexandra & Rickards, 2021; Lee et al., 2009).

The Murray-Darling Basin Plan

The Murray-Darling Basin Plan has been a culmination of events and water policy reform that has occurred since the 1990s. Since then, there have been additional policy developments that are related to the MDBP, such as the Water Act of 2007, which created a framework for legislation to address excessive water use and environmental degradation (Colloff et al., 2024; Wheeler et al., 2024). This was expanded upon with the introduction of the Murray-Darling Basin Plan (MDBP) in 2012, a key component of which was the Sustainable Diversion Limit (SDL), which caps annual water extractions to maintain rivers, lakes, and wetlands (MDBA, 2024; PC, 2024).

Despite decades of reform, the environmental sustainability of the MDB continues to deteriorate (PC, 2024; Wheeler et al., 2024). Significant scientific evidence demonstrates that the Basin Plan has not delivered expected environmental benefits, especially regarding stream flows (Wentworth Group of Concerned Scientists, 2019; NRC, 2019; Colloff et al., 2024).

Key wetlands on the floodplain are not receiving regular connections, cease-to-flow events are too frequent in the northern Basin, and end-of-system flow targets are often unmet (PC, 2024). Excessive upstream irrigation extraction has led to low stream flows, which significantly contributed to water quality decline in the Lower Darling River, the mass fish kill of January 2019, and have had severe consequences for both communities and other ecosystems (PC, 2024; Wheeler et al., 2024; AAS, 2019). Some of the main issues include:

- State and Federal management issues: State water management shortcomings, a deficiency in federal leadership, and the deliberate undermining of the Plan by certain irrigators and state governments.
- Constitutional barriers: Federal constitutional limitations have created challenges for cohesive governance across jurisdictions (Wheeler et al., 2024).
- Disagreement on sustainable extraction levels: Consensus is hampered by conflicting water demands from industries, communities, and the environment (Wheeler et al., 2024).
- Delays in key measures: Less than half of the 605 GL/year supply measure offset has been achieved, and projects to ease river constraints are progressing slowly (PC, 2023).
- Missed targets: Despite being due in 2019, 10 of New South Wales' 20 water resource plans are still unfinished, and only 26 GL/year of the additional 450 GL/year of water recovery has been accomplished (PC, 2023).
- Monitoring and Compliance Challenges: Environmental water reporting and monitoring are inconsistent and opaque (PC, 2023). According to Colloff et al. (2024), there is currently no strict, responsible framework in place for assessing and disclosing environmental results. When reporting does take place, it frequently emphasises the volume of water delivered rather than the real environmental advantages attained (PC, 2023).

Several states and territories, including Victoria, Queensland, South Australia, and the ACT, have produced water resource plans in a reasonable timeframe, including

as it concerns accreditation and operation of the plans (PC, 2023). However, New South Wales' water resource plans have been regarded as lagging in their commitment to schedule. Despite this there have been no significant consequences for delays, which may be perceived as a lack of incentive for the state to uphold its requirements to producing water resource plans on time. The Basin Plan's objectives are also considered ineffective regarding accountability when it comes to states' inability to fulfil crucial supply projects (PC, 2023).

Water market integrity

Despite progress, barriers to effective water markets remain, including administrative inconsistencies, high transaction costs, delays in price information, and distrust due to hoarding and uncertainty (Poddar et al., 2014). Complex entitlement arrangements, lack of compliance, and instances of corruption have further eroded market integrity (Baird et al., 2021; Poddar et al., 2014).

The 2012 Basin Plan has faced strong criticism from the South Australian MDB Royal Commission for failing to address governance, compliance, climate change, Aboriginal engagement, water diversions, groundwater monitoring, and transparency (MDB Royal Commission, 2019; Grafton & Williams, 2019). The Commission found "gross maladministration," "negligence," and "unlawful actions" by Commonwealth officials in mismanaging billions in subsidies and grants intended for river replenishment and water buybacks (MDB Royal Commission, 2019; Baird et al., 2024).

Investigations have revealed political influence in irrigation subsidies, benefiting specific interests at the expense of public water reform objectives (Grafton & Williams, 2019). A 2017 ABC investigation exposed water theft, regulatory inaction, and poor government oversight in the northern MDB, further damaging public trust (Besser, 2017; Baird et al., 2021). Although the NSW ICAC (2020) found no corrupt conduct, it identified systemic failures, including decisions favouring irrigators over legislated water-sharing priorities.

Since the Basin Plan's implementation, poor oversight, inconsistent management, and weakened water reform efforts have undermined national water policy (MDB Royal Commission, 2019; PC, 2024). Restoring confidence in water markets requires stronger governance, transparency, and environmental protections to ensure fair and sustainable outcomes (ACCC, 2021).

Recent developments

The Water Amendment (Restoring our Rivers) Act 2023, passed by the Australian Parliament in 2023, gave Basin governments and communities more time, money, and flexibility to carry out the Plan (PC, 2024; Colloff et al., 2024). The legislation extends the deadline for the delivery of water infrastructure projects to December 2026 and for the recovery of water for the environment to December 2027 (DCCEEW, 2023).

However, the Productivity Commission's 2024 inquiry report warns that even with this extension, achieving the 605 GL/year supply measure offset remains unlikely (PC, 2024). According to Colloff et al. (2024), the Act contains no provisions for

increased accountability in the reporting of environmental data. It will take renewed coordination, increased accountability, and dedication from all stakeholders to address these ongoing issues.

Recommendations for future policy directions

Improving water quality

Addressing water quality issues requires proactive monitoring, disaster preparedness, and cross-agency collaboration to manage emerging threats. Key prevention strategies include surveillance of environmental exposures and disease outbreaks, immunisation against waterborne illnesses, and investment in secure water, sanitation, and electricity infrastructure (Lansbury Hall & Crosby, 2022).

Climate adaptation is essential, particularly for remote communities, where Indigenous-led approaches can integrate health prevention with cultural, environmental, economic, and social priorities (Green & Michin, 2014). Recognising and applying Indigenous ecological knowledge can improve water management, community resilience, and overall well-being (Lansbury Hall & Crosby, 2022; Green & Michin, 2014).

Significant knowledge gaps remain in understanding the biogeochemical processes that influence water quality, particularly under climate variability and change. Further research is needed to improve water quality models, incorporating the interconnectivity of surface waters, floodplains, and groundwater, as well as multiple water quality threats (Beavis et al., 2023).

A renewed and updated NWI will be crucial for helping governments navigate growing water security challenges. Addressing disparities in water access between rural and metropolitan areas must be a key priority in achieving equitable water security (Thompson, 2006; PC, 2024). A nationally consistent framework for planning, markets, and regulations is needed to optimise economic, environmental, social, and cultural outcomes while ensuring climate resilience for entitlement holders, communities, and ecosystems (PC, 2024).

Groundwater

To guarantee sustainable groundwater use, a redesigned National Water Initiative (NWI) must incorporate climate resilience, Indigenous water rights, and more robust compliance procedures. Improved oversight, sustainable extraction limits, and increased regulation are necessary to address these issues. Priority areas include:

Strengthening groundwater management

- Eliminating Industry Exemptions: In order to ensure that all users adhere to the same entitlement and regulatory frameworks, the NWI should be updated to remove any special provisions for the mining and petroleum industries (PC, 2023).
- Mandatory metering and reporting – Require all groundwater users to obtain licences, track usage, and report consumption to improve transparency and accountability (Robertson, 2020).

- Enhance compliance enforcement – Allocate state and federal resources to prevent over-extraction and improve monitoring and enforcement (Cook et al., 2022).
- Sustainable extraction limits: The implementation of groundwater caps per catchment will need strict enforcement to protect water-dependent ecosystems and species (Pointon & Rossini, 2020).
- Adaptive groundwater management: risk-based strategies accounting for year-to-year variability and long-term climate change impacts will need to be applied (Barron et al., 2011).

Improving groundwater quality protections

- Enhance EPBC Act water trigger – all activities with significant groundwater impacts must be properly assessed with no exceptions (Pointon & Rossini, 2020).
- Integrated bioregional assessments – Ensure regulatory planning is appropriate to regional scales (Pointon & Rossini, 2020).
- Strengthen disposal regulations – controls on the discharge of treated co-produced water will need to be enhanced and strictly regulated without exceptions to prevent long-term ecosystem harm (Peng et al., 2022).

Strengthening governance and accountability

- Establish an independent Commonwealth Environmental Protection Agency – Improve regulatory oversight, enforce compliance, and strengthen environmental protections (APEEL, 2017).
- Reinstate the National Water Commission – Restore independent research and oversight using a consistent, transparent, and scientific approach (Wheeler et al., 2024).
- Increase collaboration with Traditional Owners – Ensure Indigenous water values are embedded in governance structures (Nelson, 2019).
- Transparent data-sharing – national groundwater databases will need to be developed and shared with relevant stakeholders to support informed decision-making (Nelson, 2019).

Expanding water banking and managed aquifer recharge

This strategy reduces climate variability, stabilises water supplies, and improves drought resilience (Page et al., 2023). Managed aquifer recharge (MAR) initiatives should be expanded in order to replenish over-extracted aquifers and store excess water for later use (Schuster et al., 2020; Dillon et al., 2010). This would include the creation of a national policy framework to facilitate the integration of MAR into larger water management plans by establishing uniform legal rights for recharge, storage, and recovery (Page et al., 2023), as well as government support through financial incentives for water banking to facilitate pricing schemes that promote water recovery during dry spells and storage during rainy years (Gonzalez et al., 2020).

Adaptive water management is limited by the lack of development in groundwater trading and regulation, despite some advancements in recycling, MAR, and water allocation reductions (Cook et al., 2022; Schuster et al., 2020; Robertson, 2020).

Securing Australia's groundwater resources requires proactive water management, research funding, and an open, science-based regulatory process. To guarantee long-term water security and environmental resilience, it will be essential to close policy gaps, bolster enforcement, and adopt sustainable extraction methods (Dart et al., 2022).

Ecosystems

Responsibly managing ecosystems, including natural water resources such as basins, lakes, flow-stressed rivers, and estuaries, requires a coordinated, catchment-wide approach that fosters collaboration across local, state, federal, and international levels (Gawne et al., 2020; Wheeler et al., 2024). Governance frameworks must be updated to promote sustainable water use and implement fair, efficient, and effective allocation reforms (Colloff et al., 2024). Effective management should diversify water sources, incorporate non-conventional options, and implement both voluntary and mandatory conservation measures (Tzanakakis et al., 2020).

Federal legislation, including the Water Act and the Basin Plan, enables intervention in transboundary water governance, allowing for the nationwide management of the MDB. This includes restoring and protecting flow-dependent ecosystems from climate change and other threats, as well as establishing an environmentally sustainable level of take and a sustainable diversion limit (Colloff et al., 2024). The Australian Government also holds significant responsibility for protecting nationally significant environmental values, including Ramsar wetlands, endangered species, and international treaty obligations, and has the authority to act in their defence (Wheeler et al., 2024).

Restoring whole-of-catchment environmental flows and connectivity is crucial to mitigating water scarcity and its widespread impacts on food security, human health, economic development, and ecosystems (Huang et al., 2021; Lake et al., 2017). However, achieving this remains a major challenge, requiring political action to address water demand, land use changes, and climate-driven stressors (Thompson et al., 2024).

Agriculture

- Careful Planning for Water Recovery Programs: The design and staged implementation of water recovery programs must be carefully considered to minimise negative impacts. Future water recovery efforts should be accompanied by a commitment from governments to support affected communities in transitioning to a future with less available water (PC, 2024; Wheeler et al., 2024).
- Balancing Irrigation Efficiency with Environmental Conservation: A balanced approach is needed to improve irrigation efficiency while supporting environmental conservation, such as groundwater recharge and maintaining stream flows (Koech & Langat, 2018). Water-efficient technologies alone cannot reduce basin-scale consumption; they must be combined with conservation incentives and regulatory limits on water

allocation to be effective (Grafton & Wheeler, 2018; Alexandra & Rickards, 2021).

- Shifting to Proactive Water Management: Government policy must shift from crisis management to proactive and strategic risk management to help farmers, their families, and rural communities prepare for future challenges, rather than waiting until a crisis occurs to provide support (Kiem, 2013).
- Ensuring Transparency in Regulatory Decisions: Regulators must ensure transparency in decisions regarding who bears the costs and losses of irrigation infrastructure upgrades and changes in water consumption (Owens et al., 2022). Decision-making should account for water-dependent environments, ecosystem services, key drivers of change, and affected communities, ensuring their inclusion in the process (Owens et al., 2022).

The Basin Plan

Strengthen water recovery efforts:

- Put into practice a new water recovery strategy with quantifiable goals (PC, 2023).
- Restore voluntary water purchases, remove the buyback cap from 2015, and redirect funds from efficiency and supply projects to voluntary buybacks (PC, 2023; Wheeler et al., 2024).
- To avoid more delays, it is imperative that unfinished NSW water resource plans be finished and accredited (PC, 2023).
- Make sure states fulfil their obligations; if they don't, funds will be withheld (Wheeler et al., 2024).

Improve climate change integration:

- Embed best available climate science in the Basin Plan to guide water reallocation decisions (Wheeler et al., 2024).
- The 2026 review of the MDBA should evaluate the effects of climate change on water resources and suggest any necessary changes (PC, 2023).
- To gauge the resilience of ecosystems that depend on water, set clear goals and metrics (PC, 2023).

Strengthen governance and compliance:

- The National Water Commission should be reestablished for impartial supervision (Wheeler et al., 2024).
- With adequate funding and enforcement authority, the Inspector-General of Water Compliance should be strengthened (Wheeler et al., 2024).
- Increase water audits and accounting, working with states to monitor with satellite data (Wheeler et al., 2024).
- Make government funding decisions clearer and project information more publicly available (PC, 2023).

Promote equity and cultural water justice:

- To ensure real consultation and shared decision-making, strengthen the role of First Nations in Basin governance (PC, 2023).
- Integrate Indigenous water rights into allocation frameworks to address issues of cultural water justice (Wheeler et al., 2024).

Increase market transparency and accountability:

- Review water trading rules and allow the ACCC to assess regulations independently (PC, 2023).
- Ensure that data, modelling outputs and research used to make decisions is made publicly available and shared with stakeholders for feedback and input (PC, 2023).
- Enable MDBP outcomes to be measured by strengthening monitoring, evaluation, and reporting (PC, 2023).
- Funding for supply projects that are judged unfeasible should be suspended, and their cost-effectiveness should be reevaluated and where possible they should be optimised to run in cost-effective ways that demonstrably lead to improved outcomes (PC, 2023).

These changes should be implemented as soon as practicable to ensure long-term water sustainability throughout the Basin. Doing so will also restore trust, efficacy, and efficiency in the MDBP by tackling these governance, climate, equity, and transparency issues.

coastal erosion

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The protection of the Australian coast is of immense significance. Stretching 36,000 kilometres, Australia's coast is home to 87 percent of Australia's population. (Clark, Fischer & Hunter 2021; Laubenstein et al. 2021). Its environment is diverse, consisting of sandy beaches, dunes, mangroves, salt marshes, gulfs, bays, seagrass beds, estuaries, and wetlands (Gurran 2021). Coastal habitats and wetlands, such as reefs, mangroves, saltmarshes, and seagrass meadows are home to a multitude of species and are vital for filtering water coming off land and down rivers, and removing sediments, nutrients, and other pollutants (Laubenstein et al. 2021). These ecosystems are highly effective carbon stores, responsible for capturing millions of tonnes of carbon per year (Serrano et al. 2019). Wetlands also help to protect the coast from erosion, stabilise sediments, hold shorelines in place, dissipate storm surges through the absorption of flood waters, and reduce wave energy, helping to protect valuable coastal infrastructure, real estate, and other assets, substantially reducing the damage costs of storms (Carnell et al. 2019 as cited in Laubenstein et al. 2021). Furthermore, the coast is the focus of many industries, making it a vital part of Australia's economy (Laubenstein et al. 2021). For example, boating infrastructure, transport of freight and passengers, and ship building and repair, are worth $7 billion to Australia's GDP, while coastal and ocean tourism inject $25 billion domestically, and $5 billion internationally, into the economy (Clark, Fischer & Hunter 2021; Laubenstein et al. 2021).

The Australian Government is obligated by international agreements to take measures to protect the coast. Indirect measures include the reduction of emissions and creation of National Adaptation Plans to respond to the impacts of climate change (the Paris Agreement 2015); the implementation of disaster risk reduction measures (the Sendai Framework for Disaster Risk Reduction 2015-2030); and the prevention of ocean pollution (International Convention for the Prevention of Pollution from Ships 1973).

Direct measures include the protection of wetlands through the Ramsar Convention on Wetlands 1971, the protection of specific coastal heritage sites such as the Great Barrier Reef through the World Heritage Convention 1972, the protection of coastal ecosystems through the Convention on Biological Diversity 1992, and the protection of the marine environment through the United Nations Convention on the Law of the Sea 1982 (Clark, Fischer & Hunter 2021; Gurran 2021; Laubenstein et al. 2021).

However, the effects of climate change are putting the Australian coast under severe pressure. Rising sea levels and sea surface temperatures, and increased intensity and frequency of extreme weather events are rapidly outweighing the direct effects of population and industry (Clark, Fischer & Hunter 2021; CSIRO & Bureau of Meteorology 2024; Gurran 2021). The global mean sea level has risen over 11 centimetres since 1970 and has been accelerating over time, amplifying the risk of storm surge, coastal inundation, erosion, and saltwater intrusion into groundwater systems (CSIRO & Bureau of Meteorology 2024). Although assessments of the condition of beaches and shorelines vary, all are deteriorating due to sea level rise (Clark, Fischer & Hunter 2021). Additionally, between 1998 and 2019, over 11 percent of Australia's non-rocky coastlines displayed coastal retreat, with a majority of these coastlines exceeding recession rates of 0.5 metres per year (Bishop-Taylor et al. 2021). The southern Van Diemen Gulf coastline has been particularly impacted by coastal erosion, where an almost unbroken 100 kilometres of coastline has retreated by an average of 3.5 metres per year since 1998 (Bishop-Taylor et al. 2021). Localised areas within this hotspot such as Point Stuart have receded at even higher rates, up to a maximum of approximately 14.5 metres per year since 1988 (Bishop-Taylor et al. 2021).

Although current levels of inundation, erosion, and recession in Australia are dynamic but stable in many areas, they are expected to be significantly increased by sea level rise in all regions of Australia, especially coastal wetlands (Clark, Fischer & Hunter 2021). In addition, the 2011 National Coastal Risk Assessment estimated that the impacts of inundation and shoreline recession with a sea level rise of 1.1 metres, will affect 187,000–275,000 residential buildings, 5,800–8,600 commercial buildings. 3,700–6,200 light industrial buildings, and 27,000–35,000 kilometres of roads and rails, with an estimated replacement cost totalling around $164.2–226.7 billion (Clark, Fischer & Hunter 2021). Furthermore, since 1900, sea surface temperatures have risen by an approximate average of 1.1 °C, affecting the abundance and distribution of coral reefs, sea grasses, fish species, and seabirds. (CSIRO & Bureau of Meteorology 2024; Gurran 2021). Extreme weather events have also had significant impacts on Australia, such as the mass dieback of mangroves along 1,000 kilometres of coast in northern Australia as well as parts of Western Australia in 2016, and the 2019–2020 megafires, which devastated coastal habitats and ecosystems in south eastern Australia and is estimated to have had costs exceeding $100 billion (Clark, Fischer & Hunter 2021; Geoscience Australia 2024). The loss of coastal habitats also affects many species which rely on them, including species listed on the Environment Protection and Biodiversity Conservation Act (Clark, Fischer & Hunter 2021). For example, climate pressure's effects on seagrasses in south-eastern Queensland have affected dugong populations, which rely on

seagrass for food (Clark, Fischer & Hunter 2021). As climate change impacts are expected to drastically increase in the future, the loss of habitats and infrastructure will also worsen, while increasing the effects of coastal storms and causing significant environmental, social, financial, and legal risks to coastal populations (Clark, Fischer & Hunter 2021; CSIRO & Bureau of Meteorology 2024; Gurran 2021).

To better support Australian coasts, including coastal communities and ecosystems and industries that rely on coasts, the Australian Government must take leadership in coastal management through the creation of a national agency to set national standards and facilitate ongoing and consistent integrated coastal management.

Case Study: New South Wales 2016 East Coast Low

In early June 2016, the entire New South Wales coast was hit by an east coast low (Australian Institute for Disaster Resilience 2016). Characterised by extreme water levels and wave conditions, which have historically generated severe coastal impacts, it resulted in significantly elevated water levels along the open coast, widespread rainfall, strong winds and flash flooding, with rainfall adding to coastal inundation and flooding in certain coastal lagoons and river systems, such as Narrabeen and Terrigal (Australian Institute for Disaster Resilience 2016; NSW Department of Justice 2016). In exposed locations, the combination of high waves and elevated ocean water levels led to severe beach erosion along many parts of the coast (NSW Department of Justice 2016). Airborne Lidar data of 177 kilometres of sandy coastline revealed that a total of 11.5 million cubic metres of beach sand above mean sea level had been eroded (Harley et al. 2017). Collaroy-Narrabeen Beach and Wamberal Beach were particularly affected, with Collaroy-Narrabeen Beach experiencing coastal erosion levels at an average of 103 and a maximum of 151 cubic metres per metre shoreline, making it one of the most severe beach erosion events at Collaroy-Narrabeen Beach since 1976 (NSW Department of Justice 2016).

This event resulted in a significant State Emergency Service response, with 11,000 requests for assistance, 17 general rescues and 310 flood rescues (Australian Institute for Disaster Resilience 2016). In high-impact areas, efforts were made in collaboration with Fire and Rescue, the Rural Fire Service, the Police Force, the Ambulance Service, and Volunteer Rescue Association (Australian Institute for Disaster Resilience 2016). It caused two deaths and affected 600 houses and 130 businesses, with 81 businesses sustaining damage in the central business district of Picton (Australian Institute for Disaster Resilience 2016). The Insurance Council of Australia estimated its costs to be in excess of $304 million (Australian Institute for Disaster Resilience 2016).

Observations presented by Harley et al. (2017) of six representative embayed beaches (including Narrabeen-Collaroy) revealed rapid natural recovery of the coast in the 6 month period following the event, with 51 percent of eroded sand and 19 percent of eroded dune volume returning in the first six months. However, with ocean acidification and rising sea levels expected to place increasing pressure

on Australian beaches and sand dunes, there is an urgent need for action to prevent severe future damages (Clark, Fischer & Hunter 2021).

History of national policy to protect the coast

Responsibility for land planning and management, including of the coast, has been delegated to the state and territory governments under the Australian Constitution since 1901 (Wescott 2009). Despite this, since the 1970s, the Australian Government has played an important role in coastal policy development through a series of policy development and funding initiatives, and the provision of mechanisms to facilitate cooperation between the states over resource and environment management issues (Gurran 2021). In Sorenson's (1997) review of national and international efforts at integrated coastal management, he credits Australia, alongside the United States and the UN Regional Seas Programs, as one of the first adopters of integrated coastal management during the 1970s. However, since then, Australia has struggled to achieve intergovernmental integration between federal, state, and local governments. While state governments have created policies such as the NSW Coastal Management Act 2016, which aims to implement a sustainable and integrated approach to coastal management to mitigate risks from coastal hazards, there has been a lack of political will from the national government to implement federal integration (Laubenstein et al. 2021; Wescott 2009). Significantly, since the lapse of the Commonwealth Coastal Policy 1995, a policy that encouraged ecologically sustainable land use, the Australian Government has not had a national coastal policy (Dedekorkut-Howes, Torabi & Howes 2021). Furthermore, coastal initiatives and national focus on climate change have fluctuated with political will and whichever party has been in power, leading to an absence of consistent policy (Dedekorkut-Howes, Torabi & Howes 2021; Gurran 2021; Thom 2022). In these ways, national coastal policy has a tumultuous history, facing many obstacles to its implementation.

Current national policy to protect the coast

Australian coastal governance is shared between federal, state, and local government, although there is limited coordination between levels (Clark, Fischer & Hunter 2021). The Australian government has no coastal legislation, national policy, or management plan, and has not taken leadership in coastal matters (Elrick-Barr & Smith 2021; Harvey & Clarke 2019). Its responsibilities for the environment are limited to maritime areas of national sovereignty as well as 'matters of national environmental significance', which arise mostly from international treaties and international instruments relating to oceans (Gurran 2021). Federal Government responsibilities for 'matters of national environmental significance' are delegated under the Commonwealth Environmental Protection and Biodiversity Conservation Act 1999, and include world heritage properties, national heritage places, nationally threatened species and ecological communities, wetlands of international importance as listed under the Ramsar Convention, migratory species protected under international agreements, the Great Barrier Reef Marine Park, Commonwealth marine areas, water resources at risk of impact from coal seam gas development and large coal-mining development (Gurran 2021; Trebilco et al. 2021). In cases where these responsibilities

overlap with State environmental planning laws and processes, states require additional approval from the Australian Government Minister for the Environment (Gurran 2021).

Most responsibility for implementation of management and regulation of the coast is delegated to state governments, which generally have control of coastal waters for up to three nautical miles to sea, as well as responsibility for land use, control of coastal resources, planning, development, and management (Clark, Fischer & Hunter 2021; Harvey & Clarke 2019). Coastal management responsibilities are also delegated by the state to local governments, which do the majority of local planning and implementation (Harvey & Clarke 2019).

The absence of a national approach to integrated coastal management has resulted in policy reforms in New South Wales, Victoria, Queensland, and Western Australia (Clark, Fischer & Hunter 2021). These reforms include responses to improve integration, climate change adaptation, and coastal and marine environments (Clark, Fischer & Hunter 2021). While New South Wales, Queensland, South Australia, and Victoria have dedicated coastal legislation, Western Australia manages the coast through its planning legislation (Harvey & Clarke 2019). Major state coastal policies include the QLD Coastal Protection and Management Act 1995, the SA Coastal Protection Act 1972, the NSW Coastal Management Act 2016, and the Victorian Marine and Coastal Act 2018, while Western Australia addresses the coast through its Planning and Development Act 2005 (Clark, Fischer & Hunter 2021).

Australian Government efforts to meet international obligations

The Australian Government is working towards meeting its international obligations for coastal protection. It has taken steps towards the protection of world heritage properties, national heritage places, wetlands of international importance, nationally threatened species and ecological communities, migratory species and Commonwealth marine areas through its responsibilities under the Environmental Protection and Biodiversity Conservation Act 1999, creating a large network of coastal marine protected areas (Clark, Fischer & Hunter 2021; Trebilco et al. 2021). It is in the process of developing a national Sustainable Ocean Plan, National Climate Risk Assessment, and National Adaptation Plan, as well as already having created strategies and plans addressing the protection of the coast such as the Marine Bioregional Plans and National Biodiversity Strategy and Action Plan (Department of Climate Change, Energy, the Environment and Water 2021; Department of Climate Change, Energy, the Environment and Water 2024b; Department of Climate Change, Energy, the Environment and Water 2025a; Department of Climate Change, Energy, the Environment and Water 2025b).

However, although the Australian Government has taken steps to meet its international obligations, the levels and effectiveness of protection have been found to be inadequate (Clark, Fischer & Hunter 2021). The coast continues to deteriorate, while rising sea levels, temperatures, and increasing frequency and intensity of extreme weather events associated with climate change are expected to place significantly more pressure on the coast (Clark, Fischer & Hunter 2021).

State of the Environment 2021 Report findings show that although beaches and shorelines are in varying conditions, all are deteriorating due to sea level rise and human use of the coast (Clark, Fischer & Hunter 2021). With the exception of seagrasses, most coastal habitats, including mangroves, salt marshes, dune vegetation, and islands are considered to be in poor and declining condition (Clark, Fischer & Hunter 2021).

Case Study: Protection and Restoration of Australian Coasts

Coastal protection and restoration efforts in Australia involve both hard engineered structures and nature-based methods. Although hard engineered structures have traditionally been used to protect the coast, nature-based methods have been shown to have many advantages (Morris, Boxshall, & Swearer 2020). However, with the continued degradation of coastal habitats, nature-based methods require greater Government investment and support to achieve restoration at sufficient scales.

Hard engineered structures such as seawalls, groynes, and breakwaters have commonly been used in Australia to protect communities and coastal assets from erosion (Morris, Boxshall, & Swearer 2020; Morris et al. 2021). One example of seawall use in Australia is in the Gold Coast, where seawalls are constructed using large boulders buried under the sand along an approved alignment called the A-line, which was established by the Queensland Government following severe storm erosion in the 1960s and 1970s (City of Gold Coast 2024). The alignment's location is dependent on the presence of existing walls and placed to create a smooth line along the foreshore (City of Gold Coast 2024). Peel back projects are used by the City of Gold Coast to assess the condition of seawalls, in which the sand covering them is excavated for engineers to assess their condition and identify areas for maintenance, as recently undertaken through the Burleigh Heads and Rainbow Bay peel back projects (City of Gold Coast 2024). Due to the long growth and recovery periods of nature-based methods, hard engineered structures can be favourable in areas with little land between the shoreline and infrastructure, or areas with higher-intensity hazards (Morris et al. 2021). However, these structures can also cause damage to the coast by severing the transition between terrestrial and shallow marine ecosystems, resulting in a significant loss of natural habitats (Morris et al. 2021).

Nature-based methods include both hybrid and soft approaches and are aimed at the restoration of ecological processes and functions that provide coastal defence (Morris, Boxshall, & Swearer 2020; Morris et al. 2021). Hybrid approaches involve a combination of hard and soft engineering, such as the placement of rock sills in front of mangroves (Morris, Boxshall, & Swearer 2020). An example of a hybrid approach in Australia is the seeding of shellfish onto reef substrate (Morris et al. 2024). Notably, in 2020, 13 projects across Australia received funding under the Australian Government's $20 million Reef Builder program, which used over 98 tonnes of recycled shells to restore more than 40 hectares of lost shellfish reefs (Clark, Fischer & Hunter 2021; Department of Climate Change, Energy, the Environment and Water 2024a). Soft approaches such as beach scraping, sand nourishment, and dune management, only incorporate the restored habitat

(Morris, Boxshall, & Swearer 2020). For example, the Bayside Council's beach sand nourishment project in New South Wales, which involved the transportation of 20,500 cubic metres of sand from Kyeemagh to Brighton Le Sands to reform a 450 metre long beach area to help protect the foreshore and stabilise the area during the development of a long-term beach management plan (Bayside Council 2024).

Nature-based coastal defences are particularly beneficial because unlike traditional coastal protection methods, such as seawalls, breakwaters, and dikes, which have significant maintenance costs, natural habitats are able to self-repair after storm events and adapt to changes in climate (Morris, Boxshall, & Swearer 2020). For example, oyster reefs have been shown to have vertical reef growth at rates corresponding with sea level rise (Morris, Boxshall, & Swearer 2020). Furthermore, nature-based coastal defences have been shown to have significantly less costs than hard engineered structures. For example, a cost analysis of different erosion risk reduction options in Western Port Bay, Victoria found the most expensive hybrid mangrove option to be 3.5 times cheaper than a seawall (Morris et al. 2021). Significantly, in 2021, salt marshes and mangroves in Australia provided coastal protection values estimated to cost around $228 billion to replace with seawalls to provide the same benefit (Australian Bureau of Statistics 2022). However, most habitat restoration has been undertaken at scales too small to address degradation (Clark, Fischer & Hunter 2021). Furthermore, while most states have provided guidelines and support to local councils for undertaking coastal hazard assessments, considering nature-based options, and developing appropriate adaptation strategies, such as the Queensland QCoast2100 program, local government efforts to protect and restore the coast are often hampered by limited budgets, extensive areas of coastline to cover, and few professional staff (Clark, Fischer & Hunter 2021; Gurran 2021). Therefore, it is imperative that the Australian Government provides significant investment and support into coastal restoration efforts, particularly nature-based coastal defence, which plays a vital role in the protection of coastal communities and infrastructure (Laubenstein et al. 2021).

Critiques and proposals for national policy

Coastal management in Australia has often been criticised for its lack of national leadership, with many national enquiries and reports having recommended that the Australian Government play a more significant role in coastal management (Clarke & Harvey 2013). Key recommendations from previous Australian coastal enquiries to improve integration, cooperation, and coordination in coastal management, include the development of national coastal objectives and principles, federal coastal legislation and national coastal policy or strategy, as well as the establishment of an independent coastal council and an intergovernmental agreement on the coastal zone (Clarke & Harvey 2013).

Although localised coastal management can be advantageous for addressing the different climate, geomorphology, development patterns, exposure to extreme weather events, and pressures of each coast, it is not always effective (Elrick-Barr & Smith 2022). Depending on perceptions of and values relating to the coast, management responses and environmental outcomes can vary, leaving many

parts of the coast without adequate support (Dedekorkut-Howes, Torabi & Howes 2021; Elrick-Barr & Smith 2022). For example, while almost 87 percent of Tasmania's marine protected area is fully protected, the Northern Territory has no fully protected areas (Clark, Fischer & Hunter 2021). Furthermore, the inaction of state or local governments can undermine the adaptation strategies of neighbouring ones, as climate pressures often transcend boundaries (Dedekorkut-Howes, Torabi & Howes 2021). In addition, local governments are often restricted by limited state support and coordination, and, in some cases, they are directly hindered by state governments, such as local government attempts at implementing no-development zoning rules being overruled by states in favour of developers (Clark, Fischer & Hunter 2021).

Thom (2022) argues that despite federal legislation showing an enduring reluctance to provide sustained support to state and local governments, the significant effect that climate change is predicted to have on the coast offers new scope for engagement. Yet, without a national office dedicated to coast and marine police and management issues, progress will be impeded (Thom 2022). Similarly, Laubenstein et al. (2021) suggest that a national agency that coordinates coastal and ocean governance across all tiers of government and delivers programs at a large scale can improve integration and remove unnecessary complexity and conflicts between jurisdictions, allowing nationally accepted standards to be set, and keeping consistency in outcomes while allowing for flexibility. Shumway et al. (2021) also advocate for the development of a more cohesive strategy for coastal and marine management, including restoration, at all levels of government. They argue that the absence of national coastal management legislation or policy and lack of national coordination has caused restoration to be implemented primarily at the local scale, without the coordination and consistency necessary to address larger scale issues such as climate change mitigation (Shumway et al. 2021).

The establishment of a national agency to set standards and create national coordination through vertical integration between the federal, state, and local levels of government, as well as horizontal integration between neighbouring jurisdictions is necessary to avoid varying effectiveness of coastal management and to enable larger scale issues to be addressed. Importantly, findings from Dedekorkut-Howes, Torabi and Howes (2021) show that policy and plans for climate adaptation are more effective when they are consistent over time. However, regular changes of political parties and varying perspectives on climate change have led to reversals which undermine these policies and plans (Dedekorkut-Howes, Torabi & Howes 2021; Thom 2022). Thus, Dedekorkut-Howes, Torabi and Howes (2021) argue that bipartisan commitment and consistent political effort across the major political parties is required to achieve effective climate change adaptation efforts.

Recommendations

This policy report recommends that:

- A national agency or coordinating body is established to facilitate ongoing and consistent integrated coastal management
- National standards are created and upheld by this agency

- The Australian Government provides greater funding for nature-based coastal defence methods

Without national leadership, climate change impacts will continue to deteriorate the Australian coast, preventing the Australian Government from achieving its international obligations. Coastal management requires an integrated approach, with vertical cooperation between the different levels of government and horizontal cooperation between neighbouring jurisdictions. Adaptation efforts must be consistent over time to create effective outcomes. To do this, a national agency or coordinating body must be developed to create and uphold national standards, facilitate ongoing and consistent integration, and improve policy across federal, state, and local levels of government. It must focus on collaborative efforts, respecting state sovereignty on coastal matters while supporting such efforts through enhanced funding, the production of national frameworks, and cooperative efforts at all levels of government, with a key focus on allowing for coastal policy to effectively address climate change pressures and meet international obligations over the long term.

Due to the significant benefits of nature-based coastal defence, it is also imperative that the Australian Government provides greater funding and support into nature-based methods so that the restoration of Australian habitats can be undertaken at a sufficient scale.

the energy transition

fossil fuel subsidies and rebates

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In 2023, Australia had the highest per capita greenhouse gas emissions of all OECD member countries (Tiseo, 2024). Excluding land use, the country generated 527 MtCO2e, or about 1% of global greenhouse gas (GHG) emissions. This increases to 1.7 GtCO2e or 4.5% when including exported emissions (Grant & Hare, 2024). Thus, by global standards, Australia is a major contributor to climate change and global warming. The country's GHG emissions originate mainly from energy production, which in 2023 accounted for approximately 76% of domestic emissions (Grant & Hare, 2024). Fossil fuels contributed 65% of the total electricity generation, with coal providing 46%, gas 17%, and oil 2% (Department of Climate Change, Energy, the Environment and Water, n.d.a). In addition to the country's GHG emissions associated with domestic production and consumption (direct emissions) noted above, Australia is a large exporter of fossil fuels, which in turn further contribute to global emissions when these fossil fuel exports are used by other countries (indirect emissions). Between 2022 and 2023, the country exported over two-thirds of its fossil fuel production, including 89% of black coal, 73% of natural gas, and 97% of crude oil (Department of Climate Change, Energy, the Environment and Water, n.d.b). These exports are responsible for a total of 1.15 Gt of CO2, of which 430 MtCO2 is from metallurgical coal, 443 MtCO2 is from thermal coal, 231 MtCO2 is from LNG, 48 MtCO2 is from oil, and 46 MtCO2 is domestic emissions from extraction and distribution for exportation purposes (Grant & Hare, 2024).

At the same time, Australia is highly vulnerable to the effects of climate change. Rising sea levels, severe weather, storm surges, extreme heat, droughts and heavy rainfall are already a problem and likely to become more severe over the coming years. Thus, like other countries, Australia needs to focus on how to accelerate and shape the energy transition to combat climate change. However, to move in that direction, the country will need to address the challenges created by fiscal instruments such as the Petroleum Resource Rent Tax (PRRT) and Fuel Tax Credit Scheme (FTCS).

The PRRT is a tax that allows the country to benefit from oil and gas extraction and hence efforts to reduce the country's dependence on fossil fuels would negatively affect not only the country's external balance (due to lower exports) but also its fiscal position and hence its ability to provide services to the population. On the other hand, the FTCS provides businesses in certain activities with a refund of the fuel tax they pay, something that in turn encourages consumption of fossil fuels. Therefore, reducing the FTCS could make some activities unviable and hence face opposition from the parties benefiting from the subsidy. The PRRT and FTCS have roles across fossil fuel consumption, production and revenue raising, yet both of these instruments have potential economic risks in the context of a changing climate. The Australian government should therefore consider climate friendly revenue-raising alternatives that align with the Paris Agreement and mitigate the short-term negative economic impact of lowering Australia's dependence on these taxes.

Australia's climate change policies

Under the Paris Agreement, Australia has committed to submit emissions reductions targets consistent with an increase of global temperature below 2°C above pre-industrial levels. In this regard, the government has developed a "Net Zero Plan" which aims to reform six key sectors (Department of Climate Change, Energy, the Environment, and Water, 2025):

- Electricity and energy
- Transport
- Industry
- Agriculture and land
- Resources
- The built environment

The Net Zero Plan's efforts are complemented by the Climate Change Act 2022. This bill, which was approved by the Senate in September 2022, outlines Australia's greenhouse gas emissions reduction targets consisting of (i) a 43% reduction from 2005 levels by 2030 and (ii) net-zero emissions by 2050 (Australia Office of Financial Management, 2022). A key element of these efforts regards energy production. Indeed, the government aims to generate 82% of the country's energy from renewable sources by 2030 and is heavily investing in electricity network updates to facilitate the energy transition (Australian Government, 2024).

Likewise, the Future Made in Australia (2024) agenda allocates funds to aid Australia's net-zero economy transition. AU$22.7 billion will be allocated in building capacity in areas such as skill and training workforce, renewable energy, supporting investments, and natural resource and critical minerals, and industrial innovation and technology (Australian Government, n.d.). Key funding allocations include:

- $11.4 billion for renewable energy
- $8.71 billion for critical minerals
- $1.03 billion for quantum computing and geoscience
- $641 million for sustainable workforce training
- $189.2 million to attract investment in renewables (Nedopil & Zhang, 2024)

However, Nedopil & Zhang (2024) argue that despite these investments, the agenda does little to reduce Australia's reliance on fossil fuel exports.

Fossil fuels and the economy

Australia's fossil fuel taxation mechanisms play a significant role in the country's economy. The Petroleum Resource Rent Tax (PRRT) and the Fuel Tax Credit Scheme (FTCS) influence fossil fuel market prices, and consumption, and consequently, affect GHG emissions. For example, the PRRT, designed to ensure that Australia raises revenue from fossil fuel extraction by taxing resource rents, now raises concerns about LNG production decline in government revenue-raising. Likewise, the FTCS has provided a significant amount of rebates to fuel-intensive industries, something which has been highly criticised. This is motivated by the fact that Australia collects relatively low revenue in comparison to other global fossil exporters. Ultimately, both of these fiscal policies promote fossil fuel extraction with little return of investment.

Petroleum Resource Rent Tax (PRRT)

The Petroleum Resource Rent Tax Act 1987 is a profit-based tax applied to the recovery of all marketable petroleum commodities (Australian Taxation Office, 2009). The PRRT relies on a 40% tax on petroleum, gas, and condensate, to ensure that Australia benefits from fossil fuel extraction (Thrower, 2024). As a profit-based tax, unlike royalty regimes, the PRRT applies to the profits derived from a petroleum project and not the volume or value of the petroleum produced (Australian Government, 2016). However, the tax is not applied to value products such as liquified natural gas (LNG) (Australian Taxation Office, 2009). The PRRT is assessed on an entity basis, paid within a financial year, and is deductible for income tax purposes (Australian Government, 2016). Since its first collection in the 1989-90 financial year through to 2015-16, the PRRT generated AU$33 billion in revenue for the Australian Government (Australian Government, 2016). However, revenue peaked at AU$2.4 billion in 2000-01 and has declined since. Additionally, the relationship between industry production and corporate tax contributions has weakened.

A controversial issue of the PRRT is the insufficient taxation of LNG. As the tax was originally designed for oil projects, it primarily targets the revenue raised from exploration and extraction. Consequently, LNG producers minimise their tax liability by valuing the gas before liquefaction. Therefore, nearly half of the resources are untaxed (Thrower, 2024).

Before 2015, corporate tax revenue from oil and gas closely mirrored PRRT revenue. If this trend had continued, the gas industry would have contributed an additional AU$14 billion in taxes in 2020–21 (Jericho, 2024). In 2022, Australia saw a surge in LNG exports, yet PRRT revenues remained a minor contributor to government income (Burke, 2023). Furthermore, fossil fuel production has declined, with coal production falling 3.4% and oil and gas output dropping 2.5% between June 2023 and June 2024 (Department of Industry, Science and Resources, 2024).

Australia is a major fossil fuels producer, yet by global standards its revenue-collection mechanisms are weak. In 2020, coal mine royalty payments averaged 9.8% of total export value. This was a higher yield in comparison to previous decades; however, it is below other global exporters. For example, Australia surpassed Qatar as the largest LNG exporter in 2020, yet the country collected $25.6 billion less in annual LNG royalties (Foote, 2021). Norway has taxed profits in its oil and gas sector at 78% since 1996, incorporating the 22% corporate rate and a 56% petroleum tax (Bleakley, 2022).

Concerns over the PRRT have fueled political debate. In 2023, the Labor Government responded to the Treasury Gas Transfer Pricing (GTP) review and the Callaghan Review by implementing eight of eleven recommended changes. One significant reform limited the proportion of PRRT assessable income that deductions can offset to 90%. Then Treasurer Jim Chalmers argued that these changes address the underpayment of LNG projects and are expected to increase tax receipts by AU$2.4 billion over the forward estimates (Chalmers, 2023).

However, the reforms have faced criticism. The Greens argue that the changes could result in lower revenue than projected and point out that the government collects more from student debt indexation than from fossil fuel corporate taxes (The Greens, 2024). The Australia Institute contends that the reforms are too mild and will not significantly boost PRRT revenue (Jericho, 2024). They suggest that adopting the Greens' proposed 80% cap on deductions would nearly double the projected revenue impact, raising AU$654 million annually. A stricter 60% cap could generate AU$7.8 billion more than the current plan between 2023-24 and 2026-27.

Contrarily, the Liberal Party has a different view on these reforms. They argue that higher taxes will increase costs for the resources industries and discourage investment. Especially in Western Australia, where resource exports support jobs and public services (Liberal, 2024). This was reflected when Shadow Treasurer Angus Taylor stated that raising taxes is not the solution for ensuring affordable energy (Karp, 2023).

Fuel Tax Credit Scheme

Historically, Australia has had a variety of tax and credit schemes for fuel. Before the introduction of the Fuel Tax Credit Scheme (FTCS), Australian fuel taxes were directed at diesel specifically. Fuel taxes in excise and customs regimes were introduced in 1957 to fund road construction. Subsequently, the Australian Bicentennial Road Development Trust Fund Act came along in 1982 also with an eye towards funding road construction. In parallel, the Diesel Fuel Rebate Scheme was introduced to provide tax credits for the off-road consumption of diesel. This would be excluding diesel and petrol from on-road fuel tax. And in 2006, the government consolidated fuel tax and excise credit in the Fuel Tax Act into the FTCS as it exists today (Pollard & Buckey, 2023).

Yet, the FTCS is criticised on a number of grounds including that (i) this tax break makes fossil fuel consumption cheaper exclusively for energy-intensive industries, i.e. coal mining (Campbell et al., 2024), therefore promoting consumption of fossil fuels; and (ii) the scheme has unclear objectives and beneficiaries. Whereas these

tax credits were initially intended to support regional Australia, there is limited evidence suggesting that this area benefits. Rather, the five industries that receive 90% of the value of credits have 60% of businesses and 67% of employees located in major cities (Terril & Bradshaw, The fuel tax credit scheme has no good rationale, 2023).

Moreover, the financial implications of the FTCS are significant and controversial. According to the Australia Institute, the FTCS is the largest tax rebate granted to fossil fuel industries, reaching a record AU$14.5 billion in 2023–24. Over the lifetime of fossil fuel projects, its projected cost is AU$65 billion (Campbell et al., 2024). To put this into perspective, this amount is 16 times the balance of Australia's Disaster Ready Fund and 6.5 times the size of the Housing Australia Future Fund (HAFF). The Federal Government's share alone is AU$54 billion—5.4 times the HAFF (Campbell et al., 2024).

Considering the large volume of resources dedicated to the FTCS, there is a debate among various political parties, industries, and interest groups considering the merits of its continuity. For example, in the 2019 Post-election report of election commitments, the Greens Party proposed abolishing the fuel tax credit for all industries except agricultural businesses. They argue that businesses' fuel demand is inelastic, and removing fossil fuel tax credits would not significantly reduce fuel consumption (Parliamentary Budget Office, 2019). Other interest groups have alternative proposals. For example, The Grattan Institute argues that on-road heavy vehicles should be paying the same rate as utes, vans, cars, and small trucks used by Australian businesses, whereas off-road vehicles and machinery should still be eligible for fuel tax credits but at a lower rate than now (Terrill, 2023; Terril, Burfurd, & Bradshaw, Fuelling budget repair: How to reform fuel taxes for business , 2023). Similarly to the Greens Party, the Australian Institute argues that the government should abolish the FTCS and other subsidies as these promote the production and consumption of fossil fuels Campbell et al., 2024).

In contrast, the Labor Party administration, has no apparent plans to alter the scheme despite pressure from the Greens and left-leaning think tanks. Following warnings from opposition leader Peter Dutton that the government might remove tax credits and impose a road tax on industry, Resources Minister Madeleine King reassured businesses that the Albanese government would not change the FTCS (Chambers, 2024).

To date, the Liberal National Party (LNP) has not explicitly stated its stance on the FTCS. However, the LNP supports expanding gas production and lowering energy costs in the short term while advocating for nuclear energy as a medium-term solution (Liberal, n.d.). The coalition has also pledged to subsidise fossil fuel industries, including funding for new and existing power plants (Morton, 2024).

Other conservative groups, such as the Mineral Council, are in alignment with a report from economist Chris Richardson, acknowledging that it is necessary to lower CO2 emissions. Yet, it is argued that abolishing the FTCS is not the way to do it. Rather than "one bird, one stone", it should be "two birds, two stones", meaning that avoiding taxes with the fuel tax credit regime and having an effective mechanism to reduce carbon emissions are two separate issues that require their

own respective policy measures. The report states that Australia already has a good policy structure around fuel tax credits and a safeguard mechanism for capping emissions of some 220 of Australia's largest mining, gas and industrial facilities (Richardson, 2024).

Climate change economic risks

The development of Australia's 2050 Net Zero Plan was a step in the right direction to fight climate change. However, a valid question that arises is whether the Plan is ambitious enough to contribute to the Paris Agreement objective of limiting global temperature rise to the 1.5°C or 2°C threshold. According to the Climate Action Tracker, Australia's Net Zero targets apparently are "insufficient." This conclusion stems from the fact that (i) the Net Zero objectives do not account for aviation and shipping CO_2 emissions, (ii) the Plan lacks comprehensive planning and transparency, and (iii) policies have not been fully legislated and hence approved. Current policies are projected to achieve emission reductions of only 17% to 21% below 2005 levels by 2030, excluding land use and land use changes (Climate Action Tracker, 2024).

Despite energy transition efforts, Australia remains the world's second-largest coal exporter, and in 2024, three more coal mines were granted extensions to operate for another 30 to 40 years (Climate Action Tracker, 2024). Maintaining strong ties with fossil fuel producers not only worsens climate change but also perpetuates GHG emissions through subsidies and tax rebates. A study by Arzaghi & Squalli (2023) estimates that countries with high-subsidy policies produce 11.4% more GHG emissions than those with high-tax policies. Therefore, maintaining large fossil fuel subsidies/rebates will continue to drive climate change and exacerbate risks associated with natural disasters.

The global cost of climate change is estimated to be between $1.7 trillion and $3.1 trillion per year by 2050 (Bennett, 2023). While climate justice discussions often focus on the vulnerability of lower-income economies to climate change, high-income countries like Australia also face significant risks. Not taking climate action may cost Australia between $1 trillion and $6.8 trillion by 2050 if there is a failure to adapt to climate risks (Australian Government, 2023; Investor Group on Climate Change, 2024). Climate change will likely affect key sectors such as labour productivity, infrastructure, and agriculture.

According to the 2023 Intergenerational Report, rising temperatures will increase safety risks. In a scenario where global temperatures rise by 3°C by 2100, Australia's national temperature is projected to increase by 1.7°C. Labour productivity will vary depending on the industry, with physically intensive jobs (e.g., machine operators and labourers) being the most affected (Australian Government, 2023). Due to intensified heatwaves, it is projected that by 2061, between 700,000 and 2.7 million additional workdays will be lost annually (NSW Government, n.d.).

Australia is also highly vulnerable to climate-related infrastructure damage, including rising sea levels, severe weather, storm surges, extreme heat, and heavy rainfall (Australian Government, n.d.). As oceans warm, the likelihood of stronger and more frequent storms, such as the recent Alfred Cyclone, increases (Climate

Council, 2025). In a high-impact scenario, over $226 billion in commercial, industrial, transport, and residential assets could be exposed to inundation and erosion hazards if sea levels rise by 1.1 meters (Commonwealth of Australia, 2011). According to the National Climate Risk First Pass Assessment, bushfires, grassfires, and air pollution remain Australia's most pressing climate risks in the short, medium, and long term (Australian Government, 2023).

Australia's agricultural sector is also at risk of climate change related factors such as increasing temperatures and declining winter rainfall. These climatic changes are estimated to reduce farm profits by 23% on average per year or about AU$29,200 per farm (Hughes & Gooday, 2021). On a seasonal basis, rainfall is estimated to reduce between 6.1% and 30.1% on average in a high-emission scenario. Additionally, climate catastrophes have the ability to intensify extreme climatic factors such as water scarcity, reduction in pollination, and pest infestation, which eventually threaten our food security (Australian Government, n.d.).

Recommendations

Since 2022, fossil fuel extraction has generated approximately AU$8 billion in revenue, rising to AU$12 billion when including fuel excise and customs duties (Burke, 2023). However, production has declined over the past year, with coal output falling by 3.4% and oil and gas production decreasing by 2.5% between June 2023 and June 2024 (Department of Industry, Science and Resources, 2024). Therefore, considering that Australia is experiencing low royalties and providing high-tax rebates, the country must review its economic policies. In a future where fossil fuel demand decreases, future schemes could be aligned with the Paris Agreement's objectives.

According to the International Energy Agency (2023), fossil fuel demand is expected to peak this decade. However, whether the energy transition will prove to be equitable or whether the renewables investments can match the fossil fuel revenues is yet to be seen (Joyce, 2024). Nonetheless, considering these social dimensions, Australia must explore alternative low-carbon revenue streams to ensure an effective transition.

There is a variety of different positions regarding Australia's sustainability policies and falls differently on the spectrum of fossil fuel reliance. The Greens advocate for a rapid transition and decarbonisation. Contrarily, the Liberals focus on solving the cost-of-living crisis via lowered energy prices sustained by the continued use of fossil fuels. And finally, Labour seeks to progressively phase out fossil fuels. The problem lies in costs and risks associated with climate change, and therefore, aligning with the Paris Agreement remains a priority as current efforts are insufficient to prevent global temperature rises exceeding 2°C (Climate Action Tracker, 2024).

Burke (2023) proposes alternative, low-carbon revenue-raising strategies that are cost-effective and may have higher social acceptance:

- Corporate Income Tax Reform – Targeting excess profits instead of standard business income can increase revenue without discouraging investment.

Implementing Allowance for Corporate Equity (ACE) would allow corporations to deduct equity returns before taxation, improving tax efficiency.

- Government Co-Investments – Expanding public-private co-investments, such as those managed by the Commonwealth Clean Energy Finance Corporation (CEFC), can promote industry growth and economic resilience.
- Industry Levies – Introducing targeted levies on emerging clean energy sectors (e.g., green hydrogen, ammonia production) could fund sector-specific research, development, and infrastructure.

By prioritising these strategies, Australia can reduce its dependence on fossil fuel subsidies while fostering a resilient, low-carbon economy. A well-structured transition will not only mitigate climate risks but also drive innovation, job creation, and long-term economic stability. A "just" transition is also needed to ensure multiple stakeholders and communities benefit from reforms. For example, it would be important to consider the local social impact of closing mines in the name of climate change. According to (Harrahill & Douglas, 2019) the transition needs to be planned in phases. The pre-transition phase will have to be dialogued with the local community with enough time and set timelines for when mines are closing. The transition phase should compensate workers and support them with the welfare state for new opportunities. This is reflected in the Future Made in Australia agenda when investing in workforce training, as the renewable energy industry could provide more jobs for those with transferable skills, and has been implemented partially through the Energy Industry Jobs Plan, the Net Zero Jobs Plan, and the Regional Workforce Transition Plans.

A study by the International Monetary Fund (IMF) analysed the barriers that countries experience when attempting to reform energy subsidies. Research finds that there are economic impacts and opposition from interest groups and good communication between the government and citizens is necessary to avoid unrest (Alleyne, et al., 2013). Considering the Liberal Party's perspective that higher taxes will increase energy costs (Liberal, 2024) and, therefore, increase inflation, it is necessary to ensure there is clear communication between each of the stakeholders. A just transition, good communication, and a step-by-step plan that outlines how the increased revenue will be used (from abolishing tax rebates), relieving cost-of-living pressures while investing in low-carbon economic opportunities, and offering alternatives to those dependent on fossil fuel economies would allow social cohesion and ease the transition towards a net-zero economy.

solar power

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Australia is bestowed with abundant renewable energy, including solar, wind and hydroelectric power. Being one of the sunniest countries globally, solar energy is a significant contributor to the energy mix. Australia has invested significantly in solar farms and residential rooftop solar systems, and also has a long coastline which helps to harness the wind energy through offshore and onshore wind farms. Hydro electric power, although limited, still contributes to the nation's energy mix (A. A. R. E. Agency, 2024).

Although Australia's renewable energy transition is gaining momentum, it has to overcome the biggest challenge of its reliance on fuels like coal and natural gas for electricity generation. With the country's state and federal government's drive to shift towards cleaner energy, there have been many initiatives underway to address the issue of climate change (C. E. Council, 2024b). Australia's National Energy Market (NEM) has been modernising the grid for the integration of renewable energies through the Integrated System Plans (ISP) (AEMO, 2025b). With the advancement in energy storage technologies to support grid resilience, Australia is showcasing its desire to adopt renewable energy technologies.

Australia has targeted to mitigate GHG emissions by 43% by 2030 under the Paris Agreement and achieve net-zero emissions by 2050. As a part of global renewable energy adoption, Australia has pledged to generate 82% of its electricity from renewable sources by 2030. There are several challenges Australia has to overcome to reach the set targets (Robertson, 2024). Australia's grid is old and unreliable, especially at places where renewable energy sources are abundant (Australia, 2020; Economy, 2024). There is significant investment needed to upgrade the grid to accommodate distributed energy sources. The high costs of transitioning existing fossil-fuel based industries and retaining the workers pose a significant socio-economic challenge. Furthermore, with the political changes there are policy changes that lack cohesiveness and long term energy transition further exacerbates these challenges (The University of Sydney & Institute, 2023).

Because of these and other challenges, there is concern that Australia will miss both the 43% reduction in emissions and the 82% renewable energy target by 2030 (Energetics, 2024).

In less than five years, Australia has doubled its share of electricity production from renewable energy sources. More than 3.6 million Australian households have installed rooftop solar showcasing their involvement in mitigating greenhouse gas emissions and helping Australia achieve its Renewable Energy Target (RET). Along with the states and territories, communities and households are also showcasing their interests in renewable energy adoption (D. o. C. C. Australian Government, Energy, the Environment and Water, 2024b).

Australia receives large amounts of solar energy compared to many other nations, however, harnessing this energy efficiently remains challenging. A study confirms that, if a PV power station in Central Australia considers 15% efficient PV panels, it has the ability to trap 1.05kWh/m^2/day of solar energy and could supply a continuous and uninterrupted energy of 44kW/m^2/day, while it can harness 32kW/m^2/day of energy considering transmission losses (Wright & Hearps, 2010; Trainer, 2012). The available solar radiation per capita is beyond par when compared to the rest of the world, which signifies Australia's ability to equip for energy requirements or demands (Mishra et al., 2012).

Australia's solar energy policies

Australia has implemented a range of policies to promote solar energy adoption and support a smooth and efficient renewable energy transition. Some of the initiatives provided by the Australian Government are the Renewable Energy Target (RET) and related Schemes (Australian Government, 2025). The RET is a long term policy which is strategically aimed at mitigating greenhouse gas emissions and adopting renewable energy sources, including solar energy to a larger extent. RET comprises two main components, which are:

- Large Scale Renewable Energy Target (LRET) - This aims to promote large scale renewable energy projects such as solar farms, with the objective to produce an extra 33,000 gigawatt-hours (GWh) of renewable energy every year from 2020 to 2030. The large scale energy producers are being provided with large-scale generation certificates (LGC), which they can trade in to assist the LRET.
- Small-scale Renewable Energy Scheme (SRES) - Small-scale Renewable Energy Scheme supports installation of small scale renewable energy systems (like rooftop solar panels, solar water heaters, etc) for residences and small businesses. These small scale installers are eligible for Small Scale Technology Certificates (STCs) to offset the costs of installation of their renewable energy systems.

The Australian Renewable Energy Agency (ARENA) provides funds for innovative renewable energy projects (including solar energy projects). It assists in increasing solar energy adoption into the grid by including hybrid energy systems and batteries. Additionally, ARENA aims to accelerate the development and

commercialisation of renewable energy projects in Australia (A. R. E. A. Australian Government, 2025).

State based solar policies

All the Australian states and territories have put forward energy policies in aiding the country's RET. These policies play a vital role in shaping Australia's energy mix while also achieving the Zero emission target that the country is aimed to achieve. Each state and territory has tailored its strategy to solar energy production depending on the available resources, needs and grid specifications. These approaches through policies include rebates, incentives, targeted programs to encourage solar energy, and battery storage adoption. Most Australian states and territories have some form of solar feed-in tariff, as well as other policies to support the uptake of solar installations.

New South Wales (NSW) (Government, 2024):

- Solar Battery Rebate Program: This program encourages installation of batteries and solar systems by providing rebates to help offset the upfront cost of installation. The battery helps to enable the use of stored solar energy during peak demand hours or during the absence of solar energy availability.
- NSW Energy Saving Scheme: This program offers financial incentives for energy-saving projects, such as the installation of solar power systems. By participating, households can earn Energy Savings Certificates (ESCs), which can be sold to energy retailers, helping to lower the cost of installing solar systems.
- NSW Renewable Energy Roadmap: NSW has targeted 12 gigawatts (GW) of renewable energy by 2030 as part of a larger renewable energy contribution. Solar energy system integration along with other renewable energy sources are considered to provide reliable energy to consumers.
- Solar for Low-Income Households: To guarantee fair access to solar energy, the NSW government has collaborated with non-governmental organisations to assist low-income households in installing solar panels. These initiatives aim to lower energy costs for vulnerable communities.

Victoria (Victoria, 2024):

- Solar Homes Program: This program provides rebates for roof top solar panels, solar hot water systems and solar battery installations. This rebate help in making solar energy more affordable for Victorian households and aims for over 1 million residential solar installations by 2030.
- Solar for Business: The Victorian government provided rebates and financial incentives to businesses for installing solar energy systems. This was to support small and medium-sized enterprises (SMEs) in transitioning to renewable energy, helping them lower their energy costs and reduce their carbon footprint. This program is now ended.
- State-Based Renewable Energy Target (VRET): Victoria has set an ambitious Renewable Energy Target (VRET) of 50% by 2030. Solar power provides a

significant share in the RET, the state government offers several schemes to align with this goal.

- Energy Efficiency Programs: To reduce overall energy consumption, Victoria has set up various energy efficiency programs. This program is also an initiative to promote solar energy adoption to decrease reliance on fossil fuels to mitigate greenhouse gas emissions.

Queensland (Government, 2024a, 2024b):

- Solar Bonus Scheme: offered a 44 cent per kilowatt-hour feed-in tariff. However, the scheme is closed to new applicants, but existing participants may continue to receive this rate until 2028. Alternative feed-in tariffs that are still ongoing include for South East Queensland and regional Queensland, however these are managed by electricity retailers.
- Battery Booster Program: provided rebates for Queenslanders to buy and install a home battery system. The program has closed and rebates are no longer available.
- Grid Integration and Energy Storage: Queensland has invested in integrating battery and large scale solar projects and solar farms into the broader grid. This has been guided by planning documents such as Queensland's SuperGrid Infrastructure Blueprint.
- Federal and private initiatives: Many support mechanisms for Queenslanders and local businesses are not driven by state-sponsored schemes but instead rely on federal programs or energy providers, an example of which is virtual power plants.

South Australia (G. o. S. Australia, 2024):

- 100% Renewable Energy Target: SA state has set an ambitious aim to achieve 100% renewable energy by 2030, with solar energy contributing its larger share. SA is amongst the leading states in solar and wind energy generation with already on-going large scale projects.
- Home Battery Scheme: This program encouraged the installation of batteries and solar systems by providing rebates which offset the upfront cost of the installation. This scheme is currently closed.
- Virtual Power Plants (VPPs): South Australia has been trialling and implementing Virtual Power Plants (VPPs). These VPPs combine solar panels and battery systems from various households to form a large, decentralised renewable energy source. VPPs assist in stabilising the grid and offer consumers an extra income by selling surplus stored energy.

Western Australia (G. o. W. Australia, 2024):

- Energy Storage Rebates: This scheme will provide rebates for solar battery installations to support the use of solar energy during peak periods and reduce grid dependency from July 2025 onwards.
- Energy Buy Back Scheme: The Distributed Energy Buyback Scheme (DEBS) provides eligible customers with payments for the electricity they export to

the grid, including energy from solar panels, batteries, and electric vehicles. This scheme was launched as part of the Energy Transformation strategy.

Tasmania (Quotes, 2025; Renewables, 2020):

- Energy Saver Loan Scheme: Tasmania provides incentives for energy saving initiatives which can include solar energy installations.
- Renewable Energy and Battery Storage: Tasmania is focusing on both solar power and energy storage. The state has been exploring opportunities to increase solar energy storage capacity to aid in mitigating carbon emissions and meeting renewable energy goals.

Northern Territory (CCA Tracker 2024):

- Home and Business Battery Scheme: Grants to support home owners and businesses to buy and install batteries and inverters with their rooftop solar systems. Eligible homeowners and businesses can access a grant of $400 per kilowatt hour of useable battery system capacity, up to a maximum of $5000.
- Remote Power System Strategy: Aims to deliver 70% renewable energy to remote communities currently provided electricity through the Indigenous Essential Services (IES) program. Delivery of the strategy is an action under the government's climate change response and a key pillar of the 50% by 2030 renewable energy target

Australian Capital Territory (CCA Tracker 2024):

- Achieving 100% renewable electricity and phasing out fossil-fuel gas in the ACT: The government has implemented a reverse auction process that achieved zero emissions from electricity by securing 100% renewable electricity from large-scale generators located across eastern and southern Australia as part of the National Electricity Market, with a legislated requirement to maintain 100% renewable electricity every year from 2020. The electrification pathway will be supported by continued growth and uptake of household and business solar systems and battery energy storage, as well as increased energy efficiency of buildings and appliances. The ACT's Integrated Energy Plan 2024–2030 sets out the next stage of work for the Territory's transition to an all-electric city over the next 20 years.
- Next Gen Energy Storage: The program supports the development of the energy storage industry in the ACT by providing a rebate to households and businesses for the purchase of a battery system that is coupled with solar panels. The program reached its target of 5,000 batteries and Is no longer accepting applications.
- Solar for Apartments Program: The program provides owners corporations up to $100,000 in grant funds and a zero-interest loan, to install rooftop solar on eligible apartment complexes in the ACT. This Program is co-funded up to $3.6 million under the Solar Banks Initiative of the Commonwealth Government and the ACT Government's Sustainable Household Scheme.

Analysis of Federal government solar policies

The Australian Government has implemented several key policies and mechanisms to promote renewable energy and support consumers facing high energy costs. These include the Large-scale Renewable Energy Target (LRET), the Small-scale Renewable Energy Scheme (SRES), the Australian Renewable Energy Agency (ARENA), Small-scale Technology Certificates (STCs), and the Energy Bill Relief Fund.

The purpose of LRET was to ensure that renewable energy was the main part of the national energy mix. With the aim of 33,000 GWh of Australia's electricity should come from renewable energy sources by 2020 in addition to an extended goal aligned with Australia's 2030 emissions targets. This target was achieved ahead of schedule by 2019-2020 and continues at the same level through 2030. It is also a major initiative to mitigate carbon emission in the electricity sector. LRET has created a wider impact in expanding large scale renewable energy projects like wind farms and solar power plants by providing incentives through renewable energy certificates (Australia Government, 2012). Although, it should be noted that investors in renewable energy projects rely on clear, concise and stable policies, there have been uncertainties noted in delivering this policy. There have been changes in LRET over time which includes reductions in renewable energy targets and adjustments to energy certificate systems prior to 2015, but the target has remained stable at 33,000 GWh since then. With the share of renewable energy boosting through this policy, integrating the variable energy share into the NEM along with ensuring the grid stability is a challenge (Australian Government, 2025; Borealis, 2024; Byrnes et al., 2013; Energetics, 2024; Tracker, 2024).

The Small-scale Renewable Energy Scheme has been crucial in the proliferation of rooftop solar installations across Australia, making renewable energy more accessible to households. It has driven the Australian solar market to become one of the largest in the world on a per capita basis. However, as more renewable energy systems, especially rooftop solar, are installed across Australia under the Small-scale Renewable Energy Scheme (SRES), the creation of Small-scale Technology Certificates (STCs) increases is managed through annual targets. This would result in an increase in the number of installations leading to larger demand for STC in addition to an increase in supply. This oversupply can drive down the value of the certificates, making them less financially attractive The number of STCs available decreases annually by design as part of the scheme's planned phase-out by 2030, which maintains market balance. As STC values drop decline annually by design, the upfront discount or financial incentive for consumers and installers becomes less substantial each year, which can discourage new installations, thus resulting in the unsustainability of this program because of this delicate balance and further making it challenging for increase in renewable energy adoption like solar roof tops encourages earlier adoption before the scheme concludes. Furthermore, SRES helps people install renewable energy systems by giving financial incentives, paid for by energy retailers who must meet certain renewable energy targets or obligations. However, these costs can end up being passed on to consumers through higher electricity prices though this represents a

small percentage of overall electricity costs. As more renewable systems are installed, the cost of these incentives may increase, causing electricity bills to rise, especially for low-income households. From July 2025, battery systems will be eligible under SRES but the government will directly purchase battery-related STCs, preventing additional cost pass-through to consumers. Overall, if this scheme is not managed properly, it could negatively impact energy prices making it harder for consumers to benefit from clean energy. (Analysis, 2023) (Alliance, 2024; Power, 2025; Tasman, 2011; Terrapon-Pfaff et al., 2014)

ARENA has been instrumental in driving forward key projects in Australia's renewable sector. It has supported solar, wind, bioenergy, and energy storage projects. It also has a pivotal role in funding research initiatives aimed at improving renewable energy technologies and energy efficiency. However, there were attempts to reposition ARENA's mandate during the Morrison government that were not well received by the public and rejected by the Senate. This attempted change focused on funding projects that include not only renewable energy but also technologies like carbon capture and storage, hydrogen production, and even some gas-related initiatives. Critics suggest that ARENA should focus on its main purpose of funding clean energy technologies, that directly help reduce carbon emissions, instead of supporting projects like gas, which do not align with long-term climate objectives. (Priorities, 2025) (Australia Government, 2025) (A. R. E. A. Australian Government, 2024a) (Foundation, 2021)

Small-scale Technology Certificates (STCs) have been created to provide an immediate financial benefit to individuals installing renewable energy systems, which has helped drive the uptake of rooftop solar across Australia. However, STCs may create long term sustainability challenges due to the increase in solar installations resulting in an overall increase in the cost of the scheme to the government and for electricity consumers. Additionally, due to the volatile market for STCs resulting in fluctuating values for the certificates, this uncertainty in financial incentives for installers and may cause resistance to wider solar energy adoption among some consumers (Jacobs, 2024).

The Energy Bill Relief Fund has provided essential financial relief to consumers, especially to vulnerable and lower income populations, which is very critical for the fund's success. Although it provides short term relief to consumers, critics claim that it does not address the root cause for rising energy costs like cost of transition to renewable energy or the inefficiencies of the energy market (Review, 2025) (Council, 2023).

Barriers for solar production

Although Australia is rich in solar availability, harnessing solar energy is a challenge. Australia has historically been dependent on cheap and easily available fossil fuels, making adoption of renewable energy slow to compete with other fuels in the energy mix. However, Australia has increased its solar energy share greatly, but as the energy harnessed from the Sun needs to be stored, solar energy uptake requires additional battery storage. Additionally, Australia's grid infrastructure faces challenges which makes it very difficult to efficiently manage and distribute

solar energy across such a large geographical area. Most of the large-scale solar farms are located in isolated areas where grid access is minimal (Engineers, 2025; Poddar et al., 2023; Saiprasad, 2019).

Despite the Government providing financial assistance and programs designed to assist low-income households with solar energy adoption, not all Australians have equal access to these opportunities. With financial institutions helping in larger uptake of solar installations and with available rebates set by the government, installation costs are still high for low-income families. This makes harnessing solar energy less affordable for these people, groups and communities. It is to be noted that some Australians may still lack sufficient knowledge or understanding of the benefits of solar energy and how to access government rebates, making it harder to reach full adoption potential. In the case of shutting down a coal or any fossil fuel plant, and building a solar farm instead, this can create social impact because of the lack of job availability for coal plant workers. Large-scale solar farms can sometimes face opposition from local communities due to concerns about land use, biodiversity impacts, and the aesthetic value of landscapes. In addition to all the aforementioned hurdles, the biggest challenge may be the inconsistency in energy policies set by the government. Feed-in-tariffs set by the Government is not in line with the available energy source: for example, for states like the Northern Territory, which have larger amounts of solar availability and land availability, feed-in-tariffs could be set higher compared to places that are colder and with less solar availability. Also, feed-in-tariffs undergo revision, for example the Government of Victoria is set to decrease the Feed-in-tariff 0.04 cents per kilowatt hour (kWh), which is much lower than the present FiT rate of 3.3cents/kWh (E. S. Commission, 2025). The electric price per KWh is comparatively higher than the FiT, which makes the cheaper and fossil fuel driven electricity more affordable than the returns that a household might get from solar energy installations.

Conclusion and recommendations

Although Australia has been using a larger amount of fossil fuels for its energy production historically, renewable energy has slowly been shaping its way to the larger amount of the country's energy mix. Supplementing these aspects, Australia is bestowed with rich natural resources like abundant solar radiation and wind speeds. Some of the initiatives that Australia can consider to better improved outcomes for solar energy adoption are:

- Modernising grid infrastructure and expanding energy storage solutions: Australia's grid is old and needs a complete overhaul. Australia has to prioritise grid modernisation which will aid in retrofitting of newer renewable energy systems. Investing in small grids with real-time solar management, encouraging virtual power plants to integrate distributed solar storage would make solar adoption easier.
- Strengthening Feed-in-Tariffs and introducing dynamic pricing: The government should introduce time-varying feed-in tariffs and extract more solar energy. The government must encourage solar exports when grid demand is high and set minimum FiT guarantees to protect small-scale solar

owners. This will provide reassurance for the small scale solar owners in investing more on solar energy. Better integrating grid systems and allowing the trade of solar energy by selling excess solar directly to neighbors and other persons or businesses in the grid should be encouraged.

- Assisting Battery and energy storage incentives: Initiatives like battery storage incentives and interest free loans for battery storage and grid linked battery rewards not only helps in increasing solar energy intake but also lessens the burden on the grid.
- Increased Large scale solar energy investment: Large scale solar energy investments particularly in Renewable Energy Zones (REZ) must be assisted with low-interest financing and fast-tracked approvals.
- Solar education programs: Australia must further concentrate on national solar education programs to ensure quality installations and informed decision-making, maximising the long-term benefits of solar energy.

Australia has already matured the adoption of solar energy compared to other renewable energy sources. However, due to the aims that Australia has put forward in achieving RET and Zero-emission targets, increasing solar energy adoption would be ideal. Australia has good land availability and solar energy availability, and exploiting solar energy would be comparatively easier compared to other sources, so therefore should be taken advantage of.

wind power

This chapter can be referenced as "Vassallo, P. (2025). Wind power. In B. Goodsell (Ed.), The State of Policy Report (pp. 93-104). The Climate Centre."

There is potential for wind power to be upscaled in Australia which can contribute more sustainably sourced energy to the national energy market (NEM). Hence, helping lower Australia's global emissions and aid in achieving the net zero by 2050 goal. Wind farms contribute 12% to the total electricity generation. Nevertheless, there is potential to increase the amount of wind power generated in Australia through the adoption of offshore wind farms (Australian Government 2023, Australian Energy Market Operator 2024). By building upon the wind energy sector that already exists, it has the potential to reduce the need for fossil fuels and support the transition to a renewable future. Australian wind farms produce large amounts of electricity due to the strong winds that it receives (Hallgren et al. 2014). Moreover, Australia's location lends itself to strong southerly wind gusts, which produce large amounts of energy generation. Thus, why most onshore wind farms are located along the coast in the southern region of Australia (Leslie et al. 2024). Onshore wind farms are used nationally in Australia, with a total of 114 wind farms in operation as of May 2025, totalling 15 GW of energy production (Open Electricity 2025). Additionally, Australia has very high quality and abundant offshore winds which could be tapped into as an energy source, and there is projected to be 5,000 GW of energy that could be harnessed from offshore wind farms (National Offshore Petroleum Safety and Environmental Management Authority 2021). Due to the large potential that wind can provide to the national energy market (NEM), Australia has some policies that aid in environmental protection from construction and operation of wind farms. As both onshore and offshore wind has the capacity to generate large amounts of energy, it is important that specific wind power policies exist in Australia to foster its development and growth to meet renewable energy and emissions targets. This development can also be encouraged through government financial agencies and other schemes that are put in place to aid financially, promote technological advancements, improve competitiveness and investment, and help proponents navigate complex governance and permit approvals. The federal government needs to enhance its policy position in order to take advantage of the positive benefits that will result from offshore wind farms being built.

Current Policies

Onshore

Onshore wind farm development in Australia is currently regulated by both the federal and state governments, with major overlaps in responsibilities and policies (Kallies 2021, Senate Select Wind Turbines Committee Secretariat 2015). Each state and territory has their own planning policies, regulations and laws, but all proposed projects need to be assessed under the Environment Protection and Biodiversity Conservation (EPBC) Act for potential environmental impacts through environmental impact assessments (EIAs) and social impact assessments (SIAs) (Australian Government 2022). The EPBC Act was created in 1999 as a key way to protect the unique Australian environment from construction and infrastructure (Australian Government 2024a, Australian Government 2022). This Act is the main national environmental legislation, which gives outlines and regulations for protecting and managing plants, animals, habitats and places (Australian Government 2024a). Furthermore, this policy requires proponents to have proposed actions that will protect any potential world heritage properties, national heritage places, Ramsar wetlands or places of international importance, listed threatened species and community, migratory species protected internationally, and commonwealth marine environments (Department of Environment, Water, Heritage and the Arts 2009). The Act also outlines the regulations in which proponents must adhere to when producing EIAs and SIAs (Department of Climate Change, Energy, the Environment and Water 2024). EIAs and SIAs act as documents that outline any potential harm to the environment or community that may occur during the construction and operation of wind farms (Department of Climate Change, Energy, the Environment and Water 2024a). These documents are either approved, approved with further requirements or can be rejected by the Commonwealth Minister (Department of Climate Change, Energy, the Environment and Water 2024a). There are governmental schemes and financial aids that proponents can have access to when needing assistance for constructing and operating onshore wind farms.

The Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA) provide financial support for renewable energy initiatives at various stages of wind farm development (Clean Energy Finance Corporation 2024, Australian Renewable Energy Agency 2024). The CEFC is a corporate commonwealth entity regulated by the Federal Government, with the purpose to increase and facilitate finance into clean energy generation and reduce Australia's emissions in the energy sector (Clean Energy Finance Corporation 2024). Whereas ARENA's purpose is to accelerate the shift to affordable and reliable renewable energy, through increasing competitiveness in the renewable technology space and increasing renewable energy supply in Australia (Commonwealth of Australia and Australian Renewable Energy Agency 2024). As such, both ARENA and CEFC have financially supported many onshore wind farm projects (Clean Energy Finance Corporation 2024, Commonwealth of Australia and Australian Renewable Energy Agency 2024).

The Australian Energy Market Operator (AEMO) released an Integrated System Plan (ISP) in 2018, to provide a national roadmap for electricity grid transformation (Australian Energy Market Operator 2024). The ISP focuses on many renewable energies, with wind as a major component in their plan to best support reliable and secure energy (Australian Energy Market Operator 2024). The ISP aims to optimise value to consumers and supply low-cost energy (Australian Energy Market Operator 2024). It plans to do this by working with the government and the private sector to design a low cost and secure energy system which is capable of meeting any emissions trajectory determined by policy makers (Australian Energy Market Operator 2024). The Renewable Energy Target (RET) is another government scheme which aims to reduce emissions in the energy sector. This is to be achieved by increasing renewable energy and reducing fossil fuels through mechanisms such as providing incentives for investments into renewables like energy certificates (Clean Energy Regulator 2024). This plays a major role in the planning, investment and consequently, construction and operation of wind farms in Australia (Clean Energy Regulator 2024). The RET increased investments into onshore wind farms between 2022-2023, with 1.3GW of renewable energy approved from new wind farms (Clean Energy Regulator 2024). The Large-scale Renewable Energy Target (LRET) plays a major role in incentivising investments into wind farms, by selling large-scale generation certificates (LGC) to liable entities that want to demonstrate renewable energy use for voluntary purposes (Clean Energy Regulator 2024). These certificates act as investments into large-scale renewables, with wind power being the most popular LGC type compared to solar, hydro and other (Clean Energy Regulator 2024). Overall this has led to an 8% increase in total renewable energy generation compared to 2022-23 (Clean Energy Regulator 2024). The Climate Energy Council (CEC) is a non-government organisation (NGO) that aims to grow the Australian energy sector into becoming more efficient and sustainable (Climate Energy Council 2024). They play a major role in the wind energy sector, by providing guidance and assistance to government and private proponents on best practice community engagement and benefit sharing (Climate Energy Council 2025).

However, there is no national wind farm framework that would oversee national guidelines for the approval of wind farm projects. Further, the Department of Environment noted that states and territories have primary responsibility to monitor and ensure wind farm compliance (Senate Select Wind Turbines Committee Secretariat 2015). For example, the Victorian state government has guidelines that provide a framework that assist proponents in planning new onshore wind farm projects. These guidelines aim to provide a consistent approach and assessment of wind energy projects, operational performance standards and operation of the facility, guidance on planning permit applications, and regulations for wind turbine noise. They also ensure other considerations such as community and First Nations People consultation is done (Victorian Government Department of Transport and Planning 2023). The recently announced Onshore Wind Farm Guidance is a step in the right direction and aims to reduce impacts to, and manage protection of; the unique environment; provide an efficient regulatory pathway essential to a renewable energy transition; provide clear guidance for

onshore wind farm assessments; and, provide certainty to industry around regulatory expectations (Department of Climate Change, Energy, the Environment and Water, 2024).

Offshore

Currently there are no operating offshore wind farms in Australian Commonwealth waters. However, they are being discussed as a new addition to Australia's energy mix, as they would be able to provide better power generation than current onshore wind farms (Galparsoro et al. 2022). Alongside the EPBC Act, the Offshore Electricity Infrastructure Act (OEI) applies to offshore wind farms ensuring that they have an additional layer of environmental protection (Department of Climate Change, Energy, the Environment and Water 2024). Created in 2021, the OEI Act is a legal framework that sets out the requirements for offshore projects that are done within Commonwealth Waters (Australian Government and DCCEEW 2024a). It sets out a regulatory framework and licensing for the construction, operation and decommissioning of offshore infrastructure such as offshore wind power farms (Offshore Infrastructure Regulator 2024). By establishing a national renewable energy framework, improving financial support mechanisms, enhancing regulatory coordination, and promoting knowledge-sharing between jurisdictions, the federal government can help state governments work with proponents to adopt these renewables (Kallies 2021, Vorrath 2024, Clapin and Longden 2024). Simply, the OEI Act has the power to authorise or prohibit proponents from constructing, installing, commissioning, operating, maintaining or decommissioning offshore renewable energy infrastructure in Commonwealth waters (Department of Climate Change, Energy, the Environment and Water 2024a). Consequently, any proposed offshore wind farms located greater than 3 nautical miles from shore must go through the OEI Act and the EPBC Act to be approved. Additionally, offshore wind farms will have to operate under the EPBC Act, and EIAs will need to be conducted (Department of Climate Change, Energy, the Environment and Water 2024a, Department of Climate Change, Energy, the Environment and Water 2023a, Australian Government and Department of Climate Change, Energy, the Environment and Water 2025). As such, the combination of the OEI Act, EPBC Act and authorisation by the DCCEEW, should ensure that offshore wind farm operations will thoroughly be examined, planned and operated by federal government bodies. Alongside the OEI Act, the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) was given the role of Offshore Infrastructure Regulator (OIR), to oversee health and safety, infrastructure integrity and environmental management (National Offshore Petroleum Safety and Environmental Management Authority 2024). As an independent body from the government and commonwealth, NOPSEMA can help states and territories with regulatory powers regarding proposed offshore wind farms, as well as oversee activities involving construction, installation, operation, maintenance or decommissioning (Muller and Forster 2023). Furthermore, they can provide advice to stakeholders, assess risk management plans and conduct inspections to ensure and promote industry performance. As OIR, they are heavily involved in offshore projects and planning, with the recent approval of the Blue Mackerel project off the coast of Gippsland being a key example of the power they

have in this emerging sector (Offshore Infrastructure Regulator 2025). This means any activities for this project will be carried out under the OIR, with the legally binding management plan needing to be approved first by the OIR under the OEI Act (Offshore Infrastructure Regulator 2025).

Currently, there have been 6 priority that were chosen due to their strong and consistent winds, close to areas of high electricity demand, have existing transmission infrastructure, existing transport and port infrastructure and the industry is interested in development in these areas (Department of Climate Change, Energy, the Environment and Water 2023). This includes Gippsland and Southern Ocean in Victoria (both areas have been declared and feasibility licences granted), Hunter and Illawarra in New South Wales (an offer of feasibility license has been made for Hunter, while license applications have closed for Illawarra), Bass Strait in Tasmania (license applications have closed), and Indian Ocean off Bunbury in Western Australia (license applications have closed). Once the projects are approved, the process for offshore energy infrastructure will take several years for planning and building before generation can commence.

Policy Analysis and Discussion

Onshore

Onshore wind farms have been used as a sustainable energy source in Australia since 1987, with 170 projects being completed between 2000 to 2023 (Clapin and Longden 2024). Policies, planning procedures, permits and noise regulations have shifted over time, thus encompassing more community consultation and a focus on the environment around the turbines (Bošnjaković et al. 2024). Whilst there have been improvements over time, the confusing nature of the Australian federal, state and local government responsibilities, and no national wind farm framework can create issues when proponents plan and submit for wind farm permits. Howard (2015) discussed how community engagement in regards to wind farms is problematic due to the guidelines and frameworks not requiring or facilitating active community involvement or support. To further support this, the Victorian government states that “pre-application consultation… is encouraged” (Victorian Government Department of Transport and Planning 2023:14). This demonstrates a gap in the Victorian wind farm policies, by outlining to proponents that community consultation is only recommended. Despite community engagement being mandatory for wind farm development proposals and EIAs, it can be seen by proponents as a hindrance and complete it inadequately (Colvin et al. 2016, Colvin et al. 2019). Furthermore, the requirements for community engagement is very minimal, with proponents only having to inform the community, with active involvement and feedback not being a requirement in the EIA/SIA to receive the permit (Colvin et al. 2016). Additionally, the Australian Energy Infrastructure Commissioner (AEIC) conducted an independent community engagement review, finding that community consultation and involvement should be improved nationally (Dyer and AEIC 2024). Whilst this recommendation was made, the federal Australian government’s response has not been as strong as it could be, with many recommendations accepted in principle rather than being adopted in full (Australian Government and Department of Climate Change, Energy, the

Environment and Water 2024a). As such, this highlights the lack of responsibility the federal government has towards ensuring community involvement is embedded in the permit and planning process of wind farms. Despite this, the CEC have created community engagement guidelines for the Australian wind industry. These guidelines help proponents conduct effective community involvement and work with potentially impacted communities to minimise negative outcomes (Clean Energy Council 2018). Involving the community and providing transparency around proposed wind farms improves community engagement and support for the project's completion (Colvin et al. 2016). Colvin et al. (2016) found that in Australia, the social conflict about wind farms arises from land use change and the possible effects of health impacts, landscape changes and reduced property values. They suggest that collaborative and participatory community engagement has better outcomes for both the community and the proponent.

The federal government does provide support to state and territory governments for proposed wind farm projects through monetary subsidies. For example, the CEFC committed up to $350 million to the Golden Plains wind farm in Victoria; becoming Australia's largest wind farm, aiming to accelerate grid decarbonisation (Clean Energy Finance Corporation 2022). The Golden Plains farm was the largest CEFC single debt commitment, and with private sector investment totalling $1.8 billion (Clean Energy Finance Corporation 2022). This will have a 30-year life cycle, and is projected to abate 23 million tonnes of CO2 and generate 1330 MW of electricity with 215 wind turbines (Harber 2023). This demonstrates how the CEFC can be effective in implementing and aiding the growth of wind farms in Australia. Additionally, ARENA has made major contributions to aiding the wind power sector in Australia. ARENA's large-scale competition in the wind sector has helped close the gap in wind energy costs (Australian Renewable Energy Agency 2018). Furthermore, ARENA has been funding wind projects since 2012; totalling 663 projects and $2.25 billion invested at all stages along the innovation chain (Australian Renewable Energy Agency 2025a). Hence, demonstrating their commitment to wind power and growing the industry in Australia.

However, if Australia wants to achieve their net zero by 2050 goal, changes need to be made to climate change legislation, wind farm frameworks and state-federal relationships regarding renewable energy generation (Kallies 2021). Wind farms are essential to achieve this goal, however due to overlapping responsibilities from federal and state governments, it creates confusion within the climate and energy sectors, causing projects to be delayed for approvals as there is no national planning framework (Vorrath 2024, Clapin and Longden 2024). The RET does provide good avenues for companies and individuals to invest into wind farms. It has been effective in stimulating innovation through technological advancements (Abdulrasheed Zakari et al. 2024). Through this, RET has contributed to short and long term decreases in carbon emissions, by providing support for both individuals and large companies to invest into different renewable types and scales (Abdulrasheed Zakari et al. 2024). Furthermore, RET has made a significant contribution to renewable rebates and promotes environmental sustainability. Thus, RET has a high potential to influence more environmentally sustainable changes in the energy sector (Abdulrasheed Zakari et al. 2024).

The EPBC Act has a specific policy for onshore wind farms to help proponents in effective mitigation actions when planning for wind farms. Whilst this policy document is useful for proponents, there have been many identified issues that are yet to be reformed (Herbert Smith Freehills and Clean Energy Investor Group 2024). The first of these issues surrounds the lengthy wait times for project approvals. The growing backlog of referrals can be attributed to the administrative and not the legislative process (Herbert Smith Freehills and Clean Energy Investor Group 2024). Moreover, the EPBC Act is not always enforced in a way that requires proponents to respond adequately to legitimate environmental needs. Thus, proponents are not taking actions to follow the hierarchy set out in the EPBC Act, which is to avoid, minimise, and only then, offset (Bell-James et al. 2024). There is a lack of transparency of the decision process to proponents, with them only being notified once the proposal has been approved or not (Herbert Smith Freehills and Clean Energy Investor Group 2024). This creates large wait-times as there is no statutory timeframe of when decisions by the Minister needs to be made. Whilst the EPBC Act has gone under review and updates are underway to be made, it is clear that the EPBC Act does fail in protecting the environment from onshore wind farms due to its inability to address new issues with the changing climate and advancements in technology (Peel 2024). During the EPBC Act's life, it has gone through various proposals to include 'greenhouse triggers' but nothing has progressed. This lack of progression has seen environmental decline and increases in climate change. Additionally, the government has continued to express little interest in climate change reform as part of the EPBC Act reform (Peel 2024). This demonstrates the lack of care the federal government has towards the environment, and the inability for the EPBC Act to efficiently address growing issues of environmental harm from climate change and infrastructure.

Offshore

Offshore wind farms are considered as one of the most effective sources of renewable energy production and can help increase decarbonised energy supplies (Galparsoro et al. 2022). Whilst they can be effective in their implementation for a more sustainable future, the planning and technology required for these farms is expensive due to its very recent adoption. However, offshore wind farms have become more popular within the last decade (Galparsoro et al. 2022, Dawid 2018). Utilising offshore winds can increase power generation due to the steadier and stronger sea winds compared to land winds, and turbines can be larger and do not create issues surrounding community land use changes (Dawid 2018, Larkin et al. 2023). It is estimated that if 5% of the accessible offshore wind resources is tapped into, it could double the current energy generation (Larkin et al. 2023). This would reduce the need for fossil fuelled energy, reduce emissions, and aid in achieving sustainability goals (Larkin et al. 2023). Offshore wind farms are seeing a wide expansion internationally, with Europe leading the way in technologies and energy generation (Office of the Australian Energy Infrastructure Commissioner 2023). For example, in 2024 the operational capacity of offshore wind farms was 14 GW in the UK, and has targeted to reach 50 GW by 2030, and 140 GW by 2050 (Giddings et al. 2024, Office of the Australian Energy Infrastructure Commissioner 2023). In the Australian context, wind speeds are comparable to average UK wind speeds in the

North Sea, highlighting how the benefits seen in the UK could be received in Australia (Cowin et al. 2023). Hence, Australia has the potential for a high success rate of offshore wind farms due to our geographical location.

Wind is an abundant resource and could provide long-term, sustainable energy solutions and reduce the need for fossil fuelled energy (Gao et al. 2022). The benefits of offshore wind farms compared to onshore wind farms makes them a viable option for Australia as a new source of sustainable energy into the energy grid (Gao et al. 2022, Cowin et al. 2023). This is due to the greater wind speeds offshore than onshore, the ability for larger wind turbines, and locations nearby high energy demand centres such as Melbourne and Sydney (Gao et al. 2022). Moreover, offshore wind farms are less likely to cause community involvement issues, due to their location away from towns and farms (Cowin et al. 2023). Whilst there is limited research, some suggest that offshore wind turbines can be more environmentally beneficial than onshore wind farms (Hall et al. 2020, Rezaei et al. 2023). The wind turbines can create an artificial habitat for marine organisms, such as fish, seabirds and marine mollusks (Rezaei et al. 2023). However, the government and private sector need to fund more research into the potential environmental harm or benefits of offshore wind farms, as there are notable research and data gaps (Watson et al. 2024).

Under the OEI Act, the Minister for Energy and Environment has the powers to make all licensing decisions (Larkin et al. 2023). This means the Minister has the ability to consider national interest of offshore projects, including national security, project delivery time, location and if there is any potential conflict with other uses (Larkin et al. 2023). Whilst the Minister has to consider national interests, they must also consider potential economic benefit or harm to local regions before granting a licence to begin construction. However, the EPBC Act will only be involved in offshore wind farm projects, if the project triggers any potential, significant or confirmed harm to the environment (Gibson 2024). This suggests that offshore wind farm projects may not undergo assessment from the EPBC Act if there is no identified potential harm to the environment. This could create issues if any environmental harm was to occur that was not considered as part of the initial EIA or SIA process by the proponent. Additionally, as proponents have no legal obligation to the EPBC Act, risks to the environment from offshore wind farms may not be realised until they are constructed or in operation and could create substantial harm as there would be no protection actions in place to prevent harm (Bell-James et al. 2024, Herbert Smith Freehills and Clean Energy Investor Group 2024). However, if the EPBC Act is triggered, the proponent must create separate applications for both the OEI and EPBC Act (Larkin et al. 2023). This will add waiting times for project approval, and increase complexity in obtaining a licence to begin construction.

The CEFC has recently created the Rewiring the Nation (RTN) plan which aims to fast-track renewables in Australia, including offshore wind farms (Prime Minister of Australia 2022). In conjunction with the Victorian government and the Commonwealth, an agreement was made which allocates $1.5 billion of concessional financing towards projects under the RTN (Prime Minister of Australia

2022, Clean Energy Finance Corporation 2023a). However, some of this funding will be used to either enhance grid infrastructure to support a hydrogen hub or offshore electricity (Clean Energy Finance Corporation 2023a). This demonstrates that whilst money has been allocated towards building renewables and improving the transmission systems, there is potential for this funding to go to hydrogen rather than offshore wind. Conversely, ARENA has allocated $1.5 million towards the Spinifex Offshore Wind Farm (Australian Renewable Energy Agency 2022). This project demonstrates how ARENA is actively involved in creating an offshore wind farm sector in Australia. Whilst this project will only power the Portland Aluminium Smelter, it will demonstrate and accelerate the pathway for offshore wind farms to contribute to the NEM (Australian Renewable Energy Agency 2022). Additionally, it will improve commercial viability of offshore wind and reduce barriers to creating more offshore wind farms in the future by acting as the first project to utilise this type of energy (Australian Renewable Energy Agency 2022). Moreover, if the farm proceeds, it could provide 100% of the energy required for aluminium smelting, with the additional generation being exported back into the grid (ARENA 2022). ARENA is taking actions to push for an offshore wind sector in Australia, by providing funding and support for a commercial grade farm (Australian Renewable Energy Agency 2022). The ISP outlines that offshore wind needs to be included in the energy mix, due to its potential to supply reliable energy (Australian Energy Market Operator 2024). Whilst offshore wind is currently expensive and has weak policy, it has great potential to add renewable energy to the mix. AEMO discusses that with policy and financial support, offshore wind may be attractive for investors and proponents to build in Australia (Australian Energy Market Operator 2024). Hence, AEMO does include offshore wind as part of the ISP (Australian Energy Market Operator 2024).

NOPSEMA is an effective governance body as they undergo independent reviews every 5 years to ensure operations are effective and any identified issues can be resolved to ensure up-to-date policy and operations (National Offshore Petroleum Safety and Environmental Management Authority 2020). Recommendations and opportunities are made to NOPSEMA, where opportunities are improvements that could enhance operations, whereas recommendations are strategic and critical to improvements (National Offshore Petroleum Safety and Environmental Management Authority 2020). These opportunities and recommendations from the 2020 review include, but are not limited to: engagement with industry and adjacent stakeholders to develop clean and common understanding, continue to invest in development of renewables, update the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGS), and develop an integrated plan to shift to a One NOPSEMA operating model. In their 2020 review, NOPSEMA was found to be making positive contributions to enabling safety, well integrity and environmental outcomes in the offshore industry (National Offshore Petroleum Safety and Environmental Management Authority 2020). Furthermore, stakeholders perceive NOPSEMA positively due to their role in promoting strong safety culture, encouraging new and preventive environmental management strategies, and supporting continuous improvement within the industry (National Offshore Petroleum Safety and Environmental Management Authority, 2020). However,

changes need to be adopted to have a better regulatory strategy, which should outline how their activities play into the OPGGS Act's objectives (National Offshore Petroleum Safety and Environmental Management Authority, 2020).

Recommendations

Onshore

Recommendations outline:

- The federal government should ensure proponents conduct effective community consultation.
- Strengthen coordination between tiers of government, private industry and community for the development of onshore wind farms, potentially building on the Onshore Wind Farm Guidance policy and existing partnerships.

The Australian federal government can improve its current policy position by ensuring that proponents are generating effective community involvement in the planning of onshore wind farms. Additionally, strengthening coordination that can be used by federal, state, territory, and local governments and proponents, will create clarity surrounding permits and legislation. Thus, highlighting the responsibilities of each involved party. It is recommended that the federal government should work with organisations like the CEC, to create reference documents and guidelines for states, territories and wind farm proponents to improve their community engagement and involvement. However, this should be the first step to improve community involvement by the federal government. Providing resources and guidelines will give proponents the ability to better engage the community and better manage negative perceptions or outcomes. Furthermore, this would enable better collaborative community engagement (Hindmarsh 2010, Colvin et al. 2019). Collaborative community engagement helps ease and create better understandings of the complex social conflicts that may arise during the planning process of a wind farm (Colvin et al. 2016, Colvin et al. 2019). Thus proponents should be utilising community engagement, with the federal government's assistance (Colvin et al. 2016, Colvin et al. 2019).

Alongside creating guidelines and resources to improve community engagement, strengthening coordination through federal policies and legislation will ensure communities are involved, and reduce the complex nature of the wind farm industry. Enhanced coordination would reduce overlapping of responsibilities, increase regulatory authority and create defined structures to improve cooperation and conflict resolution (Kallies 2021). Furthermore, this would better align with Australian governance and create better communication channels between the climate and energy sectors, thus working towards a sustainable future. Additionally, improved coordination would help eliminate waiting times for licence approvals by the EPBC Act. The first steps could involve aligning state and territory definitions of habitat with the Commonwealth definitions (Herbert Smith Freehills and Clean Energy Investor Group 2024). Furthermore, improving upon transparency with proponents would eliminate confusion and create accountability, thus making the approval wait times shorter. Alongside this,

making the EPBC Act regulatory and not administrative will also improve approval times, and allow for wind farm projects to actually go ahead (Herbert Smith Freehills and Clean Energy Investor Group 2024). Therefore, it is recommended that the federal government should strengthen coordination mechanisms.

Offshore

Recommendations outline:

- Invest and build offshore wind farms.
- Use successful countries's offshore wind farms as case studies.
- Reform policy to better support the development of offshore wind farms
- Combine and improve coordination between Commonwealth and State/Territory planning processes
- Conduct thorough research for additional and specific suitable farm locations

Offshore wind farms should be built in Australia, and it is recommended that the federal government should invest into offshore wind power, and enable proponents to work with the government and the commonwealth to tap into an energy source which will help achieve sustainable decarbonisation of the energy grid. Australia is in a prime position to use technologies developed internationally and also aid in research and advancements in the offshore wind farm space. By upscaling to offshore wind farms, Australia can substantially increase current energy generation, and lower emissions through reducing the demand on fossil fueled energy. It is recommended that the federal government look towards other countries, such as the UK or Denmark, and use their successes and failures to produce effective offshore wind farms. The first step towards making an offshore wind farm industry in Australia is to establish a more inclusive and streamlined governance structure, by involving a broad range of stakeholders to ensure that policy creation, planning, and execution is carried out effectively (Fairbrother 2017). This includes recognising power relations between governments, the Commonwealth, proponents and the community, as all stakeholders will be involved at different stages. This should involve the combining of the Commonwealth with State/Territory environmental planning processes (Larkin et al. 2023). Moreover, by looking at the successes of other countries, the federal government should adopt similar policies and legislation, which would help eliminate confusion, permit and licence approval times, and promote faster adoption of offshore wind (Kallies 2021, Goodman 2023). Additionally, as offshore energy is still being drafted in legislation, Goodman (2023) suggests that Australia should use the United Nations Convention on the Law of the Sea as a backbone. This would ensure that regulations and legislation will operate effectively and pursue environmentally safe, yet effective energy from offshore winds (Goodman 2023). Hence, it is recommended that better coordinating and even combining Commonwealth and State/Territory environmental planning processes with international examples and regulations will create the best outcome for the future of offshore wind farms. Alongside this, the federal government needs to make improvements to the EPBC Act to be more involved in offshore wind farm developments, which will be necessary due to the unknown environmental

impacts that it may cause. By ensuring proponents are using mitigating actions to reduce risk and environmental harm will boost the positive outcomes for offshore wind farms, and ensure their long-term future in Australia. Lastly, NOPSEMA needs to update and change some of their policies and operations to align with the recommendations and opportunities in their most recent review. This will improve their role and better support the growth of the offshore wind farm sector.

The federal government should ensure that comprehensive research is conducted to identify suitable and specific farm locations and implement precautionary measures to mitigate potential environmental risks. This will improve the sustainability of farms by protecting the surrounding environment and thus produce effective offshore wind farms. They should utilise the most up-to-date technology and ensure routine maintenance is conducted to ensure efficient energy production (Larkin et al. 2023, Fairbrother 2017). These recommendations are made to the federal government as offshore wind farms will be essential in the decarbonisation of the energy grid and will play a major role in achieving the net zero by 2050 goal. Additionally, if Australia is to establish these farms in Commonwealth waters, it has the potential to play a key role in advancing global offshore wind farm research, drive technological advances, support and enhance research, and aid international efforts to reduce emissions (Watson et al. 2024, Larkin et al. 2023).

hydropower

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Hydropower is one of the oldest forms of energy technology, due to being used and adapted over thousands of years (Australian Renewable Energy Agency 2018b). Hydropower uses the movement of water, usually from a reservoir or dam, and converts this energy into electricity by passing it through a turbine or generator. This generator is connected into the transmission grid and distributes energy, providing power to consumers when needed (Australian Renewable Energy Agency 2018b). Pumped Hydro Energy Storage (PHES) is a recent addition to this type of energy generation and is becoming popular due to its ability to act as a natural battery (Blakers et al. 2021). Hydroelectricity provides 6% or 7.5GW of total electricity supply in Australia, and with projects such as Snowy 2.0, there is a large potential for PHES growth (Australian Renewable Energy Agency 2018b, Australian Government 2023b). The potential for growth lies within the Kosciuszko National Park in New South Wales and many locations in Tasmania. There are over 120 operating power stations in Australia, with the majority located in the south-eastern region, many of which are part of the Snowy Mountains Hydro-Electric Scheme (Australian Renewable Energy Agency 2018b). The original Snowy Mountain Scheme was launched in 1949, and at the time was the largest engineering project to be undertaken in Australia, with the goal to offset the effects of drought by diverting water for irrigation and creating infrastructure for hydro-electricity generation in the Kosciuszko National Park (Snowy Hydro 2020c). Normally the water would flow east to the coast, but the Snowy Mountain Scheme captures and stores the water and redirects it into the Murray and Murrumbidgee Rivers for irrigation systems (Snowy Hydro 2020b, Australian Government 2018). Construction took approximately 25 years, occurring between 1949 to 1974, with over 100,00 men and women from over 30 countries (Snowy Hydro 2020c, Snowy Hydro 2020b). These men and women included workers from war-torn European countries and were part of an immigration scheme by the Commonwealth (Snowy Hydro 2020c).

Because of Australia's historical association with hydropower as a matter of the national identity, as well as the potential for this energy to support the renewable transitions, Federal Government must ensure that current policies and actions are as effective as possible at supporting hydropower in Australia's energy mix.

Current Policies

State governments work closely with the federal government, proponents, and other stakeholders to plan, fund and produce PHES power stations. Proponents must abide by state government regulations, laws and policies when planning and submitting PHES power station applications to ensure maximum effectiveness and reducing potential environmental and social harm (Australian Government 2022).

The Australian Renewable Energy Agency (ARENA) and the Clean Energy Finance Corporation (CEFC) work with federal, commonwealth, state governments and proponents to provide guidance and funding on existing or proposed PHES stations (Heidari et al. 2020). ARENA was established in 2012 by the Australian Renewable Energy Agency Act 2011 with the purpose to fund innovative projects and provide pathways for the commercialisation of renewable technologies (Australian Renewable Energy Agency 2024). They support the global transition to net zero emissions through funding for research and renewable energy projects. Additionally, ARENA plays a major role in many hydropower/PHES stations in Australia, such as the Snowy 2.0 project (Australian Renewable Energy Agency 2021c). The CEFC provides financial support at various stages of multiple renewable energy projects, including PHES (Clean Energy Finance Corporation 2024, Australian Energy Market Operator 2024). The CEFC was established in 2012 by the Clean Energy Finance Corporation Act (Department of Finance 2024). As a corporate Commonwealth entity, the CEFC was established to promote increased finance into renewables to help achieve Australia's emissions reduction targets (Department of Finance 2024). As such, the CEFC has shown support towards PHES through schemes they have developed such as the 'Rewiring the Nation Fund' (RTN) (Clean Energy Finance Corporation 2023a, Clean Energy Finance Corporation 2023b). The CEFC has been allocated an additional $19 billion by the Federal government to help deliver the RTN, and support priority transmission projects identified by the Australian Energy Market Operator (AEMO)'s Integrated System Plan (ISP) (Clean Energy Finance Corporation 2023a, Australian Energy Market Operator 2024).

AEMO is a semi-governmental body with government and industry shared ownership (Australian Energy Market Operator 2025). Created in 2009, AEMO's responsibilities include assessing gas and energy market functions, production and generation, and distribution across Australia (Australian Energy Market Operator 2025). As the energy landscape is undergoing rapid change due to the renewable energy transition and the evolution of the national energy market (NEM) to include various sources of energy, the ISP was created to give guidance for the transition to a cleaner power system (Australian Energy Market Operator 2024). Hence, the ISP intends to provide a better understanding of PHES developments and associated transmission infrastructure, and convey up-to-date

information to stakeholders which support action to increase future resilience and adoption of hydropower (Australian Energy Market Operator 2019). Additionally, the ISP aims to increase the NEM's resilience to future risk through assisting proponents and governments in providing timely information, assisting in modelling and planning, and providing deeper insights for increased PHES market benefits (Australian Energy Market Operator 2019).

The Environment Protection Biodiversity Conservation Act 1999 (EPBC) plays a major role in managing and protecting the environment from risks presented by the construction of hydropower stations. The EPBC Act is the main legislation for environmental protection from infrastructure, and specifies guidelines for managing aspects of the environment such as animals, plants, habitats and places (Australian Government 2024a). The EPBC Act enforces environmental protection through requiring proponents to submit environmental impact assessments (EIA) and social impact assessments (SIA) (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a). EIA's and SIA's are submitted by proponents which are created to outline risks and mitigative actions that will be taken to minimise potential environmental harm from the project (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a). Thus, pumped hydropower projects must undergo assessment from the Commonwealth Minister, which are either approved, approved with further assessment and requirements, or rejected (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a).

Research Discussion

As Australia is the driest inhabited continent, with around 80% of the country receiving less than 600 mm of annual average rainfall per year, it can be difficult to justify hydropower generation (Heidari et al. 2020). However, off-river PHES systems can overcome this. PHES systems are closed-loop and they recycle water for generation (Currie et al. 2019, Stocks et al. 2021). By using closed-looped systems that do not require access to rivers, Australia can harness pumped hydropower effectively (Currie et al. 2019, Stocks et al. 2021). Hydropower and PHES act as a cheaper alternative to batteries for large-scale energy storage on longer time scales due to water storage in the upper reservoir, which is then released into the lower reservoir to generate energy (Blakers et al. 2021, Snowy Hydro 2020a). Moreover, PHES was found to be 30% less expensive for large single-cycle loads due to the high storage capacity (Gilmore et al. 2023). China, Brazil and Canada were the world's largest hydro-electricity generators (Statista 2024). Of these countries, Canada is the most similar to Australia in terms of politics and governance structure. PHES is a crucial component of Canada's renewable energy transition in addition to other renewable sources such as solar and wind (Bennett et al. 2023). Canada has a long history of using hydropower, starting in 1882 at the Chaudieres Falls in Ottawa River (Alfredsen et al. 2021). It has steadily grown, and produced almost 400 TWh in 2022, thus being the third largest producer globally (Natural Resources Canada 2022, Alfredsen et al. 2021). Canada has installed 81 GW capacity, but has approximately 155 GW of undeveloped potential PHES (Alfredsen et al. 2021). Canada's geography and hydrography makes it highly favourable to this type

of energy generation, especially in Quebec, British Columbia and Newfoundland (Natural Resources Canada 2022). The majority of shareholders of hydropower are either government owned or controlled enterprises, with a small percentage being privately owned companies (Alfredsen et al. 2021). However, all proposed and current projects must follow federal and provincial governance and regulatory schemes, with primary responsibility over management and permit allocation coming from Provinces (Alfredsen et al. 2021). Furthermore, through treaties and self-government agreements, Indigenous peoples have increasing responsibility over land, resources and environment (International Energy Agency 2022). This aids in planning and management of hydropower stations, resulting in effective yet sustainable development (International Energy Agency 2022). The International Energy Agency (IAE) released an energy policy review of Canada in 2022, and found Canada has one the cleanest electricity systems in the world, with hydroelectricity playing a major role (International Energy Agency 2022). The IAE concluded that due to their dominance of hydropower, strong interconnections between provinces and territories, national goals and enhanced communication with Indigenous communities, Canada has successfully integrated hydropower into their energy mix in a sustainable and energy efficient way (International Energy Agency 2022). The view of PHES is shifting from becoming a main source of renewable energy generation, to becoming the backbone of a decarbonised society. The Clean Energy Council (CEC) (2021) explains how hydropower can act as the backbone energy source for other renewables in the NEM, as it can rapidly provide on-demand power when the sun is not shining or the wind is not blowing (State of New South Wales and Department of Planning and Environment 2018, Blakers et al. 2021, Clean Energy Council 2021). This enables hydropower to fill in the gaps of energy when demand is high and supply is low. Thus, PHES is a reliable energy source due its ability to act as a natural battery, supplying energy during peak load periods (Heidari et al. 2020, Vagnoni et al. 2024). The CEC has provided recommendations on how Australia can best support hydropower: by firstly, modernising and refurbishing existing assets, which is viewed as being essential to ensure the future of PHES by extending the lifetime of these power stations. Alongside this, developing frameworks to enable routine refurbishments will reflect the reliability and security benefits that hydropower can provide. Secondly, new markets need to reflect the true value of hydropower. This will enable cost-effective services and lower costs long-term. Lastly, coupling the new markets to reflect hydropower's value, providing mechanisms and supporting lower risk investments into new and existing hydropower assets will lower costs and enable better future economic planning (Clean Energy Council 2021). Adjusting policies to better support hydropower will benefit Australia, as pumped hydropower will safeguard the transition to renewable energies (Clean Energy Council 2021).

The Snowy 2.0 project is updating the original Snowy Mountain Scheme and will ultimately underpin the transition to renewables (Snowy Hydro 2024). Snowy 2.0 aims to secure the transition to renewables in Australia by providing an additional 2 GW of hydropower (Anagnostou et al. 2023). This project involves linking the two existing dams, the Tantangara and Talbingo, with 27 km of underground tunnels that will be linked to a new underground hydro-generating station (Snowy Hydro 2020a, Snowy Hydro 2024, Currie et al. 2019, Anagnostou et al. 2023). The Snowy 2.0

Scheme works with multiple stakeholders, including the federal and NSW state government, and private and public stakeholders (Snowy Hydro 2024). In 2020, the Snowy 2.0 EIA and SIA were approved by the federal government and granted A$5.1 billion for civil works (Currie et al. 2019). However, the project is projected to cost a total of over A$10 billion, with all transmission upgrades included (Currie et al. 2019). The implementation of PHES in Australia will be highly advantageous to grow renewable energies, however PHES construction and related disturbances will likely have a negative impact for the biodiversity within the area (Normyle and Pittock 2019). With a closed-loop system the Snowy 2.0 will impact major river systems and catchment areas, especially the Murray-Darling, which is already under stress from climate change and human pressures (Normyle and Pittock 2019). Maintenance and proper mitigative actions are needed to prevent environmental harm during the construction and operation of Snowy 2.0 (Normyle and Pittock 2019, Bender et al. 2022)). The original Snowy Hydro Scheme caused substantial damage, causing soil destabilisation, wetland destruction and the introduction of invasive species from road clearing, construction and soil dumping (Normyle and Pittock 2019, Currie et al. 2019, Bender et al. 2022). These are lessons that can be learnt and implemented into Snowy 2.0 to have further protection against known and potential environmental risk.

The EPBC Act approved the Snowy 2.0 project in 2020. Under the approval, the proponents are required to ensure that actions are taken to ensure environmental impacts do not exceed the initial scope of plannings that were approved by the NSW Planning Minister, under the EPBC Act (National Parks Association of NSW 2024). Whilst these environmental protections and mitigation actions were put in place during planning and permit approval, there is an abundance of evidence that highlights that Snowy Hydro and contractors are not meeting these approvals, and environmental harm is becoming a great risk (National Parks Association of NSW 2024). As project reports and Independent Environmental Audits (IEAs) are conducted, multiple failures have been identified in completing mandatory site management plans, along with ongoing environmental breaches. Consequently, Snowy Hydro and its contractors are failing to meet expectations for environmental protection (National Parks Association of NSW, 2024). These failures to meet environmental protections and mitigative actions demonstrate the failings of the EPBC Act to ensure proponents are conducting and performing actions to protect the environment (National Parks Association of NSW, 2024). Therefore, the EPBC Act is failing to protect the environment from harm from projects like Snowy 2.0, however projects like this are essential if sustainable energy is to replace fossil fuelled generation. Maitz et al. (2022) found that projects that were granted by the EPBC Act are likely to not undergo their assessments and not do the actions required to protect the environment. Furthermore, they found that the EPBC Act is failing to adequately protect the environment, despite the EPBC Act putting mitigative requirements on permits that proponents need to follow (Maitz et al. 2022). Additionally, Ward et al. (2019) found that between 2000 to 2017, 7.7 million ha of potential habitat and communities were cleared, with 93% of this clearing not referred to or approved under the EPBC Act. This demonstrates further failings of the EPBC Act, as it is ineffective in protecting the environment from either legal or

illegal land clearing. Consequently, is having negative effects on the land and ecological communities (Ward et al. 2019, Ashman et al. 2021).

There are other large scale hydropower projects such as the Battery of the Nation, and related infrastructure projects, such as the Marinus Link, which will help support Australia's renewable transition. These projects are aided by bodies and instruments such as ARENA and AEMO's ISP, which is a major player in renewable energy, working with multiple stakeholders, and analysing system changes and risks for energy transmission including for hydropower (Lovell 2021). The ISP recognises significant challenges to the Australian NEM, which includes consumer preferences slowly shifting towards renewables and reducing energy use. Hence, the ISP advocates for more investments into renewable grid transition, thus aiding proponents to build more renewable energy power stations. Additionally, the ISP and AEMO have an influential role in planning and informing Australia and proponents about possible energy futures with renewables, including hydropower (Lovell 2021). The ISP aided the Battery of the Nation by promoting this project alongside ARENA for funding (Hydro Tasmania 2023, ARENA 2021a). Battery of the Nation is led by Hydro-Electric Corporation, with a concept study being undertaken between August 2017 to January 2018 to investigate the pathways of developing opportunities for Tasmania to have a greater contribution to the NEM (Australian Renewable Energy Agency 2021a). ARENA provided financial support of $300,000, which was channelled into high level technical assessments of possible project sites for pumped hydro storage (Australian Renewable Energy Agency 2021a). This initiative found that over these 14 sites, there is a potential for Tasmania to produce 4.8 GW of energy from pumped hydro, which could be added to the NEM (Australian Renewable Energy Agency 2021a). The ISP highlighted the importance for new generation in Tasmania through different energies such as wind, solar and hydro. Moreover, as the ISP recognises the Hydro Tasmania project, they will play a key role in cost-effective clean energy which is reliable (Hydro Tasmania 2023). Overall, the ISP provides modelling and influential power to support the change towards renewable energies in Australia. It has been effective in updating data and adjusting their 20-year ISP, closely working with stakeholders and influencing changes that lead to financial support for hydropower and other clean, cost-effective energy sources (Longden 2022).

Recommendations

Recommendations outline:

- Integrate hydropower as a backbone renewable.
- Continue Snowy 2.0 support.
- Enhance pre-existing guidelines and policies to allow hydropower development.
- NEM to incorporate hydropower more effectively.
- Improve policy for environmental protection

It is important to shift the view of hydropower from another renewable source of energy, to becoming the backbone for other renewables. Hence, the goal is to make hydropower play an integral role in the integration of other sustainable

energy sources, such as wind and solar. Firstly, the federal government is already underway with updating and refurbishing existing hydropower stations, such as the Snowy 2.0 project. It is recommended that the federal government continues with their efforts and financial support in this project. Additionally, the federal government should also develop and support smaller PHES stations to maintain and develop a mature hydropower backbone, particularly whilst Snowy 2.0 is in development. However, continuing Snowy 2.0 should include additional mitigative strategies from lessons learnt from the original Snowy Hydro Scheme. This includes better water management from and to nearby river systems and water catchments, especially the Murray-Darling Basin (Bender et al. 2022). Furthermore, having measures in place to reduce soil contamination and destabilisation by properly disposing of excess soil will ensure the health of the surrounding environment and ecological communities. These recommendations need to be included in the planning processes of the Snowy 2.0, to protect the environment during construction, but to also provide long-term protection throughout the entire lifetime of the scheme.

It is also recommended that the federal government should establish a national regulatory framework, so it can offer timely support and alerts to proponents and operators. This would facilitate monitoring and modernising of hydropower stations as needed (CEC 2021). Moreover, this will future-proof hydropower generators and guarantee they are working efficiently and effectively to provide energy to the NEM (CEC 2021, Vagnoni et al. 2024). The federal government should follow Canada as an example when creating a national framework for pumped hydropower, which will benefit Australia, as there are similarities in governance structure and social aspects. The federal government should learn lessons by implementing better communications with Indigenous peoples, and ensure they have responsibilities within planning and managing hydropower in Australia, as this has been proven to be successful in other case examples (International Energy Agency 2022). Hence, these policies can aim to use hydropower as a supporting energy source for other renewables, reducing the need for natural gas or coal powered energy when demand is high and renewable supply is low. Furthermore, coupling this with adjustments to the NEM to incorporate hydropower more effectively and accurately, will enable cost-effective services and underpin a reliable operating power system (CEC 2021, Vagnoni et al. 2024). These changes made by the federal government will help states and territories and proponents better operate hydropower stations, making them more effective. Thus, hydropower stations will help support a decarbonised future and contribute to achieving national and state net zero goals.

Lastly, improvements need to be made to the EPBC Act to ensure proponents are making effective mitigative actions to protect the environment throughout the entire project's lifetime. It is recommended that the federal government make changes to the EPBC Act to legally ensure compliance is done by proponents to protect the environment from hydropower projects. The Snowy 2.0 is a prime example of why this needs to happen quickly, as it is located in an area with high culture and biodiversity significance. The Kosciuszko National Park needs to be protected from environmental harm whilst this project goes ahead, and the EPBC

Act has this responsibility to ensure the proponents are taking mitigative actions. Hence, the government needs to strengthen mechanisms that enforce appropriate penalties for noncompliance of the EPBC Act and permit requirements (Thomas et al. 2024). This would support state and territory governments better, but also provide additional support and guidance for proponents when navigating permit approvals. Furthermore, the Act should deliver better outcomes by clarifying the definition of 'ecologically sustainable development' (Climate and Health Alliance 2020). This will ensure that the policy effectively protects and conserves the natural environment. Additionally, it will promote a better understanding of why protecting and promoting a healthy environment is essential during the transition to clean energy (Climate and Health Alliance 2020).

wave energy

This chapter can be referenced as "Vassallo, P. (2025). Wave energy. In B. Goodsell (Ed.), The State of Policy Report (pp. 113-119). The Climate Centre."

Wave generated power utilisation in Australia has historically been, and currently is, very limited, with only a handful of prototype and demonstration projects having been developed. Despite this, it is a viable alternative for both federal and state governments to consider and adopt as an energy source, reducing reliance on fossil fuel-based generation. Australia has a large potential to adopt wave power to generate electricity due to the strong and reliable wave swells generated on Australia's coasts (Australia's Offshore Energy Regulator 2022). Additionally, wave power is abundantly available and has lower variability in power generation output compared to solar and wind and is not heavily reliant on perfect weather conditions (Satymov et al. 2024). Hence, wave power would be a beneficial addition to the current national energy market (NEM) in Australia. However, the technology for wave generation is still relatively new, due to few countries adopting it into their energy mix (Satriawan et al. 2021). Despite being relatively new and currently costly, wave power is projected to decrease in cost into the future, making it an option against fossil fuel energy generation for coastal regions and islands (Satymov et al. 2024). Additionally, with continued government funding and increasing competitiveness, costs of projects can decline further. Thus, making wave power generation more obtainable in Australia. The Federal government should introduce policies and government schemes that support wave power to ensure that Australia can become a world leader in the adoption of this new energy source.

Current Policies

If wave power generation is to be harnessed in Australia beyond prototype demonstrations, it would be located within Commonwealth waters, which are defined as being greater than 3 nautical miles from the coast (Department of Climate Change, Energy, the Environment and Water 2024). The Offshore Energy Infrastructure Act (OEI) was commenced in 2022 to establish a regulatory framework for offshore renewable energy infrastructure and transmission (Australian Government and DCCEEW 2024a).

The operation of the OEI Act is conducted under the Offshore Infrastructure Regulator (OIR), which is currently the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) (Offshore Infrastructure Regulator 2024, National Offshore Petroleum Safety and Environmental Management Authority 2022). NOPSEMA's responsibilities as the OIR is to provide advice for the OEI Act Minister, who administers licenses for proponents' offshore projects (National Offshore Petroleum Safety and Environmental Management Authority 2022). Additionally, the OIR is responsible for management plan assessments and post-approval compliance and enforcements (National Offshore Petroleum Safety and Environmental Management Authority 2022, Offshore Infrastructure Regulator 2024). Furthermore, the OEI Act sets out legal boundaries that stakeholders would need to operate within to obtain licensing for project planning, approval, construction and operation (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a). Therefore, if developments of wave power infrastructure were to commence, the Federal government would be responsible to regulate that sector (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a). Additionally, wave project approvals would need to undergo assessment from the Environment Protection Biodiversity Conservation Act (EPBC) (Australian Government and Department of Climate Change, Energy, the Environment and Water 2024a, National Offshore Petroleum Safety and Environmental Management Authority 2022). The EPBC Act's role is to assess the potential environmental impact that a project may have on nationally protected matters (Australian Government 2022a). For wave power, nationally protected matters would include: world heritage areas, national heritage places, wetlands of international importance, listed threatened species and ecological communities, listed migratory species, Commonwealth marine areas and the Great Barrier Reef Marine Park (Australian Government 2022b).

Funding and investment of wave energy projects from the government has mainly been facilitated by the Australian Renewable Energy Agency (ARENA) (ARENA 2018a). ARENA aims to support the growth and improvement of renewable energy and technologies in Australia (Commonwealth of Australia and Australian Renewable Energy Agency 2024). They do this through funding projects and research, assist in the sharing of knowledge to drive innovation, and collaborate with many private companies, governments and universities (Commonwealth of Australia and Australian Renewable Energy Agency 2024). Hence, their main objective is to "improve the competitiveness of renewable energy technologies, increase the supply of renewable energy in Australia and facilitate the achievement of Australia's greenhouse gas emissions reduction targets." (Commonwealth of Australia and Australian Renewable Energy Agency 2024:12). ARENA operated under the Australian Renewable Energy Agency Act 2011 (ARENA Act), which was amended in 2022 to expand the agency's support for energy transition and efficiencies to reduce emissions (Commonwealth of Australia and Australian Renewable Energy Agency 2024).

Research Discussion

Wave power is generated by the use of wave turbines or generators. There are multiple different types of generators, which can be used in different coastal or deep ocean areas and suit many locations (Australia's Offshore Energy Regulator 2022). This makes wave power incredibly adaptable, due to the technology offering many options for different environments and needs. Australia has the second largest potential for wave power globally, with the majority of the resource along the west and southern coast (Hemer et al. 2018). If Australia were to tap into this resource, 11% of energy needs could be met by 2050 (Australia's Offshore Energy Regulator 2022). Hence, the deployment and use of wave energy is essential for governments to increase sustainably sourced energy, whilst decreasing fossil fuel powered energy (Wang et al. 2024). To best utilise this resource, wave generators need to be located along the southern coast, especially concentrated in WA and southern Tasmania (Australia's Offshore Energy Regulator 2022). The abundance of wave power in these regions is due to the strong Southern Ocean winds that generate large waves and ocean wells (CSIRO 2022). These swells generate consistent and abundant wave energy, making these locations ideal for wave energy generation (Commonwealth Scientific and Industrial Research Organisation 2022). There is a strong potential for wave power to be harnessed, but there need to be changes made by the federal government through investments and stakeholder engagement in order for these generators to be implemented.

ARENA is a major stakeholder in conducting research and funding towards the adoption of wave generated electricity (Commonwealth Scientific and Industrial Research Organisation 2022, Australian Renewable Energy Agency 2018a). They have provided partial funding for multiple wave energy generation projects including but not limited to: UniWave 200 King Island Project - 'Wave Swell', the 'Perth Wave Energy Project', and the 'Moored MultiModal Multibody M4' wave energy prototype (Australian Renewable Energy Agency 2025b, Australian Renewable Energy Agency 2020, Maksumic 2024). These projects tested the viability and adoption of this energy source (Hemer et al. 2018, Australian Renewable Energy Agency 2020).

Wave Swell Energy's project, King Island Project, aimed to close a scientific gap of knowledge in temporal and spatial variability of wave power and the potential power output (Hemer et al. 2018). It aimed to assess the potential of the 200 kW wave energy converted by UniWave200, over a 5 year period of development, designing, building, installing, operating and decommissioning (Australian Renewable Energy Agency 2025b). ARENA contributed $4.03 million towards the project, with the entire project costing $19.37 million. The location of King Island, Tasmania, was specifically chosen to thoroughly test the UniWave200's structure and resilience against challenging conditions including remoteness, cold and wet winter months and harsh environmental and wave conditions. Hence, they were able to assess the resilience of the wave energy converters and their ability to survive harsh conditions in the Southern Ocean, and therefore, improving confidence in the future success of wave energy commercialisation in Australia (Australian Renewable Energy Agency 2025b).

The Perth Wave Energy Project was led by Carnegie Clean Energy between April of 2012 to December of 2017 (Ilyas et al. 2014, Australian Renewable Energy Agency 2020). This project aimed to implement the CETO 5 technology created by Carnegie Clean Energy on Garden Island, Western Australia (Australian Renewable Energy Agency 2020). This was part of ARENA's Emerging Renewable Program, and they funded $13.09 million towards the total project cost of $39.87 million (Australian Renewable Energy Agency 2020). The CETO 5 technology operated by using pressured water onshore to generate electricity (Ilyas et al. 2014, Australian Renewable Energy Agency 2020). It created a closed-loop system by using and returning ocean water via subsea pipelines (Australian Renewable Energy Agency 2020). Additionally, the CETO 5 technology was capable of producing desalinated water, reducing the reliance on fossil fuel powered desalination pumps (Australian Renewable Energy Agency 2016). Ultimately, this project aimed to generate and supply power and freshwater to the largest Australian naval base, HMAS Stirling (Australian Renewable Energy Agency 2016, Wimalaratna et al. 2022). The CETO 5 project was initially successful, with ARENA and the Australian government pledging another $2.18 million towards the Carnegie CETO 6 technology project, which had a total cost of $5.3 million (Australian Renewable Energy Agency 2021b). However, this project was short lived, as federal and state governments pulled funding due to Carnegie failing to meet reporting deadlines and dropping company assets (Turner 2019).

The Moored MultiModal Multibody M4 wave energy prototype was a project between the University of Western Australia, including Marine Energy Research Australia (MERA), as well as the Blue Economy Cooperative Research Centre, the Western Australian government, and numerous other organisations including BMT, M4 WavePower Ltd, Huon Aquaculture, Albany Shellfish Hatchery, University of Tasmania, University of Queensland, and Climate-KIC Australia. The project received $4.8 million in funding, with contributions from the Blue Economy Cooporative Research Centre and the WA state government (approximately $1.6 million each), and similar in-kind contributions (The University of Manchester 2024). It was deployed during Spring 2024 in King George Sound near Albany, Western Australia, a location that was set to become Australia's first commercial-scale wave farm in 2019 but never went ahead due to issues with funding (ABC News 2024). The M4 demonstration model was scaled to 24 m length and expected to absorb up to 10kW. The project cost was largely reinvested locally through project staff and locally sourced materials with the timeline indicating the device was to be retrieved in April 2025 (MERA 2025).

Research projects like King Island, Perth Wave Energy Project and the M4 prototype are essential if the government wants to tap into this unused resource to further decarbonisation efforts and achieve net zero targets. ARENA has been valuable in the funding for wave powered energy research in Australia. Their model of knowledge sharing and investments have supported growth and research into many different renewable energies, including wave generated power. Additionally, collaboration with different stakeholders and funding towards projects highlights their key role in the renewable space. However, ARENA's support demonstrates the need for long-term funding so research can be done to pursue the advancements and adoption of wave energy (Owens 2024).

Alongside supporting private companies in pursuit of wave generation projects, ARENA has worked with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in conducting research (Australian Government 2024b). The CSIRO found that wave energy has the potential to be a large contributor to decarbonising the NEM (Commonwealth Scientific and Industrial Research Organisation 2022). The creation of the Australian Wave Atlas, supported by ARENA, was made as a research tool to assess viability of harnessing wave power in Australia (Commonwealth Scientific and Industrial Research Organisation 2022, Australian Renewable Energy Agency 2021d). The atlas outputs information which can be used to determine electricity infrastructure, marine and spatial constraints, and spatial information (Hemer et al. 2018). As such, the atlas aims to fill identified gaps in wave power research, providing knowledge to relevant stakeholders and proponents (Hemer et al. 2018).

Whilst the OEI aims to regulate offshore power generation, in the context of wave power, it sets out very broad regulations and legislation (Frohlich et al. 2023). This is useful in the first steps of wave power in Australia but still fosters complexity for proponents to gain permits and licences, as the OEI only operates for projects in Commonwealth waters. The complexity arises from overlapping governance responsibilities. If the project's location overlaps in both Commonwealth and state waters, the proponent is required to operate within local, state, federal and Commonwealth governance, which can be complex due to overlapping responsibilities (Frohlich et al. 2023). Additionally, this complexity, in combination with little investments and low competition, generates a relatively small wave power sector globally and in Australia. The shutting down of the CETO 6 project demonstrates this well, as if governments are not willing to fund and invest, projects cannot go ahead. The OIR does support wave power generation and promotes the advantages of harnessing wave power, but there is a lack of transparency of any plans that may work towards a wave power sector in Australia. This is evident in the 'Offshore Renewables Environmental Approvals' report, where wave energy is only briefly mentioned (National Offshore Petroleum Safety and Environmental Management Authority 2022). Additionally, the resource, 'Harnessing Wave Energy', provides general information about wave power and the generators, but lacks any planning, policies or steps to develop a wave energy sector (Australia's Offshore Energy Regulator 2022).

Whilst wave generated power is not a popular energy source, Portugal has supporting policies for wave power generation (Ocean Energy Systems 2021, Majidi et al. 2025, Majidi et al. 2024). In 2021, the 2021-2030 National Ocean Strategy was approved in Portugal (Ocean Energy Systems 2021) This strategy has the purpose of enhancing the contribution of the ocean to Portugal's economy through decarbonising the economy, promoting renewable energy, stimulate scientific knowledge and promote blue economy innovation (Ocean Energy Systems 2021, Directorate General for Maritime Policy 2021b, República Portuguesa 2021). This strategy outlines that in order to meet national 2050 goals, the gradual adoption of cost-effective technologies is essential (República Portuguesa 2021). Hence, the targets set within the strategy such as establishing 370 MW of offshore wind and wave by 2030 will enable this gradual decarbonisation and progress towards ocean renewables. Portugal has already delegated model zones for projects, which

demonstrate the possibility of wave power technologies pre-market stages (República Portuguesa 2021). Additionally, Portugal has implemented wave energy converters (WECs), contributing a substantial portion of energy to the main grid, and being the largest wave energy resources in Europe (Majidi et al. 2025). Majidi et al. (2025) found that the deployment of WECs in Portugal has been extremely promising due to the favourable conditions and location, and the amount of government support towards wave generation. Portugal's strategy was framed within their maritime policy, which is aligned with European policies (Directorate General for Maritime Policy 2021a). The combination of national and international bodies ensures their policies have targets that benefit Portugal nationally but also assist in research and wave power generation across the European Union (EU).

Recommendations

Recommendations outline:

- Prioritise research for wave power.
- Long-term financial support to develop a local wave energy industry.
- Improve policy to support and streamline approvals for wave energy projects.

It is recommended that the Australian federal government should prioritise further research and testing within the country to facilitate the adoption of wave power in the near future. Australia's access to this large and reliable resource for energy should not be wasted, as tapping into this resource will allow for faster decarbonisation of the NEM. Conducting further research and investing more into this sector will enable the government and stakeholders to assess appropriate technology and attempt to implement this resource into the energy grid. Cost reductions can be made through appropriate location decisions, thorough research and planning, ensuring correct technology and foundation design is used, and combining methodological and rigorous approaches to optimise outcomes (Gaudin et al. 2021). Additionally, as Wang et al. (2024) explained, there are multiple cost-cutting efforts that could be done to install wave power converts. For example, mooring and anchoring can account for up to 30% of wave generation costs, but due to the slow development status of the wave energy industry, there are many unused opportunities such as using large scale seabed footprints (Wang et al. 2024). These would allow for many converts to be built on one foundation, thus, cutting costs. Furthermore, shutting down fossil fuel powered generation and allocating it towards wave power can enable this generation to be utilised (Wang et al. 2024).

Another recommendation is for the federal government to make greater subsidies available for state governments and stakeholders. Whilst ARENA provides financial support to proponents, long-term solutions are needed to ensure continuous support for wave power generation. In order for subsidies to effectively reduce the financial stress on states and proponents, collaboration with the federal government is essential to ensure thorough planning (Meya and Neetzow 2021). This will facilitate more accurate cost projections by including infrastructure costs, wages, potential risks and mitigative actions, and ongoing operational maintenance (Meya and Neetzow 2021). By aligning efforts and responsibilities

across all levels of government, it will help reduce financial barriers and enable the adoption of wave power. There are many avenues and opportunities for the Australian government to work with major stakeholders and state governments to cut costs and utilise wave power in Australia, and thus, ensuring Australia's journey to achieving a net zero future.

Lastly, improving policy is needed for wave power to become more accessible. Updating the EPBC Act and the OEI Act would ensure proponents are conducting EIAs thoroughly, and using research to evaluate and mitigate against associated risks. Furthermore, by improving the OEI Act with specific details regarding the processes for wave energy, it can include proposed projects that sit within Federal and state waters. This will improve certainty for how proponents need to navigate governance to obtain funding, permits and licences. Additionally, working with the OIR to integrate better planning of wave power, and ways to harness this energy generation will enable better pathways for proponents to create these generators in the future. Utilising similar techniques to Portugal's National Ocean Strategy into Australian wave policies would benefit the economy and decarbonisation efforts over the short and long-term. Having a separate strategy that outlines the goals and targets specifically for offshore wave energy will hold the government accountable. Thus, ensuring they take appropriate actions to achieve these goals and targets. Additionally, it would give guidance for proponents and governments on where the next steps can be taken towards a future where wave power is generated in Australia.

hydrogen

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Global energy availability is formed by an intricate network of diverse energy sources. It includes fossil fuels (coal, oil, and natural gas), nuclear power, and renewables. Fossil fuels have dominated the global energy mix, however, its environmental impact in terms of carbon emissions promoting global warming has initiated a need for the shift to cleaner energy options, such as hydrogen. With the increase in global population and energy demand, consistent and secure access to energy is a key challenge, particularly for developing countries (Oyedepo, 2012). Energy security, through diversification of sources like distributed energy systems, including storage systems and improvement in energy infrastructure, is critical for minimising reliance on fossil fuels avoiding supply disruptions. There are still places particularly in rural areas where energy access is challenging (Chaurey et al., 2004; Kanase-Patil et al., 2010).

Renewable energy provides an alternate option for the global energy transition, being both cleaner and more sustainable (Akorede et al., 2010; Apergis & Payne, 2010; Valadkhani, 2014). Many countries globally are investing in solar, wind, and other alternative energy options to mitigate carbon emissions and promote environmental stewardship. Hydrogen energy is a less common choice for investment compared to solar and wind but has many applications in the transition to net zero. This transition is supported by advancement in technology, energy storage, and grid modernisation and robustness, which makes renewable energy a more viable and economical option. While the global energy transition towards renewable energy is complex and it demands a significant long-term investment, it offers long term sustainable results contributing to a cleaner future (Liu & Feng, 2023).

To address environmental, economic, and social challenges by adopting cleaner, more sustainable energy systems, renewable energy targets are set by countries (I.-I. R. E. Agency, 2024). Many countries have pledged to achieve ambitious goals, including net-zero emissions by mid-century by including renewable energies in their overall energy mix (IEA, 2024).

Hydrogen energy represents an important and unique form of energy in how it is both used and transported making it an important supplemental component of energy systems The United Nations' Sustainable Development Goal 7 emphasises universal access to affordable, reliable, and modern energy, with a strong focus in relying on renewable energy technologies like solar, wind, and hydropower and developing new technologies such as wave energy or hydrogen energy (Nations, 2024). Global agreements, like the Paris Agreement, have encouraged nations to establish clear renewable energy goals and invest in cleaner energy infrastructure (Liu et al., 2020; Liu & Feng, 2023).

Australia's Renewable Energy Policies

Energy policy plays a vital role in designing the future of the global energy system. It focuses on key challenges related to climate change, sustainability, and economic development. The actions, decisions and strategies executed by the governments or organisations to monitor and manage energy production, distribution and consumption to ensure reliable, sustainable and supply to meet the consumer ends. It considers the economic, environmental and social perspective in designing the energy future of a country.

Australia's energy policies are shaped by a combination of federal and state-level frameworks aimed at regulating energy security, affordability, and sustainability. While Australia also has hydrogen specific policies, hydrogen energy is also impacted and guided by these broader policies that are also applicable to the wider renewable transition. These policies are set to achieve their aforementioned targets on renewable energy adoption and reducing GHG emissions. Some of Australia's renewable energy policies are:

- Renewable Energy Target (RET) (Australian Government, 2025) - Australia's RET has aimed to meet an additional 33,000GWh of renewable energy every year between 2020-2030, with an emphasis on adopting solar, wind and other renewables. This target has made Australia explore further into the renewable energy sector and include more renewable energies into its electricity grid. Furthermore, this RET has boosted large investments by the renewable energy distributors to sell their generated renewable energy through certificates.
- Capacity Investment Scheme (CIS) (DCCEEW 2025g) – The CIS aims to accelerate investment in renewable energy by providing long-term revenue safety nets for investors. It aims to deliver an additional 32 GW of capacity by 2030 to help reach Australia's target of 82% renewable electricity, operating through auctions held approximately every six months from 2024 to 2027 for the NEM (National Electricity Market) and every 12 months for the WEM (Wholesale Electricity Market).
- Future Made in Australia (CSIRO 2025c) - The Future Made in Australia plan is a $22.7 billion government initiative that identifies five priority industries aligned with Australia's National Interest Framework, including green metals, low carbon liquid fuels, and renewable hydrogen, aimed at

strengthening Australia's industrial capacity and creating sustainable economic opportunities

- National Electricity Market (NEM) (AEMO, 2025b) (AEMO, 2024) - Australia's National Energy Market makes up Australia's southern and eastern states while it mainly manages the electricity transmission and distribution from diverse energy sources. NEM supplies approximately 181.4 terawatt hours of electricity to homes and businesses a year. However, Australia's NEM has been facing issues with stabilising fluctuating energy because of the grid instability.
- Safeguard Mechanism (D. o. C. C. Australian Government, Energy, the Environment and Water, 2025) (Taylor, 2023) - Australia's Safeguard mechanism focuses on industries (like mining etc) to restrict or mitigate the emissions within the set limit. While this is a part of the country's emission reduction policies is has historically received wide criticism for being lenient.
- Emissions Reduction Fund (ERF) (Australian Government, 2020) - Emissions Reduction Fund was introduced to mitigate the greenhouse gas emissions through various strategies like deforestation, better land management. It provides financial incentives for the owners or businesses to pursue mitigating the emissions for their projects.
- Energy Security and Affordability (Australia Government, 2022) - Energy Security and Affordability is playing a vital role in aiding the government's focus towards renewable energy transition. With the decommission of coal fired plants and instability in the electricity prices, it is utmost important to look for alternative measures to support a smooth renewable energy transition. The government has committed to new gas generation and energy storage projects to secure supply while supporting the shift to renewable energy.

Australia's Hydrogen Energy Focus

Australia is aiming to expand its hydrogen sector, with initiatives and policies concentrated at scaling up production and integrating hydrogen into its energy mix. Australia has been exploring hydrogen as a clean energy source, with interest particularly growing in the late 2010s due to global pressure to decarbonise and Australia's vast renewable energy resources. Hydrogen has potential in reducing emissions in sectors like heavy industry, transport, and power generation. By leveraging the country's abundant availability of renewable energy, several strategies have been designed to explore Australia's hydrogen sector.

Australia is focusing on both green hydrogen, produced from renewable energy like wind and solar) and blue hydrogen, which is produced using natural gas with carbon capture and storage. The hydrogen being produced has been aimed for domestic usage to decarbonise heavy industries and for exporting it to countries like South Korea, Japan, India and China. Australia's hydrogen industry stakeholders are diverse, comprising government entities, private companies, research institutions, and industry bodies. There are also private sector players who are energy companies like Woodside, AGL Energy, and Origin Energy, while some of the projects are joint ventures with international partners. Research institutions like the CSIRO, contribute to Australia's hydrogen future along with industry bodies

like the Clean Energy Council, Hydrogen Australia and the Australian Hydrogen Council (H. A. H. Council, 2025; CSIRO, 2024; Government, 2025). The following is a list of some of the hydrogen projects that have been planned or are planned in Australia:

- Hydrogen Energy Supply Chain (HESC) Project (HESC, 2025). Located in Victoria and involving Japan's J-POWER, Sumitomo Corporation, Marubeni Corporation, AustHydrogen, and Woodside Energy. The Hydrogen Energy Supply Chain (HESC) project is aiming to create a supply chain for hydrogen export. The project is still in the pilot phase with testing and commercial viability under exploration. This is a joint venture aiming to produce hydrogen from brown coal (via gasification) and export it to Japan in the form of liquefied hydrogen.
- Australian Renewable Energy Hub (AREH) (Hub, 2025). Located in the Pilbara Region, Western Australia, the Australian Renewable Energy Hub (AREH) is an ongoing project with a focus on scaling up and integrating hydrogen into Western Australia's energy mix. This project is focused on producing hydrogen from renewable sources. The hydrogen would be for domestic use- to support local industry decarbonisation and exported to international markets. The project also explores using hydrogen as a grid balancing solution.
- Western Green Energy Hub (WGEH)(Energy, 2025) is located in the Goldfields region, Western Australia, and is a collaboration between InterContinental Energy, CWP Global, Mirning Green Energy Limited (MGEL). The Western Green Energy Hub is in its early stage, aimed at utilising Western Australia's abundant wind and solar resources to produce hydrogen for both domestic use and export.
- H2-Hub(TM) Gladstone (CSIRO 2024d) is located in Gladstone, Queensland and is being led by the Hydrogen Utility (H2U). It's main end use is for ammonia production and will involve a 3 GW electrolyser plant capacity at full scale and is currently under development. It aims to provide up to 5,000 tonnes per day in ammonia production capacity and will use renewables-based energy from new-build solar and wind resources in the Queensland region of the National Electricity Market.

Australia's Hydrogen Energy Policies

There are a set of policies Australia is set to strategically achieve in exploring the hydrogen energy sector, they are as follows (D. o. C. C. Australia Government, Energy, the Environment and Water, 2024; A. R. E. A. Australian Government, 2025; D. o. C. C. Australian Government, Energy, the Environment and Water, 2024d; Corporation, 2024; Government of South Australia, 2025; Group, 2018):

- National Hydrogen Strategy - Australia's National Hydrogen Strategy launched in 2019 as an aim to make Australia a global player in the hydrogen energy market by 2030. The main objective of this strategy is to provide an alternative, clean and cheaper energy option as compared to fossil fuels by engaging in hydrogen production from renewable energy sources like solar and wind energies. Through the National Hydrogen Strategy Australia has

aimed to establish new export markets and domestic applications for hydrogen, especially in areas such as transport, industry, and power generation.

- Hydrogen Head Start Program - The Australian Government has announced a total of $4 billion for the Hydrogen Headstart Program delivered by ARENA through two rounds, the first of which was announced in 2023, with the second announced in 2024 but yet to be released. The program has and will provide revenue support for large-scale renewable hydrogen projects through competitive hydrogen production contracts. This investment is intended to help bridge the commercial gap for early projects (CSIRO 2025c).
- Hydrogen Production Tax Incentive – Administered jointly by the ATO and Clean Energy Regulator, and is worth AUD$2 per kilogram of renewable hydrogen produced between 2027–2028 and 2039–40 for up to ten years per project. The value of the production tax incentive has been estimated at AUD$6.7 billion over 10 years (CSIRO 2025c).
- Hydrogen Export Hub Initiatives - States like Western Australia and the Northern Territory, have been spotted as potential hubs to establish hydrogen production, storage and export. The hydrogen produced in these hubs shall be exported to countries like South Korea, China and Japan.
- Clean Energy Finance Corporation (CEFC) - CEFC primarily funds the renewable energy projects in Australia, including hydrogen production. CEFC shall be used to support hydrogen production centres and integrate hydrogen into Australia's wider energy market.
- ARENA (Australian Renewable Energy Agency) - ARENA actively provides financial support for renewable energy projects, including hydrogen projects. ARENA plays an important role in making hydrogen energy economically viable.
- National Hydrogen Regulatory Review - A Federal-led cross jurisdictional process to identify barriers in the regulation of hydrogen. A first phase was conducted in 2022 through a review of existing hydrogen regulation and providing recommendations to Energy Ministers on how to improve the regulation of Australia's hydrogen industry and support its safe and efficient development, resulting in the development of National Hydrogen Codes of Best Practice (CSIRO 2025c).

In addition to these policies, other Australian states have showed interest in exploring the hydrogen market. Every state has come up with its state defined policies to achieve this ambition (D. o. C. C. Australia Government, Energy, the Environment and Water, 2024; Government of South Australia, 2025) . Some of them are as follows:

- States like Queensland, have invested in hydrogen hubs. These hubs have been initiated to produce hydrogen using renewable energy sources. This would provide tough competition to the existing coal mines.
- Victoria had been investing in providing a knowledge hub for hydrogen production by investing in research and development.
- South Australia, which is already known for renewable energy production, is developing a strong focus on hydrogen export.

Analysis of Federal Government's Hydrogen Policy

Some of the critical analysis conducted about these policies include:

- National Hydrogen Strategy - The National Hydrogen Strategy is designed to promote long-term hydrogen growth in both green hydrogen and blue hydrogen production and it also creates a regulatory environment conducive to scaling up the hydrogen industry. Recent studies show that hydrogen production could be promising especially due to Australia's large renewable energy availability like solar and wind energy along with the ample access to the coast for potential export hubs. Many assessments stress the importance of technological advancements in electrolysis and storage to lower production costs and improve efficiency. Even though hydrogen offers opportunities for economic growth and job creation the current challenges include high production costs, infrastructure needs, and uncertain market demand remain. To better support the industry Australia will need clear government policies, sustained and improved investment, and international trade partnerships that are fully supportive of Australia's hydrogen export potential. The Australian Hydrogen Council emphasises that addressing both domestic hydrogen demand and export opportunities is crucial for developing a sustainable industry in Australia. (C. E. Council, 2024a),(Brear et al., 2020; H. A. H. Council, 2024; Hossain Bhuiyan & Siddique, 2025; Siemens Energy, 2022; The University of Melbourne, 2023; The University of Melbourne, 2019; Victoria, 2021).
- Hydrogen Headstart Program – Independent assessment has identified that even though Australia may be tracking well in certain areas of hydrogen development, overall it is lagging especially when compared to international comparisons. Australia is no longer considered a global policy leader in developing a hydrogen industry (Allens 2023b). There are key limitations around the Hydrogen Headstart Programs financing mechanisms that are hampering its ability to accelerate the hydrogen industry (Herbert Smith Freehills 2023). While the program has been generally welcomed, some criticism has also been directed towards its lack of focus towards heavy industry or specific industrial regions specifically rather than general incentive mechanisms (Climateworks 2023).
- Hydrogen Production Tax Incentive – Assessments have noted that while the $2/kg offset is a good start that further support will be needed and that the 10 year support window may not be sufficient (Hamilton Locke 2024). Others have also noted the complexity of the scheme being jointly managed by multiple agencies and that the ability of companies to maximise benefits under both initiatives is reduced, hampering the true ability of these schemes to work in synergy (PWC 2025; Pinsent Masons 2025).
- Hydrogen Export Hub Initiative - Hydrogen hubs have been initiated to create hydrogen export in strategic regions across Australia. The initial studies conducted for these hubs include the location and infrastructure feasibility for hydrogen production and transport. Australia's hydrogen production is in preliminary stages. The Australian National University (ANU) has examined the economic impacts of hydrogen exports, noting that

Australia's competitive edge in the hydrogen export market will rely on production costs, infrastructure development, and global hydrogen demand (Australian National University, 2022).

- Clean Energy Finance Corporation (CEFC) - CEFC has been instrumental in investing in clean energy, including hydrogen, it also aids in Australia's low-emission energy transition. However, the CEFC's capacity to mitigate risks in early-stage hydrogen projects is crucial for drawing private investment according to the Clean Energy Council. Additionally, Institute for Sustainable Futures (ISF), University of Technology Sydney highlights that CEFC is bridging the financial gaps in these hydrogen projects, when the technology is in its incumbent stage and is very expensive for private investors. Thus, CEFC's success will depend on its ability to identify commercially viable projects and align with broader government policy and industry needs. (N. R. D. Council, 2025; Institute of sustainable Futures, 2023).
- Australian Renewable Energy Agency (ARENA) – ARENA plays a significant role in funding innovative projects, including hydrogen production and storage, to improve the economic feasibility of these technologies. ARENA's annual reports and research demonstrates a significant role in driving down the hydrogen production cost by funding projects in its early stage. This effort has resulted in making hydrogen production more economically viable. ARENA's funding towards research and development has helped to facilitate developments in electrolysis technology, which is important for reducing the green hydrogen production cost. Although ARENA's ongoing focus on innovation, especially in improving electrolysis efficiency and integrating with the energy market, is key to making hydrogen commercially viable, the agency should also encourage collaboration amongst industry players to speed up technological advancement (Andeobu et al., 2024; Association, 2023; A. R. E. A. Australian Government, 2024b; A. R. E. A. Australia Government, 2024; University, 2024).

Barriers to Hydrogen Production

While Australia's hydrogen energy policies are ambitious, challenges remain in terms of cost competitiveness, infrastructure and policy coordination. Hydrogen technology is relatively new to Australia compared to the well-established fossil fuels which makes hydrogen production (particularly green hydrogen) very expensive despite the cost of electrolysers and other related technologies decreasing. Australia is still in early stages of hydrogen energy development which implies that the country needs to establish infrastructure facilities for hydrogen production, storage and export. These hydrogen hubs which are mainly planned are in the isolated and remote areas where significant investment is required for infrastructure development. The public acceptance of new technology is always a challenging aspect, especially if it might be perceived as replacing pre-existing employing industries, meaning that public awareness campaigns and education are crucial to gaining acceptance. There is a need for a skilled workforce to support the growing hydrogen industry.

One of the challenging aspects of using hydrogen technology is also its storage and transportation. Hydrogen has low energy density, which makes it difficult and

expensive to store and transport. Hydrogen has to be compressed or liquified for storage, and the whole process is energy intensive. Transportation of hydrogen is through pipelines or in the form of liquid hydrogen. Both these methods require specialised infrastructure which is limited in Australia (Andeobu et al., 2024; D. o. C. C. Australia Government, Energy, the Environment and Water, 2024). Commonly, hydrogen is mainly produced using renewable energy sources like solar or wind. However, hydrogen can also be produced from natural gas (blue hydrogen) which is not environmentally viable. Blue hydrogen can be made environment friendly by using carbon capture and storage technology (A. E. Council, 2025). This process makes blue hydrogen a more complex and costly option, reducing its attractiveness and viability, meaning that green hydrogen options may be preferred.

Recommendations and conclusion

With respect to hydrogen production there are certain lessons that Australia can learn from other countries, they are:

- Integrating hydrogen into the transportation sector similar to Germany and Japan through hydrogen powered vehicles (Agency, 2019; Studies, 2021) (Government, 2025).
- Assisting in research funding and providing subsidies, tax incentives and thus showcasing stable policies for hydrogen innovation like occurs in the European Union and South Korea. (E. Commission, 2025) (Cho et al., 2024; Korea, 2019).
- Enhance and optimise pre-existing incentive and subsidy schemes and programs such as the Hydrogen Headstart Program and the Hydrogen Production Tax Incentive (Herbert Smith Freehills 2023; Hamilton Locke 2024; PWC 2025; Pinsent Masons 2025).
- As mentioned earlier, Australia has to focus on improving its infrastructure, this also includes hydrogen refueling stations and pipelines for hydrogen transport like is present in Norway and UK.(Cheng et al., 2024; Hydrogen, 2025).
- Germany has used public-private partnerships to accelerate hydrogen technology and production, and Australia can learn to collaborate in a similar manner to expand its hydrogen energy market (Quitzow et al., 2024).
- Australia should continue funding local pilot projects to refine and scale hydrogen applications across various sectors, including taking advantage of local renewable energy sources to create green hydrogen, and local applications to heavy industry (Wang & Walsh 2025).

These hurdles can be dealt with through improved and consistent energy policies supporting renewable energy uptake, while these policies must be consistently supervised and revised to ensure that progress is tracking with emission reduction milestones. Consistent and sufficient support from both federal and state government policies backed with public support can make Australia a fore runner globally in the hydrogen energy market. However, the industry in Australia risks failing to meet its own goals. An example of this is that several previously considered active hydrogen projects have been archived, many due to shifts in

funding priorities (CSIRO 2024b; CSIRO 2025b). The reduction in the number of active hydrogen projects reflects the challenges faced in securing funding and aligning with market conditions, but the continued focus on some key projects suggests that hydrogen still holds potential for the nation's energy strategy if better supported.

nuclear energy

This chapter can be referenced as "Tweed, I. (2025). Nuclear energy. In B. Goodsell (Ed.), The State of Policy Report (pp. 129-137). The Climate Centre."

Countries all over the world have been utilising nuclear power in their energy mix for decades, with the first commercial nuclear reactor designed and fired up in 1957 in the USA (Outline History of Nuclear Energy - World Nuclear Association, 2024). According to the International Energy Agency (IEA), nuclear power currently provides about ten percent of the world's electricity, and in December 2023, at COP28, 25 countries pledged to triple nuclear capacity by 2050 (US Department of Energy, 2023). However, to this day, Australia sits among the countries to have never introduced nuclear power, going so far as to ban the development of nuclear power at both federal and State levels.

Australia's demand for electricity will more than double before 2050 (AEMO, 2024), and the Australian Energy Market Operator forecasts 90 percent of coal-fired power stations will be decommissioned by 2035, with the last being closed in 2038. As such, there is an urgent need to rapidly introduce new forms of power generation and add capacity to existing generation. At the same time Australia needs to recognise the role energy plays in contributing to its greenhouse gas emissions and therefore needs to consider ways to enable reduction by committing to investing in net-zero energy technology to address and achieve Australia's climate commitments under the Paris Climate Agreement. Nuclear energy is a dispatchable, emissions free source of power, but there is considerable debate as to whether it can play a role in the future of Australia's energy mix.

History of uranium mining in Australia

Australia has the largest known uranium resources in the world, and as it stands, all of this is exported (Australia's Uranium - World Nuclear Association, 2025). These resources were first discovered in Carcoar in New South Wales in 1894 (Broinowski, 2022) and were used in early treatments of cancer and health and beauty treatments (Cawte, 1992). The Australian Atomic Energy Commission (AAEC) was set up to "undertake and promote nuclear research and oversee mining of Australian uranium" in 1953 (Martin, 1982).

There were limited discoveries in Australia during the 1940s and 1950s. In the 1960s, due to a drop in demand for Uranium from the West developing nuclear weapons, mines were shut. But, during the late 1960s, when nuclear programs were expanding as global tensions were rising, exploration efforts redoubled (Broinowski, 2022). Major finds in the 1970s led to mining companies seeing a potential new major earner, and successive government's contemplated, if properly regulated, whether to use Australia's rich uranium resources as a channel to get involved in global nuclear affairs (Broinowski, 2022). According to Ian Lowe (2021), "Australian assistance was absolutely essential to the development of British nuclear weapons". British bomb tests occurred off the coast of Western Australia and Australian mined uranium was used to make the weapons. During this time, following the devastating images from the nuclear attacks in Japan which ended the Second World War, politicians chose not to make the sharing of uranium public, with Prime Minister Robert Menzies opening the Rum Jungle uranium mine in 1953 stating it "can and will within a measurable distance bring power and light and amenities of life to the producers and consumers and housewives of this continent" (Lowe, 2021). However, this vision was never achieved.

The Australian Atomic Energy Commission (AAEC) was established to build a prototype nuclear reactor at Lucas Heights in 1958, with the vision to develop the expertise to eventually roll out nuclear power stations in Australia (Lowe, 2021). Subsequent projects were raised, postponed and abandoned. No governments were able to keep the debate moving forward enough to make nuclear energy a reality. To this day, nuclear energy hasn't played a part in the Australian energy mix. In fact, steps have been taken to actively prevent its use. By the late 1990's laws were in place banning the development of nuclear energy in Australia, namely, the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) and the Australian Radiation Protection and Nuclear Safety Act 1998 (ARPANS Act).

Nuclear in the energy mix

The nuclear debate has always been simmering in the background of Australian political debate around powering the country and the future energy mix. Arguably, we're currently in the most fraught and contentious era of the debate with it at the forefront of the overarching political agenda, intersecting multiple areas from energy and climate change to cost-of-living. Australia has always been cognisant of the knowledge that its reliance on coal-fired power would need to be replaced by another form of reliable power in the future. In 2023 fossil fuels contributed 65 percent of total electricity generation, mainly including coal (46%), with gas (17%) and oil (2%) also in the mix. Renewables contributed the other 35 percent (Australian Electricity Generation - Fuel Mix | energy.gov.au, 2025).

In March 2025 Nexa Advisory released a report highlighting the declining operations of Australia's largest power station - the Eraring coal fired power station - finding the plant 'experienced approximately 6000 hours of outages across its 4 units in 2024' (Ferrari, 2025). Despite this, the NSW government negotiated a two-year extension of its original 2025 closure date to 2027, which Nexus says could cost New South Wales taxpayers up to $450 million (Bashir, 2024).

The example of Eraring shows us two things. Firstly, many of Australia's coal fired power plants are heading towards end-of-life. Eraring is not unique: it is just one of many coal power stations aging out of use. Secondly, the extension demonstrates the awareness that the energy output derived from the plant, despite its numerous falterings, which come with an economic cost, is worth investing large sums of money in, due to a lack of available energy elsewhere in the mix.

This indicates that Australia urgently needs to transition to new and reliable forms of energy, but also that it doesn't have decades to do so. As mentioned, the Australian Energy Market Operator (AEMO) estimates that the NEM must almost triple its capacity by 2050 to replace retiring coal capacity and meet increased electricity consumption as other sectors electrify. Australia needs to act on building out the infrastructure needed for new and increased levels of electricity, work out how to generate the level of energy output needed for a growing nation, and what sources will play a role in the mix.

Nuclear abroad

An argument of the proponents of nuclear energy in Australia argue that it exists as part of the energy mix elsewhere in the world, so why shouldn't Australia develop its own nuclear energy industry. One reason is the time it takes to get nuclear built and into the system. Indeed, places such as the UK and France have a long history of using nuclear energy. But one of the reasons why they can commit to the continuation of nuclear and new plants is because the infrastructure and skills already exist in this long history. France derives its electricity from almost 70 percent nuclear energy sources from 57 Operable Reactors generating around 63,000 MW (Nuclear Power in France - World Nuclear Association, 2025). The country opened its first nuclear power plant in 1956 and has been building on its capacity since then.

An example of a new nuclear project being developed is the Hinkley Point C plant in Somerset, UK. The project is the first new nuclear power plant being developed in Britain in over 20 years. The majority shareholder developing the project is EDF Energy, a British energy company wholly owned by the French state, with China General Nuclear as a minority partner. The project, which began construction in 2016, with an expected completion date of June 2027, is now expected to be finished in 2031 and cost £2.3 billion more, £35 billion in total. This is undeniably a huge additional cost and delay. With Australia already facing imminent coal-fired plant closures, this demonstrates the need to look toward energy opportunities where the technology and infrastructure is more readily available.

Policy

Australia has a longstanding bipartisan moratorium on nuclear power, with legislated prohibitions in place at both state and federal level. The Commonwealth Australian Radiation Protection and Nuclear Safety Act 1998 (ARPANS Act) and Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) prohibit approval being granted for the construction or operation of nuclear power plants. These laws 'effectively preclude the implementation of any nuclear power program in Australia (Select Committee on Nuclear Energy, 2025).

Federal legislation

In order to get a new nuclear research reactor built at the Lucas Heights site, home to Australia's Nuclear Science and Technology Organisation (ANSTO) in New South Wales, in 1998, then Prime Minister John Howard signed a deal with the Senate Greens agreeing to an amendment to the Australian Radiation Protection and Nuclear Safety (ARPANS) Bill 1998. The Act essentially enabled the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to become the regulatory body for radiation protection with its primary objective to protect citizens and the environment from harmful nuclear radiation. It also empowers the ARPANSA to promote the use of nuclear fission in various forms, such as medicine. However, the amendment insisted upon by the Greens at the Bills establishment in 1998 prohibited the development of other nuclear facilities (Australian Energy Council), essentially cutting off any near-term nuclear energy future, at least until the amendment was further amended or overturned.

There have been several serious attempts to overturn the ban, including by Howard himself in 2006, opening a Prime Ministerial Taskforce to review uranium mining, processing and nuclear energy, and calling for "an open-minded and as emotionless fashion possible, to have a serious debate about this issue" (Howard, 2006) at a press conference in Parliament House. Despite the report finding nuclear energy could be viable and recommending lifting the ban, the Howard government faced public and political backlash, and the issue was subsequently dropped when the Labor government, under Prime Minister Kevin Rudd, was elected a year later, in 2007.

In addition to the ARPANS Bill, the Nuclear Non-Proliferation (Safeguards) Act 1987 is the Act that governs Australia's compliance with international treaties related to non-proliferation. The Australian Safeguards and Non-Proliferation Office (ASNO), in the Department of Foreign Affairs and Trade portfolio, established in 1998 acts as the regulator. They mainly operate under the Nuclear Non-Proliferation (Safeguards) Act 1987, the Chemical Weapons (Prohibition) Act 1994 and the Comprehensive Nuclear-Test-Ban Treaty Act 1998 pieces of legislation. This all ties into Australia's position as signatories of the Global Non-Proliferation Treaty, an international treaty to prevent the spread of nuclear weapons across the globe. It came into force in 1970, extended indefinitely in 1995, and is signed by the five nuclear weapons states as well as 186 other signatories (Treaty on the Non-Proliferation of Nuclear Weapons (NPT) – UNODA, n.d.). This position and pieces of associated legislation all keep the research and development of nuclear capabilities under strict regulation.

There have been several inquiries into overturning nuclear prohibitions at both a state and federal level. These include:

- The South Australian Nuclear Fuel Cycle Royal Commission 2015-16.
- The Victorian Inquiry into Nuclear Prohibition 2019-20.
- The Federal Inquiry into the Prerequisites for Nuclear Energy in Australia 2019.
- The Federal Environment and Other Legislation Amendment (Removing Nuclear Energy Prohibitions) Bill 2022.

- The Federal Inquiry into nuclear power generation in Australia 2025.

The most recent inquiry into the deployment of a nuclear energy industry in Australia came in February 2025 conducted by the federal government House of Representatives select committee on nuclear energy, focussing on deployment timeframes and cost. While the committee highlighted more research needs to be conducted, on the two focuses of the report concluded "deployment of nuclear power generation in the Australian context is currently not a viable investment of taxpayer money" (Select Committee on Nuclear Energy, 2025).

Introducing nuclear power in Australia isn't just about a pro-nuclear government being elected and developing Australia's first nuclear energy reactors. It would need a significant legislative change, backed by political consensus and public support, or at the very least a relative level of appetite and understanding. Of course, a significant amount of local public engagement and engaging with Indigenous and environmental stakeholders would also need to take place for a government to have the social licence to make this a reality. This, as well as political consultation and debate, will take a significant period of time and investment.

State Nuclear policies

While a ban on nuclear power at federal level has existed since 1998, State bans also exist across Australia. Even if a future federal government were to overturn the nuclear ban, it would still face significant challenges in State's where bans exist in order to get any nuclear project off the ground. State legislation preventing nuclear energy includes:

- In Queensland the primary legislation enforcing a ban on nuclear energy is the Nuclear Facilities Prohibition Act 2007. The Act prevents the construction and operation of nuclear power plants and other related infrastructure within the state, specifically nuclear reactors, uranium enrichment plants and spent fuel reprocessing facilities. The scope of the Act spans power generation, uranium enrichment and the disposal of nuclear waste in the State.
- In New South Wales the key piece of legislation banning nuclear power is the NSW Nuclear Facilities Prohibition Act 2000.
- In Victoria the Nuclear Activities (Prohibitions) Act 1983 is the key legislation banning nuclear power, uranium enrichment and nuclear waste facilities.
- In South Australia, the Nuclear Waste Storage Facility (Prohibition) Act 2000 banned the establishment of nuclear waste storage or disposal facilities in the state. However the state does allow uranium mining, including sites such as Olympic Dam.
- Western Australia has no specific law banning nuclear power but in 2017 a previously repealed ban on uranium mining was reinstated under the McGowan Labor government, though existing projects were exempt.

Each State's parliament would need to amend their laws to allow projects to be built in their jurisdictions. For example, Queensland's Liberal Premier David Crisafulli MP has made his State government's opposition to the Federal Coalition's nuclear plans public, basing his opposition on the fact that Queensland has the

youngest fleet of coal-fired power stations and that these, supported by a renewable energy mix, will help drive down energy costs for residents of the State. Overturning State bans would therefore follow long periods of consultation, even if leaders were in favour of overturning the ban. Ultimately, nuclear energy becoming a reality has a number of timely hurdles to overcome before any planning and subsequent building can even take place.

Policy Analysis

The cost of nuclear power

As previously discussed, new nuclear comes with a high price, as seen at the significant cost blow out of the Hinkley Point C project in the United Kingdom. As Lowe notes, "the modifications required more recently to assure the public of the safety of nuclear reactors, however, have dramatically inflated the delivered cost of power, now beyond the reach of even the most creative arithmetic" (Lowe, 2021). As the World Nuclear Association states: "A nuclear power plant project is characterised by high upfront capital costs and long construction periods, low and stable operational costs, and lengthy payback periods" (World Nuclear Association, n.d.).

With the need for a change in the energy system as it moves away from coal, conversations around nuclear have inevitably come to the fore. The economic viability has been a focus as it was raised as an energy solution for Australia. This has particularly been scrutinised in comparison to the country's existing technology around renewable energy sources. The Commonwealth Scientific and Industrial Research Organisation (CSIRO), the government's scientific advisory body, in collaboration with the Australian Energy Market Operator (AEMO) conducts detailed annual assessments through its GenCost reports, providing evidenced based projected costings of various energy generation technologies. These assessments have found that renewable energy sources remain the most cost-effective sources for new electricity generation, falling for the seventh consecutive year (Graham, et al. 2024). In the 2024-25 report the CSIRO estimated the levelised cost of electricity (LCOE) for large-scale nuclear power to range between $145 and $238 per megawatt hour (MWh) by 2040. This is compared to costs for solar being estimated between $22 and $53 per MWh, and for wind between $45 and $78 during the same period. From this data we can deduce that nuclear power would cost at least twice as much as renewables (Graham, et al. 2024).

Conversely, the recent economic analysis by Retail Economics on the cost of nuclear energy in the National Energy Market, released at the end of 2024, argues that incorporating nuclear power into Australia's energy mix could lead to cost savings. They state they are using AEMO modelling as the basis for comparison, using its 'Step Change' and 'Progressive' scenarios to compare the costs of nuclear power in Australia's energy ecosystem (Frontier Economics, 2024). The report writes that nuclear energy could be up to 44 percent cheaper than AEMO's projections around a renewable transition, with a total expenditure of $331 billion. It also argues that costs would be driven down by the nature of it being a dispatchable energy source that can operate at all times of the day as opposed to the intermittent

character of renewables that need 'expensive grid storage and backup power' to ensure reliability (Frontier Economics, 2024). Finally, it argues that nuclear provides a smoother transition as it would maintain grid stability while reducing emissions.

Nuclear power timelines

In the GenCost report, the CSIRO argues that nuclear projects in Western countries frequently exceed cost projections and take over 15 years to build, making it unlikely that nuclear could replace coal affordably or on time. The Climate Council points out that with the timelines to get nuclear up and running appearing a minimum of 15 years down the line, and that's before the lengthy legislative overhaul that will need to take place at both state and federal parliaments, with coal aging out by 2038, nuclear won't be on grid in time to replace it (Climate Council, 2025).

In the 2025 federal election, the Coalition campaigned on a promise to build nuclear power plants and for them to be in operation and supplying energy to the NEM by the mid 2030's. However, as Hugh Durrant-Whyte, New South Wales' chief scientist and engineer, said, it's not even just about the time it would take to build, construct and be operating at the plant, but also Australia would need "many decades" to develop the regulations and skills to operate a nuclear power plant (Hannam, 2024). Ultimately, if nuclear was pursued at the expense of a fast roll out of renewables, the time it would take to establish a nuclear power industry from scratch would have a detrimental effect on the country's climate change impacts through delaying moving to cleaner forms of energy.

Stakeholder perspectives

The Climate Change Council advocates against nuclear energy in Australia arguing that it risks energy security, would increase energy bills for Australian residents, projects are expensive and usually run over time and reactors post significant community, environmental and health risks. They also raise the massive amounts of water needed to cool facilities in a country that suffers with droughts, with reactors poised to be built in drought prone areas (Climate Council, 2025).

The Australian Energy Market Operator (AEMO), the quasi-government body managing the planning and development of Australia's energy system, also has doubts about the feasibility of a nuclear power industry in Australia. Chief Executive Daniel Westerman said: "even on the most optimistic outlook, nuclear power won't be ready in time for the exit of Australia's coal-fired power stations" (Macdonald-Smith, 2024). This highlights the recognition of the urgent need to replace aging coal-fired power in an efficient and equitable way to minimise the impact on the Australian consumer.

Australia's Nuclear Science and Technology Organisation, is Australia's sovereign nuclear organisation, based at the Lucas Heights facility in New South Wales. ANSTO also represents Australia on the global stage, engaging in nuclear policy with multilateral platforms such as the International Atomic Energy Agency, the Nuclear Energy Agency of the OECD and the Generation IV International Forum. ANSTO is directed by the government to remain impartial and does not advocate for or against the development of a nuclear power industry in Australia, however it

contributes to the development of nuclear technologies through its research capabilities and expertise.

In June 2024 the Coalition proposed to build seven nuclear power plants and two small modular reactors as a solution to Australia's energy generation needs. The seven sites have been strategically chosen at locations where existing coal fire plants will be shutting down. These sites were Tarong in north-west of Brisbane, and Callide west of Gladstone in Queensland; Liddell in the Hunter Valley, and Mount Piper near Lithgow in New South Wales; Port Augusta in South Australia; Loy Yang in the Latrobe Valley in Victoria; and Muja near Collie in Western Australia (Herbert Smith Freehills Kramer 2024). However, the plan failed to consider is that, particularly in South Australia, these lines are already saturated with an abundance of renewable energy being generated from wind and solar projects in the vicinity. The proposal included plans to develop two initial projects using small modular or modern larger reactors, expected to produce electricity by 2035 or 2037 respectively (Dutton, et al. 2025). While some Coalition members have indicated ongoing support for nuclear energy despite the party loss at the 2025 election, others have labelled such a position as "electoral suicide" and it is unclear if this will remain the party's position moving forward (SBS News 2025).

Another proponent of developing a nuclear power industry is Nuclear for Australia. The group advocates for the peaceful applications of nuclear science and technology in Australia. The group posits that with the pressure Australia is under to produce enough energy to power the nation while coal plants are ageing out of the system, the long-term solution needs to be nuclear alongside gas and renewables. In March 2025 it cited Rystad Energy's research which argued that Australia has a 17% shortfall in the delivery of renewables and that this highlights the necessity to address including nuclear energy in the future power mix (Shackel, 2025). Will Shackel, Founder of Nuclear for Australia said: "Nuclear energy is a proven, zero-emissions technology powering 32 countries worldwide, yet Australia remains the only G20 nation not embracing or moving towards it [...] We need a debate based on facts—costs, safety, and environmental benefits—not ideological opposition." (Shackel, 2025). Nuclear for Australia has run a public petition which has amassed over 100,000 signatures, calling for the legislation of nuclear power. In addition, in June 2024 the Lowy Institute conducted a poll which showed that 61 percent of Australian's either 'strongly' or 'somewhat support' Australia using nuclear power to generate electricity, alongside other sources of energy (Lowy Institute, 2024).

Another advocate is the Minerals Council of Australia, who are active in providing industry perspectives toward the development of a nuclear power industry in the country's energy portfolio. It argues that "a broad portfolio of low-emissions technologies, including gas and renewables is essential if Australia is to meet its net zero emissions goals by 2050" (Minerals Council of Australia, 2024), including nuclear energy. In 2019, it presented its case to the House of Representatives Standing Committee on Environment and Energy's Inquiry into the prerequisites for nuclear energy in Australia. The Council put forward six key arguments:

1. Nuclear energy can provide zero emissions affordable 24/7 power for Australian industry

2. SMRs could provide the cheapest zero emission 24/7 power in Australia
3. Nuclear power is the only energy source which deals with its own waste
4. There is no justification for the continued prohibition of nuclear power in Australia
5. Australia is short-changing itself by not allowing nuclear power
6. Australia can start developing a regulatory framework for SMRs now

The Council also argues that in order for Australia to meet its decarbonisation targets, it needs to address high polluting sectors that use high amounts of heat and energy. It argues nuclear energy "brings a powerful tool to address difficult to decarbonise sectors" such as steel production and chemical manufacturing (Minerals Council of Australia, 2024).

The impacts of a nuclear power industry on the environment

As the World Nuclear Association explains, nuclear energy is low-carbon and produces "no greenhouse gas emissions during operation" (Nuclear Essentials - World Nuclear Association, n.d.). In addition, it argues that over its full life-cycle it equals wind in terms of the emissions produced per unit of electricity, which is one-third the emissions of solar power. It further argues that the "use of nuclear energy today avoids emissions roughly equivalent to removing one-third of all cars from the world's roads" (Nuclear Essentials - World Nuclear Association, n.d.).

Despite the low-carbon nature of nuclear energy production, the most significant issue with nuclear energy impacting our environments is the production of radioactive nuclear waste. In addition to high capital and operational costs, there is no Australian facility to store or dispose of the high-level waste that would result from the nuclear fuel cycle (Hutchinson, 2022). As Lowe argues, "most of the forty nations using nuclear power are just piling up the spent fuel, with no clear plan to manage it for the incredibly long periods required. That is a very serious environmental legacy for future generations." (Lowe, 2021).

Conclusion and recommendations

While nuclear power may become an economically sound opportunity for Australia's power generation in the future, especially as the technology advances, in its current ideation, the costs to build and timeframes to having an impact in the NEM make it infeasible for Australia's current needs around climate and power generation. In order to meet its climate commitments and meet the energy demands of the population, Australia in the near term needs to focus on existing low emissions technology, such as wind and solar and Battery Energy Storage Systems (BESS).

energy grid optimisation

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Australia's power grid is currently undergoing a transformation as it aims to increase renewable sources whilst trying to provide affordable electricity supply. As coal becomes obsolete at faster than anticipated rates, the need for intermediate energy sources rises. All but one coal power station in the remaining fleet are scheduled for retirement by 2051, with approximately half set to close by 2035 (AEMO 2024). This issue has come about due to ownership becoming less attractive, due to higher operating costs, reduced fuel security, increased maintenance costs and greater competition from renewable energy in the wholesale market (AEMO 2024). The challenge for maintaining power supply while undergoing power system transformation in an Australian context often mirrors that of other grid systems around the world in that it relies on support for gas-powered production, batteries, and pumped hydro as firming technologies to level out the peaks in variable renewable energy, as well as technological advances in grid technologies to increase renewable distribution. Managing these different energy sources can be achieved through implementing policies specific to gas markets, battery energy storage systems (BESS), and pumped hydro. In light of the fact that Australia is not implementing policies that are sufficiently supportive of the need to keep climate-induced warming to within 1.5 or 2 degrees, the federal government has an opportunity to enhance its policies to get a better outcome for Australia's power grid and the Australian people.

Introduction to federal government policy

The federal government has responsibility in managing the national electricity grid through the Australian Energy Market Operator (AEMO). It was originally established by the Council of Australian Governments in 2009 to manage the National Electricity Market (NEM), which is both the wholesale market and the physical infrastructure located in the eastern and south-eastern states (AEMO 2025a).

It's initial responsibilities also included managing the national gas market, and its responsibilities have grown over time, including to operate other areas and other power grids, for example the Western Australian Wholesale Electricity Market (WEM), which supplies electricity to the south-west of Western Australia via the South West Interconnected System (SWIS), and includes the Reserve Capacity Mechanism, which is a system unique to Western Australia that ensures there is enough generation to meet demand at all times (AEMO 2025b). AEMO also manages the Northern Territory NTESMO system (AEMO 2025c). AEMO ownership is shared between federal and state governments as well as industry, with all operating costs being recovered through fees paid by industry participants. It has three stated areas of responsibility (AEMO 2025d): maintain secure electricity and gas systems; manage electricity and gas markets; and, lead the design of Australia's future energy system. It is also responsible for policies, such as the National Transmission Network Development Plan, which is a 20-year planning strategy for the NEM, which aligns with the National Electricity Rules and the National Electricity Law that establish AEMO as the transmission planner for all of Australia (AEMO 2025e). Related functions are supported by other bodies such as the Australian Energy Market Commission (AEMC), and the Australian Energy Regulator (AER), which provides guidance and advice, and acts as a regulator, respectively, in energy markets within Australia. Initiatives that fall within the scope of these bodies include the regulatory investment test (RIT), and the Service Target Performance Incentive Scheme (STPIS).

Major policies that the federal government is responsible for that relate to grid optimisation include the National Energy Transformation Partnership (NETP), which is a partnership between Australian state, territory and federal governments to modernise Australia's energy system in line with our net zero goals, which was agreed to in 2022. This includes the national renewable electricity target of 82% by 2030 and net zero by 2050, and the bilateral negotiation of Renewable Energy Transformation Agreements with each state and territory to address their unique needs. Other priorities include: the Capacity Investment Scheme, which encourages investment in renewable generation and clean dispatchable capacity including through the use of large-scale generation certificates (LGCs); supporting states and territories to embrace the Rewiring the Nation initiative; implementing a First Nations Clean Energy Strategy; meeting workforce needs through the National Energy Workforce Strategy (NEWS); and implementing ten intergovernmental working groups to progress these and other key reforms, with reporting to the Energy and Climate Change Ministerial Council (DCCEEW 2022).

The Rewiring the Nation initiative has the goal of making clean energy more accessible and affordable for Australians. The program involves significant investments in new transmission lines and grid infrastructure and is managed by the Clean Energy Finance Corporation (CEFC), while the funding is administered by the Department of Climate Change, Energy, Environment and Water. This initiative works in tandem with AEMO's Integrated System Plan (ISP), which provides a forecast of the infrastructure needs, proposes an Optimal Development Path (ODP) which indicates a lowest-cost strategy to meet emissions reductions, identifies renewable energy zones (REZs) for the development of clusters of large-

scale renewable energy projects, and makes recommendations for investing in transmission to ensure the supply of reliable and secure energy. For example, in 2024 the ISP forecasted the need for an estimated 4,581 km of new transmission lines to meet 2030 targets. It then works with state and territory governments to fast-track key transmission projects. For example, the Victoria-New South Wales Interconnector West, the Marinus Link in Tasmania, or modernisation of the North West Interconnected System (NWIS) and the SWIS in Western Australia (DCCEEW 2025).

Other than the power supply issues caused by the fluctuation of renewable energy sources, the fragmentation of Australia's network grid is a critical issue that needs to be addressed by government policy. The federal government is attempting to address this through several initiatives that target regional areas, including the Powering the Regions Fund, the Outback Power Program, and the Regional Microgrids Program (DCCEEW 2023, Solar Hybrids 2025, ARENA 2025a).

Gas Market Code Policy

For gas, its role in the renewable energy transition is primarily focused on providing base load power to help balance the variability in renewable sources, which supports electricity supply during periods of high demand (AEMO 2024). The rise of gas peaker plants, which are specifically built to fill supply shortages in bridging supply constraints, represent a change in the role of gas-powered generation, and requires specific mechanisms to address their unique needs, such as on-site gas storage. This is required as stability will be needed when electricity demand peaks at times of low renewable energy generation, pipeline constraints will limit the ability of gas generation to support other dispatchable reserves. Thus, the need for refuelling infrastructure will be a key consideration for future gas generation projects (AEMO 2024).

The Gas Market Code Policy was enacted to cap gas prices at $12/GJ, however in late 2023 and early 2024, several major gas producers received special permission from federal government to operate under modified price rules set out in the 2023 Gas Market Code. These conditional exemptions allowed them to resume offering gas supply contracts for 2025–26 (ACCC 2024). Following this, both gas producers and retailers significantly increased their market activity, with a notable rise in supply offers during the first half of 2024. Companies included Woodside Energy (Bass Strait) Pty Ltd, Esso Australia Resources Pty Ltd, Santos, Senex Energy, APLNG, and Walloons Coal Seam Gas Company Pty Ltd. Gas buyers have reported significant difficulties in securing gas at the regulated price of $12/GJ under the Gas Code. This is because most gas production expected in 2025-26 is unavailable for domestic purchase at this price point, being either pre-committed to export markets or controlled by producers who have received conditional Ministerial exemptions from the Gas Code's price regulations (ACCC 2024).

Therefore, gas producers are moving away from long-term agreements, now favouring contracts shorter than 2 years, with LNG producers particularly active in short-term sales. This shift towards shorter contracts creates concerns for buyers about price volatility and supply security (ACCC 2024). It also risks deterring

investment in gas infrastructure projects, which typically require long-term price and supply certainty to secure financing. Adding to these concerns, gas sellers are increasingly using Expression of Interest (EOI) processes to market their gas. Buyers worry that EOIs further disadvantage them in negotiations since they must bid without knowing other offers. The often-lengthy duration of these EOI processes has also raised concerns among buyers, despite the Gas Code not specifically requiring this sales approach (ACCC 2024).

Retailers have stated that the Gas Code has had minimal price impacts. Current domestic prices have been driven up by international prices and domestic demand-supply condition (ACCC 2024). With a majority of producers granted exceptions, market dynamics are influencing price where producers are reluctant to offer supply at prices below the cap of $12/GJ. The price cap is effectively serving as a minimum price for producers. Thus, additional domestic supply and increased supply investment coupled with more competition and supplier diversity to ensure the gas market functions effectively during the energy transition is necessary to put further downward pressure on prices. This is even more important particularly given declining east coast gas supply and seasonal shortfalls in southern states that must now rely on Queensland gas. In the longer-term, significant volumes of additional supply will be required to avoid shortfalls (ACCC 2024).

Due to increased costs, offset to higher gas prices has been sought by procuring gas through AEMO markets either directly or via a retailer or intermediary. It is expected these prices will be lower than the prices they had been offered by producers and retailers under longer-term GSAs (ACCC 2024). This dramatic decline in long-term GSA volume can be noted where 2021 supply year reached about 275 PJ by December 2020, while the 2024 supply year only achieved approximately 75 PJ by December 2023. This stark difference represents roughly a 73% decrease in long-term gas contracts over this period, reflecting producers' significant shift away from long-term agreements (ACCC 2024).

Policy outlook must move beyond the Gas Market Code to a ‘gas market system plan’ alike the Integrated System Plan to co-ordinate future gas investment and align with fuel mix investments (ACCC 2024). Additionally, policy in alignment with the current Western Australia gas reservation policy that requires 15% of gas produced over each LNG export project’s life is committed for domestic supply will be beneficial in Queensland and beyond. Western Australia’s gas reservation policy has delivered adequate and affordable supplies of gas to the state’s consumers. Alternatively, applying tax sanctions on gas corporations with large exports could help fund grid investments to alleviate energy supply pressures (ACCC 2024).

While there is broad support for using gas to supplement renewable sources of electricity in the short to medium term while Australia’s energy grid undergoes transformation, it should be noted that AEMO’s warnings of shortfalls in power supply and the need for increased gas supply has recently been questioned. It has been suggested that recent reduced gas demand has been caused by a combination of the acceleration of renewable uptake and the reduced need for power during winter for heating due to more mild temperatures (ABC News 2025).

Battery Energy Storage Systems (BESS)

In 2023, the Australian Energy Market Operator (AEMO) introduced changes to the Market Ancillary Service Specification (MASS) that aimed to better integrate battery energy storage systems (BESS) into the National Electricity Market (NEM). These changes are part of the Integrating Energy Storage Systems (IESS) project. The policy expanded the BESS market participation through allowing smaller units to provide ancillary services, whilst improving grid stability. Hybrid systems are now allowed operation under Aggregated Dispatch Conformance (ADC). Expansions upon this will allow participants to manage energy portfolios dynamically whilst reducing regulatory burdens.

BESS technology is excellent for short duration storage. They charge during periods of excess solar and discharge during evening peaks and provide valuable frequency control ancillary services (FCAS) (AEMO 2024). However, this shift towards BESS has seen battery operators prioritise financial advantage in current market conditions over providing longer term storage alternatives to alleviate reliance on gas power technologies. AEMO has stated that revenue from charging - buying electricity at low and negative prices - during the last quarter of 2024 periods increased by $3.9 million, totalling $7.2 million from Q3 2024 (AEMO 2024). The reliance on arbitrage opportunities and FCAS revenue has also risen. The increased energy arbitrage revenue across the NEM was partially attributed to expanded battery capacity, which enhanced both availability and market output; “NEM-wide average battery availability grew by 44%, from 755 MW in Q4 2023 to 1,087 MW in Q4 2024” (AEMO 2024). This enhanced arbitrage potential translated into substantial revenue gains across all regions.

At current, government support will be needed for battery generation to go beyond short-term yields to providing long term stability. The current Integrated System Plan (ISP) displays significant battery storage is required by 2030, although currently most batteries have 1-4-hour storage duration. This is not sufficient for multi-day low renewable output (AEMO 2024). The Optimal Development Path (ODP) too includes no clear prioritisation for long-duration BESS, instead it implicitly believes pumped hydro is the only current solution; “The deepest storages available to the NEM are the existing deep-reservoir hydro assets, which can also mitigate renewable droughts and balance energy availability across seasons” (AEMO 2024).

The Capacity Investment Scheme (CIS) can aid BESS technology as a key component in the Capacity Investment Scheme Agreement (CISA) that provides long term revenues underwriting to decrease financial risk for investors. CIS is formed as a contract between project owners and the Australian Government, where partial revenue support (90%) is provided if revenues for a project fall below an agreed floor. The Australian Government will receive revenue (50%) of amounts above the projects agreed ceiling (DCCEEW 2024). Consequently, this policy has limitations due to dispatch at negative prices, and thus projects are still exposed to physically losing money with no CISA bail outs. Project approvals lack the financial understanding of bids that can cause further grid congestions. It is suggested improved measures to account for negative price revenue as it will formulate more

accurate modelling and force developers to hedge or design projects resilient to curtailment. The real risk of renewable oversupply needs to be considered in current designs. Currently, purpose-built long-haul BESS systems are not included (DCCEEW 2024). Government is urged to consider the benefits of long-haul storage into system design. Although the objective of CIS is to incentive 32GW of renewable and clean dispatchable capacity by 2030, it is hoped that the CIS will include BESS technologies (DCCEEW 2024).

Large-Scale Renewable Energy Certificates (LGCs)

During peak generation periods, Australia's renewable energy production occasionally exceeds demand. These periods of excess renewable energy generation force electricity prices into negative territory where generators must effectively pay consumers to take their power output. Moreover, as the morning and evening price spikes are becoming more extreme, a wider gap has been created between periods of high renewable output with low/negative prices and the peak demand periods with high prices (Flow Power, 2023). These price signals in the wholesale electricity market during the middle of the day clearly indicate an oversupply of generation capacity during peak sunlight hours.

At current, government policies incentivise renewable energy generators offering additional revenue from Renewable Energy Certificates (RECs) and Large-Scale Renewable Energy Certificates (LGCs) for every megawatt-hour (MWh) of eligible electricity under the Australia's Large-scale Renewable Energy Target (LRET). As of the December 2024 quarter there were 14 million LGCs, demonstrating strong supply growth. The market saw LGC spot prices fall from $41.50 to $26 in November 2024, reflecting the volatility due to market saturation and the growing mismatch between generation and demand (CER 2024). This is significant as renewable generators can continue to operate during negative prices as long as the LGC revenue offsets the financial losses. The relationship between negative spot prices and REC prices is viewed as a form of stable market equilibrium, however this mechanism is becoming increasingly fragile under the resigning LGC supply as renewables enter the grid, the number of REC's must also increase.

Expected oversupply is expected to reach a 21.1 million surplus in 2025 alongside a 4.3 million certificates eligible for shortfall return. This future oversupply places downward pressures on prices and weakens investment. The Clean Energy Regulator states "Increasing capacity of storage will be important to ensure the rapid increase in generation from rooftop solar does not result in increasing curtailment of large-scale wind and solar to maintain power system security" (CER 2024). It is urged that incentives towards capacity storage are prioritised with incentive to time-shifted renewable generation through a differentiated certificate value. Policy should additionally allocate LGCs for stored or dispatchable renewable electricity.

Inter-regional Settlement Residue (IRSR)

Inter-regional Settlement Residue (IRSR) is the financial mechanism used in the Australian Electricity Market (NEM) to account for price difference between regions. It is usually the money collected from electricity flowed from low price regions to

high price regions. In last quarter of 2024, ISSR saw the NEM record a $38.7 million loss, which represented a 157% increase in losses compared to Q4 2023, with 88% of the loses arising from counter price flows (AEMO 2024). This inefficiency was caused by transmission constraints meaning the grid was unable to direct power where it was most valuable. These current situations indicate physical constraints are overriding economic logic and are causing challenges to Renewable Energy Zone (REZ) planning through a lack of clear price signals and increased electricity costs reflected in market and consumer costs. Therefore, acceleration towards AEMO ISP projects that reduce congestion and counter-price flow risks should be prioritised. At current, counter-price flows are occurring between NSW and Victoria suggestion additional inter-state co-ordination to be announced (AEMO 2024).

Service Target Performance Incentive Scheme (STPIS)

The Service Target Performance Incentive Scheme (STPIS) faced updated proposals from the Australian Energy Regulator last year. STPIS rewards and penalises Transmission Network Service Providers (TNSPs) based on their performance regarding maintaining and improving network reliability (AER 2024). The scheme was originally deployed in a thermal generation era, the three key components of the scheme are the Service Component (SC), Market Impact Component (MIC) and Network Capability Component (NCC).

The Market Impact Component (MIC) was designed to reduce grid congestion caused by outages encouraging TNSPs to schedule outages at low impact times. However, as more variable renewable energy enters the grid, radial lines now carry generation with outages causing larger market impacts. Moreover, penalties are based on historical data which are unable to reflect today's grid meaning MIC is basically a congestion tax on TNSPs (AER 2024). The current MIC can't distinguish between events that have market impact or not. Therefore, all binding constraints above the $10/MWh are treated equally regardless of whole price spikes, generator effects or period of demand. This leads to radial lines seeing the same penalties as large baseload generators. This matters as it provides no incentives to improve scheduling. It also has no reflection on our renewable grid structures. Policy should be reformed to ensure that MIC recognises congestion constrains from clean and low-cost generations. It must reward actions to prevent this outage.

Policy to prioritise Dynamic Line Ratings (DLR) can fast track this as it accounts for real-time environmental factors such as temperature, wind speed, and solar radiation, allowing more flexible and accurate transmission capacity estimates, this is unlike Static Line Ratings (SLRs) that are designed with assumptions regarding worst case weather conditions that lead to the underutilisation of transmission capacity (Simshauser 2023). The Clean Energy Council highlighted that DLR's can increase network capacity by 20 to 30%, suggesting that regulatory incentives would only evolve to support such technologies (Clean Energy Council, 2024).

Reform is required to the Network Capability Component (NCC) as it is underused and too bureaucratic. Though imposed to incentivise low-cost operational and minor capital upgrades, administratively it's too complex with too many regulatory barriers between TNSPs, AEMO and the AER (AER 2024). The system is too slow to

respond to current grid dynamics. The AER proposal to link NCC to the Transmission Annual Planning Report (TAPR) will help reflect updated network conditions. However, this process must simplify interactions with AEMO.

It is pivotal that changes to the Service Target Performance Incentive Scheme (STPIS) are implemented to not allow TNSPs to continue to be disadvantaged from smart and proactive scheduling. The current policy will leave our grid structures unable to keep pace with the current ISP aligned renewables integration protocols.

Integrated System Plan (ISP) & Optimal Development Path (ODP)

Currently, the policy guides investment in utility-scale renewables, transmission, firming technologies and consumer energy resources. The policy goal is stated as: "The ODP aims to deliver reliable and affordable power to meet NEM needs for at least 20 years, fulfil the NEM's security and reliability requirements, meet government policy settings, and manage risk through a complex transformation". The ISP sees this as renewable energy backed by storage and gas-powered generation (AEMO 2024). Importantly the ISP states three key components that are currently undelivered, including increases to NEM storage capacity, adding approximately 10,000 kilometres of additional transmission, and large amounts of firm dispatchable capacity alongside additional power system security services (AEMO 2024).

There are several issues with the ISP. Though the ISP provides the pathway to forecasting what is required, the ISP is non-binding. AEMO can present a recommended path but it relies on State Governments, TNSPs and market investors to build (AEMO 2024, 56). This process currently lacks accountability. This was brought to light in an October 2024 Parliamentary Inquiring from the Senate's established Select Committee on Energy Planning and Regulation in Australia that stated the Integrated System Plan must as well be assured to meet National Energy Objectives. While the ISP rightly defines transmission needs, it does not go as far to prioritise congestion hotspots. The ISP has emphasised the urgent need for fast responses, and a key problem with the ISP and ODP is its inflexibility to fast changing grid needs. The ISP has locked a 20-year build path, but congestion, curtailment and battery economics change rapidly. Dynamic modelling assumptions become obsolete faster than the 2-year update cycle (AEMO 2024). Establishment of a formal mechanism for mid-cycle reviews and interim updates must be introduced. A percentage change - 15% in forecasted gas prices - and change in storage cost assumptions and average storage hour capacity should issue new changes to the current pathway. Additionally, the modelling lacks attentive updates to ongoing projects at the same time for new market entrants (AEMO 2024).

The process focuses at large on reaching the targeted renewable goal but it substantially lacks new techniques to reach this setting. It gives priority to larger scale projects when Australia is needing to prioritise medium-scale renewable energy projects. The ability to provide increased flexibility and build projects closer to where energy is required will in turn reduce transmission costs (LEK 2024). It has been modelled that connection costs can be lowered by 40-60% saving consumers

$4 billion annually. The Federal government must support a regulatory framework that is backed by the ISP to unlock burdens placed on medium scaled projects. There is also a need for consumer energy resources (CER) to be added to the ODP & ISP roadmap. CER requires larger co-ordination than what currently exists. Based on the ISP's Progressive Change scenario for battery storage, CERs could save consumers $0.5 billion per year by 2030, and $4 billion per year by 2050 (LEK 2024). Without improved co-ordination, these resources could disrupt supply-demand balance, forcing higher capital investments into physical infrastructure potentially exceeding $37 billion in network upgrades. The lack of CER co-ordination in the ISP causes false economic investments (LEK 2024).

Renewable Energy Zones (REZ) and Renewable Energy Industrial Precincts (REIPs)

Renewable Energy Zones (REZ) are areas identified for co-ordinated development of large-scale renewable energy projects, optimising resource rich locations, prioritising reducing costs, and streamlining integration. Though federal level efforts exist, the planning, regulation and implementation are primarily managed by state and territory authorities. AEMO has identified 43 possible REZs (AEMO 2024). As congestion risks grow, current REZ rollouts are not fast enough. It is suggested that accelerated transmission corridors use bundled land, social license and environment approval pathways. New South Wales has declared five REZs overseen by Energy Co. The NSW government recently removed landowner's ability to block projects. At current stance, the New South Wales is the most built out REZ model choosing most competitive and social beneficially projects. Victoria has six REZs and has also launched the Victorian Access Regime to create REZ connection rules; "The Victorian Access Regime will improve investment certainty for VRE generation developers and investors in REZs by coordinating connections on the network" (Victorian Government 2024). The Victoria approach is fully government controlled, which the Clean Energy Council flags as a major departure from the open-access system in the NEM which has the potential to cause issues (Clean Energy Council 2024). Queensland has the largest number of REZs (12), which are part of a super grid aimed to connect to major demand centres (Queensland Government 2024). The Department of Energy and Climate is operating through a social license and local benefit approach (Queensland Government 2024). This approach makes REZs determined by community readiness, infrastructure availability and investor interest. Currently there is no intention to implement an access regime in Queensland. This presents a different approach where Queensland has set aside funds for early scoping coupled with regional economic future funds and local energy partnership frameworks. (Queensland Government 2024).

Renewable Energy Industrial Precincts (REIPs) can reduce grid loads, maintain and accelerate manufacturing and act as a scale up practical solution (Climate Works 2023). Moreover, they can reduce renewable overgeneration and gas supply burdens due to industrial settings making a large proportion of market bids. This will allow industrial settings to work in tangent to REZs through high voltage transmission lines and present economic benefits from shared infrastructure,

labour pooling and knowledge spill overs creating opportunities to commercialise new technologies and solutions onshore in Australia. The current idea, alike REZs, requires government led development for strategic land use and infrastructure planning with appropriate funding and underwriting renewable developments to supply precincts. Though policy should go further using industrial precincts for developing transmission infrastructure firmed and at low costs. REIPs can also help to identify workforce skill gaps (Climate Works 2023).

RIT-Test

Major grid investments are currently subjected to Regulator Investment Test for Transmission (RIT-T) which are administered by the Australian Energy Regulatory (AER). These are a mandated cost-benefit test with the core purpose to ensure new transmission investment delivers a net economic benefit; “The purpose of the RIT-T, as set out at clause 5.16 of the electricity Rules, is to identify the credible option that maximises the present value of net economic benefit to all those who produce, consume and transport electricity in the market” (AEMO 2024). Moreover, “this reduces the risk that consumers will pay for inefficient investments”. These tests are typically evaluated by transmission network service providers. The strength of the RIT-T framework arises from evaluating projects grounded in microeconomic efficiency and accounting for non-traditional solutions - demand response, local generation and storage - encouraging innovation and least-cost outcomes (AER 2024).

In 2024, reforms were introduced, with an updated cost threshold from $24 million to $28 million (AER 2024). The RIT-T application threshold additionally increased from $7 million to $8 million and for RIT-D applications from $6 million to $7 million (AER 2024). This is in alignment with construction cost inflation. Notably, projects below $54 million can have a streamlined process with no draft report process. While this goes some way to reducing burden to smaller upgrades it may not go far enough in sufficiently helping smaller projects. The policy has increased stakeholder consultation where ISP alignment is claimed. The AER review additionally required RIT-T proponents to include a ‘Value of Emissions Reduction (VER); essentially a dollar-per-tonne figure to quantify the benefit of emission abetment (AER 2024). However, it is recommended that future considerations should incorporate metrics such as “option value” and “resilience.” The AER guidelines do mention option value qualitatively, but proponents may not give it full weight (AER 2024).

The policy should work in tandem with ISP guidelines requiring ISP-listed projects to be evaluated for high impact and low probability scenarios. This could see further weight added to RIT-T that safeguard the system. However, the current policy frameworks lack of cohesion with ISP guidelines means particular projects that can unlock Renewable Energy Zones lack feasibility. Socially, the tests could incorporate First Nations and regional employment to current cost-benefit analysis job employment scaling. At current consultations have seen projects take 12-18 months to be completed, urging the need for target timelines with conditional approval processes. Notably, the RIT-T & RIT-D applications are alike the Capacity Investment Scheme (ISP) where co-ordination of projects in not evaluated. An ISP

framework that requires RIT-T's to have a system-wide market benefit should be implemented.

Powering The Regions Fund

The Powering the Regions Fund (PRF) is a $1.9 billion federal government commitment to support industrial decarbonisation. Administered by ARENA, the Australian Renewable Energy Agency. This is orchestrated through the Industrial Transformation Stream (ITS) designed to drive down Scope 1 and 2 emissions through investments; "Projects may target a reduction in Scope 1 and/or Scope 2 Greenhouse Gas Emissions through solutions including, but not limited to, investment in electrification, fuel switching or Energy Efficiency, or critical enabling infrastructure" (ARENA 2025).

The priority for regional facilities is covered under the NGER scheme that requires projects to demonstrate replicability, technology advancement and contribution to the workforce. This is illustrated under the Round 2 focus area, "Round 2 will support projects that align with one or both Focus Areas to reduce emissions, improve energy productivity and advance the commercial readiness of decarbonisation technologies" (ARENA 2025b).

The PRF ITS has an indirect contribution to grid optimisation. It works to reduce Greenhouse Gas emissions, and importantly in relation to Scope 2 emissions - "the emissions released to the atmosphere from the indirect consumption of an energy commodity. For example, these indirect emissions may be from the use of electricity produced by the burning of fossil fuels in another facility" (ARENA 2025b). Therefore, the policy provides solutions in electrification, fuel switching, energy efficiency and critical infrastructure replacing fossil-fuel processes supporting demand side electrification that will tangibly improve grid utilisation during periods of renewable oversupply (ARENA 2025b). Enabling these technologies such as thermal energy storage will support load flexibility and demand management allow our energy demand to become more easily matched with renewables supply. At current stance, this policy has a burden on small and medium sized businesses. Emitters under 50kt Co2-e are ineligible (ARENA 2024). This disincentivises a large base of manufacturing and agri-processing entities for reducing emissions. It only allows larger players first-mover advantages. It is recommended to introduce a 'cluster' mechanism to allow small and medium sized businesses to work together and meet thus meet the threshold NGER eligibility.

Recommendations

There are several changes that Federal government can make to policies to improve energy grid optimisation. These include:

- The Gas Market Code should be enhanced by developing a comprehensive "gas market system plan" similar to the Integrated System Plan to better coordinate investment and implement a gas reservation policy similar to Western Australia's model to ensure local supply security.
- AEMO should establish a formal mechanism for mid-cycle reviews of the Integrated System Plan (ISP) triggered by significant market changes. The

current ISP has been criticised for its inflexibility to rapidly changing grid conditions. As noted in AEMO's own documentation, "Dynamic modelling assumptions become obsolete faster than the 2-year update cycle" (AEMO, 2024). Specific triggers should be established (e.g., 15% change in gas prices, significant battery cost reductions) that automatically initiate targeted ISP reviews. This approach has precedent in other jurisdictions; for example, the UK's National Grid ESO conducts "horizon scanning" between its formal planning cycles to identify emerging trends requiring immediate attention (National Grid ESO, 2023).

- AEMO should adopt open-source software principles for its grid modelling to enhance transparency and enable broader stakeholder input. The October 2024 Parliamentary Inquiry from the Senate's Select Committee on Energy Planning and Regulation in Australia highlighted that "Aligning AEMO's Grid Modelling with Open-Source Software and Data requirement [will] improve transparency" enabling "system-wide market benefit" and "extensive scenario modelling" (Parliament of Australia, 2024). Research by Simshauser and Gilmore (2022) demonstrated that open-source models can significantly improve market outcomes and reduce costs. AEMO should publish key modelling assumptions, methodologies, and data in accessible formats, allowing third-party verification and alternative scenarios to be tested.
- AEMO should differentiate between short and long-duration storage in its planning frameworks, recognising their distinct system roles. Current AEMO planning inadequately distinguishes between storage durations. As noted, "currently most batteries have 1-4-hour storage duration. This is not sufficient for multi-day low renewable output" (AEMO, 2024). This gap in planning threatens system reliability during extended low-renewable periods. Develop specific targets for long-duration storage (8+ hours) in each region alongside existing short-duration batteries, with clear modelling of their distinct system benefits.
- NETP should establish a nationally consistent framework for Renewable Energy Zone (REZ) approvals while preserving state implementation flexibility. The current fragmented approach to REZ development across states creates inefficiencies. There are substantial differences between NSW's competitive model, Victoria's government-controlled approach, and Queensland's social license framework (NSW Government, 2024; Victorian Government, 2024; Queensland Government, 2024). These inconsistencies create regulatory complexity for developers operating across multiple jurisdictions. NETP should develop minimum standards for REZ approval processes while allowing states to implement according to local conditions, reducing investment uncertainty.
- NETP should create a dedicated coordination office for industrial decarbonisation that works across state boundaries. The current approach through programs like the Powering the Regions Fund excludes smaller emitters: "Emitters under 50kt Co2-e are ineligible" which "shuts a large base of manufacturing and agri-processing entities for reducing emissions" (ARENA, 2024). Additionally, Renewable Energy Industrial Precincts (REIPs)

require "government led development for strategic land use and infrastructure planning" (Climate Works, 2023). This office would coordinate industrial cluster approaches to help smaller businesses participate in decarbonisation programs and align REIP development with broader energy transition goals.

- Introduce "clustering" approaches to the Powering the Regions Fund for small and medium sized businesses to allow these businesses to work together to meet eligibility thresholds. This would ensure that benefits are not only delivered to large organisations and would promote inclusivity and broader participation.
- NETP should streamline cross-jurisdiction transmission projects through a unified approval process. Current RIT-T processes for major transmission projects take 12-18 months to complete (AER, 2024), creating significant delays. Additionally, "the RIT-T & RIT-D application is alike the Capacity Investment Scheme (ISP) where co-ordination of projects is not evaluated". Develop a single coordinated assessment pathway for cross-border transmission projects that incorporates both national and state interests while creating binding timelines for decisions.
- Rewiring the Nation funding should prioritise projects that address counter-price flows between regions. Recent data shows "the NEM record[ed] a $38.7 million loss for the last quarter of 2024" with "88% of the loses [arising] from counter price flows" (AEMO, 2024). These losses represent direct economic inefficiency in the electricity system. Establish a specific funding stream within Rewiring the Nation for projects that demonstrably reduce counter-price flows, with an expedited approval process.
- Expand Rewiring the Nation to include targeted support for medium-scale transmission projects. Research indicates "connection costs can be lowered by 40-60% saving consumers $4 billion annually" through medium-scale renewable energy projects that can be "built closer to where energy [is] required" (LEK, 2024). Create a specific medium-scale project stream within Rewiring the Nation with streamlined approval processes for projects under $100 million.
- Mandate Dynamic Line Rating (DLR) implementation in all Rewiring the Nation funded projects. “Dynamic Line Ratings (DLR) can increase network capacity by 20 to 30%" by accounting for "real-time environmental factors such as temperature, wind speed, and solar radiation, allowing more flexible and accurate transmission capacity estimates" (Clean Energy Council, 2024; Simshauser, 2023). Make DLR implementation a funding requirement for all applicable transmission projects, with a specialised funding stream for retrofitting existing critical transmission corridors with DLR technology.
- Enhance RIT by incorporating metrics such as “option value” and “resilience” and adopt an ISP framework that requires RIT-T’s to have a system-wide market benefit.
- Potential improvements to the REZ and REIP schemes include: finalising REZ boundaries to provide clarity for investors and developers (clear boundaries are fundamental for investment planning); publishing a dynamic model showing each REZ's hosting capacity and remaining

available capacity (transparency enhances market efficiency); and clarifying the types of constraints considered in curtailment assessments (vital for accurate project risk assessment); using industrial precincts for developing firmed transmission infrastructure at lower costs (leverages economies of scale); implementing government-led strategic land use and infrastructure planning (reduces coordination failures); using REIPs to identify workforce skill gaps (addresses a critical transition challenge).

electric vehicles

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Electric vehicles (EVs) are an important part of the energy transition, as transportation is a high emitting sector and needs to undergo decarbonisation. According to The Department of Infrastructure, Transport, Regional Development, Communications and the Arts (2023c), transport and related activities are estimated to be Australia's third highest source of emissions and were responsible for 21% of emissions in 2023. The International Energy Agency (2023) predicted the sector's emissions to rise with an annual growth rate of 1.7%, becoming the largest emitting sector by 2030. This data underscores the importance of Australia to transition from conventional vehicles towards cleaner transportation alternatives to achieve net-zero emissions by 2050 (Department of Climate Change, Energy, the Environment and Water 2023b). This can be achieved by adopting EV-supporting policies including through support of charging infrastructure as well as vehicle subsidies. There are a variety of challenges that require policy enhancements and will be important to address to ensure Australia's federal EV-related policies are aligned with broader emission reduction goals and international best practices.

Current EV market in Australia

Data demonstrates that approximately 114,000 EVs were sold during 2024, accounting for 9.65% of all new car sales in Australia, which was an increase compared to the total EV sales share of 8.43% for 2023 (Electric Vehicle Council 2025a). Nonetheless, Australia is demonstrating weak EV adoption when compared to other developed nations such as China (48%, Clean Technica 2025), the United Kingdom (28.2%, Zapmap 2025), and the European Union (22%, ICCT 2025).

Charging stations

Support for public charging infrastructure in Australia is an important stimulus for customers wishing to purchase an EV (Electric Vehicle Council 2021). Over the last few years, Australia's charging infrastructure for EVs has experienced high demand.

In 2024, Australia had approximately 5,000 public charging stations (Stott 2023), with 1,059 locations offering high-power public charging (24+ kW) and 1,849 individual high-power public EV chargers in service (Electric Vehicle Council 2024). This marked a 90% increase in high-power charging locations compared to 2023. The EV charging industry in Australia was estimated to be worth USD$97 million (approximately AUD$150 million) in 2022. It is projected to be worth AUD$1.28 billion by 2030 at a compound annual growth rate (CAGR) of 31.1% (Next Move Strategy Consulting 2025).

Yet, in comparison to other emerging and advanced economies, Australia's EV charging infrastructure is underdeveloped. For instance, the United Kingdom has over 70,000 public charging points, with 5,920 charging locations offering rapid or ultra-rapid public charging (50+ kW) (Zapmap 2024). The IEA reported that in 2023, Australia had the second-highest ratio of vehicles per charger, approximately six times that of the global average, demonstrating a lack of supporting infrastructure and slow policy follow-up (The International Energy Agency 2024).

The unequal spread of fast and ultra-fast charging stations across Australia is also problematic. Electric Vehicle Council (2024) found that the majority of fast and ultra-fast charging stations are in urban centres, with almost 50% being in New South Wales and Victoria.

Charger types and provider

Different EV charger types are designed to serve assorted settings and charging needs. In Australia, there are three levels of chargers based on their power output and the speed at which they can recharge an EV (Electric Vehicle Council, 2025):

- Level 1 / Mode 2 Charging – Standard household power point (10-15 Amp, single-phase) with a specialized cable, typically supplied with the vehicle. Ideal for standalone domestic homes for vehicles to park for extended periods. Approximately 10-20 km of range/hr of charging, depending on the vehicle. Suitable for daily recharge, but may not fully recharge a typical pure EV overnight.
- Level 2 / Mode 3 Charging – Dedicated AC EV charger with power up to 22 kW (32 Amp, three-phase). Ideal for destinations such as residential and commercial buildings for vehicles to park for extended periods. Approximately 40-100 km of range/hr of charging, depending on the vehicle. Capable of daily recharge overnight, or recharge for daily use in approximately 1 hour.
- Level 3 / Mode 4 Charging – Dedicated DC EV charger with power levels ranging from 25 kW to 350 kW (40–500 Amp, three-phase). Ideal for commercial premises and roadside locations to facilitate faster recharging compared to Level 1 and Level 2 chargers. At the lower end (25 kW), it can provide up to 150 km of range/hr of charging, depending on the vehicle. At the upper end (350 kW), it can fully recharge some EVs in approximately 10 to 15 minutes. Capable of quick top-ups during long-distance travel or in commercial settings where rapid turnaround is essential.

The electric vehicle charging network in Australia is backed by several service providers, and the most prominent players in the market include Chargefox, Evie Networks, and Tesla Superchargers (Man, 2023). Australia lacks a standard payment system that can be used across various charging networks. Most providers in Australia require separate apps or payment methods, leading to fragmentation and a less seamless user experience for regular EV users and travellers. On the contrary, some European countries already have roaming agreements that authorise drivers to access multiple charging networks with a single account (Falchetta & Noussan 2021).

EV Policy Framework in Australia

Federal, state, and local governments each have a role to play in encouraging the adoption of EVs and stimulating infrastructure development. Federal and state governments have complementary EV policy roles and implementation with a larger guiding role in the transition, yet each has distinct individual responsibilities. The federal government is primarily responsible for setting overarching national policies, regulatory frameworks, and funding programs. On the other hand, the state and local governments focus on implementation, infrastructure rollout, active community engagement and financial incentives at the state and local levels (Electric Vehicle Council 2020).

Federal Government Policies and Initiatives

National Electric Vehicle Strategy

The National Electric Vehicle Strategy (NEVS) by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) in 2023 was the first comprehensive framework in Australia aimed at expanding affordable and accessible EV supply at a national level, establishing the resources, systems and infrastructure for future EV uptake and encouraging an increase in EV adoption (Department of Climate Change, Energy, the Environment and Water 2023b). It was set to address the key barriers to EV adoption while aligning with broader climate commitments, including the nation's net-zero emissions target by 2050. Key Initiatives Under the National EV Strategy include introduction of New Vehicle Efficiency Standards, charging infrastructure investment, financial incentives including electric car discounts and rebates, and domestic market development.

The New Vehicle Efficiency Standards (aka Fuel Efficiency Standard or NVES) is the core initiative of the NEVS, marking the first-ever fuel efficiency standard in Australia (Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2022b, 2023b). The standard set an average CO2 emissions target for new light vehicles sold in the country, encouraging manufacturers to supply cleaner and more efficient models (Department of Climate Change, Energy, the Environment and Water 2023a). The standards are expected to reduce consumer fuel costs, increase the availability and choices of EVs in the domestic market, and most importantly, reduce fuel consumption per kilometre (Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2024). The NVES aims to facilitate consistency in key areas affecting EV adoption and usage, including signage, charging infrastructure,

accessibility, and safety. Supporting policies including EV charging connectors and payment system standardisation (Department of Climate Change, Energy, the Environment and Water 2024) and building code updates to mandate EV-friendly infrastructure (Australian Building Codes Board 2024).

NEVS committed $500 million to the Driving the Nation Fund, which aimed to expand the nation's EV charging network and Hydrogen Highways and support the Australian automotive sector (Department of Climate Change, Energy, the Environment and Water 2025). The fund includes a $60 million allocation for the Dealership and Repairer Initiative for Vehicle Electrification Nationally (DRIVEN) Program to install EV charging infrastructure at dealerships and repair centres; a $39.3 million allocation for the National EV Charging Network to deploy 117 chargers along key highways; up to $80 million in co-investment for the Hydrogen Highways initiative to decarbonise heavy transport by expanding hydrogen refuelling stations on major freight routes; and the Driving the Nation Program on reducing road transport emissions nationwide. This program complements private sector investments and state government initiatives, assuring a comprehensive and accessible EV and infrastructure network nationwide.

The government has introduced various financial incentives towards sellers and buyers of EVs priced below the Luxury Car Tax threshold to lower the cost of EV ownership (Australian Taxation Office 2024). Private use of an electric car and associated car expenses with certain conditions met, including salary sacrifice or novated lease arrangements, are exempted from fringe benefits tax (FBT). For an EV valued at approximately $50,000, the FBT exemption can result in annual savings of up to $9,000 for employers or up to $4,700 for individuals using salary sacrifice. However, from 1 April 2025, PHEV were no longer considered a zero or low emissions vehicle under fringe benefits tax (FBT) law and wasn't eligible for the electric car exemption (Australian Taxation Office 2025).

The strategy seeks to strengthen the supply, demand, and manufacturing capabilities of EVs and related industries such as battery production and recycling programs in the domestic market. Measures and policies such as Vehicle-To-Grid funding (Australian Renewable Energy Agency 2024) and the National Battery Strategy (Albanese & Husic 2024), demonstrate a strong foundation for next-generation EV technologies. Support from recently established Jobs and Skills Councils (JSCs) can facilitate the transition by enhancing the industry's strategic influence in workforce planning and vocational education, ensuring that Australia's vocational education and training (VET) sector delivers more effective outcomes (Department of Employment and Workplace Relations 2024). Overall, the strategy provides numerous domestic economic opportunities and reduces import dependence, which is beneficial for the industry's long-term development.

Other policies and initiatives

Other relevant policies and initiatives include the Commonwealth Fleet Vehicle Selection Policy, Real-World Testing of Vehicle Efficiency, New Australian Design Rules (ADRs), and the Green Vehicle Guide.

The Department of Finance updated the fleet vehicle selection policy to reduce carbon emissions in 2024. Low-emission, preferably zero-emission vehicles are required for all future vehicles within the Commonwealth fleet. Moreover, the vehicles ought to obtain a 'five-star' Australasian New Car Assessment Program (ANCAP) rating with a date stamp within the past three years; and meet 'fit for purpose' and 'value for money' requirements, including consideration of environmental and climate change impacts (Department of Finance 2025).

The Department of Infrastructure, Transport, Regional Development, Communications and the Arts collaborated with the Australian Automobile Association (AAA) and designed a 4-year program to test the fuel consumption and emissions of vehicles in real-world conditions to allow consumers to have accurate information about running costs (Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2022c). It is expected to test approximately 200 model variants throughout the program (2023 to 2026), and the results will be published on a separate website run by the Australian Automobile Association (Australian Automobile Association 2023). The program aims to provide real-world data, including but not limited to the effect of traffic and weather conditions, on vehicles besides internationally standardised laboratory tests.

The Australian Government has implemented the new Australian Design Rule (ADR) 80/04 (Emission Control for Heavy Vehicles), ADR 79/05 (Emission Control for Light Vehicles), ADR 111/00 (Advanced Emissions Control for Light Vehicles), ADR 112/00 (Control of Real Driving Emissions for Light Vehicles), which aligns with the European Euro VI standard for heavy and light vehicles (Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2023a; National Heavy Vehicle Regulator 2024). The regulation set lower emissions limits for nitrogen oxides, introduced a limitation on particle numbers from petrol vehicles with direct injection fuelling systems, implied strict on-board diagnostic system conditions and improved emission tests (laboratory and on-road) to ensure emission reductions are also realised during regular on-road operation.

The redeveloped Green Vehicle Guide by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts is the official national guide to vehicle fuel consumption and environmental performance (Department of Infrastructure, Transport, Regional Development, Communications and the Arts 2022a). The guide contains a range of information, data and tools to provide a comprehensive comparison between vehicles. The tools include a home charging and fuel and carbon dioxide calculator, and fuel lifecycle emissions and vehicle guides. It assists customers in making more suitable choices during selection.

State and Territory Government Policies and Initiatives

State and territory governments' primary role in the EV transition is to complement and address gaps in federal EV policies. Targeted incentives, infrastructure investment and jurisdiction-tailored regulatory frameworks are a fundamental component of state and territory government policies. Some of these initiatives include:

New South Wales (NSW)

- Strategic plan: NSW Government Electric Vehicle Strategy
- Current incentives: There is no incentive program at the moment. The recent Electric Vehicle Fleets Incentive: Kick-start Funding NSW closed on 30 June 2025. This initiative supported organisations with funding of $5,000 to $20,000 per EV (for up to 15 vehicles) and $4,000 to $8,000 per smart charger.

Victoria

- Strategic plan: The VIC Government Transport Sector Emissions Reduction Pledge 2021-2025
- Current incentives: The $100 registration fee discount for light zero and low emission vehicles (ZLEVs) (Victorian Transport, Projects & Planning Resources 2024).

Queensland

- Strategic plan: Queensland's Zero Emission Vehicle Strategy 2022–2032; Zero Emission Vehicle Action Plan 2022–2024
- Current incentives: The Zero Emission Vehicle (ZEV) Rebate Scheme closed in September 2024. Lower vehicle registration duty rate and registration fee for hybrid or electric vehicles (Queensland Government 2023).

South Australia

- Strategic plan: South Australia's Electric Vehicle Action Plan
- Current incentives: Registration fee exemption for new battery electric and hydrogen fuel cell vehicles was valued at up to $68,750 (inclusive of GST), however the scheme closed 30 June 2025 (Department of Treasury and Finance (South Australia 2024).

Western Australia

- Strategic plan: State Electric Vehicle Strategy for Western Australia
- Current incentives: $3,500 rebate program for a value of $70,000 or less in new light zero-emission vehicles (powered solely by batteries or hydrogen fuel cells) purchase (Department of Transport (Western Australia) 2025).

Tasmania

- Strategic plan: TAS Government Electric Vehicle Rebate Program
- Current incentives: $500 to $10,000 interest-free loans for home charging infrastructure for EVs (Renewables, Climate and Future Industries Tasmania 2022).

Northern Territory

- Strategic plan: Electric Vehicle Strategy and Implementation Plan 2021-2026
- Current incentives: Free registration and stamp duty waiver for EVs up to $50,000 (saving up to $1,500) until 30 June 2027 (Northern Territory Government 2021)

Australian Capital Territory

- Strategic plan: Emissions-based registration
- Current incentives: $2,000 - $15,000 interest-free loans for energy-efficient upgrades, including but not limited to household battery storage systems and EVs (Government of the Australian Capital Territory 2021).

Discussion

Before the introduction of the NEVS, Australia was struggling to grow the EV market. There was little to no incentive for manufacturers to prioritise the distribution and introduction of EVs or locally produced EVs or related green technologies in the country. It resulted in a heavy dependence on imports, with limited and high-cost options being released into the market. NEVS and the supporting policies constitute a step in the right direction of sustainable transport and energy in Australia, however, doubts remain about whether the steps are adequate when compared with world leaders in the uptake of EVs.

The present availability of incentives from the Australian government highlights the lack of support for the transition. The reliance on state-level initiatives also results in inconsistencies across jurisdictions. The lack of alignment between federal and state and territory initiatives leaves customers confused about what grants or programs they can apply for. The overall incentives and commitments from states and territories, while beneficial are still limited, short-term and unstable. In addition, while the New Vehicle Efficiency Standard was a long-overdue milestone after years of debate, it has drawn criticism from researchers (University of Technology Sydney 2024) and experts (Visontay & Butler 2024). The standard is not only weaker than the initially proposed but also lags behind the more stringent policies implemented by nations that have achieved significant progress in EV adoption.

In contrast, other EV-developed countries generally adopt a relatively strict and direct approach during the transition. For instance, Norway provides nationwide extensive tax exemptions (including but not limited to registration tax, VAT and motor fuel tax exemption), toll road waivers, ferry and parking fee reductions, and much more, to encourage behaviour and consumption habit changes, resulting in 88.9% of new cars sold in the country in 2024 being EVs (Norsk elbilforening 2025). Similarly, China has endeavoured to subsidise the manufacturing of EVs, battery recycling, and charging facilities across the nation, providing a smooth transition to producers and consumers alike (Li & Lee 2023). Moreover, China's government introduced an incremental policy towards achieving the goal of 20% New Energy Vehicle (NEV) sales by 2025, which was achieved several years in advance due to adequately supportive policies (Sandalow et al 2022). Since 2019, Chinese passenger vehicle manufacturers and importers producing or importing over 30,000 vehicles annually have been subject to escalating NEV credit requirements. Initially set at 10% (equivalent to 3.8% EV production with a 200 km range), the mandate increased to 12% in 2020, then progressively to 18% by 2023, with long-range EVs earning additional credits, leading to an exceptional result of achieving the 2025 target in the first half of 2022 (Sandalow et al 2022).

The Australian federal government should draw on the successes of leading EV-adopting nations to establish a cohesive, nationally consistent framework for incentives and standards. A well-structured policy approach with direct EV purchase subsidies, home charging tax rebates, and reduced import tariffs can enhance consumer demand and accelerate EV adoption. The government must also enable a smooth transition by supporting local manufacturers, encouraging EV supply chains, and subsidising workforce reskilling. These measures will guarantee the sustainability of EV growth in Australia.

Other than policy stringency and incentives, infrastructure remains another critical factor. Further government investment in charging stations, notably increasing the amount of high-speed charging stations, is the most direct approach. Australia's geography demands improved strategic charging access planning, especially for regional and remote areas. Public-private partnerships need to be sought by the government to drive infrastructure rollout and interoperability, applying international best practices to ensure maximum network coverage.

Public awareness and education are fundamental in fostering a sustainable environment for EVs. Research indicates that only 26% of Australians feel knowledgeable about EVs, and 47% are eager to learn more (NRMA Insurance 2024). It shows that Australians are interested in EVs but lack a suitable channel, which may lead to misunderstandings such as safety concerns, high cost and battery degradation.

carbon capture and storage

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According to analysis by the University of Melbourne, the University of Queensland, and Princeton University, to achieve net zero by 2050, Australia will require the development of a large carbon capture and storage (CCS) industry which is capable of storing 80 to 1000 Mt of CO2 per year (Net Zero Australia, 2023). A report by the International Energy Agency (IEA) further supported the findings of the study. The IEA also came to the conclusion that reaching net zero will be almost impossible without the help of carbon capture, utilization and storage (CCUS) (Internatinal Energy Agency, 2020).

CCS is a complex process that starts by capturing CO2 from industrial processes, such as oil and gas activities. After that, the CO2 is condensed into liquid form for transportation, before finally injecting and permanently storing it into a stable underground geological formation. There are three main methods for capturing CO2, which are post-combustion, pre-combustion, and oxy-fuel combustion. Post-combustion separates CO2 from the flue gas by using chemical solvents after the fuel is burnt. On the other hand, pre-combustion captures CO2 by converting the fuel into a gas mixture of hydrogen and CO2 before it is burnt. The last method, oxy-fuel combustion, separates CO2 through burning the fuel with pure oxygen to produce a gas mixture of steam and CO2 (The London School of Economics and Political Science, 2023).

Conventional carbon capture devices can be divided into 2 types (IEA, 2025):

- Direct air capture (DAC) or direct air carbon capture and storage (DACCS): extracting CO2 directly from the atmosphere, which is energy-intensive due to low concentrations of CO2 in ambient air.
- Point source carbon capture and storage: extracting CO2 from concentrated sources such as power plants and cement factories.

Australia has a massive theoretical capacity for carbon sequestration in saline aquifers and depleted fields (Geoscience Australia, 2024). It is estimated that Australia has approximately 31 Gt of sub-commercial storage capacity and 470 Gt in undiscovered storage resources, where much of this storage resource is found in the sedimentary basins of offshore Victoria (Gippsland Basin), Western Australia (Browse, Perth, Northern Carnarvon basins) and Northern Territory (Bonaparte Basin); and onshore in South Australia (Cooper-Eromanga Basin) and Queensland (Surat Basin). Because of this, Australia theoretically has more than sufficient geological formations to support CCS when compared to the recommended annual capture sequestration level of 80-1000 Mt (Net Zero Australia, 2023).

Australia has three current operating CCS projects, which are Chevron's Gorgon project on Barrow Island, Western Australia, CO_2CRC's Otway project in Victoria and Santos' Moomba project in South Australia. The Moomba and Gorgon projects were built to store 1.7 and 3.3 million tonnes of CO_2 annually. In contrast, the Otway project does not have an annual storage capacity because it is a research and demonstration facility. The Moomba project has stored approximately 800,000 tonnes of CO_2 since the start of its operations in September 2024 (Santos, 2025), the Gorgon project has stored over 9 million tonnes of CO_2 since it started in August 2019, and the Otway project has stored around 100,000 tonnes of CO_2 as of December 2024 (Geoscience Australia, 2024; CO2CRC, 2024).

Technical Challenges & Costs

Despite the identified need for a substantial CCS industry in Australia (Net Zero Australia, 2023), there are several technical challenges and problems with CCS technology. Failure can occur during three stages:

- CO_2 capture: This is the most common source of failure, due to technical difficulties in capturing CO_2 from flue gases or process stream in pre- or post-combustion. Issues often arise from poor performance of solvents, sorbents or membrane technologies (Bhattacharyya & Miller, 2017).
- CO_2 transport: CO_2 is commonly transported via pipeline, thus making it more reliable. However, this makes transport susceptible to impacts due to delays in infrastructure construction where they occur (AP News, 2025).
- CO_2 injection and storage: CO_2 injection instabilities mostly occur due to unpredictable geological behaviour, which can lead to unexpected leaks or reduced storage capacity. For example, the Gorgon project reduced its CO_2 injection volume because the geological structure was not dispersing models had initially predicted (IEEFA, 2022).

Given these technical challenges, projects such as Santos' Moomba represent a special case, since their total costs are already lower as the CO_2 was already separated as part of the natural gas processing. However, this does not directly mean that all CCS projects are always cost-effective or successful, as even similar projects might encounter different technical challenges, which may add up to a higher cost. This means each CCS project is different depending on where it is built. As a result, this makes it harder to solve their technical challenges under a single one-for-all approach (Rui, Zhenhua; Zeng, Lianbo ; Dindoruk, Birol, 2025).

Apart from technical issues, another challenge is the high capital and operational costs of CCS projects. CCS is less cost-effective for emissions reduction when compared to other strategies, such as electrification, energy and material efficiency improvements, and enhanced recycling (IPCC, 2023). The high capital costs of CCS projects primarily come from retrofitting existing plants. This is because retrofitting the plant requires building new infrastructure, such as CO_2 compression units, dehydration systems, pipelines, and injection wells. For example, Australia's Gorgon CCS project costs more than $3 billion just for its carbon capture and storage units (Upstream Online, 2024). In addition, operating the CO_2 capture system consumes a significant amount of electricity, typically around 20-30% of the plant's total energy capacity. The high operational costs of a CCS project usually consist of the need to replenish and treat solvent-based capture systems, as they tend to degrade over time. Research shows the current cost per tonne of CO2 captured varies from US$60–$150/tonne for coal-powered plants and US$20–$50/tonne for gas processing plants (Global CCS Institute, 2017; Schmelz, Hochman, & Miller, 2020).

Different from point-source carbon capture, direct air carbon capture and storage (DACCS) removes CO2 directly from the atmosphere. For DACCS to be sustainable, this technology can be paired with renewable energy facilities to help offset hard-to-abate industry emissions, such as cement production. However, DACCS currently consumes a huge amount of energy and is usually associated with high costs, with estimates between US$600–1000 per tonne of CO2 captured (World Economic Forum, 2023). Thus, in order for the technology to be viable at scale, significant cost reductions and efficiency improvements will be required. The technology will need to improve to be able to achieve at least $100 per tonne CO2 captured.

Although CCS is often promoted as having enormous potential to help achieve Net Zero, the majority of projects are associated with oil and gas activities (Zero Carbon Analytics, 2024). Historically, CCS was primarily used for enhanced oil recovery (EOR), in which CO_2 is injected into reservoirs to boost oil production. At present, 82.5% of the 41 operational CCS projects worldwide are used for EOR, and 53% of global CO_2 storage capacity is associated with natural gas processing.

Most of the world's operational CCS facilities are currently underperforming. For instance, Australia's CCS flagship project, the Gorgon project, has not captured the CO2 emissions amount it intended to since its operations started in 2019, only capturing 44% of the original capacity between FY2019-20 and FY2023-23 (IEEFA, 2024). This underperformance has forced Chevron to purchase an additional 5.23 million carbon credits (Chevron, 2022). As a result, costing an additional $40 million. However, despite the poor track record, the Australian government has decided to approve the Gorgon Stage 2 expansion in 2023. This expansion is projected to emit around 3 billion tonnes of CO_2-equivalent emissions over the next 50 years (The Australia Institute, 2024).

Regulatory Framework

Australia's regulatory scope can be split between federal and state and territory responsibilities, where offshore projects are governed by the federal government

and onshore projects are regulated by state and territory authorities. Offshore CCS projects are governed under the national framework established by the Offshore and Greenhouse Gas Storage Act 2006. The offshore CCS projects' approval process starts with obtaining exploration permits and ends with site closure procedures. This also includes requirements for environmental plans, safety cases, and EPBC Act approval between the processes (Australian Government, 2023). Onshore CCS projects do not have a national framework and are regulated through state and territory laws. Same as the national framework approval process, onshore projects also start with obtaining exploration and storage licences, followed by securing environmental and development approvals, and meeting state-specific closure and monitoring requirements in the end (Tim Power, 2021). However, because of the lack of a national framework, onshore CCS projects often encounter different rules and approval sequences depending on their jurisdiction. This approach shows the difference from the national framework that offers a single streamlined pathway to offshore CCS projects.

Offshore CCS regulations

Primary Legislation and Regulators

The primary law for governing offshore CCS is the Offshore Petroleum and Greenhouse Gas Storage Act (OPGGS Act) 2006, administered by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). The Act applies from 3 nautical miles from the coastline and extends to the boundary of Australia's Exclusive Economic Zone (EEZ) (NOPSEMA, 2006). The National Offshore Petroleum Titles Administrator (NOPTA) administer greenhouse gas storage titles, while NOPSEMA regulates offshore petroleum and greenhouse gas storage activities, including storage health and safety, well integrity, and environmental management. The department also assesses and approves environmental plans.

Environmental Regulations

Environmental regulations for offshore CCS are regulated by both: Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023, which covers environmental planning and compliance (Australian Government, 2023), and the Sea Dumping Act 1981, which implements Australia's obligations under the London Protocol to prevent marine pollution (Australian Government , 2024).

In 2023, the Environment Protection (Sea Dumping) Amendment (Using New Technologies to Fight Climate Change) Bill was passed in parliament. This amendment allows the export of captured CO2 to other countries for offshore carbon sequestration and allows Australia to accept captured CO2 from other countries (Parliament of Australia, 2023). This opens up opportunities for Australia to offer carbon storage services for countries without geological storage capacity.

This marks the shift of CCS models from single company stand-alone projects to shared storage hub models. Different from the past approach, the shared storage hub model carbon capture services are provided by the company that constructs the transport and storage infrastructure, and clients simply purchase this service for access to carbon sequestration. This new approach reduces costs because it

spreads risk across stakeholders rather than just a single company (IEA, 2020). Apart from the three projects already in operation, new shared storage carbon hubs are proposed, and their development is underway. These include:

- The Santos-led Bayu-Undan CCS project
- The CarbonNet Project in Victoria
- The Northern Low Emissions Hub
- Pilot Energy's Mid-West Clean Development Hub

EPBC Act accreditation

Offshore CCS projects may also trigger the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) if they affect Matters of National Environmental Significance (MNES) such as Commonwealth Marine Areas, Ramsar wetlands, or listed threatened species and communities (Australian Governnment, 2025).

However, since 2014, the Environment Minister has granted strategic accreditation to NOPSEMA's environmental regime under the OPGGS Act within the EPBC Act framework, streamlining all offshore CCS project approvals (DCCEEW, 2014). This supposedly strong move, achieved through cross-departmental collaboration, is now being undermined by the Offshore Petroleum and Greenhouse Gas Storage Legislation Amendment (Safety and Other Measures) Bill 2024 (Parliament of Australia, 2024). Section 790E of the Bill would lock in the offshore regime as permanently meeting EPBC Act standards, meaning no future offshore petroleum or CCS project would trigger an EPBC Act EIA, even if it should. This could create significant regulatory gaps, as projects would be deemed EPBC-compliant without giving the Environment Minister the power to conduct further reviews (Biodiversity Council, 2024).

Emissions Accounting

The National Greenhouse and Energy Reporting Scheme (NGERS) provides the framework that requires operators to report captured CO_2, underground storage amounts, leakage, and cross-border transfers. Parallel to this, the National Greenhouse and Energy Reporting Act 2007 (NGER Act) mandates reporting for corporations where emissions or energy use exceed certain thresholds (≥50,000 tonnes CO_2-e per year or ≥200 TJ of energy use), regardless of their project classification (including CCS) (Australian Government, 2007).

Onshore CCS Regulation

Onshore CCS regulation falls under state and territory governments. Only four jurisdictions currently have comprehensive CCS legislation:

- Queensland: Greenhouse Gas Storage Act 2009 (Queensland Government, 2025)
- Victoria: Greenhouse Gas Geological Sequestration Act 2008 (Victorian Government, 2025)
- South Australia: Petroleum and Geothermal Energy Act 2000 (amended for CCS) (South Australia Government, 2024)

- Western Australia: Petroleum and Geothermal Energy Resources Amendment (GHG Storage) Act 2024 (Western Australia Government, 2025)

While Queensland and Victoria have CCS-specific legislation, in contrast, South Australia and Western Australia regulate CCS under amended petroleum laws, which are less comprehensive than those in Queensland and Victoria. Western Australia's 2024 update brought its framework closer to the Queensland and Victoria models, but CCS still remains tied to petroleum laws.

Strategic Policies & Government Programs

Future Gas Strategy

The Future Gas Strategy (2024) was an initiative introduced by the federal government to balance gradually reducing Australia's reliance on fossil fuels and securing affordable and reliable energy at the same time. To achieve this, it was recommended to focus on using gas as a transition fuel in order to align with Australia's Net Zero goals. The strategy suggested establishing a new Transboundary Carbon Capture and Storage (CCS) Program, designed to operationalise amendments to the London Protocol that now permit the export and import of CO_2 streams for offshore sequestration. This reform has the potential to provide options for energy security and carbon management solutions for our regional partners, turning Australia into an international geological hub providing capture storage services (Department of Industry, Sciences and Resources, 2024). The Strategy also recommends clearer consultation requirements for offshore petroleum and CCS activities, to be addressed in a three-year review of the Offshore Petroleum and Greenhouse Gas Storage Act 2006 and related environmental regulations. To support this work, the 2023–24 Budget allocated $12 million over three years.

Low Emissions Technology Statements (LETS) and Long-Term Emissions Reduction Plan

The LETS was created to act as a roadmap for government and industry stakeholders by showing which technologies Australia prioritises for reducing emissions while supporting economic growth. After the first statement in 2020, new technologies emerged, costs changed, and international expectations on CCS have grown. The 2021 statement, therefore, was built on the 2020 version, showing progress and setting new goals. This is because as low emissions technologies' landscape changes, the statement needs to be updated to reflect those changes.

LETS 2020 signalled the government's desire to commercialise CCS, highlighting its role in decarbonising hard-to-abate industries such as natural gas processing, cement, steel, fertilisers, and hydrogen production, including contributing $50 million to support pilots and demonstration projects ranging from direct air capture and geological storage linked to power plants to CO_2 utilisation in construction materials (DCCEEW, 2020).

LETS 2021 reaffirmed CCS as a priority low-emissions technology and set a stretch goal of reducing hub transport and storage costs to below $20 per tonne CO_2 (DCCEEW, 2021). It allocated $565.8 million for international partnerships in low-

emissions technologies, including CCS collaboration with Japan, Korea, and the UK. It also committed to developing new Emissions Reduction Fund (ERF) methods, one of which was directly linked to CCS-related infrastructure and technologies. The statement also emphasised Australia's geological advantage, with world-class storage basins such as the Gippsland, Surat, Cooper, Petrel, and Barrow sub-basins offering a combined estimated capacity of over 20 billion tonnes.

The Long-Term Emissions Reduction Plan (2021) was created as a technology-focused roadmap to guide Australia toward net zero by 2050, providing investment certainty while cutting emissions, supporting jobs, and aligning with international climate commitments (DCCEEW, 2021). The Plan built further momentum for CCS by investing over $300 million in CCUS hubs and technologies to reduce costs. The plan also identified CCS as a pathway to decarbonise steel, cement, and natural gas, and to produce blue hydrogen (via gasification or steam methane reforming with CO_2 capture and storage).

Historical overview of funding

Although Australia has one of the largest CCS projects in the world (Chevron's Gorgon Project), over time, CCS industry growth has been stagnant. This is because there are fewer newly announced initiatives to support larger scale deployment of CCS technology in Australia (Gilbert Tobin, 2024).

The Low Emissions Technology Demonstration Fund (LETDF) marked the start of government support for CCS in Australia (IEA, 2021). The fund provided early funding for large-scale low-emissions projects, and this eventually led to contributing up to $60 million to the Gorgon CCS project in 2019. In 2011, the Carbon Credits (Carbon Farming Initiative) Act was passed in parliament. The Act eventually led to the introduction of the Emissions Reduction Fund and the Australian Carbon Credit Unit (ACCU) Scheme in 2015 (Australian Government, 2021). The ACCU provided an alternative to direct government funding by shifting it towards market-based incentives. The new mechanism allowed CCS projects to register carbon credits under approved methodologies.

In 2020, the federal government provided support for CCS with the Carbon Capture Use and Storage Development Fund (CCUSD fund) with the aim of helping scale up CCS and CCUS through supporting pilot or demonstration projects with its $50 million funding (Australian Government, 2021). This included $15 million for the Moomba CCS project, which later became Australia's first large-scale onshore CCS facility. The federal government established the Low Technology Commercialisation Fund in 2021, a $1 billion investment administered under the Clean Energy Finance Corporation (CEFC) to combine both federal and private sector investment to support early-stage low-emissions technologies, such as CCS, through debt and equity finance mechanisms (Department of Industry, Sciences and Resources, 2021). At the same time, the Australian Renewable Energy Agency (ARENA) broadened its funding strategy (2021–2024) to include innovation for CCS. This made the strategy focus particularly on R&D that reduces system costs such as CO_2 compression, transport, and storage. This is because in order to make CCS economically feasible, capturing costs below $20 per tonne of CO2 is needed (ARENA, 2021).

The CCUS Hubs and Technologies Program (2022) is a ten-year program introduced to speed up the development of commercial-scale CCUS projects and hubs. To achieve this, the program allocated $250 million for the development of shared infrastructure and exploration for suitable CO2 storage sites (Australian Government, 2022). This program was, however, discontinued and the new Carbon Capture and Technologies Program (CCTP) which was launched in 2023 (CO2CRC, 2022). The CCTP shifted the focus to new carbon capture technologies. These include direct air capture and mineral carbonation with the aim of applying them to hard-to-abate industries such as cement production. The program had already awarded $65 million to seven projects by 2024 (Australian Government, 2023).

The 2024 Powering the Regions Fund (PRF) provided $1.9 billion to support emissions reductions for trade-exposed industries under the Safeguard Mechanism scope. $600 million of the $1.9 billion was allocated to the Safeguard Transformation Stream (STS). The STS can directly support CCS project development because it covers the high upfront capital costs. For example, $9.8 million from the PRF was invested in the Dyno Nobel ammonium nitrate facility located in the Bowen Basin, Queensland. While this project is not CCS, it shows how the STS stream can support decarbonisation efforts through the RPF investment, a mechanism that can also be transferred to CCS projects (DCCEEW, 2024).

In the same year, the Resourcing Australia's Prosperity (RAP) program was introduced by the federal government. The program led by Geoscience Australia provides $556.1 million over 10 years (2024-2034). The program serves as a basis to map national resources and geological CO_2 storage potential across the whole country (Geoscience Australia, 2024). Although the program does not directly fund CCS projects, it provides geological data on carbon sequestration capacity, which can attract investment for CCS in the long run.

Lastly, the provision in the 2024-25 Federal Budget committed $32.6 million over four years for regional cooperation on carbon sequestration, to support the establishment of regulatory frameworks and bilateral instruments (The Climate Council , 2024). This initiative helps establish clear and consistent legislation for CCS across national borders to promote collaboration with other countries for a safe and accountable cross-border carbon storage service.

CCS and ACCUs

Stable long-term funding and a carbon market are what make CCS sustainable. In Australia, CCS projects can be registered for Australian Carbon Credit Units (ACCUs) through the Emissions Reduction Fund, which is regulated under the Carbon Credits (Carbon Farming Initiative) Act 2011 (Cth) and administered by the Clean Energy Regulator (Clean Energy Regulator, 2025). Each ACCU represents one tonne of CO_2 captured, and these credits can be sold to clients who need offsets to reduce their emissions.

The Safeguard Mechanism, created by the National Greenhouse and Energy Reporting (NGER) scheme, requires large emitters to reduce their emissions intensity below the calculated baseline by 4.9% annually until 2030 (Clean Energy Regulator, 2025). This mandatory reduction is the driver for demand for ACCUs, as

stakeholders are forced to meet this target either by reducing actual emissions, purchasing ACCUs, or paying the default prescribed unit price. Although the Safeguard Mechanism reduces emissions per unit of production, the options of paying the default unit price and unlimited use of ACCUs to offset emissions have been criticised as an excuse instead of reducing actual emissions (The Australia Institute, 2023).

As part of the 2023 Safeguard Mechanism reforms, the government amended the Carbon Credits (Carbon Farming Initiative) Rules in May 2023 (DCCEEW, 2024). These changes prevent the Clean Energy Regulator from entering into new carbon abatement contracts for CCS projects at Safeguard-covered facilities. The Moomba CCS project remains the only CCS facility eligible for ACCUs under existing rules, as it was registered prior to this reform. CCS projects outside the Safeguard Mechanism may still earn ACCUs if they meet the approved CCS methodology, but these are exceptions. For large industrial emitters, CCS technology can still be implemented; however, they don't have the benefit of generating ACCUs through new federal contracts.

At the same time, replacing the ACCUs were the new Safeguard Mechanism Credits (SMCs). The SMCs are only generated when a facility's emissions are below its allocated baseline (DCCEEW, 2024). Different from ACCUs that require an approved abatement methodology, SMCs are calculated directly through the difference between their reported emissions and allocated baseline. This calculation method makes them an internal compliance instrument and is only tradable among other Safeguard-covered facilities. Therefore, if CCS projects can lower a facility's emissions below its baseline, then they are eligible to generate SMCs. For instance, if a facility captures and stores 100,000 tonnes of CO_2, eventually making its emissions to fall below its baseline, the difference can be used to generate the same amount of SMC. This can then be traded to other Safeguard-covered facilities for income.

The reforms also introduced a zero baseline for reservoir CO_2 from new gas fields supplying LNG (DCCEEW, 2024). Reservoir CO_2 is the carbon dioxide released naturally during gas extraction. These emissions were emitted directly into the atmosphere and counted against a facility's baseline emissions before the reform. Under the new reform, any gas field developed after 2023 is mandated to abate 100% of reservoir CO_2 from the start of operations. This new reform effectively rules out the possibility for proponents to use offsets to cover such emissions. This means CCS becomes the only available option for projects with high levels of reservoir CO_2 to comply with the regulation (Norton Rose Fulbright, 2025). Although this can create a strong incentive for CCS development alongside new gas developments, it also raises wider concerns that the new reform locks in CCS as a requirement for project approval. This may provide loopholes for further expansion of fossil fuel production rather than contributing to overall decarbonisation.

Criticism

According to the Climate Council, carbon capture and storage (CCS) remains an unproven technology being promoted by the fossil fuel industry in an effort to extend their business-as-usual operations (The Climate Council , 2024). The council

argue that CCS has yet to demonstrate effectiveness at scale, especially for capturing onsite emissions from coal and gas operations. CCS does not address downstream emissions produced when fossil fuels are burned for energy. The Council argues that public funding should instead be directed toward accelerating the shift to renewable energy, rather than supporting CCS as a lifeline for fossil fuels.

Concerns over Australia's climate policy integrity go beyond CCS performance. The Australia Institute, together with researchers from ANU and UNSW, have flagged questions about the credibility of Australia's carbon offset market. Their research concluded that up to 75% of Australian Carbon Credit Units (ACCUs) may not represent real or additional emissions reductions. As a result, the lack of credibility will lower investors' confidence in the carbon market and weaken the effectiveness of offset-based compliance mechanisms such as the Safeguard Mechanism (The Australia Institute, 2023).

The Future Gas Strategy has also drawn criticism for locking in fossil fuel expansion until 2050 while heavily relying on the unproven performance of CCS to justify ongoing emissions from fossil fuel activities (The Australia Institute, 2024). Despite collective agreements from the UN, IEA and CSIRO that new fossil fuel projects are in conflict with global climate goals, the Australian government is still giving green lights for large-scale gas developments. These include Woodside's Burrup Hub, Chevron's Gorgon Stage 2, and the North West Shelf Gas extension until 2070, which together are projected to emit more than 13 billion tonnes of CO_2 over their lifetimes (6.1 billion tonnes from Burrup Hub, 4.3 billion tonnes from the North West Shelf, and 3 billion tonnes from Gorgon) (The Australia Institute, 2024; Climate Council, 2025; Climate Energy Finance, 2023).

Currently operational CCS projects, which are central to the government's justification for continuing fossil fuel reliance, have all underperformed in practice. For instance, the Gorgon project, one of Australia's flagship CCS projects, is only capturing one-third of the carbon capacity of what was promised. Critics argue that this strategy is seen as doubling down on fossil fuels at the expense of practical and effective climate actions, relying on overclaimed technologies' performance, undermining Australia to achieve its 2050 net zero goals.

Recommendations

Shift CCUS investment toward hard-to-abate industries

Investment in CCUS technology, demonstration, and deployment should transition away from oil and gas–linked activities and focus instead on hard-to-abate sectors such as cement, chemicals, steel, and fertilisers (The Australia Institute, 2024). This would allow CCUS to deliver meaningful emissions reductions rather than serving to justify and prolong fossil fuel development, an outcome that undermines Australia's net-zero by 2050 commitment.

Incorporate Scope 3 emissions accounting into CCUS evaluation

CCUS is often promoted because of its potential to store large volumes of CO2. This is only partly true as most projects only accounts for Scope 1 emissions. Not incorporating Scope 3 emissions can change the perception of whether CCUS can

genuinely be considered "clean". This is because most CCUS projects are associated with oil and gas value chains, where the majority of their emissions come from Scope 3 rather than Scope 1 emissions (Zero Carbon Analytics, 2024). Thus, without Scope 3 emissions accounting, CCS projects' carbon emissions reduction benefits are at risk of being overvalued. For instance, the Gorgon CCS project emits 50 Mt CO2/ year over its full life cycle but only captures 1.5 million tonnes of CO2 per year, which is only a tiny fraction (3.2%) of what it emits annually. Therefore, mandating scope 3 accounting would provide transparency for investors, regulators and the general public to be able to distinguish between real emissions reductions and greenwashing.

Establish a national CCUS framework

CCUS development in Australia has slowed down because of the lack of a clear national framework (LETS Australia, 2025; CSIRO, 2025). This gap has resulted in offshore and onshore projects facing different legislative pathways resulting in uncertainties which can create uncertainty for investors, which in turn limits long-term funding. Therefore, a national framework should include:

- Providing stable and long-term funding to support hub development and early demonstration projects
- Streamlining regulatory processes across federal and state and territory levels to reduce duplication and delays
- Setting clear performance indicators for emissions reduction, sustainability and long-term storage safety
- Defining clear rules for liability and monitoring procedures to increase public and investor confidence

Avoid locking in fossil fuel infrastructure through hydrogen policy

The Future Gas Strategy recommended positioning CCS as the foundation for prolonging the use of natural gas until 2050. The strategy also recommended later repurposing the gas infrastructure for future hydrogen use. This continued advocacy for CCS tied to oil and gas activities risks locking in future fossil fuel extraction under the guise of the possibility of committing to a future hydrogen economy (The Australia Institute, 2023).

While hydrogen has a role in decarbonisation, CCS should not be incorporated into hydrogen policy frameworks in ways that enable ongoing subsidies for fossil fuel activities.

Prioritise high-impact sequestration options

Australia should prioritise carbon sequestration objectives through alternative methods, particularly nature-based solutions, including (Net Zero Climate, 2025):

- Large-scale native vegetation restoration;
- Improved soil carbon management;
- Coastal and blue carbon restoration;
- Enhanced mineral weathering;
- Fire regime reform.

These options should be considered complementary to CCUS, and in some cases may require more expensive upfront costs, but can also offer other important co-benefits apart from just carbon sequestration. For instance, soil carbon management can also support Aboriginal communities' culture and knowledge when traditional land management practices are adopted. Other than that, local communities can also generate income through ACCUs while improving biodiversity and offering large-scale carbon sequestration at the same time (Unimelb, 2021).

Support direct air capture (DAC) as a strategic pathway

DAC captures CO_2 directly from the atmosphere. Thus, when powered by renewable energy, it can avoid locking in with fossil fuel activities that are currently associated with most CCUS projects. Although costs remain high now, with estimates ranging between US$400–600/$tCO_2$, accelerated deployment of the technology and reduced costs can be achieved with a clear government framework and funding initiatives. This makes DAC an important control option for hard-to-abate emissions when costs are under US$100/ tCO2 (WEF, 2023; The Wall Street Journal, 2024).

Without these reforms, CCUS in Australia risks becoming a costly tool for prolonging fossil fuel production rather than a genuine climate solution. By focusing on industries that have limited options, policymakers can ensure CCUS policy is used for real carbon emissions reduction. This will require the use of full life-cycle emissions accounting and creating consistent national oversight to provide the general public with a better picture of how CCUS is contributing to Australia in achieving its Net Zero goals. Supportive actions include avoiding fossil-linked hydrogen infrastructure, promoting nature-based solutions, and supporting DAC development can help address the current flaws in the existing CCUS industry.

economic and industry impacts

climate change and the cost of living

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In Australia, climate change associated impacts should no longer be seen as a distant environmental issue, but a driving force for the current cost-of-living (COL) crisis. Climate variability has a direct and indirect interaction to human well-being, determining the availability of essential resources (Hanna & Mclaver, 2018). Over the past few decades, Australia has experienced rising temperatures and intensified extreme weather events that has undoubtably put an increasing pressure on energy, food and insurance sectors (Beggs, et al. 2025) (IPCC, 2022). With anthropogenic damage locking in long-term warming, devastating events like the 2019-2020 bushfires are expected to become more frequent and severe (Patrick et al. 2021). These compounding shocks are escalating household costs, making climate change an urgent economic challenge. The term coined, 'climateflation' describes the impacts of increasing rates of extreme weather events on agricultural and industrial production which have contributed to greater economy-wide inflation (Schnabel, 2022, Wild, 2022). Food, insurance, and energy prices, which at a government level are monitored by the Australian Bureau of Statistics, can be understood as COL indices, and have shown the strongest inflationary growth since 2022 (Cmwth 2024, Thrower, 2025). The COL crisis was a central theme in the 2025 general election, during which climate change was largely sidelined or framed as conflicting with efforts to address COL issues (Thrower, 2025).

The rise in COL is monitored in Australia using the Consumer Price Index (CPI) to inform the Reserve Bank of Australia (RBA) on how to manage interest rates (RBA, 2022). Currently, government funding in Australia is primarily handled by the Treasury, the RBA and The Department of Social Services (DSS). The RBA is slowly beginning to bring down official cash rates, however, they remain high compared to historical lows in recent periods (Beattie, 2023). This has placed significant strain on homeowners, as high interest rates drive up the COL amid stunted economic growth. As a result, the CPI, rose by 2.4% in the 2024 financial year, and whilst it has more recently stabilised, its value remains high (ABS, 2025).

In Australia, there are several governing bodies and groups that share responsibilities regarding COL policy decision-making, under the direction of the Federal Government. The Select Committee on Cost of Living has been a significant body in shaping fiscal policy recommendations, identifying the key drivers of inflation and rising living costs (Cmnwth, 2024). Since the release of the committee's final report in November 2024, the key recommendations have been to reduce inflation, to relieve the financial pressures that Australians have endured over the past four years (Cmnwth, 2024). The Senate's recommendations are essential for The Department of Treasury to organise and construct fiscal policy. The Treasury is responsible for fiscal policy and budget preparation, working in coordination with the RBA's monetary policy settings to effectively manage economic policy, which in turn affects COL issues. The Parliamentary Budget Office provides independent analysis of budget and fiscal policy matters to inform parliamentary oversight of these decisions. Accordingly, the Treasury was tasked with developing and redesigning Australia's Stage 3 tax cut scheme, which has been a key component in the strategy to ease COL pressures both before and after the pandemic (Treasury, 2024).

The volatile aspects that create COL pressures like food and energy fall under headline inflation, while housing and insurance are additional pressures towards living affordability (Cmnwth, 2024). This is governed by a combination of Federal and State and Territory policy. The Federal government sets economic and international policy, allowing for broad-scale control over budgetary spending and providing national coordination in setting guidelines and standards for each State and Territory (Farr & Nelson, 2024). The Treasury has been responsible for running key mechanisms to govern COL through various independent departments, which then distribute responsibilities to State and Territory governments (Treasury, 2024). The Australian Competition and Consumer Commission (ACCC) and The Department of Climate Change, Energy, Environment and Water (DCCEEW) are two major bodies responsible for policy affecting the food and energy sectors across the country. The ACCC is responsible for regulating pricing practices and competition in key sectors of energy and consumer goods, including food which is essential when reducing COL pressures for individuals (ACCC, 2024). National policy on food regulation and security is informed by input from the ACCC and The Department of Agriculture, Fisheries and Forestry (DAFF), alongside standards set out in the Competition and Consumer act 2010 (Cth) ensuring fair trading in the sector (ACCC, 2024). Food costs for individuals depend on coherent and fair standards set by government, however, coordination in food policy remains limited, as interactions in the food system become increasingly complex under the three tier government system (Farr & Nelson, 2024).

The DCCEEW has been at the forefront of developing and coordinating policy decisions behind the renewable energy transition in Australia (DCCEEW, 2025). It has created joint initiatives between state, territory and federal governments to provide financial assistance through the Energy Bill Relief Fund scheme, provides direct financial support to households facing cost pressures (CCA, 2024). Each State and Territory is responsible for delivering funding to eligible households, allocated through the federal budget. Incentives, rebates and schemes made by these

agencies aim to reduce household energy costs and ease COL pressures, though they are not direct tools to bring down overall inflation.

State and territory governments manage services that impact livelihoods within each state or territory (PEO, 2025). These governments also play a role in implementing aspects of social services and welfare policy, often in partnership with federal agencies, by administering programs funded by the Commonwealth that support those most affected by high COL pressures (PEO, 2025). The Department of Social Services (DSS) provides support by funding and overseeing social safety nets for vulnerable groups (DSS, 2025). The DSS delivers initiatives such as Commonwealth Rent Assistance and partnerships with non-profit organisations to support individuals. While the DSS is a federal government agency, it relies on state and territory governments and service providers to administer some payments and services (DSS, 2025). These arrangements significantly influence COL outcomes by shaping access to essential social services and amenities.

These agencies have made a substantial effort to bring down inflation and alleviate COL pressures since its sharp rise in the early 2020s. However, the RBA has had to delay achieving its inflation target by keeping the cash rate on hold several times during 2023 and 2024, following a series or rapid rate rises in 2022 and 2023 (Cmnwth, 2024). The RBA states that slow progress on disinflation is due to demand exceeding the economy's capacity to supply goods and services (RBA, 2024). The Commonwealth government also highlights impacts from the COVID-19 pandemic and recovery, global conflicts and the Albanese Government's higher spending policies as contributing factors (Cmnwth, 2023, RBA, 2024). While these global changes have undoubtedly caused global ecumenic losses and inflationary effects, there has been limited recognition by the government of climate change as a contributing factor. With supply and demand factors being crucial in shaping COL pressures including the present and ongoing crisis, it is important to recognise climate change as a driver of constrained supply and heightened demand.

After a near decade-long hiatus on climate action during Liberal-National rule, the Labor Government introduced policies to address climate change and COL pressures, however, these policies are largely pursued in parallel rather than in an integrated way (Climate Council, 2025). One example of where these issues have been identified together was in the 'Cost of Living Help and Future Made in Australia' plan proposed by the Albanese government (Thrower, 2025). The plan aimed to improve the COL crisis, whilst boosting the renewable energy transition by providing more affordable homes, significant tax cuts to 84% of Australians alongside $300 energy bill rebates for all households (Treasury, 2024).

Whilst the plan represents significant effort to mitigate the impacts of climate change by reducing emissions while cushioning households against economic strain, climate change and COL pressures should be viewed as interlinked issues across a broader policy framework. Acknowledging the economic impacts of climate change on Australian livelihoods is essential. Without this recognition, Australia risks failing to mitigate against future climate shocks, deepening economic inequality and worsening the strain on households (Thrower, 2025).

The impact of climate change on food prices

Extreme weather events significantly disrupt the production, distribution and supply of food resources, where lower supply drives up prices. Agriculture plays a vital role in Australia's economy, making supply shocks particularly damaging to livelihoods, an issue expected to worsen as climate change intensifies (UN, 2023). While current Federal government policy involves some strategy to combat food insecurity and rising food prices, there is not yet a unified national food security strategy. In fact, Australia scores zero in the Global Food Security Index measure for policy commitments to food security, compared to the global average of 47.1% (Spencer, 2025).

Australian citizens are increasingly pressured by rising food retail prices, with supermarket giants earning greater profits while consumers suffer. The Australian Competition & Consumer Commission (ACCC) supermarket inquiry, recently released 20 recommendations to reform the fairness of the supermarket sector in Australia (ACCC, 2024). The recommendations have been beneficial in creating a mandatory code of conduct for Australia's largest supermarkets, aiming to reduce competition for new entrants and benefiting customers with better pricing transparency. ACCC management of the supermarket sector can help lower prices for the consumer in the long term by increasing market competition, however in an era of high COL a more immediate approach is needed (Moskal, 2025).

Food price rises have a disproportionate affect on poorer households as a greater proportion of their household income is spent on food (Downie, 2024). Food security policy should focus on addressing the impact that persistent food insecurity has on low-income households. The DSS is responsible for providing funding towards food cooperatives like FoodBank which assist the people most vulnerable to food insecurity. Food Bank Australia has managed to distribute greater amounts of food in the last few years than previous years (Foodbank, 2025). However, they are still advocating for increased funding, with current base grant funding inadequate to meet the ongoing high demand (Foodbank, 2025). The request is in response to increasing strain on resources with Food Bank stating its inability to sufficiently prepare for natural disasters andrespond to increasing COL pressures on the community and the toll this has on food resources with its current funding. While figures are unclear, the Government is not meeting this current funding target, with a report from 2023 finding that funding to Foodbank Australia, SecondBite and Ozharvest was just $1.5 million per year (Foodbank, 2025).

It is essential that policy changes towards the food industry in Australia incorporate future uncertainty in weather extremes. A promising start has been made in the 2024-25 'Budget for Protecting and Growing the Future of Agriculture' (Watt, 2024). The project targets farmers and producers in climate change adaptation through a $789 million investment (Watt, 2024). It establishes the need for greater resilience as natural disasters increase in intensity and frequency due to climate change. This policy is crucial in acknowledging the future impacts climate change has on key industries in Australia, while enhancing support and investment in local production, thus reducing reliance on imports and stabilising food prices. However, it does not address those currently in need of immediate aid.

Australia can take inspiration from policies enacted to address immediate food security concerns by looking at international examples. Europe in particular has experienced sharp rises in food and energy prices as a result of Russia invading Ukraine (Amaglobeli, et al. 2023). Policy actions to address the issue have been analysed by The International Monetary Fund and states that the most cost-effective way of tackling COL induced food insecurity is to use a targeted approach rather than broad-based mechanisms (Amaglobeli, et al. 2023). For example, cash transfers to households who are in need of support was a successful mechanism used in a number of European countries. Direct support is advised over introducing price freezes or caps on products as this could interfere with pricing signals which are effective in reducing consumption (Amaglobeli, et al. 2023). Cash transfers are independent of food consumption and have been utilised in Austria, Cyprus, Czech Rep, France, Germany, Italy, Spain and the U.K, funded from one-time solidarity tax on high-income households (Amaglobeli, et al. 2023).

After much pressure from food cooperatives, the 'Feeding Australia' initiative could be key to addressing supply chain resilience in the food industry (Collins, 2025). While the strategy has already been funded it is still under development, with timelines and legislative changes pending. However, it represents an initial step to undergo comprehensive, evidence-based and long-term planning towards sustainable and climate-smart food security, especially for low-income households in Australia. The scheme involves better information to farmers on climate resilience and climate-smart agriculture initiatives (CCA, 2024). This enhancement of climate change mitigation integrated into the agriculture industry will be beneficial in reducing economic losses from supply chain shocks that trickle down to consumer food prices. However, given there are 3.4 million households currently experiencing food insecurity in Australia (Foodbank, 2025), incorporating climate change into food security policy can help promote greater funding to low-income households. Temporary or permanent taxation of high-income households in the form of a progressive solidarity levy can be put in place to fund food security for those who are more vulnerable to climate change. Such policy decisions can equalise the disparity in how severely low-income households are affected from climate change induced food insecurity (Green, 2020).

The impact of climate change on energy prices

The electricity sector in Australia has been experiencing challenges as weather conditions change outside of their seasonal norms leading to greater demand for energy in certain circumstances, particularly during heatwaves. Costs are also rising as energy infrastructure is destroyed by weather extremes, raising utility costs which trickles down to higher bills for consumers. For example, bushfires damaging transmission lines and cyclones causing record power outages, has been a contributing factor in increases to power bills, albeit relatively smaller when compared to price rises due to fossil fuel costs and aging coal infrastructure (Energy Networks Australia, 2019; Leading Edge Energy, 2025). Moreover, extreme heat, resulting from global warming is increasing the demand for cooling mechanisms across the country. With many regions experiencing record-breaking heights this past summer, Australia's electricity sector must be able to adapt to these new demands without the individual paying the costs. Additionally, Australia,

has been slow in its start to the renewable energy transition, thus we are currently in an era of rapid change. While the transition will be worthwhile in providing sustainable electricity sources at a lower cost (Schnabel, 2022), the transition presents instability to the electricity sector in a period where global energy bills are at new heights. Federal governance of the energy sector should therefore be comprehensive and coordinated to buffer the impacts of this instability on household electricity bills. Technological advances in renewable energy sources have meant that the upfront costs of small-scale solar energy sources will be lower than those from any fossil fuel plant (Schabel, 2022). With electricity demand already expected to be met by mostly renewable energy in Australia, households will be able to see the benefits in the form of lower electricity costs (Sathanapally, et al. 2025).

The National Energy Performance Strategy, particularly the household energy upgrade fund, is an example of fulfilling these requirements. The ongoing scheme addresses the costs of clean-energy upgrades to low-income households, whilst providing higher performance and efficient systems to lower energy bills in the long-term. Already over 1,000 social housing properties have received government funded upgrades, with a proposed target of 60,000 households (CCA, 2024). However, this target is likely to fall short of the number of households in need of assistance, with research reporting one in four households in Australia struggling to pay for energy bills (Willand et al. 2023). Such policy represents a positive steps forward in linking climate-change and COL issues and demonstrates how the renewable energy transition can be utilised to cut energy bills. The strategy is still ongoing, thus measures are yet to be completed and hence the effectiveness of the scheme is unclear (CCA, 2024).

The level of funding required to support these schemes is extensive, with high upfront costs derailing most policy proposals. However, the majority of these energy saving and renewable energy incentives will have long-term saving benefits on energy costs as more and more households become energy independent. Battery installation will be important in providing maximum renewable energy efficiency for households with the ability to provide savings of up to $1150 per annum (Straughan, 2024). The Community Batteries for Household Solar Scheme, identifies this by committing to 400 community batteries across the country, alongside a $200 million investment towards cutting energy bills (CCA, 2024). While this is not enough to cover communities across the whole country, a proposed scheme of $6500 per household to install batteries that are integrated to the grid would be enough to reduce cost of living pressures by cutting electricity bills and increasing household value (Straughan, 2024). This proposed project would provide outcomes that would make the high upfront costs of the scheme worthwhile by making all households energy sufficient, and increasing consumer savings (Straughan, 2024).

Government incentives to promote the installation of household solar panels is important for helping homeowners generate their own renewable energy, and thus reducing their reliance on the grid and its variable prices. The Small-scale Renewable Energy Scheme (SRES) programme has allowed for substantial savings through Government funding the reduction of upfront costs with the average

household saving over $1,500 through the scheme. The importance of this incentive is that it is a long-term energy saving solution that will allow households to have an independent, sustainable energy source without connecting into the grid where prices can be variable and increase. While the scheme has been successful in helping Australian households transition to solar, the eligibility process can be complex and is only possible through certain solar retailers (Sathanapally, et al. 2025). Moreover, installation of batteries do not count as small-scale technology certificates (STCs) which are what are traded in for rebates on when panels are installed (DCCEEW, 2025). A more coordinated and combined SRES and battery incentive policy would be beneficial in helping more households with solar upgrades (Sathanapally, et al. 2025).

The Energy Bill Relief Fund is one of the most direct policies addressing recent rises in energy bills and the impact this has on the COL. Eligible households have received $75 each quarter, with households receiving $300 of rebates in the 2024-25 financial year (CCA, 2024). The bill has since been extended by six months, where an additional $150 can be received in the 2025-26 financial year. (CCA, 2024). This policy has been important in addressing the need for assistance in affordability of energy bills, targeting vulnerable communities and small businesses. However, there is no specific link made that climate change is a causing factor for energy price increases. While the extension of rebates have helped many households with the continuing price spikes in the past and present financial year, such band-aid policy will not be feasible with the knowledge that electricity demand will continue at these heights if not higher as climate change persists and worsens. A more long-term solution is required to address regions most vulnerable to the affects of extreme weather on electricity prices. For example, the 'Klimabonus' policy introduced in Austria, offers up to €290 per adult to assist with energy bills based on regional location. The scheme aims to cater to those most vulnerable or who are unable to use public transport due to location, thus are forced to spend more on fuel (Klimabonus, 2024). Furthermore, the scheme is funded through carbon-tax revenues, linking policy decisions tackling COL and climate change (Klimabonus, 2024). This spatial strategy could be effectively applied in Australia, where climate conditions vary substantially across regions. Households in areas burdened by higher energy costs due to extreme heatwaves would particularly benefit, helping to reduce inequality in energy bills.

The Energy Price Relief Plan is a scheme to set price caps on coal and gas to help reduce electricity costs for the consumer (DCCEEW, 2023). However successful global policy has shown that cash transfers are far more beneficial as price caps can be disruptive to markets. Direct cash transfers target the most vulnerable and do not interfere with the carbon-emission price signals as carbon taxing is increasingly present in global emission reduction protocol (Mus, et al. 2024). In Europe, where carbon prices are above pre-pandemic levels, strategies have been implemented to assist the most vulnerable whilst incorporating renewables (Schabel, 2022). Cash transfers that are more substantial than rebates from the Energy Bill Relief Fund have been used in many countries in Europe including Austria, France, Germany, Italy, Spain and the UK in the form of energy efficiency grants and subsidies for vulnerable households (Amaglobeli, 2023). In the UK, cash

transfers of up to £650 are directed to eligible low-income households, over two times the maximum rebate from the Energy Bill Relief Fund (Amaglobeli, 2023). By directing funding to those who need it the most, energy bill subsidies in Australia will be more effective, and must be extended as a long-term policy priority.

The impact of climate change on housing and insurance costs

Climate change has had an increasing toll on insurance schemes globally. The uncertainty and severity of extreme weather events that Australia has experienced in recent decades has impacted insurance payouts, putting many people at insurance losses. Insurance prices have risen by 40% since 2021, significantly contributing to inflation and the COL crisis in Australia. Housing equity has also been impacted as a result with home insurance premiums rising by 14% on average from 2022 to 2023 (Thrower 2025). In fact, housing costs have experienced the greatest inflation of all COL aspects, with prices increasing by $220 per month on average (Wild, 2022). There is no doubt that the housing and rental market is a primary concern for many Australian citizens with costs at all-time highs. The resulting impacts can be detrimental for communities in areas where catastrophic events are more severe as these areas receive lower capital investment as they become less attractive to live and invest in (AI, 2024). This inequality is exacerbated as these regions, with northern Australia and northern Western Australia in particular, having lower average household incomes (Thrower 2025).

Climate models predict that Australia is heading for a future of lower cool season rainfall leading to more frequent and longer lasting droughts and dangerous fire weather (SOTC, 2024). Fires have extensive and extreme destructive impacts in Australia, and worldwide, and as a result, insurance prices have soared. Where Australian bushfires already cause extensive losses regionally, preventing wide scale insurance losses should be a key priority in Federal government policy. The recent California wildfires is a key example of the extensive economic losses that can result from poor insurance protection. Damages and losses from the Los Angles fires accumulated up to $450 billion, where just $32 billion of this was insured (Meissner, et al. 2025). Insurance companies pulled out of many household policies leaving numerous properties unprotected. The California fires have created a ripple effect for the global reinsurance market as insurance companies in California claimed reinsurance from the global market (Meissner, et al. 2025). Events like this have led to insurance costs rising worldwide which impact Australia, being linked to the global reinsurance market (Thrower 2025). Australia is now faced with higher insurance premiums in an era of high climate and disaster uncertainty. An even greater threat is the amount of homes that will become uninsurable as extreme weather risk becomes too high for insurance companies to deal with. Recent analysis reveals near to one in 25 homes in the country won't be insurable by the end of the decade, making numerous citizens extremely vulnerable to catastrophic weather events and its associated weather impacts (Climate Council, 2022). Governments must act fast in creating a resilient and robust policy approach to protect citizens against the insurance crisis, particularly those in high risk areas.

The Insurance Council of Australia (ICA) represents the general insurance industry and works alongside the General Insurance Code of Practice to establish service standards that insurers must meet when dealing with customers, promoting fair and honest practices in claims handling and customer service. The ICA has established the need for a 'protection gap' to cover economic losses where damages are greater than insurance can cover (ICA, 2024). However, this protection can be harmful at disrupting price signals and deterring funding and development in high risk areas which can compound COL issues. While the ICA addresses the need to protect the most vulnerable, its approach may not always be entirely beneficial. Mapping tools are an effective way to identify households most impacted by extreme weather events. These households can then be targeted using direct funding and support to offer monetary assistance. For example, the US uses a National Risk Index tool to track natural hazards in each country, predicting annual losses and level of social vulnerability (FEMA, 2025). Such systems are beneficial to effectively use disaster protection funding to those who need it the most and could be an effective strategy for households in need of insurance protection.

One way in which policy can address climate change related insurance price increases is to invest in mitigation and response to build resilience to future disasters. The Enabling Resilience Investment framework, supported by NEMA and developed by CSIRO, aims to channel capital from public and private sources towards infrastructure that builds community resilience and reduces disaster risk (NEMA, 2025). Resilience investment acknowledges climate change as a leading factor in rising disaster recovery costs and projects costs to increase in the future as a result. The government has developed various climate risk management initiatives across the public sector. Multiple programs exist to address climate-related risks and build resilience to extreme weather events, including the National Disaster Risk Reduction Framework, the Disaster Ready Fund, and various state and territory-level initiatives (CCA, 2024). However, to ensure protection of homeowners in high-risk areas, mitigation response tactics must be incorporated into all sectors.

Failure to address the insurance and housing crisis in Australia could likely lead to mass migrations away from high risk areas, creating overcrowding of 'safer' areas. The NEMA has devised a second national action plan to implement the National Disaster Risk Reduction Framework in order to better equip communities in high risk areas. With the main aim to be a coordinated approach to mitigating pre and post disaster management (CCA, 2024). With appropriate funding this initiative could prevent mass migrations to lower-risk areas. The plan is still in development making its success in achieving these aims uncertain.

Recommendations and Conclusion

Climate change and its associated impacts disrupt food production and supply chains, driving up food prices (UN, 2023). There is a lack of consideration of this evidence in national policy demonstrated by a score of 0 in the Global Food Security Index and insufficient funding to food cooperatives (Foodbank, 2025, Spencer, 2025). To improve outcomes for Australia in relation to cost of living and climate

change affecting food pricing it is recommended to: develop and implement a unified, climate-smart National Food Security Policy that directly addresses climate-induced food security, focusing on the protection of low-income households; incorporate climate risk modelling into government policy to protect vulnerable agricultural zones; introduce immediate food relief through funding for disaster-contingency support to heavily affected households; introduce targeted direct cash transfers to food-insecure households, particularly during periods of climate change associated catastrophe, funded by a progressive solidarity levy on high-income earners (Green, 2020); increase base funding to food cooperatives such as Foodbank, OzHarvest and Secondbite to match rising demand due to increase in extreme weather events (Foodbank, 2025); and, advance the 'Feeding Australia' Initiative to fast-track legislative implementation of the strategy to address the immediate impacts of climate change on Australia's expansive agriculture sector.

Climate change related impacts have contributed to a rise in electricity demand with energy bills being regarded as high and putting an undue burden on consumers (Schnabel, 2022). Therefore policy decisions should look at global techniques of utilising the renewable energy transition to simultaneously mitigate climate change and high energy bills, including expanding the DCCEEW Household Renewable Incentives scheme and extend and simplify eligibility for SRES scheme and widening access for retailers to become certified, as well as reforming and extending the Energy Bill Relief Fund to include spatial planning and investment in spatially managed energy relief, following strategy similar to Austria's Klimabonus to target regions with high energy bills due to climate extremes (Klimabonus, 2024), as well as extending energy bill relief fund to protect households against future energy price increases resulting from climate-change. The government should prioritise direct monetary funding over price caps on electricity to protect vulnerable citizens who are more impacted by energy price surges (Ngcamu, 2023), avoid price caps on coal and gas (Amaglobeli, 2023), increase investment toward direct cash transfers or energy efficiency grants funded through carbon taxing revenues (Mus, et al. 2024), and increase investment into energy resilience in disaster planning to protect current electricity infrastructure against disruption in high climate-risk areas.

Insurance schemes are unable to cope with rising severity and intensity of weather extremes threatening citizens with extreme economic losses and increasing home insurance premiums (Thrower, 2025). It is therefore recommended to develop a National Climate Insurance Framework to ensure fair insurance access for households in high-risk areas; reform ICA protection gaps to not interfere with price signals; offer partial reinsurance support for insurers covering high-risk zones; introduce a National Climate-Risk Index to track and identify high-risk areas in need of insurance protection (FEMA, 2025); and, map areas by vicinity to climate-risk and income levels. The government should also direct post-disaster insurance support to eligible citizens, expand the Resilience Investment Initiative, and increase public-private investment towards mitigation infrastructure (NEMA, 2025).

It is essential that moving forward the Federal government recognise climate change as a contributing factor towards cost-of-living (COL) pressures in Australia. Making this link in policy will ensure that decision-makers prepare for future worsening of COL in coincidence with climate change progression. While net-zero targets will help reduce the severity of climate change impacts, this will not be immediate, thus action must be taken now to address the livelihoods, communities and businesses impacted from climate change. Broadly, this will include a requirement to reform federal COL policies to include climate impact assessments to establish and report the unequal impacts of climate shocks on different socio-economic groups and to generally integrate climate change into COL policy to achieve longer-term policy objectives. While this general integration of climate change is important, strategies to address pressures need to be targeted, directing funding to those who need it the most, for example those in high-risk areas or from low income households. Without this link being made, COL will continue to worsen, widening the poverty gap for people most impacted.

housing and construction

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The residential and commercial construction industry is a critical aspect of Australia's society and economy. As the industry attempts to become more sustainable, a key challenge will be reducing its carbon footprint and preparing for the consequences of global warming in the coming decades. Legislation concerning the sustainability of this sector is divided into two aspects: the attempts to reduce carbon emissions caused during the lifecycle of infrastructure, and the efforts to ensure new and old infrastructure is resilient to the effects of climate change. These efforts are largely determined by the National Construction Code of Australia, a framework regulating the industry across Australia.

There are also non-legislative influences on policy, including how political and economic structures hinder or delay efforts by stakeholders to address the previously outlined priorities. A clear distinction is maintained between residential and commercial buildings, reflecting the classification system used in the National Construction Code, where residential buildings primarily fall under Class 1-4 while commercial buildings are mainly categorised as part of Class 5-9 (Australian Building Codes Board, 2022d).

Current Carbon Emissions

According to a recent government report, in Australia over half of all carbon emissions are caused by buildings and infrastructure. The leading sources of embodied carbon emissions in 2022-23 was calculated to be buildings (21 Mt CO_2e), followed by transport infrastructure (10 Mt CO_2e) and then utilities (5 Mt CO_2e)' (Infrastructure Australia, 2021). These figures are made up of a mix of embodied, operational, and enabled emissions. Embodied emissions represent those produced through an infrastructure's construction and demolition. This includes installation of materials, manufacturing across the supply chain, transportation of materials, and demolition. This differs from operational emissions which are derived from the use of that infrastructure. This includes heating, cooling, structural maintenance works, lighting, and ventilation.

Finally, enabled emissions are 'those made possible from an asset's existence, such as diesel emissions made possible by the presence of highways' (Infrastructure Australia, 2021). Between 1990 and 2019, construction sector emissions have not decreased significantly, however, they are predicted to decrease dramatically over the coming decade, as Australia's energy generation switches toward renewable sources with lower related carbon emissions (Department of Climate Change, Energy, the Environment and Water, 2022).

Emission Reduction

All new Australian construction projects are required to meet standards outlined within the National Construction Code of Australia (henceforth NCC), however, there is often distinct differences between the standards across Australia's numerous states and territories. Legislative authority over construction is shared between both Federal and State governance, rendering both bodies capable of shaping regulation in the construction sector. Local governments are effectively the NCC's primary enforcers through various functions: namely, checking plans initially meet the NCC through the provision of building permits, ensuring those plans are upheld by inspecting construction sites, and punishing non-compliance. Local governments are able to pursue incentive-based schemes to promote the adoption of various sustainability measures, but are restricted in their ability to affect construction through regulatory control. As a result, despite the appearance of standardisation in the NCC, the legislation and regulation of the construction sector in Australia is shared across all levels of government apparatus (Australian Buildings Codes Board, n.d.).

The NCC is divided into three volumes, with Volume One addressing building classes 2-9 and Volume Two covers for classes 1 and 10. Volume One applies to larger buildings, covering structures like apartments, offices, shopping centres, hospitals, and schools. It sets out requirements for fire safety, accessibility, energy efficiency, and structural integrity in more complex buildings (Australian Building Codes Board, 2022c). Volume Two applies to smaller residential buildings, which include houses, townhouses, boarding houses, and small sheds or garages (Australian Building Codes Board, 2022c). It focuses on structural stability, insulation, waterproofing, and other elements relevant to smaller, private dwellings. Volume Three, which relates to plumbing and drainage, applies across both sectors (Australian Building Codes Board, 2022b). The NCC ensures national consistency in construction standards while allowing for state-based variations where necessary.

The NCC includes sustainability measures aimed at improving the environmental performance of buildings. This includes the reduction of carbon emissions and the promotion of energy and water efficiency. These measures are located across all the NCC's volumes depending on the type of sustainability measure and which class of building it applies to. The volumes include provisions to improve energy efficiency for both residential and commercial buildings, such as thermal performance standards, minimum insulation levels, and glazing specifications to reduce heating and cooling demands (Australian Building Codes Board, 2022a; Australian Building Codes Board 2022c). The NCC also includes provisions for

renewable energy integration, encouraging solar PV systems and energy-efficient lighting (Australian Building Codes Board 2022a). Water conservation measures, such as mandatory rainwater harvesting systems for certain buildings and efficient plumbing fixtures, help minimise water consumption.

For residential property, these requirements are centralised within the code using a single metric, the Nationwide House Energy Rating Scheme (NatHERS) which is managed by DCCEEW. Houses total energy efficiency is calculated using available software, and a rating out of ten is provided. Buildings have been required to meet a specific star rating to be approved for development, leaving the decision as to which sustainability measures will be used up to the developers.

These energy efficiency standards help to reduce operational emissions. Increases in thermal performance can reduce the required amount of cooling and heating, contributing to a substantial decrease in energy use. There are many techniques that can be used to help improve the thermal regulation of a building. These include the building site and orientation, ratios of surface area to volume, natural ventilation, vegetation around homes, shading and cool surfaces, and the materials chosen (United Nations Environment Programme and SEfficiency, 2021). While no specific technique is required under the NCC, each of these can contribute to increasing the NatHERS rating a building receives. There are challenges with the application of these techniques, however, as often climactic scenarios present competing interests in thermal regulation. For example, in hot and humid climates, low surface area to volume ratios can help keep a building cool, but they may hinder ventilation (United Nations Environment Programme and SEfficiency).

The recent updates to the NCC, particularly NCC 2022, have strengthened sustainability mandates, including a new 7-star (NatHERS) minimum for residential buildings, as well as stricter air tightness and ventilation requirements (National Housing Energy Rating Scheme, 2022). It is important that this required rating continues to increase across all constructions projects as companies develop cheaper technologies to meet those standards. These measures can drive the construction sector toward more sustainable and climate-resilient practices, which in turn align with Australia's broader Net Zero 2050 commitments. In light of this update to the NCC, since 2023 NSW has included this requirement in its own state-wide sustainable construction standards called BASIX. This alone is predicted to reduce emissions associated with new residential developments by 7-11% (NSW Government, 2025).

Commercial buildings and large residential complexes are regulated separately, and unlike homes do not require the same energy efficiency rating. Instead, there are different options to meet compliance standards in energy efficiency. These range from Deemed-to-Satisfy, where a step-by-step approach to compliance is detailed depending on which climactic zone a buildings construction falls under, to verifications using reference buildings. There is a rating system called NABERS (National Australian Built Environment Rating System) that functions similarly to NatHERS and can serve as an important compliance method however, additional thermal comfort and other provisions must also be satisfied to meet the full standards (Australian Building Codes Board, 2024).

The Australian Building Codes Board (ABCB) has further proposed updates to NCC Volume One to support emissions reduction and a net zero future in commercial buildings and common areas of apartment buildings. The key changes in the ACBC proposal include updates to Deemed-to-Satisfy (DTS) Provisions to make them more cost-efficient, new EV infrastructure requirements to reduce the reliance on petrol cars, mandatory photovoltaics (PV) installation to aid the renewable energy transition, and electrification measures to enable an easier transition from gas-powered to electric equipment. Additionally, revisions to Section J will refine Performance Requirements, Verification Methods, and DTS Provisions to enhance energy efficiency and sustainability (ABCB, 2024).

Updates to the NCC would be a positive development, but it represents only the beginning of emission reduction in Australia's commercial and residential buildings. Operational emissions can be understood as the low-hanging fruit of the decarbonisation in this sector (Bird and Hernández, 2012; p. 1). Improved energy efficiency standards pursued in the NCC, partnered with the decarbonisation of Australia's energy production, will effectively minimise operational emissions in the coming decades. A KPMG report predicted that 'between 2020 and 2050 as buildings become more energy efficient, embodied carbon will become responsible for almost 50% of new construction emissions' (Virgo, 2023). Embodied carbon reductions, however, do not have a clear solution. Strategies to mitigate embodied carbon include changes to the materials used, such as prioritising the use of low-carbon and recycled materials. More broadly, improved energy efficiency on site can reduce emissions, as can prioritising longevity in the design process to reduce the frequency of demolition in the industry. Each of these approaches requires individual strategies, technological improvements, and legislative approaches.

As an example, the production of steel and concrete have both been touted as key industries in the future decarbonisation of construction. Both materials are critical to modern construction methods and have been estimated to cause 15% of global industrial emissions (Jelena Aleksić, Vargas and World Economic Forum, 2024). Key to the continued reduction of this is support from governments, as the primary hurdles to this decarbonisation technology are technological challenges, research gaps, securing investment, and resistance to change within the industry (Barbhuiya et al., 2024: p. 21). Governments are able to tackle these challenges by funding research, providing investment in new technologies, and regulating the industry to ensure a steady transition. A study of the current approach to decarbonisation in the cement and concrete industry concluded that 'policy considerations, both at the national and international levels, are essential in driving decarbonisation efforts (Barbhuiya et al., 2024).

The Australian Government has established key initiatives, including a nationally consistent approach to measuring and valuing embodied carbon and developing policy levers to harmonise national regulations. The National Australian Built Environment Rating System (NABERS) is creating a framework to benchmark and certify emissions from construction materials, while the Environmentally Sustainable Procurement Policy mandates carbon reporting for major projects. State governments are also taking action, with NSW implementing a

Decarbonising Infrastructure Delivery Policy and Victoria advising on emissions reduction in public infrastructure (Infrastructure Australia, 2021).

In 2024 the Federal Minister of Industry, Ed Husic, agreed to address the carbon footprint in construction, with a focus on building materials' extraction, production, and transport. A voluntary pathway for commercial buildings to report embodied carbon will be introduced in the 2025 NCC, with a future minimum standard planned for 2028 (Husic, 2024). Embodied emissions associated with infrastructure development in Australia are estimated to make up 10% of the national carbon-footprint (Infrastructure Australia, 2021). The decision to begin regulating those emissions is a positive step but must be continued to ensure that the construction industry begins reducing their emissions profile.

While new homes fall under increasingly tight environmental regulation, older homes built before these sustainability measures were introduced need to be improved through different means. This is partly addressed by the NCC, as renovations fall under the code and if substantial, they are required to meet the code's new energy efficiency standards.

One policy aimed to improve the sustainability of older homes is the Household Energy Upgrade Fund. Managed by the Clean Energy Finance Corporation, it offers discounted finance for upgrades such as battery-ready solar PV, energy-efficient appliances, and other home improvements for better comfort. The fund covers renovations, knock-down rebuilds, and multiple energy upgrades at once. It includes green home loans, personal loans, and other concessional financing products to support the transition to greener, more sustainable homes across Australia (Department of Climate Change, Energy, the Environment and Water, 2024). There is an obvious potential to expand this fund, further promoting the sustainability of Australia's current stock of buildings. There are similar schemes being pursued by various State Governments, such as NSW's Household energy-saving upgrades and Victoria's Energy Upgrades for homes (Energy NSW, 2025; Energy Victoria, 2024).

The challenge of improving existing properties is complicated within the current housing environment. Landlords are unlikely to be incentivised to improve energy efficiency in their rental properties because they do not directly benefit from the reduced energy costs resulting from such upgrades. Since tenants typically pay the utility bills, any savings from lower energy consumption accrue to them rather than the property owner. One study estimated that in homes where the owner did not pay the power bill, the energy consumption was 2.7% higher on average (Melvin, 2018). Without regulatory requirements, tax incentives, or subsidies to offset these upfront costs, landlords lack the motivation to invest in energy efficiency improvements. As a result, the potential for energy savings and environmental benefits often goes unrealised in rental properties. While sustainable construction codes are a great policy approach for ensuring that new constructions are energy efficient, they do not affect old buildings. Instead of a regulatory approach, incentives have been suggested as the best mechanism, where landlords and tenants are compelled to partake in voluntary programs (Bird and Hernández, 2012: p. 10).

Some research has focused on the cultural position taken by the code, for example distinguishing between prescriptive and performance-based solutions. Despite being performance-based since 1996, prescriptive solutions remain dominant due to difficulties in quantifying performance requirements, particularly in energy efficiency (Armstrong et al., 2017). A code that measures performance outcomes, rather than specifying construction techniques that must be used, allows for innovative solutions which can increase efficiency. One study suggested that expanding performance solutions could boost productivity by $1.1 billion in the Australian construction industry (Armstrong et al., 2017).

Despite the benefits of this performance-based approach, there is perhaps room for prescriptive legislation in the Australian context on clear issues. While performance-based approaches are highly effective in nationwide legislation that targets large areas and allows some flexibility to developers, there are some obvious technologies that if mandated in the correct areas would benefit sustainable outcomes for Australians. For example, the construction of cool roofs, a technique that uses light colours and construction methods to reflect sunlight and reduces heat absorption, can lead to a 1 to 4-degree reduction in indoor temperatures (United Nations Environment Programme and SEfficiency, 2021). In cold climates these roofs should be avoided, while in Australia's hotter territory they are highly effective thermal regulators. Research has suggested that in NSW houses with dark roofs can pay up to 38% more on energy bills (Pfautsch and Paolini, 2024). Under current legislation developers can choose roof colours, and they continue to prioritise aesthetics over energy efficiency.

Climate Resilience

In Australia, buildings are particularly vulnerable to fires, floods and extreme weather events. Given that much of Australia's population lives along coastlines, we must also contend with the impacts that rising sea-levels, increased storm surges, and coastal erosion have on property. Action is required to ensure that buildings are resilient to the potential damage wrought by climate change-enhanced natural disasters. Not only do these events pose threats to the buildings, but they also threaten to destroy further capital housed within properties, complicate the ability to insure property, evict tenants from their homes, and in extreme cases take the lives of residents. A recent report by Deloitte estimated that natural disasters cost the Australian economy $38 billion per year, and that figure is expected to increase to $73 billion by 2060 (Deloitte, 2021). Although conditional on both global and domestic actions taken in the next few decades and beyond, these figures demonstrate that Australia must prepare itself for increased economic impact from natural disasters in the future.

The NCC addresses cyclone risk through specific design and construction standards aimed at ensuring buildings in cyclone-prone areas can withstand extreme wind forces. Designing for high winds requires the use of wind-resistant materials, and reinforced structural aspects like roofs, doors and windows. In regions identified as cyclone-prone the code mandates stricter requirements, notably the use of reinforced structures, impact-resistant materials, and secure fastening systems for roofs, walls, and windows to prevent failure during cyclones.

It also requires buildings to be designed to withstand wind pressures calculated based on local wind speeds, terrain, and building height. Two issues highlighted with the current code are that water ingress associated with wind-driven rain has been a key driver in insurance claims even when wind speeds were considerably below the house's rating, and that buildings in some regions are not currently designed for high internal pressure (The Centre for International Economics, 2023)

Flood-resistant construction includes the use of porous materials, elevating houses on flood plains, using materials resistant to flood damage, and constructing drainage in the broader urban environment (United Nations Environment Programme and SEfficiency, 2021). Flood resistance is also critically dependant on the zoning decisions made by various levels of government. This points to a key challenge involved in building for climate resilience: the need to coordinate action across socio-economic, political and cultural groups. One study of post-flood measures in Kenya highlighted the structural complexity in climate risk adaptation. Five distinct scales were identified: Household-Resident, Compound-Landlord, Community-Community organisations, Settlement-County government, and Watershed-National government (Mulligan et al., 2017). Both structural and non-structural adaptations were shown to span the entire spectrum, showcasing the need for coordination across societies to tackle climate resilience. Only governments have the resources and power to coordinate action across these scales and must pursue relevant legislation and practices to achieve this.

Bushfire has long been a dominant natural force in Australia's environment and so to then has risk mitigation long been a feature of Australian building regulations. The regulation centres around a standardised nationwide measure called the Bushfire Attack Level (BAL). If a construction is zoned in what is classified bushfire prone land, then an assessment is required to determine which BAL the construction falls into (NSW Rural Fire Service, 2025). The BAL is broken into by six different levels ranging from lowest-risk to extreme-risk, where a building would be 'directly exposed to the flames of a potential fire front' (NSW Rural Fire Service, 2025). The measured BAL of a property, in combination with the intended use of the site, determines the extent of fire-mitigation required by the regulation. Depending on the property class, in relation to the BAL, varied expectations are determined within the NCC (Australian Building Codes Board, 2022a).

To minimise the risk of bushfires in property construction, several key strategies can be implemented. A large part of these measures are behavioural, such as clearing leaf litter, grass, vegetation, garden mulch and woodpiles, and other combustible materials from around the property (NSW Rural Fire Service, n.d.). However, from a regulatory perspective, action is legislated in the design of houses to reduce the risk of bushfires. Beyond behavioural adaptations, developers can use fire-resistant building materials, such as non-combustible cladding, metal roofing, and tempered glass, to enhance resilience to bushfires. Additionally, designing properties with ember-resistant features such as screens on windows and vents, can prevent embers from entering and igniting the interior.

Considering this strong regulatory framework and mature institutions surrounding bushfires in Australia, policy adaptation needs to focus on the

inevitable expansion of bushfire prone land in Australia. With increasing global temperatures more Australian buildings are likely to become vulnerable to bushfire. The record breaking 2019-2020 Black Summer bushfires were demonstrative of the magnitude that Australian bushfires are likely to become under future climate conditions. Although not linked solely to anthropogenic sources, studies have shown that these fires were made more extreme by record breaking excursions of the Indian Ocean Dipole linked to global warming (Oldenborgh et al., 2020). Government legislation must ensure that areas which are predicted to become vulnerable in the future also require stringent bushfire safety standards to ensure these buildings are resilient for future scenarios.

Another aspect of climate resilience is improving a house's ability to deal with extreme heat and drought. This includes the ability to manage increased temperatures, and these strategies closely mirror those already outlined in the previous section relating to improved thermal performance. Many of Australia's buildings were built without thought of thermal efficiency, and they are forced to rely on air conditioning which is expensive, carbon intensive, and puts pressure on the energy grid (AdaptNSW and New South Wales Government, 2025). Drought management, however, further requires that houses are built with rainwater harvesting where systems are installed to catch rainwater in tanks to minimise reliance on groundwater.

Many organisations have highlighted the need to further develop climate resilience as a category in the NCC (Insurance Council of Australia, 2021). In its current formulation, the NCC focuses on the impact to human lives of extreme weather rather than including the damage done to the built environment. This means that cost-effective and useful technologies that protect physical capital can be overlooked (The Centre for International Economics, 2023). Furthermore, the risks of extreme weather are locally determined, and the challenge brought by climate change is predicting the areas that will become at risk of bushfire or flood in the future. In the future the areas affected by each event type will expand, and legislation should be proactive in ensuring that buildings built today are resilient to the threats they will face in the future.

The need for national leadership in Australia's climate resilience is clear. 'Adaptation at-scale will not be possible without government good will in making necessary changes to building standards; promoting risk awareness; subsidizing adaptation measures in the existing building stock; and promoting skills training in the construction sector' (United Nations Environment Programme and SEfficiency, 2021). In 2024 the Australian Building Ministers agreed to include climate resilience as an objective for the ABCB. This decision responds to a 2020 Royal Commission recommendation and aims to ensure buildings can withstand extreme weather, reducing displacement, rebuilding costs, and recovery times (Husic, 2024). Further iterations of the NCC must improve methods of construction to ensure resilience to local extreme weather threats, while also accounting for the increased scale with which these events are predicted to occur.

Policy Recommendations

The following policy recommendations are suggested to ensure a continuation of Australia's transition towards sustainable construction.

Emissions Reductions

- Increase the NatHERS rating requirement for new residential constructions.
- Increase the energy efficiency standards for commercial constructions, following along with the recommendations outlined by the Australian Building Codes Board (Australian Building Codes Board, 2024).
- Increase funding and research assistance from both State and Federal governments towards initiatives aimed at decarbonising the supply chains and materials used in the construction industry (Barbhuiya et al., 2024; Infrastructure Australia, 2021; Department of Climate Change, Energy, the Environment and Water, 2024).
- Pursue the policy proposed by Ed Husic to introduce at first voluntary and eventually mandatory reporting on embodied carbon emissions in this sector. Once this reporting system is functioning effectively, a regulation mandating reduction in these emissions should be introduced (Husic, 2024)
- Increase programs that aim to improve the energy efficiency of buildings that already exist, with attention paid to make these programs appealing to renters and landlords to reduce the split-incentive problem (Bird and Hernández, 2012: p. 10).
- Focus general policy on performance-based metrics to allow industry to develop innovative solutions to reduce carbon emissions (Armstrong et al., 2017).
- Where prescriptive solutions are obvious, State governments should mandate passive design techniques like building orientation, shading, cool roofs, and natural ventilation.

By implementing these policy recommendations, Australia can enhance the efficiency and sustainability of its built environment while meeting national and global climate commitments.

Climate Risk

- Enhance the National Construction Code (NCC) to include climate resilience as a core objective (Insurance Council of Australia, 2021; Husic, 2024).
- Follow suggested improvements to the climate resilience regulations in the NCC to improve resistance to natural disasters in the future. These include an increased focus on waterproofing in cyclone prone areas and the need to include damage to property as a new focus of NCC policy (The Centre for International Economics, 2023).
- Improve energy efficiency using the same policies as detailed above to protect against extreme heat (AdaptNSW and New South Wales Government, 2025).
- Expand the risk maps for natural disasters to ensure that constructions projects are constructed to be resilient to extreme weather that areas may experience under future climate modelling.

- Develop nationwide initiatives to co-ordinate the actions taken to minimise the impacts of extreme weather across different levels of government and economic sectors (United Nations Environment Programme and SEfficiency, 2021).

These recommendations emphasise proactive policy, stronger regulations, and better coordination to ensure Australia's buildings can withstand climate change-driven disasters.

sustainable packaging

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Packaging has long provided businesses with a cost-effective means in which to house and transport goods. Yet the utility and convenience of packaging carries a hefty ecological price tag. More than 95% of single-use plastic packaging is produced using fossil fuels and virgin materials, and as much as 85% of global plastics quickly goes to landfills or is discarded, causing significant environmental harm (Chamas et al., 2020; UNEP, 2024). Climate change, ecological degradation, microplastic proliferation, including in soil and in marine environments, make addressing packaging waste an environmental and human health imperative.

Political momentum has clearly shifted towards combatting the scourge of packaging, particularly plastic packaging. In Australia, regulations on businesses and supply chains have been accelerated because of recent packaging import bans from China and South-East Asian countries (CSIRO, 2023). Businesses are now responsible for reconfiguring their supply chains to mitigate packaging waste, which until recently, was commonly offshored and quickly forgotten. However, with a packaging material footprint double the OECD average, Australia lags global standards (Melles, 2023). Since widespread commitments to the United Nations Sustainable Development Goals UN-SDGs of 2015, new global standards have emerged in initiatives such as the 2018 Plastics Economy Global Commitment (UNEP, 2025) and the European Commission's 2020 Circular Action Plan (European Commission, 2025), highlighting the shift towards stricter regulatory oversight. Coming into force in February 2025, the European Commission has enacted a Packaging and packaging waste directive (PPWR) that mandates packaging design and waste management activities across all industries (EC, 2025).

Recognising the shift towards both international and domestic environmental sustainability goals, in 2018 the Australian Government ambitiously embraced circular economy principles in its design of packaging waste policy (APCO, 2024a).

Nested in philosophies around the regenerative ecosystem processes occurring in nature (Stahel & MacArthur, 2019), a circular economy for packaging is about design and process strategies that reduce, reuse, and recycle (commonly referred to as the '3 Rs') packaging to alleviate pressure on ecological systems by minimising the need to source virgin materials, which are often produced using energy-intensive, fossil fuel-based processes, and instead retaining and restoring existing materials in circulation for longer (Geissdoerfer et al., 2017). By reducing material use while elongating its productivity, the net ecological as well as economic benefits of a circular economy for packaging make adoption appealing to governments around the world (CSIRO, 2023; European Commission, 2023).

Australian Packaging Covenant Organisation (APCO)

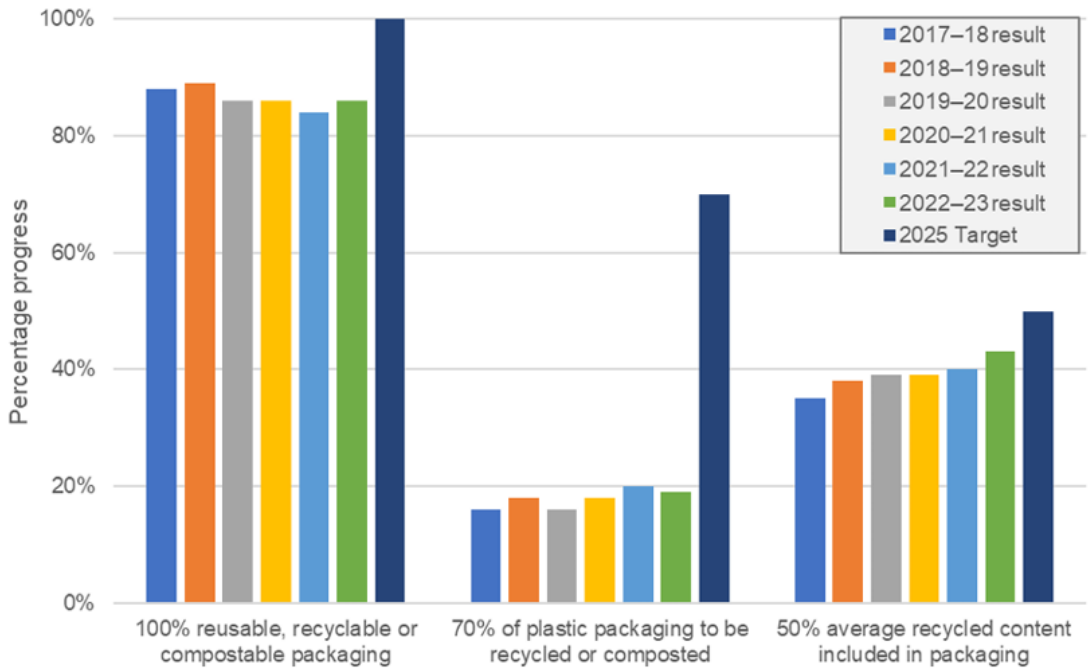
To achieve packaging waste reduction targets, the Australian Government empowers the co-regulatory non-profit, Australian Packaging Covenant Organisation (APCO) to drive its circular packaging economy agenda. APCO has over 1,000 industry-leading signatory firms operating within Australia with large packaging manufacturers and retailers spread across industries such as food and beverage, pharmaceuticals and healthcare, electronics, and many more sectors, with large retailers including Coles, Woolworths, 7-Eleven, and Coca-Cola South Pacific (APCO, 2024).

With its circularity-focused, evidence-based approach to packaging waste mitigation strategies, APCO aids business decision making offering specific strategic and operational sustainable packaging guidelines that aim to bring Australia closer to global standards. APCO aligns itself with best practices around the world, with non-profits such as Ellen MacArthur Foundation and World Packaging Organisation providing advice to governments and industry on packaging circularity best practices. Member firms are required to report annually. APCO's 2025 National Packaging Targets provide a useful instrument for determining current sector-level progress:

1. 100% reusable, recyclable, or compostable packaging
2. 70% of plastic packaging being recycled or composted
3. 50% average recycled content included in packaging
4. The phase-out of problematic and unnecessary single-use plastics packaging

Courtesy of a recent APCO report on 2025 targets, progress has so far provided mixed results. Figure 1 shows the proportion of total packaging among its member firms graphed against Target 1, Target 2 and Target 3 (APCO, 2024b). An analysis of progress towards APCO's 2025 National Packaging Targets reveals two themes requiring urgent attention: raising recycling and/or compost rates of plastic packaging (Target 2) and eliminating problematic and single-use packaging (Target 4).

Figure 1. Member progress on the 2025 National Packaging Targets (APCO (2024b) Australian Packaging Consumption & Recovery Data 2022–23).



Progress on Target 1

Target 1 requires that 100% of packaging be designed for circularity, for example, by making it recyclable, reusable, or compostable. Although the proportion of packaging that meets Target 1 is 86% as of 2023, progress towards APCO's 100% target has been somewhat stagnant, showing no overall improvement since 2020. Significant industry-specific constraints may influence the choice of adopting reuse, recycle or compostable packaging designs. For example, design for recyclability, particularly for plastics, appears to be a strategy that is more easily adopted. Plastics packaging design jumped from 62% in 2022 to 71% in 2023 (ANZPAC Impact Report, 2023), suggesting that plastic packaging recyclability may be a more viable adoption strategy for the majority of member firms.

Progress on Target 2

While target 1 specifies the design of packaging, Target 2 sets realised post-consumer plastics recycling rates targets. Clearly, there is a disconnect between Target 1 and Target 2. Current progress shows that only 19% of packaging is being recycled, revealing a gap between the target and realised circular plastic packaging flows.

Progress on Target 3

Target 3 requires member businesses to reintegrate recovered (secondary) packaging waste as feedstock to produce new packaging, reducing the need to source virgin materials while alleviating end-of-life packaging waste issues (Fitzpatrick et al., 2012). A steady increase has been seen in recycled content reintegration since 2018 (44% in 2023), six percentage points below the 50% target. The progress is not uniform as the food and beverage sector confronts viability

constraints for reintegrating or sourcing various packaging types (Liu et al., 2023). Nevertheless, APCO finds more than 80% of its members now use at least some recycled content in plastics packaging (APCO Impact Report, 2023).

Progress on Target 4

Target 4 relates to the complete elimination of problematic (i.e. toxic and unrecoverable) or single use packaging with more sustainable alternatives. Problematic packaging types include carbon black, oxo-degradables, Per- and polyfluoroalkyl substances (PFAS) (DCCEEW, 2025), all of which cause significant harm to human health and the environment. With a reduction of only 40% reduction (from 2018 baseline) as of 2023, a significant amount of progress still needs to be made.

The role of government in a circular packaging economy

To address these concerns, two key areas are recommended for government: the establishment of effective circular resource recovery, aligned with the development of circular design innovation. Circular resource recovery is achieved through the scaling, sharing and connecting of reprocessing infrastructure to create circular resource markets, and circular design innovation is achieved by mandating circular design and the encouragement of circular innovation through government-led knowledge sharing initiatives.

Circular resource recovery markets

The scale and scope of local and state government-owned reprocessing infrastructure requires significant strengthening to establish circular resource recovery operations and markets. Higher plastic recycling rates can be elevated by establishing a collaborative ecosystem of actors (packaging brand owners, retailers, waste management agents, consumers) using public and private infrastructure symbiotically for shared resource flows (Niero & Hauschild, 2017).

Collaborations should be incentivised between businesses (firms and their supply chains), stretching into multilevel perspectives that include actors linked with government (metro and regions) and industries (networked or clustered suppliers) that coordinate these levels effectively with the intention of developing economies of scale. Policy has been shown to encourage collaboration with a strong government leadership posture to developing resource recovery capacity that shares downstream collection, sorting, and reprocessing infrastructure, bringing down cost and technical barriers for multiple industries (Christensen 2021).

Circular design innovation

Research shows that circularity is constrained by packaging waste reprocessing challenges, including contaminated and fragmented waste streams that fail to create reliable and viable circular resource flows (Franco, 2017; Hahladakis & Iacovidou, 2018). As a result, recoverable packaging ends up in landfills, resulting in environmental harm and lost value in the resources that are wasted.

Contaminated waste streams containing problematic materials and single-use, often soft, fragmentable plastics that are difficult to recycle complicate recycling

rates. The closure of the REDcycle program for soft plastics has meant that recycling rates for such plastics have fallen further (APCO, 2024b). Strict design policy around the composition and complexity of packaging is required to enable efficient and effective circularity, improving waste stream quality and quantity for packaging supply chain reintegration (i.e. as recycled content).

To encourage market adoption of packaging circularity, it is important to note that business adoption will require conditions creating innovations in processes, practices and systems across the value chain. The systemic nature of these innovations demands that businesses gain new knowledge and expertise. Collaboration initiatives such as innovations hubs, communities of practice and government grant programs encouraging non-competitive triple helix (i.e. university-government-industry) collaborations and associated incentives can further drive knowledge sharing and circular design innovation. Knowledge sharing organisations such as APCO and Australian Institute of Packaging (AIP) guide businesses towards packaging design advancements. This includes through organisations such as Circular Economy Victoria, Planet Ark, ACE Hub, and Regen Melbourne, which share knowledge with industry by providing learning materials and knowledge sharing forums.

Conclusion and policy directions

Current progress indicators towards a circular packaging economy show that policy needs to be directed toward establishing effective circular resource recovery, aligned with circular design innovations.

In addition to strategies to bolster recycling rates, mandating industry compliance with APCO's National Packaging Targets would serve to further upscale circularity practices, bringing large scale cooperation for circular design innovation and resource sharing.

Government bans on single-use plastics as well as other problematic packaging materials have hastened industry response, providing evidence for the importance of tighter regulation for the advancement of sustainable practices.

Additionally, by strengthening APCO powers and scope to enforce binding policies for all relevant packaging brand owners, Australia would be more closely aligned with global standards on packaging regulation. For example, the European Commission's Packaging and packaging waste directive (PPWR) that mandates packaging design and waste management activities across all industries (EC, 2025).

Recent evidence from consultations with industry and consumers show that an increasing majority would like to see a tighter commonwealth-level packaging regulation frameworks and incentives to encourage extended producer responsibility for packaging circularity design, including through designing circular substitutions for problematic packaging (e.g. carbon black, oxo-degradables, PFAS) (DCCEEW, 2025).

A policy approach that mandates extended producer responsibilities will serve to boost post-consumer plastics, enabling such resource to be used as recycled content in new packaging.

Commonwealth-level packaging regulation should factor in local government infrastructure needs, by considering investments in reprocessing infrastructure to connect regional areas and areas outside of metropolitan areas that lack resources and have average recycling rates 20% lower than metropolitan areas (APCO Impact Report, 2023).

financial and insurance services

This chapter can be referenced as "Brouwers, S. (2025). Financial and insurance services. In B. Goodsell (Ed.), The State of Policy Report (pp. 200-212). The Climate Centre."

In 2015, Australia signed the Paris Agreement, with the agreement coming into force the year after (DCCEEW, 2024). Yet, 10 years later, Australia's climate finance strategy has a rating of 'critically insufficient', meaning our climate finance contributions to date are not in line with the Paris Agreement's 1.5°C limit (Climate Action Tracker, 2024).

While Australia's approach still falls short of Paris Agreement standards, climate-related risks are already reshaping financial markets and the insurance industry. The Government is turning to private markets to help them meet their climate goals (The Treasury, 2024).

The most impactful initiative from the sustainable finance agenda is the implementation of mandatory climate-related financial disclosures. These disclosures are changing annual reporting practices and will provide information on an organisation's impact (The Treasury, 2024). Another component of the sustainable finance strategy is the issuance of sovereign green bonds. It is a low-risk option for investors interested in allocating capital to green projects and an instrument to contribute to Australia's climate financing gap (AOFM,2023).

Apart from the sustainable finance agenda, other relevant climate policies are impacting financial institutions in Australia. This includes that the increasing frequency and intensity of natural disasters have put a strain on the insurance sector, pushing the boundaries of conventional models and increasing premiums (Dolk & Penning-Rowsell, 2020). Moreover, carbon offsets are an important mechanism for Australia's climate strategy (CER, 2024). However, they may be lacking as a tool to drive emission reductions (Calel et al., 2025). Finally, an often-avoided topic by Australian politicians: carbon taxes. Despite being a controversial policy tool, it is nonetheless considered critical for achieving net zero (Köppl & Schratzenstaller, 2023).

The Labor government has been the first Australian federal government to implement climate policies that other regions have already adopted, addressing Australia's position as a late adopter of such measures (The Treasury, 2024). The sustainable finance agenda under the Albanese government represents a significant advancement. However, Australia's current approach, which heavily relies on carbon offsets, may not guarantee long-term results due to their questionable effectiveness. Moving forward, diversifying the policy mix by revising insurance schemes, introducing a carbon tax, expanding the green bonds framework and enhancing mandatory climate-related disclosures could position Australia at the forefront of climate leadership.

Australia's Sustainable Finance Strategy

The Australian government announced a Sustainable Finance Strategy which was outlined in the Sustainable Finance Roadmap in 2024. As described by Treasurer, Jim Chalmers: "The Roadmap is all about mobilising the significant private capital required to achieve net zero, modernising our financial markets and maximizing the economic opportunities associated with energy, climate and sustainability goals" (The Treasury, 2024). The roadmap is structured as per the following three pillars:

- Pillar 1: Improve transparency on climate and sustainability
- Pillar 2: Financial system capabilities
- Pillar 3: Australian Government leadership and engagement

Pillar 1 consists of priority 1-4:

- Priority 1: Implementing climate-related financial disclosures
- Priority 2: Developing the Australian Sustainable Finance Taxonomy
- Priority 3: Supporting credible net zero transition planning
- Priority 4: Developing sustainable investment product labels

Pillar 1 of Australia's sustainable finance strategy focuses on implementing climate-related financial disclosures. The Australian Accounting Standards Board (AASB) has set new reporting obligations that have started this year. Disclosures should include an organisation's net zero transition plans, that outlines emissions reduction and climate adaptation strategies. Another important initiative included in pillar 1 is the development of a sustainable finance taxonomy, developed in collaboration with the Australian Sustainable Finance Institute (ASFI). By 2027, the government plans to introduce sustainable investment product labels to improve transparency for investors (The Treasury, 2024; Australian Sustainable Finance Institute, n.d.).

Pillar 2 comprises the following priorities:

- Priority 5: enhancing market supervision and enforcement.
- Priority 6: Identifying and responding to systemic financial risks.
- Priority 7: addressing data and analytical challenges.
- Priority 8: Ensuring fit for purpose regulatory frameworks.

The aim of the second pillar is for Australia to attract green capital. To do so, strong and proactive regulatory approaches to greenwashing and other misconduct are needed. One of ASIC's strategic priorities will be sustainable finance for 2023-2027. They will continue to address market misconduct through greenwashing surveillance and enforcement (The Treasury, 2024).

Finally, pillar 3 includes the below priorities:

- Priority 9: Issuing Australian sovereign green bonds.
- Priority 10: Stepping up Australia's international engagement.

The last pillar covers the issuance of green bonds by the Australian Government. The green bonds will be used to finance Eligible Green Expenditures. The Sustainable Finance roadmap concludes by outlining Australia's ambition to increase engagement on sustainable finance policy nationally as well as internationally. This strategy activates the private sector's role in delivering on Australia's net zero targets (UNGCNA, 2023).

Climate-related financial disclosures

The Treasury Laws Amendment Bill 2024

The existing liability framework consists of the Corporations Act 2001 and Australian securities and Investments Commission Act 2001. Neither of these Acts mentioned sustainability reporting before the Treasury Laws Amendment Bill 2024 (Parliament of Australia, 2024). The Treasury Laws Amendment (Financial Market Infrastructure and Other Measures) Bill 2024 was first introduced in the House of Representatives on 27 March 2024. The Committee appointed with examining the bill received evidence for broad support from a wide range of stakeholders.

On 9 September 2024, the Treasury Laws Amendment (Financial Market Infrastructure and Other Measures) Bill 2024 was passed in both houses of parliament and became law shortly after (They Vote for You, 2024). Despite the positive sentiment communicated by stakeholders, not every vote was a 'Yes'. All representatives for the Australian Greens and Australian Labor Party voted in favour of the bill, as well as most of the independents. The Liberal National Party, Liberal Party and National Party voted against the bill. Ultimately, with 90 votes 'Yes' and 53 votes 'No', the bill was passed.

Noise around mandatory sustainability reporting laws has not quieted down. Prior to the 2025 federal election, the Coalition promised to reverse these laws if elected. These promises were influenced by expectations that the Trump administration would roll back similar rules in the US (Read, 2025). Industry groups, on the other hand, broadly rejected the proposal made by the Coalition. They argue that climate reporting streamlines a process many large businesses are already undertaking. Treasurer Jim Chalmers, member of the Australian Labor Party, defended the sustainability reporting laws by stating that reversing laws to disclose greenhouse gas emissions will create uncertainty for investors (Read & Wembridge, 2025).

Other stakeholders warned about undoing the new rules, saying that it would make life harder for firms. Stakeholder reactions from industry groups such as the

Australian Industry Group, and the Australian Institute of Company Directors, point out that transparency and stability come with the mandatory climate-related disclosures (Read & Wembridge, 2025). This is important for Australia's economic resilience and maintaining investor confidence.

From voluntary to mandatory

An increasing number of Australian entities have started to voluntarily report on their sustainability performance, whether due to internal values, investor demand, or the expectation of regulatory changes. This data is essential for recognising risks and for meeting international goals as determined in the Paris Agreement (Zhou, 2022; Sutantoputra, 2022). For the past few years, sustainability reporting was largely driven by voluntary compliance to multiple sustainability reporting guidelines such as GRI, TCFD and SASB standards (The Treasury, 2024).

While these initiatives improve both transparency and accountability, concerns about quality differences, comparability and consistency have also grown (Zhou, 2022; Jadoon et al., 2021). Ultimately, these concerns have led several jurisdictions to introduce mandatory sustainability reporting. The aim of implementing these disclosures is improving transparency and providing more comparable information about an entity's exposure to climate-related financial risks and opportunities (The Treasury, 2024; Zhou, 2022; Jadoon et al., 2021).

The amendment to the Corporations Act 2001 and Australian securities and Investments Commission Act 2001 phases in new climate-related financial reporting requirements. This means that climate disclosures will be sitting under the existing Corporations Act 2001 and Australian Securities and Investments Commission Act 2001 (The Treasury, 2024). Therefore, a sustainability report is the fourth report entities have to prepare as part of their annual reporting obligations.

Australia's sustainability standards

On 20 September 2024, the AASB introduced the Australian Sustainability Reporting Standards (ASRS), a significant shift in Australia's corporate reporting landscape (AASB, 2024). From 1 January 2025, certain entities must comply with AASB S2 under the Corporations Act 2001, aligning Australia with global efforts to improve climate-related financial disclosures (AASB, 2024). The ASRS closely mirrors international standards issued by the IFRS in 2023 (KPMG, 2024; Climate Zero, n.d.). However, there are a few differences in:

- Scope: AASB S1 is voluntary, unlike the mandatory IFRS S1. AASB S2 focuses solely on climate, whereas IFRS covers broader sustainability topics.
- Industry-specific disclosures: Australia has not mandated these, unlike other jurisdictions (KPMG, 2024; PwC, n.d.; Watershed, 2024).

These gaps present opportunities for improvement as Australia could expand its scope beyond climate. Another potential improvement would be to introduce sector-specific standards to increase comparability (Canada Climate Law Initiative, 2024; IFRS, n.d.). Australia has, however, gone beyond IFRS in two areas:

- Applicability: ASRS includes both for-profit and not-for-profit entities (KPMG, 2024).
- Climate scenarios: AASB mandates assessment of at least two climate scenarios, including a high-warming one, following recommendations from the Australian Greens Party (Parliament of Australia, 2024).

Broader coverage is generally encouraged for transparency and accountability purposes, concerns have been raised about the burden on not-for-profits (EY, 2024). Other than these few points, Australia is generally adopting international frameworks rather than creating its own. Despite being a late adopter compared to regions like the EU, UK, Canada, Singapore, Hong Kong, and New Zealand, Australia's new standards are intended to move closer to our net zero goals (Parliament of Australia, 2024; Hanrahan, 2024). Note that these laws are not designed to directly influence corporate behaviour in the short term, but instead help investors, regulators, and other stakeholders to get clearer insights into how entities are managing climate-related risks and opportunities. While this visibility is a crucial step toward greater accountability, it does not automatically lead to changes in corporate strategy or operations.

A policy perspective for banking and finance

ASRS introduced a new focus on financial institutions. That is not unexpected, since financial institutions can play a key role in achieving Paris Climate Agreement targets. These institutions manage and direct capital flows, meaning that they can help to meet the financing needs for the transition to net zero (Teubler & Kühlert, 2020).

Although mandatory sustainability reporting has an impact on all organisations, financial institutions are facing big shifts. Sustainability reporting prior to 2025 was voluntary and mainly focused on scope 1 and scope 2 emissions, emissions directly related to the reporting entity (The Treasury, 2024; Shrimali, 2022). However, the core business of financial institutions relates to financial transactions such as loans, investments and deposits. All emissions related to these activities occur in scope 3 and are frequently called financed emissions. Scope 3 greenhouse gas emissions are emissions that occur upstream and downstream in the supply chain from the reporting entity (Nelson, 2022; Shrimali, 2022). With the newly introduced sustainability standards, financial institutions in Australia will have to investigate the physical risk of assets, present a credible transition plan, perform climate scenario analysis, and report on their scope 3 emissions (Insurance Council of Australia, n.d.; Climate Zero, n.d.).

Financial institutions have received a push to increase transparency due to reputational risks and stakeholder pressure. Financed emissions can demonstrate which institutions fund high-emission industries like mining and oil and gas and can therefore reveal their role in climate change (McKinsey & Company, 2022).

Reporting on scope 3 emissions starts in 2026, and it means that measuring financed emissions will become a priority for financial institutions in Australia (The Treasury, 2024). The quantification of emissions from lending and investing activities allows for integration of climate-related risks into the institution's

strategic decision-making process. More importantly, by incorporating sustainability into core business activities, financial institutions can decide where capital will make the most impact (Path Zero, 2023).

Measurement of scope 3 emissions is critical, as these emissions often account for the largest share of an organisation's overall emissions profile (Hettler & Graf-Vlachy, 2024; Ducoulombier, 2021). Not only will measurement allow financial institutions to make transparent climate disclosures, but it will also stimulate target setting (PCAF, 2022). Target setting and monitoring is crucial for ensuring effective emission reduction (Hettler & Graf-Vlachy, 2024). As a result of calculating financed emissions, financial institutions will be able to see the emissions-intensive hotspots in their portfolios. Once the problem areas become clear, it may drive the engagement of stakeholders to help lower financed emissions. Or it may even trigger changes in capital flows. If not mandatory, many firms will not report on their scope 3 emissions (Hettler & Graf-Vlachy, 2024; Ducoulombier, 2021).

Calculating financed emissions has not been straightforward, as financial institutions have been using different metrics and methodologies (Granoff & Lee, 2024). This can result in inconsistent and even unreliable climate impact assessments. Mandatory reporting is a step forward in setting a standard for the financial sector (PCAF, 2022; WBCSD, 2024).

Even though the call for transparency has been loud and clear, firms lack the know-how and capabilities to comply (Hettler & Graf-Vlachy, 2024). If they do have the knowledge in house, a significant amount of organizational effort is still needed to establish an appropriate process. From data management and stakeholder engagement to accounting, the resources required for reporting could go as far as setting up a whole new department (Hettler & Graf-Vlachy, 2024). The Coalition has estimated that the mandatory disclosures will cost around$1.3 million per entity (Accounting Times, 2024).

Another concern regarding the reporting of emissions is data quality (Hettler & Graf-Vlachy, 2024). If data quality is low, it misses its intended purposes of transparency and comparability. Determining what data is needed requires extensive analysis. Additionally, methodological challenges for calculating scope 3 emissions are not yet resolved, and data collection can be complex (Granoff & Lee, 2024; WBCSD, 2024).

Although these are major drawbacks, scope 3 reporting is still in its infancy (WBCSD, 2024). Climate deadlines are creeping up on governments, and there may be no time to perfect legislation before achieving much-needed results. It may be better to proceed with a flawed policy rather than waiting, because not reporting slows down any potential scope 3 emissions reductions (Hettler & Graf-Vlachy, 2024).

It should also be noted that measurement and disclosure of financed emissions, as critical steps as they are, do not automatically result in greener portfolios. Directly incentivising capital allocation to flow to climate solutions depends on subsequent strategic actions taken by investors based on the insights gained from emissions data (WBCSD, 2024; Fraser & Fiedler, 2023).

Mobilising private capital with green bonds

Mobilising capital is a key challenge in reducing the impact of climate change. The Australian Land Conservation Alliance estimates that Australia needs to spend over A$1 billion annually to 'restore nature and prevent further landscape degradation' (AOFM, 2023). Research led by the University of Queensland and CSIRO estimates that the amount needed is much higher, with the annual cost of fully restoring populations of 1,657 threatened species to be $583 billion (The University of Queensland, 2025). According to the Green Bond Framework, the Australian government has already 'committed to significant green expenditures through normal budget processes.' This indicates the belief that relying only on government investment is not sufficient. Green bonds are considered a means for unlocking private-sector participation (AOFM, 2023).

The sovereign green bonds program is one of 10 key priorities in the Sustainable Finance Strategy developed by the Albanese Government. The government is using green bonds as a tool to finance projects with targeted environmental outcomes (AOFM, 2023). The Australian Office of Financial Management (AOFM) is tasked with issuing debt securities on behalf of the Australian Government and as a result will be the responsible body for the issuance of sovereign green bonds. The proceeds from the bonds are transferred to the Reserve Bank of Australia, which will then allocate them to Eligible Green Expenditures (The Treasury 2024; AOFM, 2023). These expenditures must align with at least one of the Australian Government's three key Green Goals:

- Climate change mitigation
- Climate change adaptation
- Improved environmental outcomes

The first sovereign green bond was issued on 4 June 2024. The bond size is A$7 billion and the maturity date is in June 2034. Green bond investors can find annual impact reporting about allocation on the AOFM website starting in 2025 (The Treasury, 2024).

Green Treasury Bonds have been considered long overdue by industry stakeholders (Australian Financial Review, 2023). In comparison, European countries such as Germany have had green government bonds since 2020, and Britain introduced them in 2021 (Australian Financial Review, 2023). While their introduction to Australia was late, it was positively received by the financial market. The bond issue was heavily over-subscribed, with bids from 105 institutional investors across the globe. Given Australia's relative stability, Australian bonds have often been high in demand. There are more opportunities for these types of securities and related financial markets, if the government moves beyond issuing individual green bonds (AOFM, 2023; The Conversation, 2024).

Studies on sovereign green bonds in Europe have revealed that the bonds can reduce a country's climate risk. Good climate policies decrease the costs of issuance of green bonds, triggering a positive feedback loop which potentially accelerates the transition to net zero emissions (Chesini, 2024; Dell'Atti et al., 2022). Despite the identified benefits, Chesini (2024) emphasizes the importance of

earmarking funds exclusively for climate and environmental projects for the initiative to succeed. With the Australian government's allocation and impact reports, along with their publicly available list of eligible green expenditures, the Green Bonds Framework has strong potential to mobilize capital and help close the climate financing gap (AOFM, n.d.).

Insurance services policy

The insurance industry is facing immense challenges with the increasing impacts of climate change. The magnitude of damage and the associated costs and payout of claims has increased significantly (Insurance Development Forum, 2020). The most obvious affected types of insurance are natural disaster and property insurance. Yet other types of insurance, such as health, life, and liability insurance, will not be immune (Mills, 2005).

Insurance companies determine their premiums based on risk models. Traditional models assess the likelihood of an event occurring and estimate its potential financial loss. Policy holders are then charged a premium that incorporates the risk and covers the expected costs (Cummins, 1991). Climate change related events are usually neither predictable nor can they be estimated. The uncertainty involved, and the extreme nature of climate events, causes trouble for traditional risk models (Dolk & Penning-Rowsell, 2020). Insurance companies are updating their models, resulting in substantial changes to premium pricing. Some insurers even go as far as to completely withdraw coverage for certain disaster-prone areas (Dolk & Penning-Rowsell, 2020; Booth & Tranter, 2018).

Post-disaster, insurance plays a key role in making the social and financial costs more tolerable for communities (Booth & Tranter, 2018). In Australia, however, under-insurance has become increasingly common. The research by Booth & Tranter (2018) supports the observation that insurance can contribute to growing socio-economic polarisation. In other words, those of lower socio-economic status are more likely to be under-insured. On top of that, disadvantaged communities are overrepresented in disaster-prone areas. In case of a disaster, these households will therefore be hit harder and left empty-handed. The position of the government adds to this, as they have chosen market-based approaches to disaster management. By leaving it to the market, Australia's government has been shifting responsibility onto households (Dolk & Penning-Rowsell, 2020; Booth & Tranter, 2018).

In 2022, the Morrison government faced growing pressure to expand its $10 billion Northern Australia reinsurance pool, originally limited to cyclone damage, to include flooding (The Guardian, 2022). Although politicians from both Coalition and Labor parties called for support for broader disaster coverage, the Coalition only extended the scheme to include cyclone-related flood damage through the Treasury Laws Amendment (Cyclone and Flood Damage Reinsurance Pool) Bill 2022 (The Treasury, 2022). The scheme has struggled with limited coverage and affordability issues. In some regions, premiums have not decreased or have risen due to market conditions (ACCC, 2024).

Calls from flood-affected communities in Southern Queensland and Northern New South Wales have gone unanswered, as the scheme remains focused solely on cyclone-prone Northern Australia and excludes other disasters like bushfires and inland floods (The Guardian, 2022; The Treasury, 2022). Instead, the Coalition has proposed breaking up large insurers, while the Insurance Council supports scrapping state insurance taxes to lower costs (The Guardian, 2025). The Greens have criticised the current scheme as too narrow, and have called for a national reinsurance pool that includes all flood victims (The Guardian, 2022). However, none of these approaches tackles the root issue: climate change is expected to keep driving premiums higher (ABC News, 2023).

All efforts so far have been aimed at moderating rising insurance premiums, even though Australia has already proven to be under-insured with today's pricing (Insurance Council of Australia, n.d.; Booth & Tranter, 2018). Convincing more people to buy insurance is not the answer. Even if households were insured, insurer payouts do not always cover all costs. This raises the question of whether the insurance industry is currently 'fit for purpose' (Booth & Tranter, 2018).

Recent wildfires in Los Angeles have renewed the debate in Australia about the limits of state-sponsored insurance schemes. California's FAIR Plan, for example, ran out of funds after covering wildfire damage and shifted over US $1 billion in costs to private Insurers. They passed these costs onto policyholders (San Francisco Chronicle, 2025; Insurance Business Magazine, 2025; The Australia Institute, 2025).

A more sustainable model lies in public-private partnerships (PPPs), such as the UK's Flood Re. This scheme allows insurers to transfer high-risk liabilities to a government-backed pool, with the government stepping in only during extreme events. Unlike state-sponsored schemes, PPPs distribute risk more evenly and have shown success: Flood Re reports that 80% of previously flooded households now pay over 50% less for insurance (Flood Re, 2024; OECD, 2019).

However, PPPs are not a guaranteed solution either. Risk-based pricing still dominates, limiting accessibility. For instance, Flood Re excludes homes built after 2009, allows high excesses and is set to end in 2039 (Flood Re, 2016). To ensure access, participation should be mandatory for insurers, and coverage should be universal (Dolk & Penning-Rowsell, 2020). Moreover, insurance must complement and not replace risk reduction efforts by homeowners (OECD, 2019).

Following the 2010/2011 floods, the Natural Disaster Insurance Review (NDIR) made two key recommendations: first, that all home insurance policies should include flood cover to improve availability; and second, that a government-backed reinsurance facility should be established to improve affordability. However, insurers opposed both proposals, citing concerns about risk exposure and opposing a government-run reinsurance pool, despite supporting the idea of premium discounts (Dolk & Penning-Rowsell, 2020).

Globally, climate change is driving up insurance costs faster than inflation. Over the past five years, average annual insured losses from natural disasters have reached US $100 billion, which is 47% higher than the 20-year average (ABC News, 2025; The Australia Institute, 2025). In Australia, this trend is pricing more households out of

coverage, with insurers increasingly withdrawing from high-risk areas or limiting payouts. Australia continues to be exposed to the vulnerabilities of the insurance market and it emphasizes the importance of implementing the NDIR's recommendations (ABC News, 2025; The Australia Institute, 2025).

Carbon trading and taxing

Although neither carbon trading nor carbon taxes are part of Labor's sustainable finance strategy, carbon trading is one of the key pillars of Australia's climate plans. Carbon taxing on the other hand, is a powerful climate policy tool that Australia is not currently using.

Carbon trading

To spark an incentive to reduce or avoid emissions, the Australian Government implemented the Australian National Registry of Emissions Units Act 2011 and the Carbon Credits (Carbon Farming Initiative) Act 2011. As part of these Acts, the Australian Government supports markets for domestic carbon credits through the Australian National Registry of Emissions Units (ANREU). The Registry is aimed at holding and managing (i) Australian carbon credit units; and (ii) safeguard mechanism credit units. Also, the Registry is Australia's national registry for Kyoto units (CER, 2024).

Australian carbon credit units (ACCUs) are aimed at encouraging carbon abatement activities. Projects that are eligible to obtain these units can range from reforestation to energy efficiency. For every tonne of carbon dioxide equivalent (tCO2-e) emissions a project stores or avoids, participants earn one unit. ACCUs provide a financial incentive as units can be sold on the market or to the Australian Government. If sold to the Australian government for a fixed price, the units are used to fulfill Australia's commitment to decarbonise its economy. If sold on the market, private buyers choose to purchase ACCUs to offset their carbon footprint. There is not a set price per unit, as the value fluctuates based on supply and demand in the market. An ACCU is therefore a tradable financial product (CER, 2024; DCCEEW, 2023; DCCEEW, n.d.).

Australia wants the highest greenhouse gas emitting organisations to do their bit in the fight against climate change. Therefore, the Australian Government introduced the Safeguard Mechanism, which requires them to reduce their emissions to 43% below 2005 levels by 2030 and net zero by 2050 (CER, 2024). The safeguard mechanism credit units (SMCs) are obtained by facilities that have reduced their emissions beyond the required baseline. One tonne of carbon dioxide equivalent (tCO2-e) emissions below a Safeguard facility's baseline equals one SMC unit. Like ACCUs, SMCs are a tradable financial product as they can be sold to other safeguard facilities. SMCs are different from offsets because SMCs are generated within a regulated emissions limit that restricts the overall emissions of all facilities (CER, 2024).

Carbon credits are a core component of Australia's climate change strategy. However, not everyone agrees that they should have such a primary role in the pathway to net zero emissions. The Australia Institute argues that meeting

emissions reduction targets by depending on offsets is not only mathematically impossible, but also a 'recipe for climate disaster' (The Australia Institute, 2023). Carbon credits are usually bought to justify or compensate for releasing greenhouse gas emissions into the atmosphere. The Australia Institute calls it an accounting trick, because buyers are purchasing a credit representing that someone else has reduced CO2 emissions to offset the buyer's own emissions.

While countries or companies often claim carbon neutrality by purchasing offsets, this is frequently misleading (The Australia Institute, 2023; Kaupa, 2022). Offsets typically cover only scope 1 and 2 emissions, but leaving out broader impacts. As The Australia Institute puts it: "It's a bit like saying you're a health food company even though you sell chicken nuggets, because everyone in your office eats salad for lunch" (The Australia Institute, 2023). On top of that, credits do not guarantee real emissions reductions (Calel et al., 2025). They often shift emissions between sectors without driving actual change (The Australia Institute, 2023; West et al., 2023).

Furthermore, carbon credits have faced integrity issues before. For example, Australian businesses were buying credits from a project located in Papua New Guinea, and an investigation by Four Corners revealed extensive commercial logging at the rainforest site the project developer was supposed to protect (ABC News, 2023). There are other similar examples of integrity issues, as whistle-blower Professor Andrew Macintosh, former head of the liberal government's Emissions Reduction Assurance Committee, expressed when he called the carbon credit system fraudulent (The Australia Institute, 2023).

Alarmingly, Australia's key climate policies rely on the Safeguard Mechanism. A scheme even more dangerous due to a loophole in its system. A large supply of carbon credits on the market for big emitters has kept the price of offsets low. In other words, it is cheaper and easier for these emissions-intensive entities to buy offsets than to actually decarbonise (The Australia Institute, 2023; EY, 2023). The Albanese Government introduced reforms to the Safeguard Mechanism in July 2023 by setting baselines for facilities. These baselines will be reduced each year, forcing Australia's biggest polluters on a net zero trajectory. If a facility does not meet their reduction targets, they are required to buy SMCs or ACCUs (EY, 2023; Climate Council, 2023). Although the reforms close the offset loophole, relying on credits is still not the answer for reasons outlined in this chapter and many more (The Australia Institute, 2023).

That does not mean that carbon offsets have no potential at all. They could be a valuable addition to Australia's climate strategy, albeit not being a key pillar (Axelsson et al., 2024). To protect local stakeholders and the environment and ensure project integrity, it would be beneficial to have an independent body governing eligibility. Strict and specific criteria could be used to measure a project's contribution to sustainable development (Carbon Market Watch, 2020; Kukah et al., 2024; Axelsson et al., 2024). Most importantly, carbon offsets should not be a means for entities to buy out of climate targets and/or compromise climate ambitions. They should be an addition to an entity's climate strategy instead of replacing it. As such, entities should still be incentivized to adopt ambitious climate targets

(Carbon Market Watch, 2020; Kukah et al., 2024). This presents itself as a great opportunity for the Australian government to lead by example, a desire expressed in pillar 3 of the Sustainable Finance Strategy.

Carbon taxing

The Gillard Labor minority government introduced a carbon pricing scheme as the Clean Energy Act 2011. However, it has been a topic of discussion on Australia's political agenda since 2007 (ABC News, 2014). And since 2009, opposition leader Tony Abbot fought to prevent the implementation of such a tax. Upon prime minister Gillard's announcement of carbon tax plans, Abbot stated: "If the Coalition wins the next election, you can be absolutely confident there will be no mining tax and no carbon tax," (ABC News, 2014).

Nonetheless, the carbon tax passed the Senate in November 2011. The plans were ambitious too, as Australia's carbon price started at $23 per tonne as compared to $8-13 in Europe. Not only was it ambitious, but it had also proven successful. Emissions fell by an estimated 2% in the two years it was operating, without a noticeable effect on the economy (The Australia Institute, 2020; ABC News, 2014; Gonçalves and Menezes, 2024).

Tony Abbot called the following election a 'referendum on carbon tax'. In 2013, after winning the election, Abbot started the process of reversing the carbon tax. The 'Direct Action' policy was his answer to climate change and replaced the tax in 2014. This policy was met with skepticism due to the inadequacy of the budget and the lack of economy-wide incentives to reduce emissions (ABC News, 2014; Parliament of Australia, 2014).

In 2024, the Australian Energy Market Commission has started to give greater weight to policies that reduce emissions, making it more likely that such proposals will be approved. Although this influences regulatory decisions behind the scenes, it is not a carbon tax paid by polluters. Albeit being a proven tool in other jurisdictions, carbon taxes are currently not on Australia's political agenda (Köppl & Schratzenstaller 2023; The Conversation, 2024).

Recommendations

For Australia to align with the Paris Agreement's 1.5°C target, several policy changes should be considered. Firstly, the scope of climate-related financial disclosures could be improved by including industry-specific metrics and introducing mandatory reporting under both Australian sustainability standards. This would result in more transparent and comparable sustainability reports.

Secondly, financial institutions could benefit from the government's guidance on accurately measuring and reporting on scope 3 emissions. Standardized methodologies and encouragement of emissions reduction targets are essential to integrate sustainability into core business activities.

Furthermore, expanding the green bonds framework would allow for more private capital to be deployed to close the climate financing gap. Aside from the issuance of sovereign bonds, the Australian Government could also consider a wider offer of

securities. With these types of green securities, it is important that the funds are earmarked for impactful initiatives to ensure credibility.

For the insurance industry, revising insurance schemes is necessary. Developing innovative products like public-private partnerships and comprehensive reinsurance pools covering all natural disasters in Australia can help mitigate climate change impacts. These types of insurance products will better manage the increasing risks and secure affordability.

Carbon offsets can be used to complement broader climate policies but should not be the primary tool. Both governmental and corporate climate strategies should avoid relying on carbon offsets to reach their net-zero targets. To prevent them from weakening ambitious climate goals and to drive systemic emissions reductions, they should only be used as a secondary measure. Additionally, they require stricter governance and integrity measures. It is recommended that an independent body be tasked with overseeing eligibility and ensuring genuine emissions reductions.

Finally, a long-avoided measure by Australian policymakers is a carbon tax. This policy tool, with an embedded 'make the polluter pay' principle, creates a strong incentive to reduce emissions.

Implementing these policy changes could shift Australia's position from being a late adopter to climate leadership. Most importantly, they promote a cleaner, healthier and safer home for all Australians.

plant agriculture

This chapter can be referenced as "Baré, L. (2025). Plant agriculture. In B. Goodsell (Ed.), The State of Policy Report (pp. 213-220). The Climate Centre."

Despite the abundance of food produced in Australia, many Australians experience food insecurity, and with the effects of climate change having an increasing impact on food production, the number of people experiencing food insecurity in Australia will only increase (Eassom et al. 2024, p. 3; Henderson & Coyne 2025, p. 8; Hughes et al. 2021; Shivanna 2020, p. 104; Spencer 2024, p. 27).

Australia produces enough food to feed its entire population as well as an additional 60 million people through its food exports (Spencer 2024, p. 26). While 71 percent of Australian agriculture is exported, food imports only account for 11 percent of Australian households' food expenditure, with fresh food and beverages only making up a small proportion of that, at 1.6 percent (ABARES 2023a; ABARES 2025). From 2023 to 2024, crops made up around 35 percent of the total value of production of Australian agricultural commodities, most of which came from cereal grains, which constituted around 17 percent of the total value of production (ABARES 2025). Wheat was by far Australia's most produced and valuable grain crop in that period, with 28 million tonnes sold at a value of $8.8 billion, followed by barley, with 11 million tonnes sold at a value of $3.2 billion (Australian Bureau of Statistics 2025). Additionally, horticulture made up around 19 percent of the total value of Australian agricultural commodities, with fruits, nuts and vegetables making up a majority of that at around 15 percent of the total value of production (ABARES 2025).

Despite claims from the Department of Agriculture, Fisheries and Forestry that Australia is a food secure nation, over 30 percent of Australian households experienced moderate to severe food insecurity in 2024 (Henderson & Coyne 2025, p. 8; Spencer 2024, p. 27). This will only worsen with growing climate pressures, which have already had an impact on most of Australia's crops, including wheat and barley (ABARES 2023b; Eassom et al. 2024, p. 3; Hughes et al, 2021; Shivanna 2020, p. 104).

In addition, The Global Food Security Index has found deficiencies in Australia's food availability and sustainability, with Australia falling behind the average of 113 surveyed countries in research and development on agriculture, farm infrastructure, land degradation, soil degradation and, chiefly, climate-smart agricultural and food security policy commitments, ranking the lowest in the Asia Pacific region (Economist Impact 2022). In the face of growing climate pressures, the Australian Government must take action to ensure that Australia becomes, and remains, a food secure nation. A transition from animal agriculture to plant-based agriculture would be instrumental to this, as it would reduce Australia's greenhouse gas emissions, giving the nation a chance to greatly improve its food security (Climate Council 2024; Eassom et al. 2024, p. 3).

Climate Change Pressures and Impacts

Climate change is making extreme weather events more frequent and severe (CSIRO 2022), bringing more droughts, heatwaves, storms and floods to Australia's arable land, exposing soil and negatively impacting the ability of farmers to plant, grow and harvest successfully (Eassom et al. 2024, p. 3; Bartos 2022; Williams et al. 2021). This has driven up costs, limiting food accessibility for low-to-medium income families, and, if climate change continues to worsen, it will likely lead to a severe reduction in Australia's agricultural productivity, regardless of advances in climate-resistant innovations (Bartos, 2022; Eassom et al. 2024, p. 3).

Key impacts of climate change on agricultural productivity include:

Declining rainfall – The CSIRO and BOM (2024) State of the Climate report indicates that cool season rainfall is declining across southern and eastern Australia. While cool season rainfall has experienced an increase in northern parts of the country, the south, particularly the south-west and south-east have experienced a dramatic 'drying' effect in the same seasons, with the rainfall decrease best explained by anthropogenic climate change (CSIRO & BOM, 2024). Projected rainfall decline presents a major threat to rain-fed broadacre crops in the near future with potential yield losses of between 3% and 15% by 2030, and later, catastrophic crop failures with an up to 49% decrease in yield by the 2090s (Anwar et al. 2015). Broadacre crops – wheat, rice, and barley in particular – are foundational to national and global food security, with dramatically decreasing yields of concern, not only in Australia, but across the world (Gooding & Shewry 2022; Janni et al. 2024).

Rising temperatures and extended heat waves – While rainfall is declining, average temperatures are rising (BOM 2024). This has increased the duration of droughts and severity of fires, decreasing the amount of suitable land for farmers (NSW Government 2024). Consistently elevated temperatures have also placed stress on plants, reducing yields in key crops, such as wheat, rice, and canola (BOM 2010; DPIRD 2021).

Pests and diseases – Heat, in combination with elevated atmospheric CO2, has the potential to increase the prevalence of plant pathogens, threatening farm yields and the fluidity of global and local supply chains as crops fail, or are destroyed, and biosecurity measures require greater stringency (NSW Government 2024; Raza & Bebber 2022; Bebber et al. 2014; Ristaino et al. 2021).

Soil degradation – Conversion of land for cropping purposes leads to a degradation of the soil, causing a loss of biomass and associated carbon, moving it from the ground and into the atmosphere, a primary source of greenhouse gas emissions from plant agriculture (FAO 2020; NSW Government 2024b). Soil organic carbon (SOC) is also essential for drought resistance, affecting water-holding, and nutrient supply – SOC is projected to decline in the short and long term as temperatures rise and rainfall decreases (OEA 2018). As more crops are planted over greater areas to make up for yield losses, nutrient depletion increases, creating land unusable for plant growth in the future (Bindraban et al, 2012). The extreme soil degradation and desertification, renders fertile land unplantable, and is a problem that an already dry continent like Australia will face to a greater degree as the climate becomes hotter and dryer (WHO 2020).

Due to the key role of crop productivity in food security, the impacts of climate change are of major concern (Shivanna 2020, p. 104). Although it is difficult to predict the precise impact of climate change on crop productivity, impact model predictions have consistently shown declines in productivity (Shivanna 2020, p. 104). For example, a report based on 65 years of wheat and barley yield data and weather records from France, predicted that wheat and barley yields would decline by 17 to 33 percent by the end of the 21st century (Shivanna 2020, p. 104). The impacts of climate change could also lead to a reduction in the nutritional value of crop species, with rising CO2 levels already having shown to result in a reduction in iron, protein, zinc, and several vitamins (B1, B2, B5, and B9) in a diverse variety of rice crops grown in Asia (Shivanna 2020, p. 104).

Significantly, as of 2020, changes in seasonal conditions were estimated to have already reduced the profitability of broadacre crop farms in Australia by 23 percent since 2001, with an estimated revenue loss for the broadacre cropping industry of $1.1 billion per year (Eassom et al. 2024, p. 3; Hughes et al, 2021; ABARES, 2023). Projections estimate profits could fall a further 32 to 50 percent if climate change persists at even an intermediate rate (Hughes et al, 2021). Moreover, since 1999 (as of 2022), cropping farms in Australia have declined by 40 percent (ABARES 2024). The states with the worst decline – New South Wales, Western Australia, Victoria, and South Australia – mirror those experiencing the 'drying' trend established above; a drying trend soon expected to be year-round, with summer rainfall experienced by farms projected to decline between 7.4% and 10.8% by 2050 (ABARES 2024; CSIRO & BOM 2024; Hughes et al. 2021). As climate change worsens, conditions for farming become less ideal, farm profitability decreases, and farms are forced to shut down (MDBA 2023).

The Benefits of Plant Based Agriculture and the Detriments of Animal Agriculture

While plant-based agriculture plays a significant role in reducing greenhouse gas emissions, it also plays an important role in enabling Australia's food security, as well as having economic and health benefits. Whole plants, or foods with large plant components such as bread, vegetable oils and cereals constitute up to ninety percent of the human diet, and as already mentioned, make up for more than half of Australia's agriculture (ABARES 2025; United Nations 2019; Şerban et al. 2008).

Across 2023 to 2024, Australian agriculture accounted for 10.8% of goods and services exports ($71.5 billion in 2023-24), 2.4 percent of Australia's GDP, 5.9 percent of rural employment, and 2.2 percent of national employment (315,600 people in 2023–24) (ABARES 2025). Plant-based agriculture is also important for public health, with the National Health and Medical Research Council (2013) recommending that the predominant source of dietary energy comes from a diversity of fruit, vegetables, and grains in order for Australians to live longer, healthier, and happier lives (AIHW 2024).

Animal agriculture is also damaging to the environment, with over 75 percent of Australia's agricultural emissions in 2023 coming from livestock (Climate Council 2024; Eassom et al. 2024, p. 3), and is responsible for a substantial amount of land clearing with one glass of dairy milk using nine times more land than plant-based milk (Climate Council 2024). Land clearing for animal agriculture releases carbon, removes carbon sinks, destroys habitats, degrades soil and creates biodiversity deserts by turning complex ecosystems into simplified monocultures. Agriculture is also identified as a threat for 24,000 of the 28,000 species on the IUCN Red List that are threatened with extinction (Plant Based Treaty 2023, p. 18, 19, 45).

Australian Government Policies

Australian food security is overseen by Federal, State and Territory, and local governments (Henderson & Coyne 2025, p. 15). The Federal Government is responsible for providing national policy frameworks, and coordinating and regulating food security – focusing on broader national issues, such as food safety and standards, international trade agreements, biosecurity, crisis-response, and emergency management (Henderson & Coyne 2025, p. 16). State and Territory governments often focus on more localised regulations (Henderson & Coyne 2025, p. 16). They are responsible for environmental and agricultural management, food hygiene and safety, food access and distribution, biosecurity, public health and nutrition, and take part in national emergency management arrangements (Henderson & Coyne 2025, p. 16). Local governments have planning and development powers, implement regulations and food safety policies into local communities, and provide access to local food initiatives (Henderson & Coyne 2025, p. 16).

There are many Australian Government policies helping Australian agriculture adapt to the impacts of climate change. Policies addressing the impact of climate change on agriculture at a broader scale include the National Climate Resilience and Adaptation Strategy, the National Statement on Climate Change and Agriculture, and the Climate-Smart Agriculture Program. The National Climate Resilience and Adaptation Strategy outlines how the Australian Government will support efforts to better anticipate, adapt to, and manage the climate change impacts (Department of Agriculture, Fisheries and Forestry 2025a). The National Statement on Climate Change and Agriculture commits to improving adaptation and resilience to climate change, driving future profitability and sustainably, increasing agricultural productivity, and implementing pathways to support low-emissions agriculture (Department of Agriculture, Fisheries and Forestry 2023). The Climate-Smart Agriculture Program (which the government is investing $302.1

million into across 2023 to 2028) has been delivering grants between $70,000 and $100,000 for projects supporting sustainable and climate smart farming methods in Australia, including projects addressing climate resilience, soil health, cropping cover, regenerative farming, and water management (Collins 2025b; Department of Agriculture 2025c). The program is intended to drive agricultural sustainability, productivity, and competitiveness; support the agriculture sector to reduce emissions and build resilience to climate change; make use of carbon and biodiversity incentives; implement industry sustainability frameworks; and help farms to drive agricultural growth while adopting sustainable natural resource management practices (Department of Agriculture 2025c).

Additionally, the Australian Government has implemented several policies to address specific agricultural issues relating to climate change, such as soil health, drought, and animal emissions. The National Soil Strategy covers how Australia will manage, value, and improve its soil from 2021 to 2041, with the goals of prioritising soil, empowering soil innovation and stewards, and strengthening soil knowledge and capability (Department of Agriculture, Fisheries and Forestry 2025a; Department of Agriculture, Fisheries and Forestry 2024b). The Future Drought Fund aims to support Australian farms and communities to improve their resilience to droughts by providing them with access to climate tools and helping them to plan for drought, share resilient farming practices, and foster rural and regional leaders and networks (Department of Agriculture, Fisheries and Forestry 2024a; Department of Agriculture, Fisheries and Forestry 2025a). For example, the Future Drought Fund is investing into the Climate Services for Agriculture Program, which is providing farmers and farmer advisors with climate information tools such as My Climate View, which to date, has given over 19,000 users future climate projections for a range of agricultural commodities (Department of Agriculture, Fisheries and Forestry 2025d). There is also the National Drought Agreement (2024-2029), a five-year intergovernmental agreement, which has been set up to support farmers' efforts to prepare for, manage through, and recover from droughts, by encouraging a consistent and collaborative approach to drought across the country, through measures such as clarifying the responsibilities and roles of different jurisdictions and seeking to reduce duplication and gaps in policy implementation (Department of Agriculture, Fisheries and Forestry 2024a). The government is also funding research and upscaling of methane reducing feed additives, committing $29 million into the research and development of feed additives and forage legumes for livestock, and a further $8.1 million into the commercialisation of Australia's native red seaweed and $9.3 million into the upscale of its production (Department of Climate Change, Energy, the Environment and Water 2025).

The Department of Agriculture, Fisheries and Forestry has also been supporting and collaborating with external organisations to help Australia's agriculture sector adapt to climate change. Currently, it is partnering with the Zero Net Emissions Agriculture Cooperative Research Centre over 10 years to work towards reducing Australian agriculture's emissions (Department of Agriculture, Fisheries and Forestry 2025f). It is also supporting the Australian Agricultural Sustainability Framework, an initiative led by the National Farmers' Federation, that aims to

promote sustainable agriculture by reducing emissions, preserving natural resources, and promoting biodiversity, and improving the economic resilience of farms, and the wellbeing of people, animals and community (National Farmers Federation 2024).

The Australian Government is also in the process of developing an Agriculture and Land Sector Plan to reduce emissions and address the impacts of climate change on Australian agriculture, committing $60.8 million over 10 years to support initial emission reduction efforts (Department of Agriculture, Fisheries and Forestry 2025b). The Australian Government has also promised to commit $3.5 million towards the creation of a National Food Security Strategy, Feeding Australia, which is intended to address future trends, the consequences of natural disasters and global shocks, and trade with other nations, as well as examining the possibility of growing a biofuels feedstock industry to help Australia in achieving net zero (Collins 2025a). On top of this, its development and implementation is planned to be assisted through the creation of a National Food Council consisting of community and industry experts (Collins 2025a).

However, without a national strategy currently in place, Australia has been criticised for its lack of national food security policy commitments and accountability (Economist Impact 2022; Henderson & Coyne 2025, p. 11; Spencer 2024, p.27).

Critiques of Australian Government Policies

Since 2008, there have been at least 18 food security enquiries, reviews, and reports commissioned or conducted by government, industry, and academia (Henderson & Coyne 2025, p. 11). One of the first recommendations to come out of the most recent enquiry into food security in Australia, Food for thought: the opportunities and challenges for Australia's food and beverage manufacturing industry (released in February 2025), was for the Australian Government to develop a National Food Plan (Henderson & Coyne 2025, p. 11). This was also the central recommendation of the 2023 report, Australian Food Story: Feeding the Nation and Beyond, which argued that a food security plan should be overseen by a Minister for Food, who should be supported by a National Food Council (Henderson & Coyne 2025, p. 12).

While the government has recently flagged the creation of a National Food Security strategy, it is still considering its response to the rest of the 2023 report (Henderson & Coyne 2025, p. 13).

A lack of a national strategy has severely hindered the government's ability to address food insecurity. Henderson and Coyne (2025, p. 16) argue that the large number of departments and agencies involved in food security in Australia have created problems with coordination, communication, and shared accountability. They also raise the fact that food insecurity issues have been addressed in isolation, causing limited visibility, poor coordination, and policy misalignment across government and industry, allowing for critical vulnerabilities being overlooked. (Henderson & Coyne 2025, p. 11). A lack of an agreed upon definition of food security across all levels of government has also hindered the government's ability to address food insecurity (Spencer 2024, p. 26, 31). This is highlighted by the

Department of Agriculture, Fisheries and Forestry claiming in 2023 that Australia does not have a food security problem, despite a report from Foodbank in that same year finding that 36 per cent of Australian households experienced moderate to severe food insecurity (Spencer 2024, p. 26). Significantly, Australia scored a zero (compared to a global average of 47.1 scored across 113 countries) for its food security and access policy commitments in the Economist Impacts' Global Food Security Index due to its lack of government responsibility and accountability for food security, and the absence of a national food security strategy (Economist Impact 2022).

The government has also been criticised for failing to adequately prepare for, and respond to food security threats caused by system shocks, such as extreme weather events caused by climate change (Spencer 2024, pp. 30-31). Spencer (2024, pp. 30-31) argues that this can be seen through the panic buying experienced during the 2019-20 Australian bushfires. In addition, the Royal Commission into National Natural Disaster Arrangements 2020 argued that the Government should take a greater role in management and response to natural disasters, including the restoration of disrupted food supply chains (Spencer 2024, p. 30). Despite widespread international recognition that food systems need to evolve to adapt to climate change, the Australian Government's agricultural policies perpetuate animal agriculture rather than supporting a shift towards plant-based agriculture, which offer significant climate and food security benefits (Eassom et al. 2024, p. 3). The Australian Government has an obligation as a signatory of The Paris Agreement 2015, as well as many other international treaties, to reduce greenhouse emissions and protect the environment against the impacts of climate change (Cresswell, Janke & Johnston 2021, p. 130). However, despite this, it continues to support animal agriculture, which significantly contributes to Australia's greenhouse gas emissions (Climate Council 2024; Eassom et al. 2024, p. 3). In addition, despite Australian Government obligations to conserve the environment through treaties such as the Convention on Biological Diversity 1992, its perpetuation of animal agriculture enables mass clearing of land to create pastures for livestock, releasing carbon, removing carbon sinks, destroying habitats, degrading soil and creating biodiversity deserts (Cresswell, Janke & Johnston 2021, p. 130; Plant Based Treaty 2023, pp. 19, 45).

Without an adequate focus on preparing and responding to the impacts of climate change, as well as a shift towards plant-based agriculture, Australia will face extreme difficulties combatting the growing impacts of climate change on its food security.

Recommendations

To address these issues it is recommended that:

- The National Food Security Strategy is informed by agreed definitions and terminology
- A Ministry of Food is created, possessing central responsibility for food security in Australia

- The National Food Security Strategy aims to increase Australia's ability to prepare for and respond to climate change threats to food security
- A comprehensive agricultural transformation plan is created by the Australian Government to enable Australia's transition towards plant-based and climate-resilient agriculture
- The live export of animals for slaughter and fattening is banned

Food security is a complicated issue, covering social, economic, and environmental aspects at a local, national, and global scale (Spencer 2024, p. 29). In addition to this, food security covers many areas of policy, such as national security, environment protection, and public health (Spencer 2024, p. 29). To regulate this complex space, it is important that a national strategy is created which is informed by agreed definitions and terminology of what food security is (Spencer 2024, pp. 29, 31) The need for a shared definition of food security across all levels of government is highlighted by government claims that Australia does not have a food security problem, despite many people not having consistent access to food in Australia (Spencer 2024, p. 29). To deal with the complexity of food security policy and allow Australia to perform at an international standard, central responsibility for food security should be given to a Ministry of Food, as recommended by the 2024 parliamentary inquiry (Spencer 2025).

The National Food Security Strategy must also consider climate change threats. Due to the increased frequency and severity of extreme weather events, intermittent food shocks will also increase in frequency and severity, and therefore, a National Food Security Strategy should aim to increase Australia's ability to prepare for and respond to climate change threats to food security such as bushfires, floods and cyclones (Spencer 2024, pp. 30-31). Policy should be informed by reliable data on current levels of risk as well as past extreme weather events that have led to food system shocks, such as the 2019–20 summer bushfires (Spencer 2024, p. 30).

The Australian Government should also create a comprehensive agriculture transformation plan to diversify agricultural production towards a focus on plant-based agriculture. Such a transition should be actively built up and promoted by the Government, with incentives provided for farmers to cultivate plant-based foods (Eassom et al. 2024, p. 2). Furthermore, a plan for transitioning to plant-based agriculture should focus on utilising a diverse range of crops and crop rotations in order to boost soil quality and decrease the risks of simultaneous harvest failures (Plant Based Treaty 2023, p. 87). This would allow Australia to significantly reduce its greenhouse gas emissions, strengthen its food security, and create an opportunity to rewild unused agricultural land, which would help to restore habitats, biodiversity, soil and carbon (Plant Based Treaty 2023, p. 18).

The Australian Government should also ban live export of animals (Plant Based Treaty 2023, p. 18). In addition to the cruelty associated with transporting animals, with millions having died from starvation or heat stress before reaching their destination, live exportation is also responsible for a large amount of emissions, with Australian live exports producing 1.8 million tonnes of CO_2 in 2009 alone (Plant Based Treaty 2023, p. 18, 81).

public services

public transport

This chapter can be referenced as "Poh, Y. H. (2025). Public transport. In B. Goodsell (Ed.), The State of Policy Report (pp. 222-230). The Climate Centre."

Climate change events are happening all over the world, and Australia is already experiencing devastating impacts such as prolonged droughts, more frequent flash floods, and more intense bushfires. Extensive research has linked these events to the increase of greenhouse gas emissions, which has prompted countries to act together through the Paris Agreement (Streck, Keenlyside, & Von Unger, 2016). Under this agreement, Australia is committed to reducing emissions by 43% below 2005 levels by 2030 and reaching net zero emissions by 2050, which has been legislated in the Climate Change Act 2022 (Parliament of Australia, 2022). To achieve this, the country would require transformative changes in its current national planning. Australia's highest greenhouse gas emissions come from energy production, which makes up around one-third of the total (35.1%). This is followed by emissions from stationary energy uses such as manufacturing and mining (22.6%), transport (22.8%), and agriculture (19.1%) (Department of Climate Change, Energy, the Environment and Water, 2024).

The transportation sector is Australia's third largest source of emissions and is projected to be the biggest sector by 2030 (Department of Infrastructure, Transport, Regional Development, Communications and the Arts, 2024). Historically, Australia has been skewed heavily toward private vehicle use, resulting in severe traffic congestion, urban sprawl, and high per capita emissions. For example, census data from 2021 shows that most households own at least one vehicle, with over half owning two or more (Australian Bureau of Statistics, 2021).

Major cities like Brisbane, Perth, Adelaide, Melbourne, and Sydney all face major gaps in frequent, all-day public transport access (Climate Council, 2024). As a result, Australians spend an average of 54 minutes per day commuting (roughly 169 hours annually) and this has pushed many to rely on private vehicles as a necessary means of transport (Real Insurance, 2022). Even major cities with relatively higher public transport usage rates like Melbourne (52.5%) and Sydney (67%) also suffer from congestion, indicating that current public transport planning falls well behind the growing demand (Climate Council, 2024).

Price and coverage are two crucial factors that determine the effectiveness of public transport. Australia has the third-most expensive public transport in the world, behind only Switzerland and the Netherlands (Compare the Market, 2023). The average weekly cost for commuters was $39.95 in early 2023, with Brisbane's commuters paying the most at $59.67, followed by Melbourne at $53 and Sydney at $50 (Australian Automobile Association, 2025). The high cost of commuting has resulted in State and Territory and local governments bringing in public fare caps and discounted public transport schemes, such as Brisbane's 50-cent one-way ticket, or Perth's two-zone fare cap.

To achieve Australia's Net Zero target by 2050, encouraging a greater shift from private vehicles to public and active transport is required. Public transport currently contributes a relatively small share of national transport emissions (roughly 2 Mt CO_2-e out of 102 Mt CO_2-e from transport in 2019) (Giles & Vine, 2019). Yet its potential positive impact remains significant, as mass transit systems are far more efficient per passenger-kilometre, and encouraging greater uptake can reduce both emissions and road congestion. Emissions from public transport can be further reduced by expanding network coverage in high-growth suburbs and adopting low-emission technologies such as electric buses and trains.

However, current urban planning in Australia continues to favor private car use, as evidenced by the lack of reliable public transport in many rapidly growing suburbs such as Springfield to Ipswich in Brisbane, or outer suburb areas of major cities, such as Melton in Melbourne (ABC News 2024), which are areas that should be prioritised for greater investment (Infrastructure Australia, 2024). As a result, residents from these rapidly growing suburbs are left with no choice but to rely on private cars, which exacerbates urban sprawl and contributes to habitat fragmentation and inefficient land use. In addition, widespread urban development makes it more difficult and costly for governments to extend public transport to these areas effectively.

Current policies and governance framework

Australia's transport governance framework is divided by tier. The Federal government primarily acts as a funder and regulator, collecting tax revenue and redistributing it to States and Territories via several mechanisms such as the Federation Funding Agreement Schedule (FFAS) - Infrastructure (Commonwealth of Australia, 2024), while State and Territory and local governments are responsible for the planning, administration, delivery, and management of transport infrastructure. (Commonwealth of Australia, National Land Transport Act 2014, 2018)

The National Land Transport Act 2014 is the legislative foundation for federal investment in land transport infrastructure projects (Commonwealth of Australia, 2018). Under this Act, the Australian government funds eligible projects primarily related to roads, rail, and intermodal transport. To operationalise this, the Federal government delivers funding through the Federal Funding Agreement Schedules (FFAs) - Infrastructure, which replaced the now-superseded National Partnership Agreement (NPA) on Land Transport Infrastructure Projects (2019-2024). There are

several funding mechanisms within the FFAS but the main delivery mechanism is the Infrastructure Investment Program (IIP). Funding allocations for each State and Territory are set out in the Federal budget (2024-2029).

Public transport infrastructure policy at the federal level is primarily overseen by the Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRCA). As the lead regulator, DITRCA is responsible for administering the NLT Act 2014, managing the IIP, and coordinating state agreements through the FFAs. Supporting this framework is Infrastructure Australia (IA), an independent statutory body that assesses business cases for major infrastructure projects to guide funding decisions and strategic priorities. Meanwhile, the National Transport Commission (NTC) leads national efforts to harmonise transport regulations across jurisdictions. Although it does not oversee funding directly, the NTC plays an important role in shaping consistent laws and standards such as improved safety, productivity, environmental outcomes and regulatory efficiency. Coordination across these entities occurs through the Infrastructure and Transport Ministers' Meeting (ITMM), which serves as a forum for high-level decision-making and cross-government alignment on transport and infrastructure planning. Cross-government working groups (e.g., Infrastructure Decarbonisation Working Group) ensure common standards for materials, emissions, and mode-shift integration. Industry actors, finance partners, and research institutions contribute technical input and investment. This layered, interdependent governance model enables national emissions goals to be translated into public and active transport infrastructure.

Policies

National Land Transport (NLT) Act 2014

The purpose of this Act is to assist with national and regional economic and social development by providing Commonwealth funding to improve the performance of land transport infrastructure. Section 5 of the Act states that the Minister must determine a National Land Transport Network (NLTN) where the network includes existing and proposed roads and railways (Commonwealth of Australia, 2018, s.5).

The determination of the NLTN is important as it provides a reference for funding recipients and help to determine which recipients and projects are eligible as part of connecting the network. This ensures that funding is dedicated to projects that either are on, extend, or support that network.

Under the Act, funding recipients are approved for three main types of projects:

- Black Spot Projects: Target road safety improvements at locations with a history of serious crashes causing death or injury
- Investment Projects: Involve building or maintaining roads, railways, or intermodal facilities, or applying technology that improves transport efficiency, safety, or security.
- Transport Development and Innovation Projects: Support planning, research, and analysis of technologies or practices that enhance operations on the National Land Transport Network.

The Act funds land transport infrastructure projects such as roads and rail. This can be linked to projects such as busways and light-speed rail, significantly improving public transport accessibility. The Act also enables improvements using criteria that measure community access to services and employment, relevance to transport and land use plans, as well as the project's economic, environmental and social costs or benefits.

Roads to Recovery Program

The Roads to Recovery Program is an independent Commonwealth program that funds $1 billion annually to local governments' road works including but not limited to widening and intersection upgrades. These are projects outside of the major, state-managed infrastructure pipeline (DITRDCA, 2024). This provides local councils with the ability to decide road work priorities based on a community's needs. The amount of funding each council receives is based on a set formula which takes into account factors such length of the road network, population size and freight loading. The program limits funding to road infrastructure works such as repairs, upgrades, resurfacing, and safety improvements, and therefore, it rules out direct major improvements such as buying buses or building stations. However, improvements such as intersection upgrades can shorten bus travel times, which indirectly benefits public transport.

Infrastructure Investment Program

The program is the main mechanism for the federal government to set aside a multi-year (10-year) budget for land transport infrastructure projects. This program is administered by the DITRDCA and is reported each year in the federal budget. The current pipeline is roughly $95 billion out of the $120 billion funding for land transport infrastructure. The program is only eligible for funding that can be considered for approval under the NLT Act 2014. Funds are first earmarked through the Federal budget, and then passed to DITRDCA, which then releases funds to States and Territories, provided that an intergovernmental agreement has been made and is in place (previously was the NPA, and now it's the FFAS), and the project is approved under the NLT Act 2014.

By co-investing alongside State and Territory programs, the IIP allows the Australian Government to shape major transport corridors and advance national priorities such as decarbonisation of the transportation network, which are ultimately guided by the Infrastructure Policy Statement's (IPS) principles of productivity, sustainability, safety, network resilience, liveability, housing supply and population growth, while still respecting State and Territory delivery responsibility (DITRDCA, 2023).

Active Transport Fund

The program's purpose is to increase participation in active transport by upgrading existing bicycle and walking paths and building new ones across Australia (DITRDCA, 2024). The program was established under the National Road Safety Strategy 2021-30 and is guided by three principles: improving road safety; reducing transport emissions; and, building active and liveable communities. The 2024–25 Federal Budget provided $100 million over four years to establish the National

Active Transport Fund, with submitted proposals targetting improving road safety, emission reductions, and better community connectivity (Bicycle Network, 2025).

FFAS-Infrastructure (2024-2029)

The purpose of the program is: the delivery of specified initiatives in the Infrastructure Sector; providing a framework to reduce the complexity in the funding arrangements to States and Territories (Schedules) while maintaining accountability and transparency; and, the reduction of overall agreements through consolidating the NPA into the FFAS (Commonwealth of Australia, 2024). The objective of the agreement is to build a national land transport system that contributes to principles guided by the IPS. Additionally, the Agreement also aims to ensure that co-investment delivers these outcomes:

- Safer, upgraded and well-maintained roads/rail.
- More resilient freight and supply corridors.
- Inclusive economic growth, with First Nations and workforce training benefits.
- Reduced embodied emissions on the path to Net Zero by 2050.
- A more competitive and productive construction market.

The sustainability of the program is assessed through themes of decarbonisation and circular economy principles. National Carbon Values (NCVs) are nationally determined monetary values placed on GHG emissions in transport infrastructure business cases and expressed in dollar per tonne. The values can be found under IA's valuing emissions for economic analysis guidance, which provides an evidence-based estimate that is aligned with the federal government's emission targets (Infrastructure Australia, 2024). This ensures there is a consistent and comparable evaluation of the project's net present value and benefit-cost ratio results across each jurisdiction. Under the FFAS, any projects seeking Commonwealth funding must align with the IPS principles, apply the NCVs assessment, and report on recycled material use. This indicates that public transport project proposals that achieve larger emissions reduction and higher recycled content receive higher funding priority. Overall, the agreement uses funding carbon values and circular economy metrics to ensure the infrastructure pipeline is advancing toward low-carbon, sustainable transport infrastructure, supporting Australia's net-zero goal for 2050.

Transport and Infrastructure Net Zero Consultation Roadmap

The roadmap provides guidance for transport infrastructure to achieve Net Zero with several guiding principles, including: maximising emissions reduction and economic opportunity, value for money, being inclusive and equitable, as well as being evidence-based (DITRDCA, 2024). The roadmap suggested that the government can support the transition to Net Zero as a leader through establishing mode share and investment targets for active and public transport, urban planning and zoning reform, road pricing reforms, technological innovations, and public awareness and education. As an investor, the government can encourage expansion of public transport services, electrification of public transport, active

transport infrastructure improvements, integration of active transport with public transport, and provide incentives for them.

Initiatives should be focused around heavy vehicles, rail, and transportation infrastructure. This includes establishing foundational infrastructure for zero-emissions heavy vehicles, which covers the installation of infrastructure for hydrogen refuelling, electric charging stations, and the regulatory acceptance of low-emission fuel substitutes. In order to facilitate the wider adoption and lower costs of trucks that run on hydrogen and electricity, the emphasis will change to the development and integration of these networks in the 2030s. By the 2040s, widespread uptake of zero-emission heavy vehicles is expected, alongside a nationally coordinated refuelling and recharging grid. For rail, the initial priorities should focus on the piloting of emerging low-emission technologies and the development of initial charging and refuelling hubs. Conventional diesel engine systems will start to give way to battery-electric and hydrogen-powered systems in the 2030s. It is projected that liquid fuel systems will gradually be phased out from the rail industry as these zero-emission technologies take over by the 2040s. In terms of priorities for transportation infrastructure, standardising emissions measurement procedures and hastening the use of lower-carbon building materials like sustainable cement and green steel are examples of early initiatives. The construction industry will be directed to attain net-zero emissions in material inputs and operational procedures by the 2030s. By the 2040s, sustainable and low-carbon materials are expected to be mainstreamed.

Other policies

Policies that complement transportation planning include: the National Urban Policy (2024), which was created to give Australia an updated national framework that tackles housing, climate and economic challenges by guiding federal investment toward building more liveable, sustainable, and resilient cities and communities (DITRDCA, 2024). The 2021 Australian Infrastructure Plan, which is Infrastructure Australia's 15-year reform blueprint, which covers Australia's transport, energy, water, digital, waste and social infrastructure systems (Infrastructure Australia, 2021). The 2021 Australian Infrastructure Plan emphasises the importance of integrating social, economic, environmental, and governance goals into all infrastructure investments. The Aviation White Paper, which links decarbonisation around four themes (DITRDCA, 2024), including: building a domestic Sustainable Aviation Fuel (SAF) market (DITRCDA, 2025); supporting alternative technologies development such as electric and hydrogen-powered aircraft and introducing investment support initiatives from national funding bodies; decarbonising the industry; and working with international partners and taking part in international aviation agreements, to achieve goals such as encourage SAF use in the Asia-Pacific region, and support broader climate partnerships like the Australia–US Clean Energy Compact. The paper also highlights the new Regional Airports Program driving stronger public-transport connectivity in regional Australia (DITRDCA, 2024). Additionally, the new Airports Regulations 2024 requires the Minister to assess each leased federal airport's decarbonisation measures when approving master plans or major developments (Commonwealth of Australia, 2024). Collectively, these initiatives will help redirect

passenger and freight movements towards a more sustainable, low emissions and connected national network.

Limitations and gaps of current polices

Common issues across the current policies include a lack of legally binding targets, the absence of enforceable KPIs, the advisory nature of many policies, a lack of outcome-based funding levers, and the ability of ministerial or political discretion to override policy standards. The limitations and gaps of policies can be identified for each specific policy, which can be broadly grouped into funding and legislation, strategic and planning frameworks, and sector specific decarbonisation strategies.

Funding and legislation

The National Land Transport Act 2014 contains no statutory objectives requiring the Minister to prioritse low-emission or mode shift projects, even if recommended by Infrastructure Australia, indicating high emissions projects can still be funded. Moreover, there are no thresholds set for NCVs, thus, business cases can still be approved regardless of their high carbon cost. This is because NCVs are part of the evaluation process but not pass/fail criterion. Additionally, the Act has been criticised for lacking enforceable criteria to ensure projects are nationally significant or independently assessed (Terrill, Roundabouts, overpasses, and carparks, 2022), and thus allowing politically motivated projects to be funded. Despite recommendations made in 2022, the Act remains unchanged. The Minister still has full discretion to approve road-heavy projects, even when more sustainable alternatives exist.

For the FFAS-Infrastructure 2024, sustainability KPIs (NCVs and recycled content reporting) are included in project evaluations but are not tied to enforceable funding conditions. The sunset clause only applies when project delivery milestones are not achieved. As a result, there is no mechanism to withhold or adjust funding based on a proponent's poor performance on outcomes in emissions or circular economy principles. Although the FFAS rightly prioritises nationally significant projects, local governments have raised concerns that small scale, high impact upgrades (e.g. bus priority lanes) are being sidelined (EW, 2024). This concern is further supported by data that shows 90% of total cost overruns come from just 17% of projects (Terrill, 2016). This suggests the need for a stronger, legally enforceable evaluation tied to funding conditions.

The Active Transport Fund is insufficient and time-limited, providing only $100 million from 2024-25 to 2028-29. This is because the program is not indexed to the $95 billion IIP pipeline, therefore, cannot extract funding from it, and is not delivered through the FFAS. Although the fund requires State, Territory or local governments to contribute co-funding, it is not an ongoing program which raises concerns about long-term participation. This is further supported by research, which found that less than 1% of road funding is spent on active transport, indicating that current initiatives are well behind in addressing issues (Adhikari, Ryan, & Harrington, 2024). Additionally, there are no KPIs for emissions reduction or connectivity. Without clear performance outcomes, projects risk being implemented for funding access rather than delivering real mode-shift benefits.

Strategic and planning frameworks

The Australian Infrastructure Plan 2021 lacks measureable goals, making it hard to track progress. While the blueprint introduces many reforms, it lacks publicly accessible data with KPIs to showcase progress. It has also been recommended to link the Plan to dedicated Federal funding to address these and other issues. However, achieving this is likely to require broader national policy changes such as introducing demand-side levers like congestion pricing to make active and public transport more attractive, which are outside of IA's direct role (Williams, 2022).

It has been suggested that the National Urban Policy 2024 lacks clarity regarding Federal, State and Territory, and local government responsibilities, as well as a strong national vision for how cities and suburbs contribute to sustainable transport (Dewar, 2024). The policy lacks a clear implementation timeline or accountability mechanism. Additionally, the policy also lacks a publicly visible data with measurable targets, making progress hard to track.

It has also been suggested that the Transport and Infrastructure Net Zero Consultation Roadmap lacks clear numeric targets aligned with Net Zero (Climate Council, 2024). Additionally, the roadmap over-relies on future technology advancement and neglects the need to reduce overall travel demand through public transport and active transport (Climate Council, 2024; Bicycle Network, 2024). It also lacks a clear policy commitment to phase out petrol/diesel vehicles sales and remove fossil fuel subsidies, both of which undermine Net Zero efforts (The Australia Institute, 2024).

Sector specific decarbonisation strategies

The SAF funding initiative provides only a small pilot sum, and development of SAF would benefit from greater government support in order to create long term conditions to scale SAF and support sustainable aviation (Qantas, 2023). The Reginal Airports Program lacks sufficient and stable funding to ensure long-term commitment, which limits regional airports' capacity to provide connectivity and basic service levels, let alone sustainability upgrades (Australian Airports Association, 2025).

Recommendations

Firstly, it is recommended to address the legislative gap that allows ministerial discretion over fossil fuel heavy projects. To avoid this, it is recommended that the National Land Transport Act be amended to include binding sustainability provisions. Funding approval should be subject to when a project: passes a carbon cost-effectiveness threshold (using NCVs) and demonstrates a significant mode shift or reduced dependence on light vehicles. Additionally, the Act should require the Minister to either follow IA's independent assessment or, at a minimum, be subject to a formal review process before project approval. This mechanism would ensure the Minister's decision is screened to verify whether IA's recommendations have been properly considered or justified and amended if necessary. These changes would ensure legally binding sustainability targets in project approvals,

tying funding to clear and measurable outcomes, and limiting politically motivated approvals (Terrill, 2016; Terrill, 2022).

To improve the effectiveness of the FFAS program , KPIs should be made enforceable. For example, if a project fails to meet its KPIs, federal funding should be withheld, ensuring these indicators are not merely symbolic but tied to accountability and measurable performance outcomes. Additionally, to support small-scale, high-impact projects often overlooked in competitive funding rounds, FFAS funding should be allocated to “low-hanging fruit” initiatives, such as bus priority lanes and pedestrian infrastructure. This proposal is supported by evidence from local governments reporting that large-scale projects often dominate funding allocations (EW, 2024).

The Active Transport Fund should be expanded to account for at least 5% of the $120 billion IIP, which equals to $6 billion annually. The fund could also be made “permanent” under the 10 year pipeline making it long-term and also bring it under the FFAS rule, meaning States and Territories provide co-funding, and NCVs and recycled materials reporting would also apply to the fund. This fixes the current state of the fund that is insufficient and time-limited by embedding it into a nationally coordinated outcomes-based condition funding framework. This recommendation is supported by research which found that less than 1% of road funding goes to walking and cycling infrastructure, and recommends setting a 5% minimum benchmark (Adhikari, Ryan, & Harrington, 2024).

A centralised, publicly accessible KPI dashboard should be developed to track progress on key federal transport initiatives, such as NLT Act project outcomes, FFAS KPIs, Net Zero Roadmap timeline implementation commitments, and Active Transport Fund outcomes. This public dashboard can be overseen by IA and provide quarterly updates and open data since this is the jurisdiction that analyses business cases. By adopting this initiative, this can ensure that performance is held accountable and is transparent to the public. Moreover, this can provide a platform that turns strategic plans into visible actions. This recommendation is supported by the PIA, which has also critisied the current lack of public progress tracking (Williams, 2022).

Australia should transition from a fuel excise model to a distance-based road user charge. This would require drivers to pay per kilometre driven regardless of which fuel type is used. As EV adoption increases, fuel excise revenue (currently 47.7 cents per litre) is declining because EVs don’t use petrol or diesel (ABC News, 2023). A distance-based road user charge would ensure all drivers contribute the same and help maintain revenue during the low-emission transition which could eventually replace the fuel excise. To maintain equity for low-income and regional drivers, the scheme should also include targeted rebates for these groups. The revenue raised would then be directing specifically toward transport initiatives that reduce dependency on private light vehicles, such as bus corridors, active transport infrastructure, and first and last mile connections (e.g. micromobility). This reform is supported by the Grattan Institute, which recommends replacing declining fuel excise with a distance-based charge and directing some of the revenue to fund public and active transportation (Terrill, 2019).

public health and food security

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Food insecurity currently affects between 4-13% of the Australian population (Australian Institute of Family Studies, 2020), meaning that approximately 3.4 million Australian households (Food Bank, 2024) do not always have access to sufficient, safe and nutritious food that meets dietary needs and preferences (World Bank, 2025). This is an issue which disproportionately affects disadvantaged population groups, particularly those from low-socioeconomic backgrounds and those of Aboriginal and Torres Strait Islander origins (Australian Institute of Family Studies, 2020). Food security can be better understood through four different dimensions (World Bank, 2025):

- Availability: referring to the physical supply of food as impacted by the food supply chain.
- Access: even if there is availability of food, due to factors such as income, expenditure, markets and prices influence the ability to economically and physically access food.
- Utilisation: understanding how to obtain and prepare good quality food and maintain a diet with sufficient diversity and nutrients is key to food security.
- Stability: securing good quality and sufficient food intake in a consistent manner, which may be threatened by various external factors such as weather, political instability, and economic factors.

Food insecurity can be conceptualised as either chronic or transitory (Australian Institute of Family Studies, 2020). The former is experienced on a long-term basis, typically when income is not adequate to sustain sufficient, appropriate and quality access to food. The latter is acute due to a short-term shock, for example, due to a natural disaster or pandemic. At the same time, food insecurity can be understood as a continuum, ranging from mild to severe (Australian Institute of Family Studies, 2020).

Although Australia is one of the most food secure countries in the world (Department of Health and Aged Care, 2022), the issue of food insecurity certainly still exists, and poses a significant public health risk to Australia. When people cannot access high-quality food to maintain a sufficient, diverse, and nutritious diet, this can cause adverse physical, emotional, psychological and social health outcomes (Selvwright, Callis and Flatau, 2020). It has been established that food insecurity can impact health by increasing smoking levels, alcohol consumption, malnutrition, consumption of low cost and energy-dense foods, consumption of carbohydrate-based meals, and can cause delayed childhood development and reduced consumption of plant-based foods (Parliament of Australia, 2023). A poor diet can introduce the double burden of disease, when the prevalence of undernutrition and non-communicable diseases such as obesity, cardiovascular disease and type II diabetes coexist in a population (Min et al., 2019). In Australia, it has been established that food insecurity can contribute to the development of these various diseases (Australia Institute of Family Studies, 2011). Specifically, food insecurity in Australia has been linked with nutrient deficiencies, metabolic changes, chronic disease, stress, loneliness, depression, and reduced self-reported scores in areas of physical health as well as social and psychological wellbeing (Seivwright, Callis and Flatau, 2020).

Food insecurity also has widespread societal implications, as its associated adverse health effects hinder an individual's ability to participate economically and socially. This may stunt economic growth in Australia; decreasing productivity, increasing dependence on social welfare, and causing negative cultural consequences including increased inequality and decreased quality of life (Seivwright, Callis and Flatau, 2020). This situates food insecurity as a key public health concern for the Australian Federal government.

While food security itself is considered a social determinant of health (World Health Organisaton, 2024), food insecurity is a complex public health problem which interacts with other social determinants of health, including income, employment, education, housing, social inclusion, and structural conflict (Australian Institute of Health and Welfare, 2024). Certain population groups, therefore, may be at a greater risk of experiencing food insecurity. Some of these groups include low-income earners, people who are socially or geographically isolated, people from Aboriginal and Torres Strait Islander origins, Culturally and Linguistically Diverse (CALD) groups, single-parent households, older people, people experiencing homelessness (Australian Institute of Family Studies, 2020), as well as children, people who live with a disability, are unwell or frail, and people who experience substance misuse (Australian Institute of Family Studies, 2011). From a public health perspective, these groups should be targeted via equitable policy targets in existing and future Australian policy and legislation on food insecurity. While there are various determinants which shape the issue of food insecurity in Australia, there are external factors which operate beyond the individual level, which should be better managed by governments, businesses and institutions, including but not limited to climate change.

Climate change provokes food insecurity primarily by interfering with weather systems which determine agricultural productivity. As greenhouse gas emissions increase, so too do natural disasters and erratic weather patterns. Climate change can increase the frequency and intensity of natural disasters such as fires, floods, and storms, while also increasing extreme weather patterns such as temperature extremes, increased rainfall, and drought (Mirzabev et al., 2023). These changes impact the productivity of food systems, resources, and outputs, including livestock, aquaculture, crops, and fisheries. More specifically, climate change has been found to reduce crop yields and crop variability, increase harvest failures, cause livestock loss (Kingwell, 2006), alter water availability and quality, cause heat stress, alter phenology and ecosystems, increase water scarcity, spread disease amongst livestock, alter aquatic ecosystems including the poleward movement of marine and freshwater aquatic species, cause a loss of aquatic species due to ocean acidification, and increase biosecurity risks through the spread of pathogens and mycotoxins by interfering with the pest and disease environment (Mirzabev et al., 2023). Other key climate change effects pertaining to food security include soil runoff caused by increased rainfall which affects the nutrition of soil and increases the need for synthetic fertilisers (ABC News, 2024). While the use of synthetic fertilisers supports agricultural output, their use deepens the problem of climate change due to the energy required to produce them, in addition to affecting soil health, micronutrient content in food, and human health at large (Bailleau, 2023). Weather changes induced by climate change can also disrupt the food supply chain past the production point by causing infrastructure damage and harm to personnel who work in climate-sensitive sectors (Mirzabev et al., 2023). In addition, climate change is associated with greater social conflict which may impact global food supply chains (Bowles, Butler and Morisetti, 2015). Climate change not only threatens food security through its direct impacts on the food supply chain, but also indirectly through its impact on broader health, peace, mobility, poverty, water security, and changes in ecosystem, infrastructure and biodiversity (Mirzabev et al., 2023). As a result, the most vulnerable population groups are more likely to be adversely affected (Adom, 2024).

At the same time, the food consumption patterns of Australians influence the environment and climate. Demand for food puts pressure on the agriculture system to sustain levels of productivity that require a high use of land, natural resources, and artificial fertilisers which contribute further to greenhouse gas emissions. The global food system contributes to between 21-37% of anthropogenic greenhouse gas emissions (Forbes et al., 2021). Climate change, therefore, cannot be truly mitigated without addressing the impact of our food systems on greenhouse gas emissions. Not only does demand for quantity, but also demand for type of food, influence climate patterns and emissions levels. It has been found that the immediate adoption of a plant-based diet, globally, could reduce demand for land by approximately 76%, reduce greenhouse gas emissions from food by 49%, as well as reducing acidification and eutrophication by up to 50%, and a reduction in freshwater withdrawals by 19% compared to 2010 (Feigin, et al., 2025). These figures emphasise the significance that human food consumption has on planetary health.

Australia's food system

Australia's agriculture system contributed to approximately 19% of greenhouse gas emissions in 2024 (Department of Climate Change, Energy, the Environment and Water, 2024). In 2020-21, agriculture produced 16.8% of Australia's net greenhouse gas emissions, comprising 79% methane emissions, 18% nitrous oxide emissions, and 4% carbon dioxide emissions (Department of Agriculture, Fisheries and Forestry, 2023). Emissions from agriculture have reduced by approximately 1% since 2023, mostly attributable to a decrease in crop production (Department of Climate Change, Energy, the Environment and Water, 2024). Australian farms provide 93% of domestic food supply (National Farmers Federation, 2018), while also exporting more than 70% of its production (Department of Agriculture, Fisheries and Forestry, 2023). Consequently, agriculture makes up a large component of Australia's economy. Australia's agriculture system utilises a significant amount of natural resources. Specifically, it occupies 55% of land use, 74% of water consumption, and 10.8% of goods and services exported (Department of Agriculture, Fisheries and Forestry, 2025).

Australia has one of the most variable climates, which is only being intensified by climate change through rising temperatures, changes to rainfall and drying patterns, invasive pests, diseases and weeds, and increased frequency of extreme weather events including drought, fire, floods and storms (Department of Agriculture, Fisheries and Forestry, 2023). Changes in seasonal conditions have decreased annual farm profits by approximately 23% (Department of Agriculture, Fisheries and Forestry, 2023). Although new technology, improved irrigation and pasture systems, adoption of climate prediction and risk management tools, biosecurity practices, moving cropping to higher rainfall areas, and practices of conservation tillage and soil amelioration have been shown to slightly offset these impacts (Department of Agriculture, Fisheries and Forestry, 2023), there is still an urgent need to better support Australian farmers to adopt new climate-resilient technologies and practices which also safeguard their revenue and the production of enough nutritious food for Australia's population into the future.

Carbon emissions are intensive at all levels of the food supply chain, including the areas of transport, packaging, and household use. Approximately 10% of global greenhouse gases are caused by food waste, that is, food which is produced but discarded. In Australia, this equates to 17.5 million tonnes of CO2 each year (Food Bank, 2024). Recycling and recovery targets and the introduction of Food Organic and Garden Organic waste bins have reduced methane emissions at landfills (Department of Climate Change, Energy, the Environment and Water, 2024). Nonetheless, due to an increasing population, waste emissions are not predicted to decrease and will stagnate until 2040 (Department of Climate Change, Energy, the Environment and Water, 2024).

Policy

Australia's primary emissions reduction target is to reduce its emissions by 43% below 2005 levels before 2030 (Department of Climate Change, Energy and the Environment and Water, 2024). Despite legislating this target in the Climate Change Act in 2022 (Department of Climate Change, Energy and the Environment and Water, 2025), Australia is currently not on track to meet this goal (Grattan Institute, 2024). It has signed the three major international climate agreements including the Kyoto Protocol, The United Nations Framework Convention on Climate Change (UNFCCC), and most recently, the Paris Agreement (Department of Climate Change, Energy and the Environment and Water, 2024). The Australian government reiterates that it is working towards a net-zero future (CITE), however the environment, nor climate change, were incorporated into its 2025-26 budget priorities (Budget, 2025).

Although the Australian government has published policy and committed funding to facets of this issue, no policy on the issue of food insecurity caused by climate change has been developed. Some key policies, frameworks, and budget commitments which relate to this topic and demonstrate initial foundations for the federal government to build upon in relation to climate change and food security have been listed below.

National Health and Climate Strategy (Department of Health and Aged Care, 2023): This policy aims to address the impacts of climate change on Australia's population health and health system through fostering healthy and climate-resilient communities in a net-zero health system (Department of Health and Aged Care, 2023). This is the first of Australia's policies to elucidate the link between climate change and food security. Its use of a Health in All Policies (HiAP) approach, which is uncommon in Australian policy (Workman et al., 2024), demonstrates strength and leadership in addressing the problem of food security in relation to climate change. The National Health and Climate strategy put forward climate-smart initiatives to improve resilience and preparedness in food systems. These initiatives, however, are general and not necessarily measurable, making implementation and evaluation difficult. For example, initiatives to develop climate-smart agricultural practices, improving drought management, resilience and preparedness are not followed by specific deliverables by which this initiative can be achieved. Overall, elements of the National Health and Climate Strategy are worth building upon in future policy, particularly their use of a HiAP approach.

Climate Resilient Agricultural Development and Food Security (Department of Foreign Affairs and Trade, 2025): Australia contributes $245.1 million in official development assistance (ODA) to address food security in the Indo-Pacific region by providing emergency food assistance, providing technical and financial assistance to build long-term food resilience, developing social protection systems so there is a safety net for those affected by food price crises, and advocating for open, transparent, and predictable agricultural trade. This policy is integral to managing food security and demonstrates an understanding that the food security of Australia is tethered to the environmental and economic health of the Indo-Pacific region, a key trading network from where we source farm inputs and

export agricultural produce to. This policy however, further invests into regional and global food supply chains rather than reducing reliance on these systems and investing into localising food supply chains, therefore the ODA initiative is emissions intensive. In a country where 93% of food is produced domestically (National Farmers Federation, 2018), local and decentralised food supply chains have been found to be more environmentally and economically sustainable as well as conducive to strong community connections in rural communities (Carey, Murphy and Alexandra, 2022). Future policy should therefore continue to strengthen Australia's ODA for Indo-Pacific food security, while finding ways to boost resilience in its national food systems.

Feeding Australia (Minister for Agriculture, Fisheries and Forestry, 2025): The re-elected Albanese government has promised to improve climate resilience in food production systems and the agricultural supply chain to reduce food price volatility and cost at the consumer level, committing $3.5 million to this proposed strategy. Although only a pre-election proposal, if the re-elected government follows through on Feeding Australia, this proposal has the potential to be developed into a more durable and effective policy which demonstrates awareness of the issue of food affordability and access in an increasingly variable climate.

National Food Waste Strategy (Department of the Environment and Energy, 2017): This policy is aimed at progressing Australia's target to reduce food waste by half by 2030. Prioritising prevention over downstream resource reuse, recycling and reprocessing, the National Food Waste Strategy offers waste management practices to be employed by businesses and industry. The strategy has committed an additional $1.2 million to support key food relief organisations, which would be a key target area for any future policy on food security in Australia, especially as increasing numbers of Australians are accessing food relief (ABC News, 2023). The National Food Waste Strategy does not evaluate the effect of food waste on human health. It could become more robust by describing the effect of consumer behaviour and food supply chain waste on climate change and human health. Minimising food waste and improving circularity has been identified as a key action area for transitioning to a net-zero food system (CSIRO, 2023), therefore more ambitious food waste targets are required in future policy. A roadmap for reducing Australia's food waste by half by 2030 was developed in 2020 to build upon the National Food Waste Strategy, which substantiates this policy through implementation strategies which will also be key to incorporate in any further policy on food security and climate change, with a particular emphasis on State and Territory-based solutions (Department of Climate Change, Energy, the Environment and Water, 2020).

National Preventive Health Strategy (Department of Health and Aged Care, 2021): This policy is focused on improving the health and wellbeing of all Australians via prevention and systematic change. The strategy discusses the importance of safeguarding the natural environment due to its service provision including food, water, raw materials and medicines, pinpointing climate change as highly significant threat to human health in Australia. The National Preventative Health Strategy calls for a national policy to address food security in priority populations and recommends the delivery of nutrition education to improve population health

outcomes. The strategy stresses the public health implications of access to nutritious food, including "improving access to and the consumption of a healthy diet" as a focus area, however the policy fails to describe a climate-resilient food and agricultural system through which to achieve this focus.

National Obesity Strategy (Department of Health and Aged Care, 2022): A 10-year prevention strategy to reduce the prevalence of overweight and obesity in Australia, which has the fifth highest rate of obesity among OECD countries (Cancer Council, n.d.). This policy acknowledges the effect of access to nutritious and safe food on obesity and its associated comorbidities, positioning food security as a means by which health, social, and economic success is achieved. At the same time, this strategy recognises the environmental costs towards natural resources and ecosystems which dietary patterns and obesity can cause. The National Obesity Strategy also describes the impact of food marketing and dietary guidelines on obesity, which should be drawn upon in future policy on food security, as these have the potential to reduce emissions and reliance on other natural resources (Feigin, et al., 2025). The strategy examines how the problem of obesity is shaped by the social determinants of health, which must also be accounted for in future policy on food security. Unfortunately, this policy does not offer tangible solutions to improve food system sustainability to tackle the issue of obesity.

Healthy Food Partnership (Department of Health and Aged Care, 2023): Aims to promote healthy eating habits amongst Australians through collaborative efforts of government, the food industry and the public health sector. This policy recognises that poor diet is responsible for over 7% of the total burden of disease in Australia and is a main risk factor for years of healthy life lost to disease. This policy therefore endeavours to educate Australians on appropriate serving sizes and balanced diets comprising the 5 food groups, to develop a long-term education strategy, to work with industry and stakeholders to reduce sugar, sodium and saturated fat intake. These efforts have the potential to shape food system demands and by proxy, effects on the environment. To its disadvantage, this policy does not recognise the interconnectedness of climate change and healthy eating, and is more oriented towards improving dietary health and associated public health outcomes at the population level rather than through preventative intervention in the agriculture sector and higher up within the food supply chain.

Food Policy Index (Food Policy Index Australia, 2022): Provides a breakdown of current federal and state policy actions on food policy while also providing government-specific policy recommendations. This policy is valuable in that it emphasises the need for "a whole-of-government multi-sectoral approach" to reduce unhealthy diets and obesity. The policy is grounded in the public health principle of equity as it considers affordability for rural and regional communities, providing a breakdown of existing policy and best recommendations for each State and Territory, which is relevant for future food security policy when targeting the agriculture sector, which varies between locations due to climate variability. The Food Policy Index recognises that environmental sustainability must be considered in food policy and calls for policy reform of food systems to address food security,

which reflects a Climate in All Policies Approach (Stein and Dorner, 2024), which will be crucial to future policy.

Australian Dietary Guidelines (Department of Health and Aged Care, 2019): The guidelines provide advice to Australians on recommended food intake, including how much and what kind of foods to include and limit in their diet. These guidelines have the potential to shape dietary choices as they are Australia's leading form of dietary and nutrition education. Not all Australians are familiar with the guidelines, emphasising the need for better nutrition education in future food security policy. Furthermore, climate change considerations are not sufficiently factored into the guidelines, with too great an emphasis on meat and dairy as key food groups with understated environmental and human health considerations.

Practice Guide on Food Insecurity in Australia (Australian Institute of Family Studies, 2020): Provides information and evidence-based guidance on the problem of food insecurity in Australia, with a focus on how to support those experiencing food insecurity in Australia. The practice guide is valuable in addressing the social determinants which underpin food insecurity and emphasises the importance of education and financial assistance in mitigating food insecurity, which will be vital to include in future food security policy. The practice guide offers useful policy measures worth advocating for which can likewise mitigate the effects of climate change on food security such as encouraging disposal of surplus food via food banks or supporting local production of food. Unfortunately, the guide fails to recognise the role which climate plays in food access, availability and affordability.

Policies which are relevant to the broader issue of the effect of climate change on food systems, however do not directly relate to food security include: the Climate Change Act 2022, the Net Zero Plan, Emissions Reduction Fund/The Australian Carbon Credit Unit (ACCU) Scheme, the Future Drought Fund, the 2030 Roadmap, and Economy-Wide Net Zero by 2050, Vision 2050, the Australian Government Oceans Leadership Package, Agriculture Biodiversity Stewardship Package, Rural Research and Development Corporation Climate Initiative, the Carbon Farming Outreach Program, the Annual Climate Change Statement, Australian Red Meat CN30 Roadmap, Methane Emissions Reduction in Livestock Program, National Climate Resilience and Adaptation Strategy, and the National Statement on Climate Change and Agriculture.

These policies are lacking in their appreciation of the public health implications of climate change, particularly in relation to food security. These policies are grounded in the legislated target of reducing emissions by 43% below 2005 levels by 2030 (Department of Climate Change, Energy, the Environment and Water, 2022), working towards a net-zero future across all sectors, however Australia proves to be a laggard in both these endeavours (ABC, 2021). The emission reductions targets are insufficient, and efforts to build climate resilience in the agriculture sector are driven by economic gain rather than health benefits. Instead, future policy on this problem within the agriculture sector could prove more effective if the Federal government prioritises low-emissions technologies and practices, research and development into net-zero farming, and better carbon offsetting techniques (Grattan Institute, 2021), as well as investing into crop diversification to mitigate the

risk of food insecurity (Mihrete and Mihretu, 2025). More ambitious emissions reductions targets should be prioritised as well, although this will require concerted effort across all government sectors, all State and Territory jurisdictions, non-governmental organisations, and businesses (Oxford Economics, 2024).

Policy analysis

While the Australian federal government has published policies, strategies and frameworks designed to improve climate-resilience in the agriculture sector as well as to improve the nutrition of Australians, these two problems are primarily discussed in isolation, rather than as the dynamic and heavily interrelated problems they are. There is no existing policy which addresses the effect of climate change on agriculture and food systems in order to safeguard the food security of Australians. The only federal policy which elucidates this linkage is the National Health and Climate Strategy, yet the impact of climate change on food security remains only a component of this policy (Department of Health and Aged Care, 2023). Australia therefore lacks a comprehensive food policy in relation to the public health implications of food insecurity as caused by climate change's impact on Australia's food system. Australia should build upon the Federal Government's National Health and Climate Strategy to establish a strategy solely dedicated to mitigating the detrimental effect of climate change on food security. Such a policy could focus on how climate change impacts Australia's food systems, thereby posing a risk to the availability of nutritious, safe and sufficient food into the future, in effect threatening Australia's public health.

The new federal policy should be, first and foremost, led by a Health in All Policies (HiAP) approach, as well as a Climate in All Policies approach (CiAP). A HiAP approach is a synergistic effort to recognise the health implications of policy decisions across all sectors (World Health Organisation, 2025). It is underutilised in Australian policy and legislation and can be achieved by mandating Health Impact Assessments (HIAs) to measure the interrelatedness of policy decisions and broader health effects (Workman et al., 2024). HIAs may be advantageous in describing the interrelatedness of human health and climate change, as they can be used to evaluate climate change resilience in policy and projects and to assess the health co-benefits of climate change policies (Workman et al., 2024). Climate effects must likewise be factored into the development of this health policy, thereby building upon the concept of a Climate in All Policies (CiAP) approach (Stein and Dorner, 2024). The policy should also place food security in the context of public health by underpinning how policy must consider the social determinants of health, addressing the vulnerability faced by disadvantaged population groups to the issue of food insecurity.

The proposed policy should aim to strengthen Australia's food systems through increased financial assistance to support farmers, landowners and key stakeholders in the agriculture sector to promote the development of climate-resilient and low-emissions agricultural technologies and practices (Grattan Institute, 2021), which intensify and diversify agricultural production so that food supply and farmers' incomes are sustained long into a net-zero future. Additional financial attention should be granted to other levels of the food supply chain

including processing, transport, and distribution, where climate change may interrupt movement of food to consumers' plates (Mirzabev et al., 2023).

The proposed policy must also address the impact of Australian diets and food consumption on the environment. Recent research suggests that a public health approach which promotes plant-based dietary changes according to healthy eating guidelines and evidence has the power to reduce environmental pressures, nutrient deficiencies, and diet-related mortality more so than segregated climate and food security approaches (Springmann et al., 2018). Replacing animal-source foods with plant-based foods in high-income countries such as Australia can reduce premature mortality, and reduce environmental impacts such as greenhouse gas emissions, fertiliser application and cropland use (Springmann et al., 2018). At the same time, substituting an animal-based diet for a plant-based diet may cause increased freshwater use (Springmann et al., 2018). This is where it is important for the Australian government to prioritise localised food supply chains, encouraging the consumption of seasonal, local and native produce where possible, and investing into climate-resilient farming which keeps drought-management and resource protection at the forefront of its endeavours. Dietary guidelines and food legislation can therefore be altered in Australia to encourage a higher consumption of fruits, vegetables, legumes, and nuts, and to deter Australians from consuming excessive meat and dairy. Such changes have the power to alter production methods, technologies, commodity prices in Australia's food system and thereby shape environmental footprints and agricultural incomes (Springmann et al., 2018). Community food systems have also been found to address health and wellbeing by improving diets, developing social connection, promoting environmental stewardship and contributing to local economic development (VicHealth, 2024), and should be a focus of improving climate and nutrition outcomes in the policy.

Recommendations

The Australian Federal government should adopt the following evidence-based recommendations into a National Food Security & Climate Framework.

Build climate-resilient agriculture and food systems which are prepared to operate in a net-zero future by prioritising:

- More ambitious policy targets to reduce carbon emissions, including more Federal funding to help agriculture and land sectors move towards net-zero (Oxford Economics, 2024).
- Strengthening regional partnerships and continuing to contribute to regional and global food security to ensure that we can continue to import food and other agricultural inputs (Department of Foreign Affairs and Trade, 2025).
- Committing more federal funding and support for research and development into alternative farming practices so that Australia can sustain robust agricultural productivity into the future, including into a net-zero future (Grattan Institute, 2021).

- Increasing crop diversification in farming systems (Mihrete and Mihretu, 2025).
- Investigating how to localise and decentralise food supply chains to reduce emissions and support farmers and rural communities (Carey, Murphy and Alexandra, 2022).

Address the problem of food waste by:

- Setting more ambitious food waste reduction targets than what is set out in The National Food Waste Strategy, with an associated implementation plan (CSIRO, 2023).
- Supporting food waste initiatives such as OzHarvest through greater funding commitments and partnerships (Department of the Environment and Energy, 2017).
- Support State, Territory, and local governments to adopt effective food waste strategies at the local level, including educating individuals on the climate effects of household food waste (Department of Climate Change, Energy, the Environment and Water, 2020).

Address the effect of dietary patterns and consumer demand on climate change by:

- Adjusting dietary guidelines and nutrition education, which has the potential to reduce greenhouse gas emissions (Feigin, et al., 2025).
- Target the effect of food marketing on dietary choices (Department of Health and Aged Care, 2022).
- Incorporating taxes on discretionary food items (Department of Health and Aged Care, 2022).
- Localising food systems by encouraging engagement with community gardens, school breakfast clubs, and providing education on growing and consuming seasonal produce (VicHealth, 2024).

Recognise the public health effect of food insecurity, particularly on vulnerable population groups by:

- Improving education outcomes in relation to nutrition and food preparation within priority population groups and delivering these in a culturally and linguistically sensitive manner where necessary (Australian Institute of Family Studies, 2020).
- Developing strategies to subsidise the cost of food for priority population groups who are most likely to experience food insecurity (CITE).
- Commit greater funding to food relief organisations such as Food Bank and OzHarvest (Department of the Environment and Energy, 2017).
- Increase access to financial counselling to tackle the economic causes and impact of food insecurity (Australian Institute of Family Studies, 2020).
- Incorporate a Climate in All Policies (CiAP) approach (Stein and Dorner, 2024) and Health in All Policies (HiAP) approach (Workman et al., 2024) to the monitoring and evaluation of policy targets, including utilisation of health impact assessments (HIAs).

There are a number of implementation factors that should be considered when implementing a National Food Security & Climate Framework, based upon Parliament of Australia recommendations in their 2023 report 'Australian Food Story: Feeding the Nation and Beyond (Parliament of Australia, 2023), which includes:

- Develop a National Food Plan with defined objectives, measurable targets, and action plans which are subject to review.
- Appoint a Minister of Food within the portfolio of the Prime Minister and Cabinet to monitor and execute the framework and its associated plan.
- Develop a Food Advisory Board comprising relevant individuals with knowledge and backgrounds in the food and agriculture system, with an inclusion of First Nations expertise.
- Whole-of-government approach, working closely with State and Territory governments as well as local councils to deliver on policy recommendations.
- Multi-sector approach with partnerships across government, non-governmental organisations and businesses.
- Develop an Industry Advisory Board which would be responsible for identifying industry stakeholders, implementing policy recommendations, and mitigating risks to Australia's food system.
- Regular monitoring and evaluation.

Food insecurity is, and will continue to be, a key public health concern for the Australian government. As climate change causes weather systems to be more erratic and unpredictable, the Australian government will need to invest funding and resources into the agriculture sector and food supply chain to ensure that all Australians have access to sufficient, high-quality, nutritious food at all times. While the Australian government has begun to address some of these issues through initiatives such as the National Health and Climate Strategy and Feeding Australia, these are not sufficient to address the magnitude of the issue, particularly with respect to worsening future climate conditions and impacts. It is therefore important that the Australian government goes beyond these efforts by developing a National Food Security and Climate Framework as an initial step towards addressing this issue.

public health and heatwaves

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As the climate continues to warm, Australia is experiencing rising temperatures, with heatwaves becoming more frequent, intense, and longer-lasting. This trend is a growing public health threat, leading to more cases of heat exhaustion, heatstroke, and even death. Between 1900 and 2011, extreme heat caused over half of all deaths from natural disasters in Australia (National Museum of Australia, 2011), and a 2015 study found that heatwaves are costing the Australian economy approximately $8 billion every year because of lost work time and lower productivity (Milman, 2015). A recent study found that people with mental health issues, heart problems, diabetes, and breathing difficulties are more likely to die during heatwaves, with higher hospital visits especially among those with kidney, brain, and heart conditions (Amoatey et al., 2025). The danger isn't the same for everyone: older adults, children, outdoor workers, low-income and Indigenous communities, and those in rural or remote areas are all more vulnerable due to factors like poor heat regulation, limited access to cooling, and distance from medical services.

Australia's location and population spread make it harder to manage the effects of heatwaves. However, it is not only regional, rural and remote areas that will be increasingly impacted in a warming world. Cities in Australia are also vulnerable to heatwaves, which is amplified because of the urban heat island effect, where buildings, roads, and other surfaces trap, reflect and amplify heat, making urban areas substantially hotter than surrounding regions. This effect increases health risks during extreme heat events, particularly for people living in densely populated areas. Research shows that this effect can raise city temperatures by several degrees, with some studies showing temperatures being raised by up to 10°C during extreme heat events, especially at night (Tong et al., 2021). Heatwaves don't just affect health and productivity; they also hurt the economy across different industry sectors. For example, the Australian Climate Service says that extreme heat could cause crop losses costing over $100 million in the next few years (Australian Climate Service n.d.).

People living in rural and remote areas live with very hot weather, but they usually don't have easy access air conditioning or nearby medical services which makes it much harder for them to stay safe during heatwave conditions. Studies in Australia highlight that rural communities are particularly at risk due to factors such as limited health services, socioeconomic disadvantage, and inadequate infrastructure to manage and adapt to extreme heat. This uneven distribution of vulnerability means that while urban residents deal with intensified heat due to the urban heat island effect, rural and remote populations face compounded risks from both high baseline temperatures and reduced access to protective resources (Williams et al., 2013; Le, Adhikari, & Harrington, 2024).

Heatwaves are projected to increase in coming decades and centuries across the world, including in Australia. Even if global average temperature increase is limited to 1.5 degrees Celsius above pre-industrial averages, which is incredibly unlikely given a lack of political will to enact sufficient change, exposure to deadly heat levels will likely increase 50-100% in tropical areas and by a factor of 3-10 times in mid-latitude areas by 2100, making potentially lethal heatwave events regular occurrences (Vargas Zeppetello 2022). Australia was already experiencing heatwaves at levels that were predicted for the 2030s in the early 2010s, demonstrating that warming is accelerating beyond what climate models have initially predicted (Milman 2014), and Australia's government needs to be prepared for severe heatwave conditions in the near term.

Government policies on heatwaves

In Australia, public health governance is shared between the Federal, State and Territory and local governments. The Federal government looks after national coordination and funding while the State and Territory governments manage the health care systems and services. Local government takes care of community level support, mainly helping people during extreme or disaster events, such as heatwaves (Australian Institute for Disaster Resilience, 2022). As heatwaves are a matter that relates to health, natural disasters, and meteorology, there are several policies and governance mechanisms that can help manage this issue.

Federal government

In the last few years, the Australian Government has started taking more steps and actions to deal with heatwaves and related aspects. The National Health and Climate Strategy says that climate change is causing more health issues, including heatwaves, and that public health aspects of climate change should be included properly in health planning (Australian Government, Department of Health and Aged Care, 2023). The National Climate Risk Assessment and Adaptation plan work together to help Australia deal with climate change in a proper and planned way. The Risk Assessment finds out which climate change problems are more serious, and the Adaptation Plan shows what steps the government, businesses and people should take in response to such risks. Both are focused on working together, being better prepared, and protecting social and natural systems (Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2024). In 2023, the Federal Department of Health set up a special team called the National Health,

Sustainability and Climate Unit to guide how the health sector deals with climate change. The Unit helps carry out Australia's climate health strategy and brings together actions from different States and Territories (Huang et al., 2024). The Unit works on including climate risks in health planning, making hospitals more climate resilient, and advising the Federal government on extreme heat health policies. It also connects Federal health officials with others such as State health departments, hospitals, and the Bureau of Meteorology so everyone works together (Huang et al., 2024). This national approach means Australia can respond to climate-related health risks like heatwaves in a more coordinated way instead of leaving it up to individual States and Territories.

There are several federal tools and agencies that are specifically involved in heatwave management and response. For example, Australia has made a National Heatwave Warning Framework to give early warnings about heatwaves and to help government departments coordinate better. This helps everyone prepare in advance and respond more effectively and efficiently when extreme heat happens. It includes a heatwave warning system that clearly explains what each agency should do. The Bureau of Meteorology issues warnings when 10% or more of a weather district experiences a severe or extreme heatwave, based on three days of unusually high maximum and minimum temperatures for that location (Victoria State Government, 2024).

The heatwave service categorises events into three levels:

- Low-intensity heatwaves: Most people can cope with this level of event, which are considered to happen regularly during summer.
- Severe heatwaves: Less frequent events posing risks to vulnerable people, particularly the elderly with medical conditions
- Extreme heatwaves: Rare events posing risks even to healthy individuals (Australian Institute for Disaster Resilience, 2022).

The framework is being put in place through the Australian Warning System (AWS), which is a consistent way of giving emergency warnings for extreme events across all States and Territories. It uses three levels: Advice (yellow – be aware), Watch and Act (orange – take action), and Emergency Warning (red – danger, act immediately).

To improve access to climate risk information, the Australian Government set up the Australian Climate Service (ACS) in 2021. It brings together major science agencies like the Bureau of Meteorology, CSIRO, Geoscience Australia, and the Australian Bureau of Statistics (Australian Climate Service, 2024). The ACS was created after the national Bushfire Royal Commission to help communities become more resilient to climate change. One of its main jobs is to support disaster planning by combining data on hazards like heatwaves with information about local populations. Working with the National Emergency Management Agency, the ACS gives expert advice and data on climate risks, including extreme heat (Mirage News, 2023). Heatwaves are not usually handled the same way as other natural disasters such as bushfires, floods or severe storms. Australia's National Strategy for Disaster Resilience, created in 2009 by the Council of Australian Governments, is the main plan for managing disasters. It promotes a whole-of-

community approach, meaning everyone including governments, communities, businesses, and individuals shares the responsibility to prepare for and recover from disasters, not just emergency services (Council of Australian Government 2009). The National Emergency Management Committee with members from all levels of government leads this strategy, however such governance mechanisms often don't include heatwaves within natural disasters, instead focusing on events such as bushfires, flood or severe storms. Heatwaves are not necessary like these other types of disasters, which often happen quickly, but instead typically build up slowly and spread across wide areas, which makes them more difficult to manage in ways that align with traditional natural disaster response mechanisms (Council of Australian Government 2009). This makes cross-agency collaborations such as the Australian Climate Service incredibly important.

Other initiatives relating to heatwaves include the Heat Health Risk Index, which was introduced by the Federal government in 2024. This tool combines climate forecasts with local data such as people's age, health, housing, income, green spaces, and transport access to show how much heat risk each area faces. It shows that not all communities are affected by heatwaves in the same way, even if the temperature is the same, because some areas are more vulnerable due to factors like fewer trees, less access to services, or language barriers. The tool uses heat maps to highlight which places are most at risk so local councils and health services can focus their efforts, for example by opening cooling centres or planting more shade trees, in the right areas. This tool was created as part of Australia's first National Climate Risk Assessment and will continue to be improved with more data (McAllister, 2024). Another initiative by the Australian Government is the Caring for Older People in Heatwaves checklist for aged care providers. It gives simple and clear steps that must be followed by both home care and residential care services. This includes having cool rooms ready, making sure older people drink enough water, and having a backup plan in case there is a power cut. These steps help to protect the health of elderly people during hot weather (Department of Health and Aged Care, 2024).

Heatwaves can be managed beyond healthcare, natural disaster and meteorological mechanisms, including through building construction and infrastructure. The National Construction Code (NCC) 2022 made improvements to the standards for energy efficiency in homes in Australia, including through the Nationwide House Energy Rating Scheme (NatHERS) which raised the minimum thermal performance requirement to a 7-star rating. Specific cooling-load caps have been put in place to make sure that homes can stay comfortable inside without overly relying on air conditioning systems. The goal of these steps is to make homes more resistant to climate change and to use less electricity, especially when it's very hot (Australian Building Codes Board, 2022). Heatwaves also impact infrastructure more broadly, and Australia started taking serious steps to make its infrastructure ready for climate change through the 2021 Australian Infrastructure Plan, which talks about the need to build roads, buildings, and other infrastructure in a way that can handle problems like extreme heat. To support this, another document called A Pathway to Infrastructure Resilience gives clear advice on how

to design infrastructure that can face different types of climate risks (Infrastructure Australia, 2021a, 2021b).

State and Territory policies

While national leadership on heatwaves is limited, some State and Territory governments have taken stronger and more relevant action. For example, Victoria has a Heat Health Plan and alert system to coordinate health services during extreme heat (EMV, 2021); South Australia has an Extreme Heat Strategy (SA Health, 2024); and both Queensland and NSW include heatwave sub-plans under their disaster plans (Queensland Health, 2023; NSW Government, 2021). Some local governments have also developed heatwave specific policies, for example Blacktown City in Western Sydney has developed a heat refuge strategy, which is a local plan to protect people during extreme heat. It follows parts of the Australian government's disaster plan, including checking risks, giving early warnings, planning for emergencies, setting up safe places, and involving the community. It uses the NSW Heat Vulnerability Index and considers things like low income, not speaking English well, being Aboriginal or Torres Strait Islander, not having a car, and single-parent families. This has helped place heat refuges where they're needed most. The plan uses weather forecasts to start emergency actions when a heatwave is coming (Australian Journal of Emergency Management, 2022). These plans usually include when to take action based on temperature or heatwave warnings, who should send out health alerts, and what to do such as opening cooling centres or sharing safety messages.

Policy analysis

Historically, there has been no national heatwave risk management framework in Australia (Risk Frontiers, 2024). The Climate Council noted that heatwave strategies were primarily reactive, focusing on emergency healthcare and ambulance responses rather than proactive steps to protect communities ahead of time (Climate Signals, 2016). While having a National Health and Climate Strategy importantly recognises that every part of the health system, including State and Territory governments, needs to be involved for an effective climate and health response, there is a lack of clarity around the degree of involvement, ownership and accountability of different jurisdictions in regards to heatwave specific actions (Insight+ MJA, 2024). For example, data on heat-related illness and death may not be shared quickly between governments, and there's no national rule to make sure every State and Territory heatwave plan meets a basic level of readiness. Past events show why better coordination is needed. After the deadly 2014 heatwave in Victoria and South Australia, experts said Australia needed a more joined-up approach covering risk planning, healthcare, urban design, and community support to prevent future harm (Risk Frontiers, 2024).

Beneficial governance mechanisms include recent improvements to early warning systems, the implementation of the National Health and Climate Strategy and the National Health, Sustainability and Climate Unit, as well as responsible action in certain State and Territory and local government jurisdictions. Enhancing these pre-existing mechanisms will prove helpful towards mitigating heatwave risks, and

one way this can be achieved is by ensuring that alerts are well integrated into public services and systems, which will ensure that emergency services and hospitals have time to prepare for oncoming heatwaves. A study conducted to assess the impact of the heatwave warning system in Adelaide looked at heat-related morbidity, including ambulance callouts and emergency department visits, during a 2009 heatwave event and during a 2014 heatwave when the system was operational, and found a reduction in heat-related morbidity. While the findings demonstrated the importance of timely and well-structured public health messaging in mitigating the adverse health effects of extreme heat, the reduction in mortality was not as pronounced, indicating the need for further strengthening and fine-tuning of the system to ensure comprehensive protection, particularly for vulnerable groups (Nitschke et al., 2016).

The National Heatwave Warning Framework and Australian Warning System needs to continue its focus on easily understood colour-coded alert systems and enhancing public messaging to communicate how to stay cool, hydrated and avoid heat during these events. This system can be further improved upon by looking at lessons learned from other national emergencies like bushfires, floods and severe storms, and also by considering what has worked in similar successful systems in other countries with comparable climates or societies (Browne, 2024). Additionally, continued State and Territory level work is a key strength in Australia's overall response to rising heat risks, and the Federal government should recognise and rely on this strength. This includes through ensuring that vulnerable populations have access to emergency shelters and essential support services (Australian Institute for Disaster Resilience, 2022), as well as empowering State and Territory governments to undertake the groundwork of how to prepare, respond and recover from heatwaves, which could be further studied and used as models for national action. Several States and Territories now have strong heat and health plans and early warning systems in place (Climate Signals, 2016).

The Reducing Illness and Lives Lost from Heatwaves (RILLH) project is an example of how different government agencies in Australia can successfully work together to tackle the growing threat of extreme heat. This project involves key national bodies such as the Bureau of Meteorology (BOM), the Department of Health, the Australian Bureau of Statistics (ABS), and Geoscience Australia. By collaborating and linking their data, these agencies are able to identify which communities and individuals are most vulnerable to heatwaves. This allows them to develop more accurate and timely warnings, improve emergency response planning, and ensure that health services are better prepared to support those at risk. Through this kind of approach, the government is able to save lives, reduce illness, and strengthen Australia's resilience to extreme weather events caused by climate change (Physical Environment Analysis Network, 2021). The Federal government should embark on similar projects to ensure that all communities are protected from worsening heatwaves into the future.

Despite these positive examples of good governance there are still a number of areas that need improvement to ensure that heatwaves are appropriately managed into the future. A lack of a national framework is one such criticism. A recent analysis by Risk Frontiers (2024) found that despite some initial efforts by

various States and Territories, there is currently no dedicated national framework to manage heatwave risks. The study says that because heatwaves are quite complex, we need a combined effort from all stakeholders. This includes checking risks properly, helping vulnerable populations, improving city and land planning, preparing emergencies, and making sure both communities and businesses are strong enough to face extreme heat (Risk Frontiers, 2024). The integration of heat considerations within broader frameworks may reduce focus on the specific challenges posed by extreme heat.

Improving support for vulnerable populations is also another area where current governance can be improved. For example, studies show that some people are much more at risk than others during heatwaves. Those with mental health issues, heart problems, diabetes, and respiratory problems are more likely to be affected during extreme heat, and hospital visits also increase in number. However, current government policies do not give enough focus to these population groups. People in regional and remote areas and those living in Indigenous communities are often hit the hardest because they do not have enough access to healthcare or cooling resources (Amoatey et al., 2025). While we have basic understanding of the risks to these vulnerable populations, we need to enhance our knowledge about which areas and groups of people are most at risk during heatwaves. Vulnerability changes depending on location, income levels, and other social factors, but this is not well studied in relation to heatwaves. Many heatwave plans use information from other countries, and despite some initial work to understand Australian specific conditions, more work needs to be done to better understand the impact of heatwaves in vulnerable populations in Australia (Adnan et al., 2022).

Improvements to infrastructure and buildings is also another area that can be enhanced. For example, many rental homes do not have the required cooling or insulation standards, which disproportionately impacts low-income tenants, who may experience unsafe indoor temperatures during heatwaves. Advocacy groups have highlighted dangerously high indoor temperatures in rental homes, calling for mandated insulation and cooling standards to ensure tenant safety and comfort (Kelly, 2023). Our building codes and urban planning policies haven't kept up with the rising number of heatwaves. For example, we still see dark-coloured roofs being used, which make cities hotter. But changes in policy to fix such issues are still pending (News.com.au, 2024). Planting trees in cities and providing more shaded areas in public spaces can also be used as an effective and practical ways to reduce heat in urban areas and protect people, especially those who are more vulnerable. These actions are an important part of urban planning and climate-resilient infrastructure, as highlighted in both Federal and State and Territory level climate adaptation plans (NSW Government, 2021). Heatwaves can also severely strain energy systems, leading to power outages especially when cooling is most needed. A 2024 study highlighted that such outages during extreme heat events pose significant health risks, especially for vulnerable populations like the elderly and those with pre-existing conditions, and yet many policies still overlook the need to enhance energy infrastructure resilience against extreme heat (Bratanova et al., 2024). To respond effectively to heatwaves, we also need to improve health data, as heat-related illness and death data is often delayed or incomplete, since

some deaths are only confirmed as heat-related months later after coroner reports. This means the real impact of heatwaves is often unclear at the time. Australia is working on a project to create a system that reports heat-related deaths more quickly (Natural Hazards Research Australia, 2025).

There also exists issues regarding clarity in roles and resources for implementation, as well as mechanisms for evaluation, accountability, and improved public communication. The National Health and Climate Strategy needs to be improved to provide clarity about funding, training, and governance, for example, the strategy did not come with dedicated funding for heatwave measures (Insight+ MJA, 2024). Without proper funding or clear responsibilities, the plan might not be applied consistently across the country. It is also unclear how the Health, Sustainability and Climate Unit will work with State and Territory health departments during a major heatwave, for example whether it will coordinate national meetings, issue health advice, or leave it to each State and Territory to respond (Insight+ MJA, 2024). This needs to be addressed so that everyone understands their duties well before the next major heatwave. The absence of national targets or measurable indicators for assessing the effectiveness of these policies in relation to heatwaves is also something that needs to be addressed, as well as mature mechanisms for review and evaluation of policies.

Recommendations

There are several recommendations that can be made for strengthening Australia's approach to heatwave management, with a priority to be the development of a dedicated National Heatwave Strategy. Australia needs a national plan to deal with the health and wellbeing impacts of heatwaves, this plan should build on the resilience approach in the National Strategy for Disaster Resilience (Department of Home Affairs, 2011), but give more specific guidance for challenges related to extreme heat. Leaders from government, business non profit organisations, and communities need to understand the risks that disasters bring to their own work and the people they serve. They should take responsibility for reducing these risks and include disaster resilience in their planning and decisions, especially whey they can utilise their power to make a difference (Department of Home Affairs, 2011). Additionally, the lessons from successful State and Territory level initiatives, such as Victoria's heat health warning system, which has been effective in reducing the health impacts of extreme heat events (Victoria State Government, 2024), and Blacktown City's heat refuge approach (Australian Journal of Emergency Management, 2022), should also be incorporated.

Federal policies need to better identify and support people who are most at risk during heatwaves. Research shows that certain health conditions like mental and behavioural disorders, heart disease, diabetes, and lung problems make people more vulnerable to heat (Amoatey et al., 2025). To help with this, heat vulnerability indices should be created and tested using health data linked to specific causes. This will make sure they reflect real-life risks. These tools should guide how resources are shared and where support is focused, especially in communities with fewer ways to cope with extreme heat (Amoatey et al., 2025). Better integration between government and health systems would also be beneficial. For example,

the National Health and Climate Strategy lays the groundwork for including heat impacts in healthcare planning. This should be expanded to include clear protocols for dealing with heat-related hospital admissions, emergency visits, and ambulance responses (Insight+ MJA, 2024). Studies show that during heatwaves, more people go to hospitals for problems like kidney disease, stroke, heart disease, diabetes, mental health and neurological diseases. Knowing this can help health services prepare better for extreme heat (Amoatey et al., 2025). Extreme heat should also be treated as a disaster in law and funding. Unlike cyclones or bushfires, heatwaves don't always trigger disaster funding recovery payments. The Federal government should formally recognise extreme heat as a hazard eligible for disaster resilience and recovery funding (Insight+ MJA.2024). Doing so could unlock more funding for preparation such as through the Disaster Ready Fund, which already supports resilience projects and could specifically prioritise reducing heat risks (Department of Climate Change, Energy, the Environment and Water, n.d.).

Planning ahead to reduce heat risks is also advisable, and policy initiatives need to prioritise risk reduction proactively, before heatwaves happen, rather than in response to heatwaves after they occur. This includes preparing cities and health systems for periods of extreme heat well in advance, for example, by enhancing building codes to ensure that new homes have better insulation or designs that maintain safer indoor temperatures (Natural Hazards Research Australia, 2025). Heat-safe features can be added to existing homes, especially for vulnerable populations like older adults (Risk Frontiers, 2024). Increasing green spaces and cooling infrastructure across the country is also important. This could include a national program to plant trees and build cool refuges in every high-risk suburb. For these initiatives to be successful they need to be recognised as core parts of strategies and plans and given sufficient funding to be successful. But only by supporting heat-resilient buildings and public cool spaces can the health impacts of future heatwaves be reduced. (McAllister, 2024). Planning ahead also requires defining which jurisdictions and bodies have leadership roles and to invest in capacity of these jurisdictions to adequately respond to heatwaves. The Federal government should explicitly task a national body or coordinator (perhaps within the Health Sustainability and Climate Unit or at NEMA) with overseeing heatwave preparedness and response across jurisdictions. This leadership role would convene States and Territories, ensure plans are up to standard, and take charge during multi-state extreme heat emergencies. To succeed, the Federal budget must include steady funding for key actions like public education on heatwaves, grants to upgrade local cooling centres, research into heat illness treatments, and support for tools such as the Heat-Health Risk Index.

natural disasters

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Natural disaster preparation, response and recovery is key to combatting the effects of already locked in climate change impacts. Communities around Australia need the help of the Federal Government to support their needs with regards to natural disasters. It is therefore important that Federal Government policies enable government to support communities and stakeholders in dealing with natural disaster preparation, response and recovery. A recent example of a large-scale disaster is the Queensland outback flooding in March 2025, during which rains dropped up to four hundred millimetres of water on Western Queensland, resulting in extreme flooding that resulted in widespread devastation across a broad geographic area. During the response to this event the Disaster Recovery Funding Arrangements (DRFA) were used to respond in a joint Federal and Queensland Government funding arrangement. The areas of funding available included:

- Personal hardship and essential services.
- Freight for primary producers.
- Small businesses and not for profits.
- Counter disaster operations.
- Reconstruction and essential public assets.
- Community recovery.
- Coordinated emergency fodder and exclusion fencing restitution (Disaster Assist 2025).

Additionally, the Disaster Recovery Allowance is available to employees, primary producers and sole traders who can demonstrate they have received a loss of income because of flooding in Western Queensland (Disaster Assist 2025). Similar funding arrangements were available to those effected by Tropical Cyclone Alfred during March 2025 in both Queensland and New South Wales (Disaster Assist 2025). Unlike the Western Queensland flooding, which impacted rural, regional and remote areas, this weather system negatively impacted urban and suburban communities in and around Brisbane and other localities.

Another common natural disaster in Australia is bushfire. An example of a recent bushfire disaster are those that took place on the western coast of Tasmania in February 2025. During this event disaster funding was provided for emergency assistance grants, removal of debris, counter disaster operations and restoration of essential public assets. Funding was also provided for protection of environmental and cultural heritage areas along the West Coast (Disaster Assist 2025). Such events are not only impactful to communities, but also ecosystems, as demonstrated by the fact that these fires caused substantial damage to a world heritage site of forest and rainforests covering most of western Tasmania.

Australia is expecting to be facing increased extreme heat of many kinds such as hot days or warm nights, bushfires with a longer fire season, hail and damaging storms with increased risk of large hail, more flash flooding, more extreme cyclones, increased occurrence of droughts, sea level rise to impact coastal communities by coastal erosion and flooding as well as marine heatwaves to impact fisheries and the ocean environment in a changing climate (Australian Climate Service 2025). Because of this, it is important that Federal Government policies enable government to support communities and stakeholders in dealing with natural disaster preparation, response and recovery.

Current Government policy

Multiple policies have been developed and endorsed by the Federal Government to support natural disaster preparation, response and recovery. Starting at an international commitment then creating national policies and providing an action plan for Australia to follow. All key Australian policy uses the scope of contributions from all sectors of society. In addition to policies, multiple Federal Government agencies are responsible for the contribution towards the preparation, response and recovery of natural disasters each taking a different role. CSIRO is key to providing research on natural disasters whilst Services Australia provides funding to those in need during a natural disaster and afterwards. Disaster Assist is a website that provides all the required information to understand all declared natural disasters. Most notably the Department of Home Affairs has delegated its emergency management procedures to the National Emergency Management Agency, arguably the most important government body that guides policy development with regards to natural disasters.

NEMA

The National Emergency Management Agency (NEMA) is the key agency to lead the Federal Government's programs on natural disasters. The agency sits under the Department of Home Affairs. The purpose of NEMA is to enable more secure, stronger and resilient communities during natural disaster preparation, response and recovery. The vision is through partnership to build Australia's capacity for disaster resilience to support communities (NEMA 2024d). The agency partners with key Federal Government agencies and research institutes to reduce disaster risk often providing them with funding. Internationally the agency partners with the United Nations Office for Disaster Risk Reduction (UNDRR) who manages the Sendai framework as a key international policy. Another way the agency partners internationally is through forums to engage on risk management process such as

the Group of Twenty (G20) and Organisation for Economic Cooperation and Development (OECD). The agency is also involved in partnerships with Canada, New Zealand and the United States of America to collaborate on topics such as policy, research and management of natural disasters (NEMA 2024e).

The agency runs a range of programs and projects such as disaster funding arrangements in partnership with states and territories where funding is provided in a cost sharing arrangement, a stockpile for emergency shelter, emergency power and clean water, the national messaging system which is a nationally coordinated emergency agency operated information tool which targets individuals when a disaster strikes, the National Flood Mitigation Infrastructure program to support State and Territory governments to build flood protection infrastructure, the National Situation room which enables a whole of Government response through all hazard monitoring and reporting mechanisms which support stakeholders (Federal Government, State and Territory governments as well as industry and non-government organisations) for decision support before, during and after disasters. In addition, there are close working relationships with the Bureau of Meteorology and Geoscience Australia to ensure that all decisions are driven by relevant evidence-based climate, meteorological and Earth science information (NEMA 2025b). On top of this a key program is the National Coordination Mechanism (NCM) which is a tool that brings together government, industry and non-government organisations before, during and after a crisis to share information, solve problems and find solutions to stabilise situations. It works beyond natural disasters to look at the full scale of issues that may occur in Australia (NEMA 2025c).

Preparation

The Sendai framework for 2015–2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction from 14 to 18 March during 2015 in Sendai, Miyagi, Japan. During this conference nations of the world came together to organise their efforts on disaster preparation, response and recovery (United Nations 2015). In the preparation stage the framework seeks to understand disaster risk by research, human risk and environmental hazards, strengthen disaster risk governance by policies, regulations and incentives, invest in disaster risk reduction by both the public and private sector acting as funding sources, to promote preparedness for effective response and to recover, rehabilitate and reconstruct affected communities in a way that builds a better social future for communities.

The National Disaster Risk Framework operated under both the Sendai framework and a 2030 Vision for Disaster Risk Reduction in Australia. The vision seeks that all sectors of society:

- Make disaster risk-informed decisions.
- Are accountable for reducing risks within their control.
- Invest in reducing disaster risk to limit the cost of disasters when they occur (Home Affairs 2018).

Sitting beneath the vision, the frameworks 2030 Disaster Risk Reduction goals are to:

- Take action to reduce existing disaster risk.
- Minimise creation of future disaster risk through decisions taken across all sectors.
- Equip decision-makers with the capabilities and information they need to reduce disaster risk and manage residual risk (Home Affairs 2018).

The framework has four priorities. Priority one seeks to understand disaster risk by educating the public on the disaster risks and disclosing potential risk to all stakeholders. Ensuring that technology is in place to enable information and data availability that can be shared, and that communications capabilities can deliver disaster risk data and information, including integrating scenario modelling into planning, and enabling research into disaster risk reduction that is long term and solution driven (Home Affairs 2018).

Priority two seeks to address accountable decision making by considering potential loss and benefits in all relevant situations and the broad impact those decisions will have, as well as being able to identify the highest priority disaster risk and mitigation opportunities as well as building the capability of decision makers to support disaster risk policy, program and investment decisions. It attempts to ensure there are incentives for and addressing disincentives and barrier towards disaster risk planning, and well as ensuring that planning schemes are contemporary and continue to have a focus on the broad perspectives of sustainable development and also focuses on compliance with and embed resilience requirements in specialist disaster planning processes (Home Affairs 2018).

Priority three seeks to support enhanced investment by collaborating with commercial financing for disaster risk reduction projects, as well as developing tools to provide guidance on investment mechanisms. It also attempts to use existing and future government programs to fund priority risk reduction measures, identify additional potential and future funding schemes, improve the accessibility, variety and uptake of insurance and empowers communities, individuals and small businesses to make informed sustainable investments (Home Affairs 2018).

Priority four seeks to address governance, ownership and responsibility by establishing a national mechanism to guide disaster risk reduction efforts and cross sector dependencies. This includes through establishing a national implementation plan for the framework, supporting locally led action on disaster risk reduction, incentivise transparency of disaster risk ownership through personal and business transactions, reporting on disaster risk reductions progress, and creating clear governance structures for risk reduction projects (Home Affairs 2018).

Response

The response to a national disaster is the time directly before, during or immediately after a natural disaster (UNDRR. 2007). In Australia state-based emergency agencies, often partially run by volunteers, operate to support the communities impacted by a natural disaster. This would be adapted to a specific type of disaster. It is currently common in the worst scale of a disaster for the Australian Defence Force to be called in to support affected communities. There

are a number of federal policy and governance mechanisms to deal with natural disaster responses, many of which are maintained or coordinated by NEMA. These include emergency response plans, as well as the Australian Government Crisis Management Framework (AGCMF). Australia's emergency management arrangements bring together all stakeholders, including all relevant government entities as well as private industry and volunteer agencies to coordinate emergency management. This shared responsibility approach creates high levels of cooperation between stakeholders in a shared common purpose (AIDR 2023). The AGCMF adopts a four tier system based on the severity and complexity of a crisis, ranging from limited impact or complexity through to extreme to catastrophic impact or complexity, and it is through this framework that governance mechanisms such as the National Situation Room, the Joint Crisis Coordination Team or the National Coordination Mechanism can be activated. The Emergency Management and Response (EMR) Group is responsible for the development and maintenance of national emergency response plans, such as the Australian Government Disaster Response Plan (COMDISPLAN), and the Australian Government Space Re-Entry Debris Plan (AUSSPREDPLAN). The Department of Foreign Affairs and Trade is the coordinating agency for crises occurring overseas, and the policy instruments for guiding the national response to overseas incidents include the Australian Government Overseas Assistance Plan (AUSASSISTPLAN), the Australian Government Plan for the Reception of Australian Citizens and Approved Foreign Nationals Evacuated from Overseas (AUSRECEPLAN), and the Australian Government Response Plan for Overseas Mass Casualty Incidents (OSMASSCASPLAN, NEMA 2025a).

The COMDISPLAN is a key response instrument. This explains how the Australian Federal Government responds to non-financial requests for assistance from State and Territory Governments due to a disaster or emergency. It is only meant to be requested after a jurisdiction has exhausted all options to respond to a disaster (ANAO 2014). The NATCATDISPLAN is a national coordination plan for the Federal Government to respond to requests for assistance from State and Territory governments due to a catastrophic natural disaster where the jurisdictions capability to manage response and recovery from the disaster has been significantly incapacitated. One of the key differences between these two plans is that the COMDISPLAN is requested from the non-Federal jurisdiction where that jurisdiction is still able to function, even though its ability to respond to the disaster is exhausted or expected to be exhausted, while the NATCATDISPLAN refers to a more extreme scenario where the function of the State or Territory Government itself is substantially incapacitated, and may be activated by the affected jurisdiction or Federal government. To date the NATCATDISPLAN has never been triggered (ANAO 2024).

Recovery

The recovery from natural disasters is often left to individuals and families, local communities or State and Territory governments. However, Federal Government also supports recovery from natural disasters through both financial and non-financial mechanisms. The Disaster Recovery Funding Arrangement (DRFA) is a cost sharing agreement between Federal and State and Territory Governments. It

acts to reduce the burden on State and Territory Government and can cover up to 75% of funding allocated by the Federal Government. There are multiple ways the DRFA is used across Government and is designed to be flexible depending on the natural disaster (NEMA 2024a). To date several billions of dollars of Federal money has been provided to states for recovering from natural disasters (ANAO 2023). The Federal government coordinates a common understanding of the approach to disaster recovery through the Australian Disaster Recovery Framework (ADRF). The framework provides guidance on recovery through three key areas, which are: framework purpose and essential context, which is broken into guidance on recovery planners and practitioners, and recovery principles, characteristics and outcomes; recovery governance, which is broken into State and Territory arrangements and key Commonwealth legislation, activation of national and international jurisdictional coordination, and advice on working with recovery partners; and finally, recovery doctrine and policy (NEMA 2024b).

Research and analysis

Royal Commission

The Royal Commission into National Disaster Arrangements followed the impact of the 2019-20 Bushfires and the governments position to respond. The report outlined key recommendations some of which have already been implemented. The report sought to understand how Australia can improve its adaptation to natural disasters by preparedness, response and recovery. The report stated that the State and Territory Governments have primary responsibility but need a national approach that includes shared responsibility, more cooperation and coordination and accountability and assurance mechanisms. The report stated that the Federal Government must play a greater role in its assistance to states and territories by ways such as declaring a national emergency and deploying the Australian Defence Force (Royal Commission 2020). The report stated that "recovery will take years", and in the context of climate change bringing about multiple extreme natural disasters yearly, such a description is worrying. The Commission found that during the 2019-20 bushfires over 24 million hectares were burnt, at least 33 people died, over 3000 homes were destroyed, and the estimate of financial impacts was more than $10 billion, and the indirect impacts were felt across the nation. Recommendations made were numerous and broad, which included but were not limited to that (Commonwealth of Australia 2020):

- The Commission recommended developing a broader sovereign aerial firefighting industry through strategic procurement. For essential services, governments should review supply chain risks, improve real-time road closure information, and better coordinate critical infrastructure protection with operators during disasters.
- State governments should continue disaster resilience education programs while taking responsibility for ensuring local governments have adequate capacity for their delegated disaster responsibilities, including improved resource-sharing arrangements between councils.
- Evacuation planning reforms include improved roadside vegetation management, regular plan updates considering seasonal populations, and

nationally consistent terminology for sheltering facilities. Better community education about evacuation centres and cross-border coordination is also needed.

- The Australian Fire Danger Rating System and all-hazard Australian Warning System should be expedited with national consistency and comprehensive public education. Development of minimum standards for warning applications and exploration of a national emergency warning application were also recommended.
- Air quality information should be nationally consistent with real-time monitoring and targeted guidance for vulnerable groups. Health improvements include better integration of primary healthcare in disaster management and refined mental health services, while environmental data collection needs better consistency and collaboration.
- Public land managers should clearly communicate fuel load strategies and report annually on outcomes. Assessment processes for vegetation management need streamlining, while greater engagement with Traditional Owners should explore Indigenous fire management practices for disaster resilience.
- Governments should establish processes to communicate natural hazard risk information to households and require mandatory consideration of disaster risk in land-use planning. The insurance industry should provide clear guidance on recognised risk mitigation actions, while building codes need to consider evaluation for natural hazard effectiveness.
- Efficient arrangements for donated goods management and a single national charitable fundraising scheme should be established. The Disaster Recovery Funding Arrangements require comprehensive review including thresholds, consistency improvements, and broader incorporation of 'build back better' principles.
- Both Federal and State and Territory governments should establish independent accountability mechanisms for continuous improvement in disaster arrangements. All Royal Commission material should remain publicly accessible long-term for stakeholder benefit.

While the Commission made 80 recommendations, only 15 recommendations were directed exclusively to the Federal Government, all of which were adopted, resulting in a “significantly strengthened” ability of Federal government to support communities before, during, and after disasters (NEMA 2024c). While the Federal Government support or supported in principle most of the recommendations, it did not support the creation of a national aerial firefighting fleet (ABC News 2020).

Independent reviews

Despite the Royal Commission recommendations being adopted, a number of issues were raised with currently existing mechanisms. An audit of the AGCMF released in the second half of 2024 found that annual updates of the AGCMF, additional guidance in the AGCMF, and that an annual national exercise program were required. These recommendations were agreed to by the Department of the Prime Minister and Cabinet (ANAO 2024). An assessment of the DRFA released in 2023 contained three recommendations aimed at timeliness in DRFA assurance

activities, internal performance monitoring and external reporting. These recommendations were agreed to by the National Emergency Management Agency (ANAO 2023). However, government itself acknowledged the rapidly changing impact of natural disasters and how this will create increasingly worsening challenges for governments in the future by stretching its ability to respond to such events. One criticism is that currently a vast majority of expenditure is on response, recovery and relief, and that spending on preparedness, which was noted as 3% should be increased to 30%, and issues relating to coordination, communication and structure still exist and still cause problems (Commonwealth of Australia 2024).

The Independent Review of National Natural Disaster Governance Arrangements, also known as the Glasser Review, and the Independent Review of Commonwealth Disaster Funding, also known as the Colvin Review, were commissioned in 2023 in the context of "increasing size, scale, intensity, cost and complexity of natural disasters", with findings released in the second half of 2024. These reviews found that government mechanisms including the frameworks and arrangements are not keeping pace with how quickly natural disasters are worsening and changing in scope. Reform areas identified included clarifying the Australian Government's role in disasters and identifying priority outcomes; reforming recovery support mechanisms; uplifting national disaster governance arrangements to support policy and capability requirements; and, improving the evidence base that informs funding decisions. The recommendations support a strategic shift towards disaster risk reduction and resilience to reduce the impact of disasters. (Home Affairs 2024).

The Glasser Review states key areas for policy changes that include: strengthening coherence for natural disasters as well as other national risks, changing the National Emergency Management Ministers Meeting (NEMMM) and the Australia-New Zealand Emergency Management Committee (ANZEMC) to focus on all areas of disaster preparedness, response and recovery. Previously it was missing disaster preparedness and disaster risk reduction and to further resourcing the NEMA to become larger in scale and increase its operation (NEMA 2024f).

The Colvin review states several key areas for change in Federal Government that includes: changing the Federal Government role to prioritise a national funding model, have the responsible minister report to parliament require all federal departments to involve disaster risk reduction and resilience into strategic planning that is supported by a cross department committee, that NEMA should have a leadership role in each State and Territory to support capacity and investment operations, and implement national training and exercises to test and support local capabilities. The Federal Government should have a capability with accountability measures to capture and track all of its expenditure relating to natural disasters, and should convene a Disaster Management Advisory council to provide a constructive view on government decision making, prioritising government data collection and providing timely decision-relevant information and ensure states and territories are supported by funding (NEMA 2024g).

Other key findings from the Colvin review include adopting a National Natural Disaster Outcomes Policy to outline investment policies, ensuring that it is transferable to many types of investments, and consider natural, social, economic

and built environment factors across the preparedness, response and recovery processes. The Colvin review also suggested a Nation-wide Natural Disaster Risk Profile to understand the hazard, exposure, vulnerability and response with consideration to disaster risk reduction. This profile should form the basis of identifying and prioritising disaster funding as well as create an investment strategy, as well as the mandating of local governments to assess their risk towards natural disasters to support local action, and that the Federal government should seek to enhance relationships with non-government organisations and the private sector to support the role and understand the scope of different sectors and locations (NEMA 2024g).

Not-for-profits

Not-for-profits contribute to natural disaster preparation, response and recovery across the entire system. Not for profits contribute to community resilience by encouraging collaboration between organisations and community members, improving information sharing, and building greater community trust overall (McDermott and Volunteering Australia 2022). In a natural disaster context this helps the community mobilise and prepare for upcoming disasters. For example, the Red Cross provides training on crisis response processes and identifying areas of risk in the community as well as providing first aid training.

Not-for-profits deliver many of the key responses to natural disasters such as Foodbank that provides essential supplies, including food, water, groceries and cleaning products to those impacted by natural disasters. Foodbank also provides items that are scarce during the beginning of a natural disaster such as bottled water, batteries, toilet paper and foods that do not require refrigeration and cooking when there is no power in the area (Kasif 2023).

Not-for-profits contribute to natural disaster recovery and act to get people on the ground to volunteer. For example, BlazeAid is a not for profit that recruits volunteers to help to rebuild fences and other structures that have been damaged or destroyed during a range of natural disasters (BlazeAid, 2025).

Another not-for-profit that plays a role across the 3 stages is Disaster Relief Australia which is a veteran-led volunteer organisation incorporating veterans and other volunteers to support natural disaster affected areas by ways such as education on risks posed by natural disasters, incident management for disaster management activities, ariel damage assessment and mapping, work order management, debris removal and restoring access, chainsaw operations, basic house repairs, spontaneous volunteer management and logistics management (Disaster Relief Australia 2024).

With the not-for-profit sector so involved in the whole natural disaster preparation, response and recovery process there is a collection of research to understand the issues and opportunities available. NEMA hosted the Charitable, Not for Profit and Philanthropic roundtable in 2024 to understand the not-for-profit sectors involvement in disaster management and how it can be improved. Key outcomes from the roundtable were increasing government support and leadership for not for profits so they can better understand what role they can and need to play in

disaster management, being able to contribute to policy and program design, levels of burnout and exhaustion from those working in disaster response and disaster impacted communities, having access to more flexible funding with clearly defined outcomes and understanding through research of the social impact of natural disasters (National Emergency Management Agency 2024).

A senate inquiry titled Boots on the Ground: Raising Resilience, investigated the role of volunteers and not-for-profit organisations in natural disaster preparation, response and recovery. The inquiry noted that Federal and State and Territory governments overlooked the value of local capacity and knowledge of local communities. It was also noted that a challenge for not-for-profits is the declining number of those who volunteer in the community. The inquiry noted that government should contribute to attract, retain and reward volunteers through legislated employment and tax incentives. One option was for paid leave or time off for volunteering, employment protections, corporate volunteering and an Australian Public Service (APS) volunteering surge workforce. Another was for tax incentives such as tax deductable equipment, licenses, certification and training, or university fee relief (Parliament of Australia 2024).

Small Business

Small businesses are a key part of Australia's economy. However, many are not prepared for a natural disaster with only 25% having a business continuity plan in the event of a disaster according to a survey conducted by the Australian Small Business and Family Enterprise Ombudsman (ASBFEO n.d.).

The inquiry found that local economics doing well are more likely to recover from natural disasters than ones that are not. This includes that a strong local business community can assist new entrant businesses to learn how to manage natural disasters. In addition, regions with businesses that support active community leadership fare better, and so do businesses that are well run, planned and forward-looking (ASBFEO n.d.).

The challenges small businesses face include:

- Issues with funding and financing means small businesses struggle to obtain insurance at an affordable price.
- Being able to look after business infrastructure during a natural disaster.
- Timely and clear communication on predictions for natural disasters.
- Certainty of being offered support.
- Mental health impacts.
- Increasing natural disaster occurrence (ASBFEO n.d.).

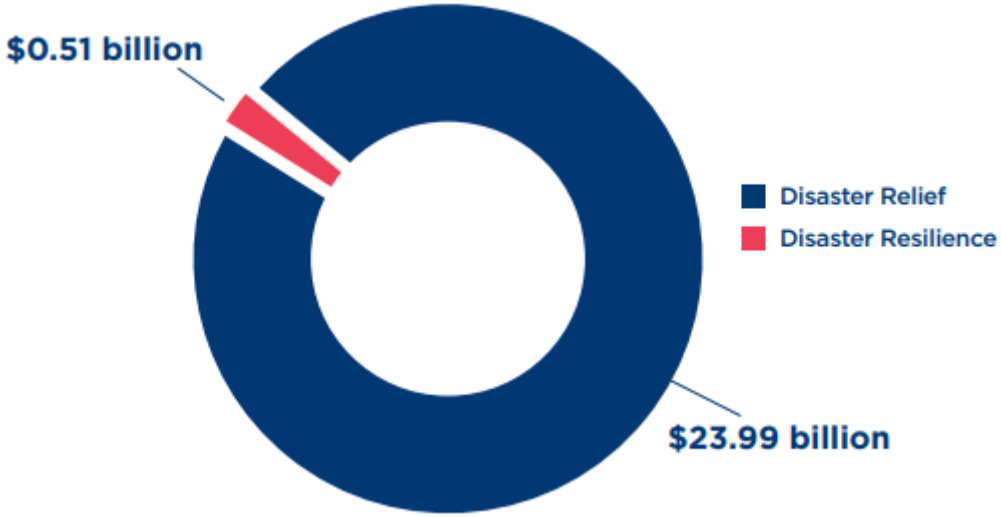
Insurance reforms

Insurance agencies are calling for government reform to better manage their clients in an unpredictable and difficult to cost worsening disaster management field (Lefebvre, Reinhard, and The McKell Institute 2022). Natural disaster impacts are wide ranging starting with those closely effected by the damage, then the regions and sometimes whole of Australia and the then after government funds and the taxpayer (Lefebvre, Reinhard, and The McKell Institute 2022).

A study by IAG saw increasing natural disasters as a threat to regional areas more so than urban areas since regional areas especially require insurance due to the limited employment opportunities and capital-intensive operations such as mining, agriculture or tourism. Urban areas can absorb the impacts due to diverse economic activity (Menzies et al., n.d.).

Federal Government funding of natural disasters is significantly focused on relief rather than resilience and recovery rather than preparedness (Figure 1). Federal Government spending covers costs such as emergency food, demolition or rebuilding of houses, restoration or replacement of essential public assets, infrastructure losses and disaster payments. The Federal Government's funding support is increased during the most severe disasters such as the 2020 Black Summer Fires (Lefebvre, Reinhard, and The McKell Institute 2022).

Figure 1: Federal government expenditure on natural disasters 2005-2022 (Lefebvre, Reinhard, and The McKell Institute 2022).



Australia is severely underinsured already with an increasing percentage of the population relying on government funding rather than their own savings or insurance (Menzies et al., n.d.). Projections show a sharp increase in government costs, and both insured costs and uninsured costs from natural disasters into the future (Table 1).

Table 1: Projected select direct costs of natural disasters ($ Billion) (Lefebvre, Reinhard, and The McKell Institute 2022).

Year	*2023*	*2030*	*2040*	*2050*
Federal Government costs	1.96	2.78	4.59	7.57
State Government costs	1.18	1.67	2.75	4.54
Insured costs	3.21	4.55	7.51	12.37
Uninsured costs	2.79	3.96	6.52	10.76

Lefebvre, Reinhard, and The McKell Institute (2022) predicts that by 2050 the average household will be paying $2,509.16 a year on direct cost from increasing extreme weather events (Lefebvre, Reinhard, and The McKell Institute 2022).

A senate inquiry titled the Impact of Climate Risk on Insurance Premiums and Availability comprised of research to support the uptake of insurance. These included:

- Rising inflation and supply chain issues.
- Rising cost of reinsurance.
- Taxes on general insurance.
- Continued development in high-risk areas.
- Cash settlements and the difficulty in 'building back better.'
- Insurers failing to recognise disaster mitigation and resilience efforts.
- Lack of transparency in pricing insurance premiums (Parliament of Australia 2025).

Recommendations

General recommendations

Various reviews have produced several key recommendations for improving Australia's natural disaster management framework.

The 2024 AGCMF audit identified three main areas requiring attention: the need for annual updates of the Australian Government Crisis Management Framework, additional guidance within the AGCMF, and the establishment of an annual national exercise program (ANAO 2024). Similarly, the 2023 DRFA assessment focused on operational improvements, recommending enhanced timeliness in DRFA assurance activities, better internal performance monitoring, and improved external reporting mechanisms (ANAO 2023). It should be noted that Federal government agencies have agreed to these changes.

The Glasser Review emphasised the need for significant policy changes to strengthen the coherence of natural disaster management alongside other national risks. The review recommended reforming both the National Emergency Management Ministers Meeting (NEMMM) and the Australia-New Zealand Emergency Management Committee (ANZEMC) to encompass disaster preparedness and risk reduction, areas that were previously missing from their focus on response and recovery. Additionally, the review called for expanding and resourcing NEMA to operate at a much larger scale (NEMA 2024f).

The Colvin Review proposed extensive changes to the Federal Government's role in disaster management. It recommended prioritising a national funding model and suggested giving NEMA leadership roles in each State and Territory to support capacity and investment operations, implementing national training and exercises to test local capabilities, and establishing accountability measures to track all disaster-related expenditures. It proposed creating a Disaster Management Advisory Council, a National Natural Disaster Outcomes Policy, a Nation-wide Natural Disaster Risk Profile, and to encourage local governments to assess their natural disaster risks and enhance relationships with non-government

organisations and the private sector to better understand and utilise their roles and capabilities (NEMA 2024g).

There is a strong emphasis on increasing investment in disaster risk reduction and preparedness, with calls to increase preparedness spending from the current 3% to 30% of total disaster expenditure (Commonwealth of Australia 2024). This reflects the recognition that existing government mechanisms and frameworks are not keeping pace with the rapidly worsening and changing scope of natural disasters.

Not-for-profits

The senate inquiry Boots on the ground: Raising Resilience provided the following recommendations for the Australian Government that are relevant to not-for-profits: amend the Fair Work Act 2009 to support time off work for volunteers to work with registered disaster recovery organisations; support Disaster Relief Australia to boost its number and partner with the Australian Defence Force and Department of Veteran Affairs to achieve this; consider ways to incentivise young Australians to volunteer with organisations that support disaster response and recovery (Parliament of Australia 2025).

Small businesses

The Small Business Natural Disaster Preparedness and Resilience Inquiry provided many recommendations on how the sector can be supported by Federal Government including: small business support should continue to be automatically elevated in disaster funding arrangements; consider funding a small business within existing collaborative peak bodies; consider a package for small business relating to call outs for volunteer work; as part of recovery and relief funding where a Federal Grant is given to a small business, an additional amount should be funded to allow for business health check afterwards; Federal Government land should be used for disaster preparedness infrastructure and activities; produce an opt-in record for all Australian businesses that holds data and information on what the business may need in a natural disaster; consider implementing disaster recovery planning as part of Federal Government funded small business training programs; and, funding a proactive community information program to support small business best practice disaster preparedness (ASBFEO n.d.).

Insurance reforms

The Insurance Council of Australia recommended that the Federal Government: establish a flood defence fund; fund better flood mapping data services to information disaster preparedness; provide grants to empower cyclone affected communities to protect themselves; reduce the cost of insurance by abolishing state duties, levies and charges on insurance products; establish policies and regulations to support competition and innovation in the insurance space; prevent housing construction in major risk areas based on current and future risk; embed the National Construction Code to support building process that withstand extreme weather conditions; and, improve transparency of strata fees, provide education for strata stakeholders and owners corporation members to reduce risk

and improve maintenance of strata properties (Hall and Insurance Council of Australia 2025).

The Senate inquiry, Impact of Climate Risk on Insurance Premiums and Availability, provided the following recommendations that are relevant to insurance and natural disaster preparation, response and recovery: the Australian Climate Service and NEMA should work with all levels of government and industry to establish and maintain a national disaster risk map and database; insurance companies should provide government a breakdown and explanation of insurance premium costs including details of changes due to natural disasters; the Treasurer should issue a Ministerial Direction to require the ACCC to monitor premium insurance prices across Australia and publish results quarterly on its website; abolish general taxes on insurance; investigate the feasibility of preventing housing developments in high risk areas; and, put a levy on coal and gas extraction companies to invest in disaster preparedness measures and to support cost of rising insurance (Parliament of Australia 2025).

climate justice and geopolitics

foreign relations

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Australia's foreign policy is committed to creating strong and meaningful relations with the Indo-Pacific region, promoting the rights inclusive to all states. Further to this it aims to achieve a greater number of opportunities for Australian businesses on a global scale, including the promoting of free trade (Australian Government, 2017). It also has an important goal of ensuring Australians are safe and secure and are not at risk of facing acts of terrorism, as well as ensuring the protection of rules that govern what constitutes a prosperous nation, working in partnership with the global community and the Indo-Pacific particularly to deliver positive outcomes in the national interest (Australian Government, 2017).

Australia's foreign policy encompasses aspects such as free trade, multilateralism, strong relationships with allies, economic cooperation, refugees, stability in the Indo-Pacific, fossil fuel exports, food and agricultural imports and exports, and international relations. Fossil fuel and food exports are some of the greatest contributors to Australia's carbon footprint and will be heavily impacted by climate change. Australian fossil fuel exports, namely coal and gas, contributed to 1.15 billion tonnes of carbon dioxide emissions throughout 2023, with 46 million tonnes emitted during the extraction process (Hare, 2024). The agricultural sector was calculated to contribute around half of the country's methane emissions throughout 2022-23 (Climate Council, 2024) and Australia exports roughly 70% of that agriculture (Department of Agriculture, Fisheries and Forestry, 2025). Because of this, there is a need for the implementation and/or revision of both fossil fuel export policies and food export policies from a geopolitical lens. Additionally, there are a number of bilateral and multilateral agreements that Australia has engaged in with other nations that are important for developing industries that will be important for Australia to meet its climate goals, outlined within the Paris Agreement.

Fossil fuel exports

Australia has no plan for reduction of fossil fuel exports, let alone eradicating them (Morton, 2024). Over the 2022-2023 period, Australia exported 14,904 Petajoules (PJ) (DCCEEW, 2024). Of this, 9,626PJ were coal, 4,541PJ were natural gas, 604PJ were crude oil and ORF, 120PJ were LPG, and 13PJ were refined products (DCCEEW, 2024). Australia's largest fossil fuel export partners are; China, Japan, South Korea and India (Hare, 2024). Participants in the exporting of these fossil fuels on an international scale include companies such as BHP, BP, Chevron, Woodside, Shell and Japan Australia LNG (World Energy Data, 2019; Snider, 2024). Complimentary to the finding from Morton (2024), a news article published by UNSW Media (2024), notes that Australia is considered one of the world's largest fossil fuel exporters, contributing greatly to its overall carbon emission profile. Australia has agreed to reduce its domestic emissions by 2050, however Australia's future plan will include further fossil fuel production for the purposes of export, reported to be 91% of coal production and 76% of gas production (UNSW, 2024 & UNSW Australian Human Rights Institute, 2024). Alarmingly, UNSW (2024) and UNSW Australian Human Rights Institute (2024) expands on this by highlighting that Australia has no current foreign policy on fossil fuel exports and continues to subsidise fossil fuel export industries. UNSW (2024) and UNSW Australian Human Rights Institute (2024) further compliment the findings of Climate Tracker (2024), noting that Australia will be unable to meet the Paris Agreements temperature goal with its current lack of policy in this sector. Similarly, UNSW (2024) and UNSW Australian Human Rights Institute (2024) note the lack of such a policy placing restrictions on fossil fuel exports is gravely concerning in regards to Australia's ability to meet ideal climate outcomes. This has been made even more concerning given the recent extension of Australia's largest gas project, the North West Shelf to 2070, in clear violation of the principles of national net zero legislation and international agreements. It also goes against scientific evidence showing that fossil fuel projects must be retired as soon as possible for humanity to avoid the worst and most catastrophic impacts of climate change (ABC News, 2025).

Australia's lack of fossil fuel export policies and its reliance on exports are also at odds with both the national and the global renewable energy transition (Kemp, McCowage, & Wang, 2021). With no strategy or policy on fossil fuel exports, the Australian government is free to do what it likes in regards to exports without having to consider limitations or the climate (UNSW, 2024 & UNSW Australian Human Rights Institute, 2024). Whilst the government has created "indirect" policies for renewable energy sources, it continues to subsidise fossil fuel exporting industries (UNSW, 2024 & UNSW Australian Human Rights Institute, 2024). The Climate Action Tracker (2024) further supports this claim, noting that Australia continues to invest in both fossil fuel domestic consumption as well as fossil fuel exports.

Climate Analytics (2022) compliments these findings from Climate Action Tracker (2024), noting that as it stands, Australia is currently not on track to meet its agreed upon emission targets by 2050. Climate Analytics (2022) notes a 43% reduction by 2030 is not in line with, or supportive of a decrease of 1.5 degrees to be achieved by 2050. Furthermore, Ghazavi (2024) raises an important thought regarding the

amount of investment the Australian government allocates to climate change. Per the 2020-2025 budget, climate aid will receive a total of 3 billion dollars to contribute to mitigation, adaptation and sustainability (Department of Foreign Affairs, 2025), and yet Australia's budget allocations are far greater for military and defense.

UNSW (2024) & UNSW Australian Human Rights Institute (2024) suggest that Australia's role in exporting fossil fuels is having severe and detrimental impacts on communities, families, livelihoods, health and safety. Oxfam Australia (2025) compliments these findings, highlighting the harmful impacts of fossil fuel exporting on Australian Indigenous Communities. Extraction of fossil fuels often involves mining on traditional and sacred land sites for Australia's First Nations communities (Oxfam Australia, 2025). Similarly, Moore (2024) notes that future promises for Pacific Nations are not only at risk of not being met, but can be considered too late: Australia's Pacific neighbours are already experiencing the harmful impacts of climate change from fossil fuel derived activities (Moore, 2024). Rising sea levels coupled with underfunded and unrecognised climate adaptation has meant relocating villages away from rising seas, however with a lack of government recognition this is not possible for all inhabitants (Moore, 2024).

Exporting fossil fuels drives up Australia's emissions and ultimately has severe negative impacts on the climate and people (UNSW, 2024 & UNSW Australian Human Rights Institute, 2024). UNSW (2024) and UNSW Australian Human Rights Institute (2024) elaborate on this further by noting a specific example from a community within the Torres Strait Islands who expressed grave concern for rising sea levels, flooding risk, damage to ancestral burial sites as well as erosion to traditional lands. The impacts of climate change on this community include their ability to be able to practice and pass on traditional culture (UNSW, 2024 & UNSW Australian Human Rights Institute, 2024).

Food security

Australia also has no current food security policy and thus no strategies to respond to deficits (Spencer, 2023). Chapter 3 - Food production, consumption and export from Parliament of Australia (2025) suggest that 11% of the food Australia consumes can be quantified as imported. These foods are imported to Australia to allow consumption demands to be met (Parliament of Australia, 2025). Interestingly, Turner et al (2018) note the detrimental climate impacts to Australia when relying on imported foods, and that the world is no longer predictable when considering environmental outcomes and food security. Severe weather disasters such as rising temperatures, fires, water scarcity and urban sprawl are creating harmful impacts that are affecting food systems, arrival times and quality of those products that are imported (Turner et al, 2018).

Given Australia's lack of policies in regards to food exports in Australia, The University of Sydney has compiled some notable recommendations in their 2021 paper, Food Policy in Australia: The role of different federal government organisations (Naudiyal, Reeve, Jones, & Mcdonald, 2021). Research conducted by Naudiyal et al (2021) from the Charles Perkins Centre recommends solid

implementation of policies across every stage of import and export. Naudiyal et al (2021) note that Australia has a complex food system and there are multiple interconnected layers that contribute to it. The stages of food export and import are recognised by Naudiyal et al (2021) as "production, processing, transport, consumption, and disposal". These stages each have their own detrimental impacts on the health of the environment as they largely rely on fossil fuel derived energy to fulfill their task (Naudiyal et al, 2021). In order to achieve peak effectiveness when considering emissions reductions, Naudiyal et al (2021) argue that policies for the above listed stages must be completed to align with one another as per their allocated department. Naudiyal et al (2021) expand on this, noting that coordination and collaboration from each federal department must occur in order to avoid unintentional contradictions that may end up causing more harm, i.e.; if one sector were to find a way to eliminate their emissions it must not mean that another sectors emissions rise due to this.

When considering the exporting and importing of food in Australia, Le et al (2015) note that food insecurity disproportionately impacts lower socioeconomic communities. Naudiyal et al (2021) compliment these findings, noting that food security in Australia largely impacts younger people, lower socio-economic families, asylum seekers, Aboriginal and Torres Strait Islander peoples, people who are unemployed and people with lower educational attainments. Naudiyal et al (2021) summarise this by noting that Australians who fall into these marginalised groups of people are experiencing the negative impacts of food insecurity throughout Australia on a disproportionate level to their neighbours. Australia, although considered a food secure place, might not actually live up to its claim, notes Le et al (2015). With a weighted reliance on food exports with 70% of agriculture products being exported, Australia must consider what our food export industry looks like in an ever changing climate (Hughes, Steffen, & Rice, 2015). Hughes et al (2015) further note the impact of climate change and the ability to be able to yield successful crops for export, considering a deficiency in rainfall, among other factors, contributing to the overall crop production. Major and destructive weather events such as cyclones, heatwaves and droughts resulting from climate change are also severely impacting the agriculture industry and its subsequent productivity into the future (Hughes et al, 2015). Fewer and stronger domestic supply chains are suggested in order to tackle the impacts of climate change on food exports, as well as supporting Indigenous owned and led operations and consuming foods that are less reliant on water to produce them, such as plant-based diets, are among some of the changes that could be made, notes Carruthers (2022).

Foreign policy and international relations

Foreign policy in Australia can be understood as establishing, developing, strengthening, and in some cases, repairing relationships with other nations that Australia has or wishes to establish connections with (Conley Tyler, 2022). The Department of Foreign Affairs and Trade (2017) notes that Australia has implemented "comprehensive" domestic policies to tackle climate change, however notes that its international policies are under review in order to ensure emissions reductions occur. The Australian government has proposed in the

Foreign Policy White Paper (2017) that its main goals to allow net zero, aligning with the Paris Agreement are initiatives such as the allocation of $1 billion dollars over a period of 5 years to support countries in the Global South, assisting in reducing their emissions and promoting climate change adaptation and building resilience (Foreign Policy White Paper, 2017). In an article published by Griffith University, author Harris Rimmer (2017) argues that Australia's Foreign Policy White Paper (2017) lacks a clear and or robust plan on how to fulfill these international promises and agreements.

Australia's first climate foreign policy was part of the Kyoto 1997 agreement and was introduced by the Howard Government (Saunders & Denniss, 2021). Crowley (2021) further contributes that not only at the Kyoto negotiations did Australia not commit to a reasonable decrease in emissions targets, they threatened to walk away following requests of a target that would be an 8% increase in 2012 from those emissions recorded in 1990. The 2007 Rudd government saw a ratification of the Kyoto protocol, agreeing to Australia's emissions not exceeding 8% above 1990 levels (Australian Broadcasting Corporation, 2007). Since then there has been a shift in government recognition and subsequent goals for reducing greenhouse gas emissions (Doherty, 2020). However there have been periods of government when little progress was made, for example then Prime Minister Scott Morrison noted in a meeting with Fiji's Prime Minister Frank Bainimarama that he would not commit to a timeline in when emissions reduction targets would be achieved (Doherty, 2020). The Morrison government also failed to introduce new targets at the 2021 Glasgow COP 26 (Crowley, 2021). Doherty (2020) notes that when the Albanese government was elected in 2022, they committed to an update of Australia's Paris agreement as climate change was considered a " key issue" among voters when analysing poll statistics. The Albanese government aimed at restrengthening Australia's working partnership with the Pacific by attending the Pacific Islands Forum (Morgan, 2023). The Prime Minister of Tuvalu joined Fiji and Vanuatu officials in launching a report from the Fossil Fuel Non-Proliferation Treaty Initiative that highlighted that across the Commonwealth countries, Australia, alongside the UK and Canada are responsible for 60% of emissions from fossil fuel extractions (Dziedzic, 2024). While not explicitly raising the amount of fossil fuels Australia can export, the Pacific-Island Nations expressed great concern and are placing pressure on countries who are the greatest contributors to the increase of emissions from fossil fuel exporting (Dziedzic, 2024).

Australia has bid to host a future COP with its neighbours, the Pacific Nations, University of New South Wales (UNSW) and COP31 Universities Alliance (2024) notes this is a real possibility for 2026 (UNSW, & COP31 Universities Alliance, 2024). Hosting the next COP meeting would prove to be an invaluable opportunity for Australia to showcase its leadership, and potential in regards to climate change (UNSW, & COP31 Universities Alliance, 2024). Society and businesses across Australia and the Pacific have begun organising to support it, identifying it as a major opportunity to advance climate change technologies, support new and revised industries and establish powerful policies for climate change and foreign relations (UNSW & COP31 Universities Alliance, 2024). However, in light of the North West Shelf extension to 2070 some voices have said the move was "a

demonstration of Australia's glaring disconnect between rhetoric and action", and that it showed "Australia is not being a trustworthy Forum partner in tackling the Pacific's number one security threat", and threatened the bid to jointly host COP 31 between Australia and Pacific Island nations (Pacific Elders Voice, 2025).

The Fossil Fuel Non-Proliferation Treaty, first initiated and launched at Climate Week in New York City in 2020 was championed by a number of nation states such as Fiji, Vanuatu, Tonga among others who have called on governments to join allegiances in implementing strategies and strict targets to eliminate fossil fuels (Fossil Fuel Treaty, 2025). Although fossil fuels have been identified as the main contributor to the climate crisis, the Paris Agreement fails to include a mandate for countries to eradicate them (Fossil Fuel Treaty, 2025). While Australia is not wholly involved or endorsing of the fossil fuel non-proliferation treaty, the ACT, City of Sydney and the mining company Fortescue have agreed to distinguish clear timelines for the phase out of fossil fuel derived practices, promoting a sustainable transition away from fossil fuel exporting (Fossil Fuel Treaty, 2025).

There is a direct correlation between climate change, foreign policy and the export of fossil fuels from Australia (Morgan, 2023). Morgan (2023) notes that Australia's foreign policies promote fossil fuel exports as well as climate change and are therefore conflicting and resistant to change. However, there are a number of foreign policies relevant to climate change that go beyond fossil fuel exports. For example, the Indo-Pacific Carbon Offset Scheme, or short-handedly known as, IPCOS aims to connect private and public investors in both climate action and low-emissions projects within the Indo-Pacific region (Climate Change Authority, 2022). Moreover, the Department of Climate Change, Energy, the Environment and Water (2024) further comments that the Indo-Pacific Carbon Offset Scheme's objectives are to support Pacific nations in the transition away from fossil fuels. When determining the effectiveness of the scheme and carbon offsetting purchases, Hemming (2022) notes it is unclear how the Australian government will achieve the scheme's objectives. In a joint media release with Minister for Climate Change and Energy, Chris Bowen, Foreign Minister Penny Wong, and Minister for International Development and the Pacific and Minister for Defense Industry and Capability Delivery, Pat Conroy (2024), it is noted that the funding that was allocated for IPCOS is being reevaluated and repurposed to be able to address the Australian-Pacific Partnership for Energy Transition, developed at COP 29 in late 2024. Bowen et al (2024) note that existing commitments affirmed under IPCOS will remain fulfilled if deemed relevant.

The India-Australia Green Steel Partnership (IAGSP) acts as a collaboration mechanism between Indian and Australian researchers, industry and government to be able to develop projects that aim to facilitate the decarbonisation of the iron-steel value chain in the context of both countries (CSIRO, 2025). Additionally, Australia is in the process of facilitating the commencement of green steel practices, namely the first has occurred in Western Australia with a green steel recycling mill funded for $400 million dollars (Australian Trade and Investment Commission, 2024). This green steel mill will utilise renewable energy and is a successful example of leading the way in new and innovative practices for climate change adaptation (Australian Trade and Investment Commission, 2024). As per

the Department of Foreign Affairs and Trade (The Australian Government, 2025), the IAGSP was launched to provide support and bolster innovative training in the transition to renewable energies. CSIRO's group leader of the IAGSP Keith Vining (2024) notes that the partnership has designed early, mid-term and long-term goals in order to meet its objectives in their entirety (Williams, 2024). Vining & Williams (2024) note that current processes for reducing coal are being tackled by applying direct reduction and transition to hydrogen or natural gas and electric furnaces. Vining & Williams (2024) note that the partnership is planning for long-term change through understanding to be able to improve the quality of ore by removing gangue. Guo, Li, Li & Hu (2024) make important note that gangue from coal is a major contributor to environmental degradation.

Another close partnership between Australia and India is demonstrated by the India-Australia Green Hydrogen Taskforce, which is inclusive of research professionals in green hydrogen from both Australia and India regarding the manufacturing and deployment of green hydrogen (DCCEEW, 2023). The taskforce is said to be effective with the allocation of chair members that the taskforce researchers are to report to (DCCEEW, 2023). The Australian Department of Foreign Affairs and Trade (2025) outlines in a roadmap that the partnership between Australia and India is effective in addressing the green hydrogen research due to their trusting neighbour relationship as well as Australia having expertise in the production of hydrogen. Whilst research remains underway, the Department of Foreign Affairs and Trade (2025) highlights the task force's effectiveness by noting that both countries are developing a large renewable hydrogen industry, with Australia being in an ideal position to meet India's decarbonisation goals.

The Australia-Asia power link, known as the Sun-Cable project, proposed to be supportive of both Australia and the wider Asia-Pacific region in supporting decarbonisation as well as promoting green industries and uplifting communities to be able to partake in the transition (Suncable, 2023). Sun-Cable intended on utilising Australia's sunshine to be able to deliver it to its partners in the Asia-Pacific region to aid them in the transition to renewable energy (Suncable, 2023). Backed and supported by 2 wealthy investors, the Suncable project is said to have gone into administration in 2023 due to malalignments of decisions regarding the future of the project (Dick, 2023). In order to support this project, both Northern Territory and Australian governments granted environmental approval for the project to succeed (Invest NT, 2024).

The Australia-Singapore Initiative on Low Emissions Technology for Maritime and Port Operation, or its acronym ASLET, (CSIRO, 2025), is a further initiative related to climate change and foreign policies focusing on the development of green shipping corridors between Australia and Singapore (CSIRO, 2025). The goal of this initiative is to deliver zero and towards zero emissions regarding the technologies of maritime and port operations while maintaining economic bilateral interests (CSIRO, 2025). Manifold Times (2025) notes that the program has selected 8 of thirty-two grant applications, ensuring a broad spectrum of research and activity covered, inclusive of research into the supply and storage of hydrogen, ammonia and methanol as well as environmental monitoring. The program is scheduled to be completed within two years (Manifold Times, 2025).

As part of the Australian Government's strategic international partnership (Australian Government; Business, 2025), the Australia-UK Renewable Hydrogen Innovation Partnership Program should also be noted. The program has been established to support the decarbonisation of “hard-to-abate” industries through collaboration between Australia and the UK, in particular, for green hydrogen projects (Innovate UK, 2024). Prime Minister of Australia, Anthony Albanese (2024) noted in late 2024, that the program successfully funded 6 projects focusing on industrial decarbonisation (Prime Minister of Australia, 2024). Albanese (2024) also notes the effectiveness of the initiative, stating that Australia and the UK have agreed to negotiate a new and revised climate and energy partnership to capitalise on the countries shared views on lowering fossil fuel emissions (Prime Minister of Australia, 2024).

Then Minister for Climate Change, Chris Bowen alongside Minister for Economic Affairs and Climate Action, Robert Habeck (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024) commented on the H2Global window scheme Australia is collaborating with Germany on. Bowen & Habeck (2024; DCCEEW, 2024) noted they revised a historic deal in order to strengthen cooperation on hydrogen supply chains by funding $660 million dollars. Following a successful pilot auction, Australia and Germany agreed to collaborate within the clean fuel market, further contributing to the success of the pilot auction (Atchison, 2024).

Australia has a number of international partnerships to combat climate change, two of these are relationships with Malaysia and Thailand (DCCEEW, 2023). The international relations between Australia and Malaysia and Thailand separately can be defined through the MRV, known as the tool for measurement, reporting and verification of greenhouse gas emissions (DCCEEW, 2023). The investment of MRV funding in locations such as Malaysia and Thailand is Australia's attempt at assisting Global South countries in granting them greater capabilities to make accurate MRV conclusions in order to best tackle climate change and meet targets (DCCEEW, 2023). Australia has redesigned a system to best manage this and one that is already being utilised in Australia (DCCEEW, 2023). Malaysia Greenhouse Emissions Information System (MyGEIS) and Thailand Greenhouse Emissions Information System (TGEIS) are modelled on Australia's Greenhouse Emissions Information System (AGEIS) and aim to enhance Malaysia and Thailand's reporting obligations, outlined in the Paris Agreement (DCCEEW, 2023). MyGEIS and TGEIS can rely on projects such as the Global Forest Observations Initiative (2025) led by Australia (DCCEEW, 2023) whereby countries are able to measure the changes in local forests, identify carbon resources and accurately report on MRV (DCCEEW, 2023; Global Forest Observations Initiative, 2025).

A further foreign initiative relating to climate change is the Japan-Australia partnership on decarbonisation through technology. This partnership focuses particularly on clean hydrogen and ammonia as well as low emissions in steel and iron ore (Ayres, 2023). Senator Tim Ayres (2023) further comments on the effectiveness of the partnership in its ability to leverage off of previous initiatives as well as prompting the involvement of Japan in over 40 hydrogen and ammonia projects across Australia. Complimentary to this, Ayres (2023) highlights that this

partnership has created world first achievements such as the success of the hydrogen energy supply chain pilot project in Victoria which was supported by Japanese partners and allowed the world's first shipment of liquefied hydrogen from Victoria to Kobe.

The Australia-United States Climate, Critical Minerals and Clean Energy Transformation Compact is fulfilled by sharing information to coordinate the supply of critical minerals essential to the energy transformation in order to identify risks and impacts on the critical mineral market (IEA, 2023). The compact has also been successful in that it has led to a non-binding agreement between the Australian Renewable Energy Agency and the US Department of Energy, as well as continuing to exchange emissions accounting, trade and climate change (DCCEEW, 2024). Additionally, the International Energy Agency (IEA) (2023) comments on the Australia – United States Net Zero Technology Acceleration Partnership, highlighting its main aim is to fast track the development of zero emissions while simultaneously upholding economic growth.

Heralded as Australia's flagship initiative in Indonesia, the Australia-Indonesia Climate and Infrastructure Partnership (KINETIK) was proposed to support Indonesian led policy (Australian Embassy, 2024). Australia and Indonesia have a shared desire to transition to net zero, and although early on in its progress, the Australian Embassy (2025) notes a USD 8 million investment through the KINETIC partnership. This investment proves that Australian businesses are identifying the importance of partnerships outlined such as KINETIC that address climate change in Indonesia and provides financial returns (Australian Embassy, 2025).

The Australia-Korea Comprehensive Strategic Partnership (CSP) is a partnership made of three pillars to establish cross coordination and support (Department of Foreign Affairs and Trade, 2025). The three pillars are identified by the Department of Foreign Affairs and Trade (2025) as: strategic and security; economic, innovation and technology; and people to people exchange. Dean (2024) further comments on the effectiveness of this partnership and what has already been achieved since it was established. In regard to pillar one, Dean (2024) notes there was a mutual understanding between Korea and Australia to extend the security cooperation beyond to include the Indo-Pacific region. When analysing the effectiveness of pillar number two, Dean (2024) notes the support for clean energy supplies coupled with the support for regional decarbonisation. Additionally, Dean (2024) highlights that pillar three has been able to fulfill its objectives by recognising closer relations in the higher-education sector. The Green Economy Partnership Arrangement on Climate and Energy (GEPACE) between Australia and the Republic of Korea is a further initiative that was agreed upon by Australia and Korea in late 2024 that will aim to enhance energy cooperation between the two countries (DCCEEW, 2024). Similar to agreements with other nations, the GEPACE also aims to foster a global transition to renewable energy (Stankova, 2024). Designed to promote reliable carbon capture techniques and simplify trade, it is the first GEPACE between Australia and Korea, established in December 2024 (Foley, 2024). The partnership aims to ensure its effectiveness by committing to a joint Korea-Australia ministerial meeting in order to direct and guide the phase out of the objectives (Foley, 2024).

Recommendations

There are several recommendations that could be considered in order to maintain a more holistic approach to international relations and climate change. While there are currently two government departments that house foreign policy issues in Australia, The Department of Foreign Affairs and the Department of Defense, it is argued that significantly more interaction between a number of other departments is integral for best quality outcomes and practice (Conley Tyler & Wyeth, 2024). Conley Tyler & Wyeth (2024) name this approach as a "whole of nation approach", whereby the federal government could be considered as a "conductor". There are a number of sectors that crossover into international relations that are outside the Department of Foreign Affairs & Department of Defense and have the potential, if worked in synergy, to benefit foreign policies, ultimately impacting the rate of positive outcomes (Conley Tyler & Wyeth, 2024).

Conley Tyler & Wyeth (2024) recommend sectors such as science and technology, First Nations, diaspora groups and civil society could be consulted in regards to foreign policy. Inviting society to be part of crucial decision making on a new level is thought of as giving people agency and to work alongside, more closely, the government they voted in, argues Conley Tyler & Wyeth (2024). Climate Council (2025) has developed a proposal document highlighting potential policies the upcoming government could implement in the next few years (Climate Council, 2025). Complimentary to this point, Climate Council (2025) recommends Australia's uptake of investing in vessels that are integral to building and maintaining offshore wind power for Australia and its neighbours in the South East Asian region and argues that this deployment of offshore vessels would allow for around the clock access to energy.

Australia has a plethora of examples for cutting emissions and implementing climate change foreign policies from an international context (Noroozinejad Farsangi & Morrison, 2024). Noroozinejad Farsangi & Morrison (2024) note one of these examples can be found within Glasgow's Financial Allianz for Net Zero (FANZ) whereby low carbon infrastructure is able to be implemented through a transition finance strategy. This policy from Glasgow proposes to be favourable in accelerating the country's trajectory to decarbonisation (Noroozinejad Farsangi & Morrison, 2024). Moreover, this is a sound recommendation and considered one that Australia could implement when considering offshore renewable projects and their subsequent infrastructure needs while simultaneously targeting finance and developing more robust climate change outcomes (Noroozinejad Farsangi & Morrison, 2024).

Recommendations for enhancing Australia's foreign policies to be more climate change ready include:

- Roll back recent extensions to gas projects beyond 2050, re-commit to reducing fossil fuel emissions both nationally and exported and re-engage with Pacific Island nations in good faith with greater support to deal with climate change impacts in these countries (Moore, 2024; Fossil Fuel Treaty, 2025).

- Embed fossil fuel phase out into foreign policy (Fossil Fuel Treaty, 2025).
- Enhance food security policy with foreign policy consideration for climate change impacts on global food supply chains into the future (Hughes, Steffen, & Rice, 2015)
- Greater inclusion of other governmental departments in overseeing policy implementation to ensure holistic approach (Conley Tyler & Wyeth, 2024).
- Including different sectors in society in policy and decision making, sectors such as; First Nations Peoples, science and technology, diaspora and civil society (Conley Tyler & Wyeth, 2024).
- Promote and support offshore wind power instalment equipment to support Pacific Island nations (Climate Council, 2025).
- Implementation of transition finance strategy based on successful policy implemented in Glasgow whereby low carbon infrastructure can be implemented, reaching a wider audience (Noroozinejad Farsangi & Morrison, 2024).

migration and displacement

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There is much supporting evidence to suggest that climate migration and displacement is increasing across the globe (CBM Australia, 2025; UNHCR, 2025). As such, the humanitarian and security implications of climate migration and displacement should be seriously considered by the Australian Government (Corlett, 2008). The humanitarian and security implications of this issue, if left unaddressed, are only set to expand over time. Federal Government legislation, frameworks, and approaches taken historically through to present day around the issue of climate migration and displacement therefore need to be analysed to see whether they are appropriate to the growing threat posed by climate change. The current Federal Government's approach to climate migration and displacement needs to be considered from the perspective of framing and communicating the challenge of climate migration and displacement within the Asia-Pacific from a human rights lens, development of a national policy framework on climate migration and displacement, expansion and broadening of migration pathways for affected Asia-Pacific countries to enable voluntary, gradual, and permanent migration of impacted individuals to Australia, and the creation of a Federal Government policy that gives humanitarian protections and support to Australians facing medium, long-term, and permanent displacement due to climate disasters.

The implications of climate migration and displacement within the Asia-Pacific region requires a consideration of not just the issue of climate migration and displacement in an Asia-Pacific context but also an Australian context, and with consideration for why this issue should be of humanitarian and security concern to the Australian Government. Climate migration and displacement can be defined as occurring when individuals and/or communities are forced to involuntarily leave their area of residence due to the occurrence of a sudden onset climate disaster or slow onset climate change event (CBM Australia, 2025). There is much supporting evidence to suggest that climate migration and displacement is increasing across the globe (CBM Australia, 2025; UNHCR, 2025).

Broadly, sudden onset natural disasters that cause climate migration and displacement can include floods, fires, hurricanes, cyclones, drought, storms, and tsunamis, whilst slow-onset disasters associated with climate change include sea-level rise, ocean acidification, and rising temperatures (DFAT, 2025; Edes and Gemenne, 2015; Filho, 2015; CBM Australia, 2025). Climate-induced conflicts that cause climate migration and displacement can also occur, manifesting due to the increased competition for essential resources such as food, water, and land, which often become depleted due to climate disasters or changing environmental conditions (CBM Australia, 2025; UNHCR, 2025).

The Asia-Pacific region has been greatly affected by climate migration and displacement, moreso than any other region across the globe (Edes and Gemenne, 2015; IDMC, 2022). This is partly because populations in this region are highly concentrated and reside in areas exposed to climate risks (Edes and Gemenne, 2015). To put into perspective just how affected the Asia-Pacific region has been by climate change, between 2010 and 2021, a total of 225.3 million people were reported to have been internally displaced within the region due to natural disasters (IDMC, 2022). This amounts to a staggering annual average of 18.8 million people displaced in the Asia-Pacific region due to climate disasters (IDMC, 2022). Of the 225.3 million natural disaster displacements in the region, 213.5 million were weather-related and caused by floods, storms, landslides, droughts, wildfires, or extreme weather conditions, and the remaining 11.8 million were geophysical, caused by earthquakes and tsunamis, volcanic eruptions, or landslides (IDMC, 2022).

More specifically, the Pacific region is of particular concern when it comes to the risk of climate migration and displacement (DFAT, 2025). This is because the Pacific includes many Small Island Developing States (SIDS) that are particularly vulnerable to sea level rise, a slow-onset climate change phenomenon, as well as sudden onset natural disasters such as cyclones and extreme rainfall (DFAT, 2025; Edes and Gemenne, 2015; Filho, 2015; Pacific Islands Forum, 2024; Philip, 2018). Worryingly, there has been an increase in the frequency and intensity of natural disasters Pacific SIDS have been experiencing (Pacific Islands Forum, 2024), which has had numerous consequences including that of migration and displacement. For Pacific SIDS, the predicted total average loss from moderate climate change scenarios amount to USD1.3 billion annually (United Nations, 2022). Tuvalu and Kiribati have been identified as two Pacific States that face the existential threat of sea level rise, with past cases of flooding in these States inundating land and homes (Corlett, 2008; Edes and Gemenne, 2015).

The current and increasing issue of climate migration and displacement within the Asia-Pacific region is of humanitarian and security concern for Australia. Climate migration and displacement within this region, especially in circumstances where internal migration is not possible such as is the case for small Pacific Island States like Tuvalu (Corlett, 2008), may lead to an increase in climate refugees seeking asylum in Australia (Parker, 2022). This is because many States that have been most affected by climate-induced displacement have not been able to adequately deal with such displacement (UNHCR, 2025). Such migration carries socio-economic risks and consequences (Filho, 2015) and is best not left unaddressed by the

Australian Government. The far-reaching implications of climate change displacement and migration should not be left unaddressed, especially as natural disasters are set to increase within the Asia-Pacific region in the coming decades (Corlett, 2008; Filho, 2015; IDMC, 2022).

The Asia-Pacific region, whilst the most affected region globally by climate migration and displacement, is not the only region affected. Australia has experienced and will continue to experience the adverse effects of climate migration and displacement within its own borders (Edes and Gemenne, 2015). In Australia, the intensity and frequency of natural disasters are increasing, and so attention must be paid to this issue (The Climate Council, 2025). Extreme weather events that do occur and will continue to occur in Australia include bushfires, floods, cyclones, heavy rain and storm-surge, coastal erosion and coastal inundation (Australian Prepardness Disaster Framework, 2018; Commonwealth of Australia, 2021; Ewenson, 2025; Rebecca et al, 2015; The Climate Council, 2025). Rising temperatures and a reduction in rainfall has also been increasing within Australia (Commonwealth of Australia, 2021). Richmond NSW, Nicholls VIC, and Mayo SA, have been identified as the top Federal electorates within Australia that have properties at high risk of natural disasters (The Climate Council, 2025).

The 2022 NSW Lismore floods and the 2019 to 2020 Australian bushfire season will be used to show the large-scale effects of climate migration and displacement in Australia. The February and March 2022 NSW Lismore floods caused widespread migration and displacement in the Lismore area. The floods were the highest inrecorded history for Lismore NSW, reaching over 2 metres above the 1-in-100-year levels at 14.4 metres high. At the time of the flooding, an estimated 4,000 people were displaced and evacuated from Lismore (Ewenson, 2025). In the aftermath of the flooding, an estimated 2,000 Lismore residents were made homeless due to a loss of housing caused by flood damage (Legislative Council Select Committee, 2022). The 2019 to 2020 Australian bushfire season, also known as the Black Summer fires, was unprecedented in terms of extent and intensity, burning at least 17 million hectares of land (IDMC, 2020; New South Wales Government, 2024). According to data from the Australian Red Cross Register Fund Reunite (RFR) service, 64,579 individuals self-recorded as being displaced following the Black Summer fires (IDMC, 2020). However, it should be noted that only individuals who sought shelter in evacuation centres were required to register for the RFR service and report as displaced, and so it is extremely likely that the 64,579 figure is an underestimate of those displaced (IDMC, 2020). Over 3,100 homes were lost to the fires, triggering long-term displacement for approximately 8,100 individuals (Australian Academy of Science, 2021; IDMC, 2020). Climate migration and displacement also has many secondary and tertiary consequences for those affected. These effects include trauma and mental distress, disruption to schooling and/or employment, loss of community networks, and loss of wages or employment, and a negative impact on economic output and productivity (IDMC, 2020; Mortimer et al, 2023). It is clear that addressing climate migration and displacement, within both the Asia-Pacific region and Australia, should be a priority for the Australian Government now and into the future.

Responsibility of Federal, State/Territory, and Local governments to address climate migration and displacement

The responsibility of addressing the issue of climate migration and displacement is shared amongst Federal, State/Territory, and Local Governments in Australia. At the Federal Government level, policies such as the Australian Disaster Preparedness Framework (ADPF) and Disaster Ready Fund (DRF) enable the Federal Government to address climate displacement by primarily trying to prevent and mitigate natural disasters from occurring within Australia. The Federal Government also has responsibility for addressing the issue of climate migration and displacement that occurs in other countries, having agreements such as the Fiji-Australia Vuvale Partnership (2023) and Australia–Tuvalu Falepili Union (2024) that take a primarily resilience-based and preventative approach to addressing this issue. A one-off 'crisis payment' is also offered through Services Australia to provide some financial relief to eligible individuals within Australia who are facing extreme circumstances, such as in the event of a climate disaster that has significantly impacted them (Services Australia, 2025). The Australian Defence Force (ADF) is also able to be deployed by the Federal Government to assist with the management of natural disasters and subsequent management of climate-induced displacement and migration (Commonwealth of Australia, 2024). The Federal Government also provides financial support to states and territories, along with public broadcasting and dissemination of information and warnings, in an effort to manage climate displacement (Commonwealth of Australia, 2024).

All 6 states and 2 territories in Australia have official emergency plan policies that outline their approach to dealing with natural disasters, including dealing with the effects of displacement and migration from such disasters (Mortimer et al, 2023). The NSW Government State Emergency Plan (New South Wales Government, 2018) and the Victorian State Emergency Management Plan (Victoria State Government, 2024) are two examples of these State Emergency plans. Such Emergency Plans are updated over time, and broadly aim to provide immediate assistance, shelter, food, and other relief services to those affected by natural disasters (New South Wales Government, 2018; Victoria State Government, 2024).

Local Governments in Australia have the primary responsibility of working in collaboration with respective state and territory governments, playing a vital role due to their local knowledge and established community networks (Commonwealth of Australia, 2024). Local governments are generally responsible for emergency response and recovery, maintaining essential services, and representing community interests throughout all stages of an emergency (Commonwealth of Australia, 2024), including when helping to deal with climate-induced displacement.

Current policy approaches

There are several historical and current Australian Federal Government policy approaches relating to the issue of climate migration and displacement.

The Migration Act 1958

The Migration Act 1958 governs activity relating to immigration within and to and from Australia, including the entry into, presence in, and departure or deportation from Australia (AustLii, n.d.) The Migration Act (1958) does not refer to displacement or migration caused by climate change.

Disaster preparedness and response

The Federal Government has several policies that aim to stop climate migration and displacement from occurring through disaster preparedness and response mechanisms. The Australian Disaster Preparedness Framework (ADPF), developed in 2018, outlines how Australia can manage severe natural disasters by guiding jurisdictions in disaster planning, prevention, response, and recovery (Australian Disaster Preparedness Framework, 2018). The ADPF takes into consideration the need to support individuals who have become displaced due to natural disasters through protocols that deal with mass movement and evacuation, also touching upon the need for displaced people to have adequate access to shelter, food, water, sanitation, clothing, and health care (Australian Disaster Preparedness Framework, 2018).

The Disaster Ready Fund (DRF), established by the Disaster Ready Fund Act 2019, details that $1 billion of Federal funding will be allocated from 1 July 2023 to fund projects that aim to address the effects of natural disasters within Australian communities (National Emergency Management Agency, 2025). Rounds 1 and 2 of the DRF do provide funding for projects that aim to address the issue of climate migration and displacement caused by natural disasters (Disaster Ready Fund Act 2019). Large-scale infrastructure upgrade projects and strategic assessments that aim to address displacement following a natural disaster will be funded. Examples of such projects to be funded under the DRF include approximately $30 million being allocated towards building a community cyclone shelter in East Arnhem (NT) and $381,600 being allocated towards refuge facility planning in Napranum (QLD) (National Emergency Management Agency, 2025).

Australia is also a member state of the Coalition for Disaster Resilient Infrastructure (CDRI). The CDRI promotes the development of resilient infrastructure, which can be defined as infrastructure that can better withstand, respond to, and recover from natural disasters (CDRI, n.d.). Developing resilient infrastructure aims to stop climate displacement and migration from initially occurring, as well as providing access to safer shelters and refuge sites for those who have been displaced following a natural disaster.

Managed retreat and buyback programs

The Resilient Homes Fund (QLD) saw $741 million allocated (funding split 50/50 between the Federal and QLD State Government) towards assisting with the repairing, raising, demolishing, rebuilding, and relocation of eligible flood-impacted homes in Queensland (Queensland Government, 2025). Three program options were available: the Resilient Retrofit, Home Raising, or Voluntary Home Buy-Back schemes to meet these goals (Queensland Government, 2025). In

addition, the Resilient Homes Program (NSW), led by the NSW State Government, was implemented as a response to the 2022 Lismore floods and is available for select homeowners (NSW Government, 2025). The Resilient Homes Program offers to buy back homes or renovate homes to make them more resilient to flooding in the future. The total funding allocated for this program is $920 million, of which the Federal and NSW State Government are both funding (NSW Government, 2025).

National Climate Resilience and Adaptation Strategy

The National Climate Resilience and Adaptation Strategy (the Strategy) aims to make Australia better able to anticipate, manage, and adapt to the threat of climate change both within Australia and the Indo-Pacific region (Commonwealth of Australia, 2021). The Strategy aims to foster resilience within the Indo-Pacific region through climate financing, climate-resilient infrastructure, and developing early-warning systems for natural disasters. Within Australia, the Strategy discusses the Preparing Australia Program (2021), which will provide $600 million to improving climate resilience in Australia, as well as committing $5 billion for the Future Drought Fund over the coming years to assist Australia in becoming more resilient to the effects of drought (Commonwealth of Australia, 2021). Whilst the terms 'displacement' and 'migration' are not explicitly used, the Strategy does aim to create a plan for Australia to manage climate migration and displacement within Australia and the Indo-Pacific region by building climate-resilient communities.

Australia's International Development Policy

Australia's International Development Policy, published in August 2023, explicitly mentions that the issue of global displacement is a consequence of climate change and is a major globally shared threat (DFAT, 2023). DFAT recognises that climate-induced displacement occurs outside of the Indo-Pacific region, and that Australia needs to continue to assist with development and humanitarian efforts of broader global areas affected by climate displacement, such as within countries in Africa, the Middle East, Latin America, and the Caribbean (DFAT, 2023). The Policy outlines that development and humanitarian support provided by Australia will be focused on building resilience and will also include assisting affected countries to host displaced populations (DFAT, 2023).

Pacific Australia Labour Mobility (PALM) scheme

The Pacific Australia Labour Mobility (PALM) scheme, managed jointly by the Department of Foreign Affairs and Trade (DFAT) and the Department of Employment and Workplace Relations (DEWR), was created on 4 April 2022. The PALM scheme allows citizens and residents of ten participating PALM scheme states – Fiji, Kiribati, Nauru, PNG, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu – to apply for the Subclass 403 Temporary Work (International Relations) Visa within Australia (PALM, n.d.). This visa allows holders to work short-term (up to 9 months) or long-term (one to four years) in unskilled, low, and semi-skilled jobs within Australia (PALM, 2024). As of March 2024, the PALM scheme provided temporary jobs within Australia to over 30,000 Pacific and Timor-Leste workers (PALM, 2024). One major purpose of the visa is to allow Pacific and Timor-Leste workers an opportunity to take learned skills within Australia back to their

community upon visa expiration (PALM, 2024). Whilst the PALM scheme does not explicitly mention the risk of climate migration or displacement, it involves countries that experience high levels of climate impacts and displacement.

Fiji-Australia Vuvale Partnership

The Fiji-Australia Vuvale Partnership, renewed in 2023, outlines the priority areas of engagement between Australia and Fiji (Fiji-Australia Vuvale Partnership, 2023). The partnership recognises that climate change is the largest shared threat between Australia and Fiji, and aims to build climate-resilient communities, provide access to development and climate finance, and support migration and adaptation within the region (Fiji-Australia Vuvale Partnership, 2023). The partnership also outlines both countries' commitment to humanitarian assistance in the aftermath of a natural disaster.

Australia–Tuvalu Falepili Union

The Australia-Tuvalu Falepili Union, established in August 2024, recognises that climate migration and displacement within Tuvalu is a threat, and that supporting human mobility with dignity in the region is a priority (DFAT, 2024). The Australia-Tuvalu Falepili Union mentions that Tuvaluan citizens will now have the option to migrate to Australia either permanently or temporarily, with 280 visas in the first year of the program being promised (DFAT, 2024). Such visas will be available under the Pacific Engagement visa (subclass 192) stream - Treaty stream (Tuvalu).

Australia-Papua New Guinea Bilateral Security Agreement

The Australia-Papua New Guinea Bilateral Security Agreement, established 7 December 2023, recognises the challenge climate change poses to both Australia and Papua New Guinea (PNG), and provides a commitment for both states to work together to secure common interests around climate change and the environment (DFAT, 2023). There is no explicit mention of the risk of climate migration or displacement made within the agreement.

Pacific Engagement Visa

The Pacific Engagement Visa (subclass 192) provides up to 3,000 visas per year for the participating countries of the Federated States of Micronesia, Fiji, Nauru, Palau, PNG, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu (DFAT, 2024). Visas are allocated to eligible applicants based on a random draw, which for a $25 registration fee eligible applicants can enter. The Pacific Engagement Visa is available for applicants of any skill level job-wise, and a successful application comes with supportive programs such as the Adult Migrant English Program (AMEP) and the Settlement Engagement and Transition Support (SETS) program for those who need it (DFAT, 2024). The first ballot for the Pacific Engagement Visa opened 3 June 2024. Whilst the Pacific Engagement Visa does not explicitly mention the risk of climate migration or displacement, it involves countries that experience high levels of climate impacts and displacement.

Nauru-Australia Treaty

The Nauru-Australia Treaty, signed 9 December 2024, recognises that climate change is an existential threat and that both Australia and Nauru are committed to ensuring climate resilience (DFAT, 2024). To ensure this climate resilience, Australia has confirmed that between 2025 and 2026, an estimated $46.0 million will be provided to Nauru to support climate-resilient infrastructure projects (DFAT, n.d.). There is no explicit mention of the risk of climate migration or displacement made within the Nauru-Australia treaty.

Australia-Pacific Regional Development Partnership Plan

The Australia-Pacific Regional Development Partnership Plan 2025-2029 (DPP) recognises that climate change poses significant risks to Pacific Small Island Developing States, including the risk of climate displacement (DFAT, 2025). The 2024-2025 DPP will see Australia provide $2.05 billion in development assistance to the Pacific, which includes funding to provide support for climate resilience. This climate and disaster resilience will be achieved in the Pacific by Australia aiding the region's transition to renewable energy, sharing climate adaptation innovations, providing access to climate finance, and improving community resilience (DFAT, 2025). There is no specific mention of how climate displacement and migration from the Pacific may be accommodated by Australia, however, the PALM scheme is mentioned in terms of providing labor mobility opportunities for Pacific peoples (DFAT, 2025).

Policy analysis

Current Federal Government approaches to managing climate migration and displacement at a global scale are focused on the Asia-Pacific region, as evidenced by Australia's International Development Policy (2023), PALM Scheme (2022), Fiji-Australia Vuvale Partnership (2023), Australia-Tuvalu Falepili Union (2024), Pacific Engagement Visa (2024), Nauru-Australia Treaty (2024), and Australia-Pacific Regional Development Partnership Plan (2025-2029). Federal Government approaches to managing climate migration and displacement within Australia are largely focused on disaster risk management, building resilience, and 'climate proofing', as demonstrated by the National Climate Resilience and Adaptation Strategy (2021), the Australian Disaster Preparedness Framework (2018), Disaster Ready Fund (2019) and Australia's current membership to the Coalition for Disaster Resilient Infrastructure. The current policy approach of building resilient infrastructure and communities in the Asia-Pacific and Australia to curtail the likelihood of climate-induced migration and displacement from occurring is an effective way to approach this issue (Corlette, 2008; Edes and Gemenne, 2015; Filho, 2015; IDMC, 2022). This is because the current approach is more cost-effective than relying on supplying humanitarian aid and assistance in the aftermath of a climate disaster to deal with internal or external communities impacted by climate migration and displacement (IDMC, 2022).

Reducing emissions will in turn ease the risk that climate migration and displacement occurs (UNHCR, 2025). The Australian Government is developing a Net Zero 2050 plan, and already has Federal policy relating to the reduction and regulation of emissions (Department of Climate Change, Energy, the Environment and Water, 2024). Even though reducing emissions will ultimately mitigate the risk of climate migration and displacement from occurring (UNHCR, 2025), a review of the existing literature regarding Australian federal government policy and climate migration and displacement affecting Australia and the surrounding region has revealed four consistent themes. These include: a lack of Government communication about the growing challenge of climate migration and displacement within the Asia-Pacific; an absence of both an international standard and Australian national policy framework that protects climate refugees; limited migration pathways to Australia offered for climate affected Asia-Pacific countries; and a lack of Federal Government policy that gives humanitarian protections and support to Australians facing long-term, and permanent displacement due to climate disasters.

Government communication

Current Australian Federal Government approaches to the issue of climate migration and displacement within the Asia-Pacific have failed to explicitly identify and communicate the risk this issue poses to the well-being and prosperity of those living within the Asia-Pacific region. As discussed, climate migration and displacement has many secondary and tertiary consequences for those affected, including negative effects on mental and physical health, loss of economic prosperity and wages, disruption to schooling, and loss of community networks (Filho, 2015; IDMC, 2020; Mortimer et al, 2023). Despite this, limited Federal Government policies and agreements relating to climate migration and displacement in the Asia-Pacific region explicitly mention the humanitarian risks associated with possible climate migration and displacement for those living in this region. In particular, the Australia-Pacific Regional Development Partnership Plan (2025-2029), Nauru-Australia Treaty (2024), and Australia-Papua New Guinea Bilateral Security Agreement (2023) do not mention climate migration or displacement at all, least of all the vast humanitarian concerns associated with this issue.

One reason Federal Government policies and agreements regarding the Asia-Pacific fail to mention the risk of climate migration or displacement may be because of a reluctance to draw attention to the possibility of an increase in climate refugees seeking asylum in Australia (Parker, 2022). It is no secret that there has historically existed xenophobia and anti-immigration sentiments in Australia (Wyett, 2013). Stanley et al (2023) examined the preferences of Australians for resettling individuals displaced by climate disasters, finding that there was less support for resettling those impacted by climate disasters compared to resettling those impacted by war, a group that Australia has historically received intakes of. As debates around immigration have historically and presently been the focus of negative political interest (Rowe and O'Brien, 2014), it makes sense that the Federal Government has avoided mentioning such a risk within policy and agreements.

Climate refugee framework

The legal basis for someone displaced by climate change to seek asylum in Australia or otherwise globally is lacking - a legal lacuna (Stanley et al, 2023; Wyett, 2013). Neither the Migration Act 1958, the Refugee Convention, nor the Status of Stateless Persons, has been found to protect those who have become displaced or migrated due to climate conditions (Koser, 2012; Philip, 2018). A newly developed and binding international protection has been suggested by scholars to provide greater protection for displaced people (Giannini & Docherty, 2009; Hodgkinson et al, 2010). However, it is acknowledged that there are significant legal challenges associated with forming such an international agreement on climate refugees, as well as the fact that it would be difficult to ascertain the difference between climate displacement and displacement due to other factors (Wyett, 2013). There are also other practical challenges associated with creating an international protection for climate refugees, such as the knowledge that countries will often interpret such protections narrowly to avoid responsibility and obligation (Philips, 2018). Alongside an absence of an international standard that protects climate refugees, Australia does not currently have a national policy framework that seeks to protect climate refugees. This lack of humanitarian protection for climate refugees will not mean that the issue of climate migration and displacement disappears, but instead will mean that humanitarian protections, aid, and support for individuals in the Asia-Pacific region facing climate change and natural disasters will be left abandoned by the international community and Australia.

Limited migration pathways

The Pacific Engagement visa (subclass 192) currently only has 3,000 spots allocated annually as part of a ballot process, for only ten PALM states – Fiji, Kiribati, Nauru, PNG, Samoa, Solomon Islands, Timor-Leste, Tonga, Tuvalu, and Vanuatu. This means that only a limited number of those impacted by climate migration and displacement in the Asia-Pacific region will be granted a visa through this visa stream. Other Asia-Pacific states such as Indonesia, Bangladesh, and the Philippines, all currently face and will continue to face significant climate challenges, yet have not been included within this visa stream.

The development of the Australia-Tuvalu Falepili Union (2024), which establishes a separate visa stream labelled Pacific Engagement visa (subclass 192) - Treaty stream (Tuvalu), is a positive step towards addressing the issue of climate migration and displacement. However, an absence of other similar agreements, which outline Australia's acknowledgment of and commitment to addressing this issue in vulnerable Asia-Pacific states, should be noted.

Displacement within Australia

The duration for which someone is displaced due to a climate-induced natural disaster can be grouped in terms of short-term, medium-term, long-term, and permanent displacement (Mortimer et al, 2023). Current Federal Government frameworks, such as the ADPF, DRF, and CDRI, focus primarily on disaster preparedness and resilience-based disaster management in an attempt to mitigate the worst effects of climate change disasters before they occur. These

frameworks acknowledge that climate disasters can result in damage or loss to housing, and thus the need for short-term emergency accommodation for displaced people is recognised within these frameworks (Mortimer et al, 2023). Whilst a focus on resilience-based disaster management and short-term accommodation for displaced Australians is not a bad thing, more attention needs to be paid to providing housing assistance to those displaced long-term or permanently due to climate disasters in Australia (Mortimer et al, 2023).

The 2019 to 2020 Black Summer fires, as discussed in this chapter previously, saw 64,579 Australians displaced (IDMC, 2020). The Homelessness NSW (2020) submission to the Commonwealth of Australia, 2020 Royal Commission into National Natural Disaster Arrangements (Commonwealth of Australia, 2020) outlined the assumptions that were held around displaced people being able to return home or to live with family or friends following a natural disaster. This left those who had no homes, unlivable homes, or no friends or family to rely on, being unaccounted for (Mortimer et al, 2023). As a result of the Black Summer fires, many NSW residents who were displaced in 2019 are still today living in short-term accommodation, with their homes not having been rebuilt or relocated (SBS News, 2024). This example clearly shows that there is an absence of humanitarian protection and support for Australians facing long-term and permanent displacement due to climate disasters.

Recommendations

It is clear that climate migration and displacement within the Asia-Pacific region and within Australia is a significant challenge that is only set to increase as climate change worsens over time (Filho, 2015; IDMC, 2022; Philip, 2018). The far-reaching implications of climate migration and displacement should not be left unaddressed (Corlett, 2008). Taking a proactive approach and planning for the risks associated with climate migration and displacement now, in a manner that is thought-out, politically realistic, and based on principles that promote the rights of displaced peoples, should be seriously considered by the current and future Australian Federal governments. Based on the current and proposed Federal Government approaches to managing climate migration and displacement, the following recommendations are given for future Australian Federal government action to better address this issue and its associated impacts on Australia.

Recommendation One *– Frame and communicate the growing challenge of climate migration and displacement within the Asia-Pacific from a human rights lens.*

It has been established that the Federal Government has been hesitant to clearly communicate the issue of climate migration and displacement within the Asia-Pacific. However, the fact that Australia historically and currently accepts a number of migrants from the Asia-Pacific suggests that Australians are at least somewhat open to the idea of assisting those impacted by climate migration and displacement (Wyett, 2013). Xenophobia and anti-immigration sentiments in Australia may be reduced if leaders emphasise shared values and commonalities between countries (Philip, 2018). In addition, framing climate migration and

displacement through a human rights lens may help shift public discourse toward greater empathy towards climate refugees (Philip, 2018). Alteration of the Australia-Pacific Regional Development Partnership Plan (2025-2029), Nauru-Australia Treaty (2024), and Australia-Papua New Guinea Bilateral Security Agreement (2023) to include clear communication about the humanitarian risks of climate displacement are encouraged. Taking these measures to explicitly identify and communicate the risk that climate migration and displacement poses to the well-being of those living within the Asia-Pacific region would better enable the Federal Government to direct more resources and time into pursuing recommendations two to four as outlined in this chapter.

Recommendation Two *– Development of a national policy framework on climate migration and displacement.*

In the absence of an international standard that protects climate refugees, Australia should consider developing a national policy framework on climate migration and displacement (Koser, 2012; Wyett, 2013). Doing so would provide a rights-based mechanism for those impacted by climate disasters in the Asia-Pacific region and Australia to be protected, and would allow Australia to tackle this issue in a proactive manner (Philip, 2018). A national policy framework regarding climate migration and displacement should include agreement on principles for how to address climate migrants who cross national borders, and what human-rights based protections they are afforded (Wyett, 2013). Such a framework should also detail the protections and rights afforded to those who become displaced due to climate events within Australia (Koser, 2012).

Recommendation Three *– Expand and broaden migration pathways for affected Asia-Pacific countries to enable voluntary, gradual, and permanent migration of impacted individuals to Australia.*

Australia should enhance the ability for those displaced due to climate disasters to migrate to Australia under the existing Australian migration system (Koser, 2012; Philip, 2018; Wyett, 2013). In theory, Australia is able to take on migrants due to being a large, wealthy country with low population density (Wyett, 2013). This would allow individuals and communities to migrate to Australia following natural disasters gradually and with dignity. Such migration also has the potential to benefit Australia's economy through fulfilling skilled labour needs (Philip, 2018; Wyett, 2013). Dealing with this matter in a proactive way to avoid any unwanted costs and complications associated with irregular migration should also be considered (Koser, 2012). To achieve this in practice, two primary changes to Australia's migration system need to be considered.

Firstly, it is recommended that Australia expand on the number of places offered in the current Pacific Engagement visa (subclass 192) stream beyond the current 3,000 spots allocated, as well as increase the number of Asia-Pacific States currently eligible for the visa. Secondly, it is recommended that Australia establish more agreements like the Australia-Tuvalu Falepili Union (2024), which created a separate visa stream labelled Pacific Engagement visa (subclass 192) - Treaty stream (Tuvalu), for the remaining nine PALM states. This would allow communities

from affected Asia-Pacific states a safe way to migrate permanently to Australia with dignity, and receive support from the Federal Government after migrating. In particular, Kiribati, a low-lying Pacific nation, is of particular risk and has been predicted to be the first state to be inundated completely with water and essentially disappear (The Iberdrola Group 2025; Wyett, 2013). In Kiribati, average sea level rise has been 3.2mm/year since 1993, and two uninhabited islands, Abanuea and Tebua Tarawa, have already disappeared underwater (The Iberdrola Group 2025). As such, developing separate visa streams under the Pacific Engagement visa for Kiribati, along with the other PALM states, is recommended.

Recommendation Four – *Creation of a Federal Government policy that gives humanitarian protections and support to Australians facing long-term and permanent displacement due to climate disasters.*

There is currently an absence of humanitarian protection and support for Australians facing long-term and permanent displacement due to climate disasters. Providing support for Australians impacted by long-term or permanent displacement following a natural disaster should be considered for implementation at the national level, potentially within a national framework as outlined in recommendation two. A national approach to planning and funding buyback and relocation schemes across areas most impacted by climate disasters in Australia should be considered. Similar to the Resilient Homes Program in NSW and QLD under State Governments, Australian's can be incentivised to move to areas that are less impacted by climate change through voluntary home buyback schemes, or be given funding and assistance to renovate existing homes to be more climate resilient. Additionally, establishing public awareness training on the rights of displaced people, including displaced people in decision-making processes within Government, and the planning, funding, and building of long-term housing beyond emergency shelters should be considered by the Federal Government (Mortimer et al, 2023).

legal assistance

This chapter can be referenced as "Parry, N. (2025). Legal assistance. In B. Goodsell (Ed.), The State of Policy Report (pp. 291-301). The Climate Centre."

The increase in frequency, intensity, scale and unpredictability of climate-induced extreme weather events and natural disasters in Australia through heatwaves, droughts, floods, fires, and cyclones has a multi-faceted impact on individuals, local communities, and society in general. The physical impacts, such as injury, loss of life and property are compounded by longer-term mental health issues like depression, anxiety, and post-traumatic stress disorder. People may receive financial support from multi-level government agencies, or emotional and practical support from family members, the local community, local businesses, social enterprises, and not-for-profit organisations. Invariably, many people will require legal assistance to deal with the complexity of legal needs following a natural disaster (Disaster Legal Help Victoria 2020). Legal assistance, and access to it, has subsequently become an integral part of the post-disaster recovery phase (Federation of Community Legal Centres Victoria 2023).

Climate justice "describes the intersection between climate change impacts, social justice, and inequality" (Federation of Community Legal Centres Victoria 2023, 12). Climate change impacts people in unequal, uneven and differentiated ways. Climate change becomes a moral and justice issue and climate justice is the systemic corollary that seeks to atone for climate change-related injustices (Sultana 2022). While it may have its roots in environmental justice, climate justice is not only discussed in philosophical and academic discourses but in more pragmatic terms in a global climate change context. These include providing climate finance for loss and damage incurred by Small Island States and other climate-vulnerable countries (Newell 2022) or the 'polluter pays principle', in which typically industrialised parties are responsible for the costs from climate change impacts and environmental harm caused to developing states. The latter example encapsulates the 'common but differentiated responsibilities and respective capacities' consensus at the UNFCCC (Schlosberg and Collins 2014). In the Australian context of natural disasters climate justice is a human rights issue and refers to access to justice in the form of legal assistance.

Policy framework

The sole policy mechanism in place at the national level of government in Australia is the National Strategic Framework for Legal Assistance, which provides the policy framework for all government legal assistance funding and guides legal assistance policy development (Commonwealth of Australia 2019) Out of this Framework came the National Legal Assistance Partnership 2020-25 (NLAP), which was an agreement between Commonwealth and all states and territories for Commonwealth funded legal assistance (Australian Government N.D.) This was superseded on 1 July 2025 by the National Access to Justice Partnership 2025-30 (NAJP). While the NLAP did not mention legal assistance for natural disasters, it is one of the Commonwealth Priorities in the NAJP, which categorises people affected by natural disasters and experiencing financial disadvantage as 'National Priority Client Groups' (Commonwealth of Australia N.D.). Furthermore, the Australian Government is providing additional funding for the legal assistance sector until 2025-26, in response to the floods in 2022 and Black Summer bushfires in 2019-20 (Commonwealth of Australia N.D.).

The primacy of providing legal assistance for natural disasters is documented in the Royal Commission into National Natural Disaster Arrangements, which was set up following the fires of 2019-20. During relief and recovery legal assistance services were in place under the National Bushfire Recovery Fund. The subsequent 'Bushfires Royal Commission' report into the bushfires recognises the role of the legal sector in post-disaster recovery arrangements and provides the following recommendation:

Australian, state and territory governments should expedite the development of pre-agreed recovery programs, including those that address social needs, such as legal assistance domestic violence, and also environmental recovery (Recommendation 22.5). (Commonwealth of Australia 2020).

While the Commonwealth devolves much of the policy implementation to the states and territories, legal issues after natural disasters is accentuated by the experience at the local community level. The Federation of Community Legal Centres Victoria (FCLC) (2023) literature review cites typical areas of legal assistance to include residential tenancy and other forms of housing law, insurance law, employment law and social security law (including accessing disaster payments).

Legal Assistance

Furthermore, a study found that domestic and family violence increased after the Black Saturday bushfires in 2009, although this was not reflected in an increase demand for legal services. The FCLC review also pointed out that after the 2019-20 bushfires, most affected people did not associate their legal needs as deriving from the fires but stated that extreme weather events raise legal issues around rights and duties that have no recourse to the law.

A National Legal Aid (NLA) submission to the Committee on Australia's Disaster Resilience attempted to bridge the apparent dissonance between government and the local legal community. The NLA recommended the integration of disaster

legal assistance into National and State emergency management, and sustainable and ongoing national funding for disaster legal assistance (National Legal Aid 2023).

Legal assistance service delivery in Australia is guided by the National Strategic Framework for Legal Assistance (National Framework) and based on an essentially four-pronged model comprised of legal aid commissions, community legal centres (CLCs), Aboriginal and Torres Strait Islander legal services, and family violence prevention legal services. Within CLCs sit not-for-profit legal organisations such as Justic Connect and the Human Rights Law Centre in Victoria. Indeed, Victoria is the only state prioritising legal assistance for climate change, extreme weather preparedness, resilience, and response (M. Taylor 2025). Organisations specifically relevant to climate and environmental issues include the Environmental Defenders Office, Environmental Justice Australia, GreenLaw, and the National Environmental Law Association.

The Australian legal landscape and climate change

There are several areas involving human rights and climate change that are currently beyond the scope of access to justice and the legal assistance services in Australia. Climate change, both the slow onset climate impacts and natural disasters, creates emerging issues for the legal practice and access to justice around unsafe housing, land use planning, displacement, transformative adaptation, and maladaptation. At the global level, human rights are embedded in climate change fora and in action on disaster risk reduction, including the right to adequate housing and the right to development (United Nations 2015; Rajagopa 2022).

It is well understood that slow onset impacts of climate change, extreme weather events and natural disasters have intensified in recent years and decades. The World Meteorological Organization reports that “the number of disasters has increased by a factor of five over the past 50 years, driven by climate change, more extreme weather and improved reporting.” In Australia, there has been changes in weather and climate extremes such as extreme heat, heavy rainfall, coastal inundation, fire weather and droughts. (CSIRO & BOM (Commonwealth Scientific and Industrial Research Organisation & Bureau of Meteorology) 2024). These changes have increased the frequency and intensity of tropical cyclones, bushfires, heatwaves, droughts, floods, and storm surges resulting in more severe, frequent, and costly natural disasters.

The tangible impacts of disasters are well known; damage to personal property, vital infrastructure, and other commercial assets as well as associated financial costs during the recovery process. However, these are often outweighed by the social impacts: injuries, fatalities, family violence, mental health impacts and high alcohol consumption. Any reference to these issues in policy directives are more likely found at the sub-national level. The Commonwealth’s Climate Change Act 2022 legislates for reducing Australia’s net greenhouse gas emissions to 43% below 2005 levels by 2030 but does not mention tackling climate injustice. However, at the state level, for example, the Victorian State Government, through the Climate Change Act 2017 (Vic) lays out policy objectives that seek to address climate change

inequality and "to support vulnerable communities and promote social justice and intergenerational equity." Nevertheless, as the Federation of Community Legal Centres Victoria argues, in current sector-wide adaptation action plans, as required by the Act, there is no legal assistance policy or mention of legal or justice isuses arrising (2023). The Federation suggests there is "a disconnect between stated legislative policy objectives and the pursuit of justice concerns across Victoria's climate adaptation planning."

Natural disasters in Australia – case studies with legal assistance implications

Natural disasters that have impacted Australia in recent years include Black Saturday Bushfires in 2009, Queensland floods in 2010-2011, Cyclone Yasi in 2011, Black Summer Bushfires in 2019-2020 and the eastern Australia floods in 2022.

Black Saturday Bushfires - 2009

The Bushfires commenced on 7th February 2009 and eventuated with 400 fires across Victoria impacting 78 communities, with 173 fatalities and 2029 properties destroyed. Individual assistance came through the Australian Government Disaster Recovery Payment (AGDRP) which distributed $30 million with $10,000 in grants to bereaved families, $7500 to the seriously injured and $5000 grants to those who lost their homes. The cost of damages in 2009 stood at $1070 million, rising to a normalised cost of $1266 million in 2010, according to the Insurance Council of Australia (Australian Institute for Disaster Resilience n.d.).

The vehicle for wholesale financial assistance through response and recovery phases was twofold. The Victorian State Government established the Victorian Bushfire Reconstruction and Recovery Authority (VBRRA) which included payments for the reconstruction of damaged and destroyed homes, compassion and bereavement assistance and psychological support packages. The contribution of the Australian Government through the Recovery Assistance Package was over $465 million and was the overlay to the State assistance program. It was designed to address the psycho-social, economic, infrastructure, and environmental impacts of the disaster and provided assistance to individuals, families, communities, businesses, primary producers and local governments (Taylor, Tharapos and Sidaway 2014).

From a legal perspective, the Australian Government provided $220,000 for Victorian community legal centres. Within two days of the disaster the Bushfire Legal Help project was established, a partnership involving the key legal bodies and organisations in Victoria: Victoria Legal Aid, the Law Institute of Victoria, Federation of Community Legal Centres, Public Interest Law Clearing House, Victorian Bar, and Victorian Law Foundation. The self-organising, co-ordinating of resources (including lawyers, case managers and volunteers), infrastructure, systems and communication, enabled Bushfire Legal Help to respond to over 2165 enquiries, provide ongoing legal assistance and resources to more than 800 Victorians affected by the bushfires (Victoria Legal Aid 2010).

However, the review by the Bushfire Legal Help partners in November 2009 recommended that the "provision of legal assistance services in the event of a natural disaster should be recognised as an integral and vital aspect of community recovery and included in emergency plans" (ibid, 3). The legal response to the Bushfires, though swift, was ad-hoc and without reference to a formal emergency framework. As such, in the fires' aftermath, Disaster Legal Help Victoria (DLHV) was formed, in association with Federation of Community Legal Centres Victoria, Justice Connect, Law Institute of Victoria, Victoria Legal Aid, the Victorian Aboriginal Legal Service and the Victorian Bar. The DLHV thus formally embedded the legal help framework into post-disaster assistance mechanisms (ibid).

Black Summer Bushfires – 2019-2020

The 2019-20 bushfire season consisted of widespread bushfires across New South Wales (NSW), which burned 5.47 million hectares (ha), followed by Western Australia (2.04 million ha) and Victoria (1.58 million ha). The total area of the fires across multiple states and territories was 10.2 million ha. Of the 33 deaths that occurred, 25 were in NSW and 9 were firefighters (Davey and Sarre 2020) while it is estimated that three billion animals were either killed or displaced including a huge loss of livestock suffered by the agricultural sector (Australian Institute for Disaster Resilience n.d.). The fires destroyed 3100 properties across Australia with NSW bearing the brunt (79%) of the losses. Victoria incurred 13% destruction, South Australia 6%, and Queensland 2% (Davey and Sarre 2020).

The Insurance Council of Australia (ICA) estimated losses to be $2.32 billion, with the majority $1.88 billion (81%) incurred in NSW (Australian Institute for Disaster Resilience n.d.). Financial assistance was provided to individuals by the AGDRP, as with the Black Saturday bushfires, and the Disaster Recovery Allowance (DRA). A total of $252.3 million (204,596 claims) had been paid by 31st August 2020 mainly through AGDRP and DRA. A range of assistance measures such as loans, grants, payments and vouchers for individuals and business were provided by Australian, state and territory governments and charities, such as the Australian Red Cross, St Vincent de Paul and the Salvation Army (Binskin, Bennett and Macintosh 2020). For demolition and rebuilding of property, assistance was provided by the state, for example in Victoria, the Personal Hardship Assistance Program (PHAP) provided a maximum payment of $42,250 per household but excluded owners who had building insurance and/or insurance for demolition. The Royal Commission into National Natural Disaster Arrangements ('Bushfires Royal Commission) reported there were "gaps in the assistance provided through the DRFA" and advocated for "the development of a suite of nationally agreed recovery funding programs" (pre-agreed assistance packages, including for legal help) (ibid: 478-479).

As such, similar legal assistance framework to the Black Saturday bushfires existed at the time of Black Summer Bushfires. Community Legal Centres Australia, in their submission to the Independent Review of Commonwealth Disaster Funding, opined that prevention and disaster-resilience should be embedded in the legal assistance sector but there was no access to funding (Community Legal Centres Australia 2023). Furthermore, funding should be considered long term to deal with the range of legal issues that can emerge long after the disaster recovery has

ended. Community legal services were also experiencing long delay in receiving appropriate funding. Notably the submission argued that recovery packages for assisting people to restore their property was of little value to renters or people experiencing homelessness, thus reinforcing existing inequalities (ibid). Indeed, the Royal Commission had recognised that "the delivery of legal assistance services is a key example of non-government recovery support which would benefit from greater planning" (Binskin, Bennett and Macintosh 2020: 439).

Eastern Australia floods - 2022

Major flooding events had already occurred in March 2021 and November 2021 which had inundated coastal rivers in NSW and caused severe weather warnings to be issued across half the State (Fryirs, et al. 2023). In February 2022 there was riverine flooding extending from the Mary River in Southeast Queensland to the Clarence River in Northeast NSW; there were major floods in the Northern Rivers of NSW (Callaghan 2023). Two urban centres in the area were devastated by floods unparalleled in recent history: Brisbane, which recorded its highest daily rainfall at the current gauge (228.4mm) and Lismore where 557 mm of rain fell on 28th February (Deloitte Touche Tohmatsu 2023).

Twenty-three people died, 14,000 were displaced from their homes (ibid) and a total of $3.47 billion was provided in AGDRP and DRA financial assistance packages, across the major flood events in Queensland and NSW, as well as Victoria and Tasmania which were also impacted. Insurance losses totalled $6 billion and there were 242,351 insurance claims, which was six times higher than average claims for catastrophes since first recorded in 2016 (ibid).

The 2022 floods particularly exposed the inconsistencies, in the manner and timeliness, of insurers' response to claims and handling complaints. The House Standing Committee on Economics (2024) in the inquiry on insurers' responses to the major flood claims reported "too many cases were badly mishandled. Inconsistent decision-making meant neighbours received different outcomes after the same event. Long delays caused negative impacts on emotional and mental health and financial strain. Many people still can't go home several years on from the floods. Initial offers were often too low, which was especially problematic for cash settlements" (Parliament of Australia 2024).

From a legal assistance perspective in the aftermath of the 2022 floods, the Australian Government put financial measures in place that recognise legal issues exist, and arise, months and years after a disaster. The additional funding totalled $17.449m to frontline legal services and community legal centres in NSW and Queensland was provided from 2022 and is due to end in 2026. Insurance issues formed the basis of all the inquiries (76.5%) that were received by Disaster Legal Help Victoria 12 months after the floods, with many insurance holders seeking legal help for the first time because of unresolved disputes and claims they had with their insurers. In light of their experience, DLHV made a submission to the Standing Committee providing recommendations that called for the insurance industry to be more transparent, robust, affordable, and effective when dealing with disaster-impacted people to ensure better outcomes. (Disaster Legal Help Victoria 2023).

Justice Connect, a not-for-profit legal help organisation, similarly highlighted insurance as the issue with most requests for assistance after the 2022 floods in Victoria, closely followed by housing and residential tenancies. In its submission to the Legislative Council Environment and Planning Committee on the Inquiry into the 2022 Flood Event in Victoria, Justice Connect identified two key areas of legal need that required review. Firstly, planning law frameworks need to include adequate drainage in development, properly protected flood zones (buildings raised and drainage increased), operational early warning systems. Secondly, insurance law is consistent with existing legal frameworks to minimise disputes and delays arising from insurance claims which have compounded the physical, mental, and emotional impacts felt by disaster victims (Justice Connect 2023). As recommended in a previous submission by Community Legal Centres Australia, Justice Connect requested in their submission that government funding be quarantined to support the legal assistance sector responses to disasters, as part of a paradigm of increasing legal capability and ensuring community preparedness to flood events (ibid).

International examples on the intersection of legal assistance and government policy on natural disaster assistance

United States

In the United States the integral role legal assistance services play through advocacy and legal advice from pro bono attorneys is exemplified by the post-disaster response to Hurricane Sandy in 2012 by the New York Legal Assistance Group (NYLAG). The law firm established a presence among the affected areas, realised there was a diversity of legal needs, set up temporary legal clinics for the initial issues in the relief and recovery phase and collaborated with city stakeholders, such as private sector donors and foundations (Ballard, et al. 2013).

The Robert T. Stafford Disaster Relief and Emergency Assistance Act 1988 was the US federal government legislative policy backdrop to the legal aid landscape to govern the national response to natural disasters and provide assistance to state and local governments. For federal assistance for post-disasters, the Federal Emergency Management Agency (FEMA) Individuals and Households Program (IHP) was often at odds with NYLAG, for example in classifying what constituted people's essential living areas affected by flooding that required compensation. NYLAG supported the claimant rights to appropriate compensation for the damaged rooms that were actually used which differed from FEMAs classification that only offered the minimal amount of disaster assistance. Thus, the responsibility of lawyers and advocates was to ensure that their clients were eligible to appeal the seemingly inadequate financial assistance provided by the state (Ballard, et al. 2013).

Obtaining justice at the local level in relief and recovery phases led to pathways for procedural and particaptory justice in the aftermath of both Hurricanes Katrina and Sandy. (Schlosberg and Collins 2014). The Sandy Regional Assembly was a collective mobilisation of community, environmental justice, labour, and civic groups from New York, New Jersey, and Long Island neighbourhoods. The group

came together to lobby government to ensure rebuilding, resilience and adaptation plans after Sandy were tailored to the socio-economic and ethnic needs of the local community (Sandy Regional Assembly 2013). Of salience was the issue of climate injustice; the NYU Furman Center (2013) reported most of the victims of Hurricane Sandy were from low-income households and likely also people of colour, highlighting how such communities can be disproportionately vulnerable to the impacts of climate change.

Canada

As with FEMA's classification of damage from Sandy, the operational capacity of rooms in a property is also a metric used by the federal government in Canada. It determines eligibility for repairs or restoration of property damaged by natural disasters or ineligibility where there is insurance cover. Public Safety Canada, the government body responsible for natural disasters implements top-down federal policy by rolling out a financial assistance program (Government of Canada 2025). The guidelines in the program stipulate the parameters of eligibility for financial assistance is determined by the insurance coverage of individuals and property owners; there is no overlap between compensation from the state and insurance payouts. As the website declares, government financial assistance "does not cover insurable losses and is not a replacement or substitute for insurance" (ibid). However, where significant changes occur in the insurance market the government may make policy adjustments commensurate with these.

Similarly legal fees, damage awards by courts, out-of-court settlements or any other expenses are not covered by the state. Assistance is also provided, for instance, with expenses incurred from displacement and temporary housing, clean up and removal of debris, and financial and psychosocial counselling (ibid). While the examples of both the United States and Canada demonstrate federal financial assistance is clearly provided on a needs basis in the aftermath of natural disasters, a top-down policy for legal assistance appears to be missing to address the rights, burdens and claims of those people directly impacted by such events.

The notion of intersectionality, which is the interaction between legal aid workers and the government disaster assistance programs, was clearly evident in the aftermath of Hurricane Katrina. However, these measures do not address wider issues around climate justice and access to legal assistance.

United Kingdom

The all-encompassing legislative directive for disaster risk reduction policy (including floods, droughts, and heatwaves) in the United Kingdom (UK) is the Civil Contingencies Act (HM Government 2004). While coordination of civil emergencies is undertaken at the highest-level, decisions are taken at the lowest appropriate level. However, a sub-national cooperation and communication mechanism was set up to synergies between central government and response at the local level to ensure resources are aggregated and work is not duplicated.

While there are a myriad of laws, regulations, policies, and plans involving multi-agency and multi-sector stakeholders that institute implementation in response

and recovery phases there is a gap in understanding the root causes of vulnerability and advocating long-term resilience to extreme weather events. Currently central government directed financial assistance for those affected by natural disasters is provided at both national and local levels. This is contingent on variables such as location of the incident, level of insurance cover, nature and impact of the incident, role of the local authority in developing a disaster appeal, level of public interest and benefit entitlement (Cabinet Office 2013) . Examples of charitable organisations providing assistance include the National Emergencies Trust and UK Community Foundations, a network of community foundations across the UK.

There is no legal assistance policy directly dealing with natural disasters. The UK government's Legal Aid Agency provides civil and criminal legal aid. Civil legal aid includes housing disputes, insurance claims, legal issues regarding liability for damages which can intersect with legal issues arising from a natural disaster (Legal Aid Agency 2023). Additionally, Citizen's Advice is a one-stop website for help with finding legal aid solicitors, law centres, legal advice clinics and case funding.

Like those most impacted by Hurricane Sandy, similarly in the UK people who are in socially vulnerable or socially deprived neighbourhoods and communities bear the brunt of extreme weather events, notably flooding (Carvalho and Spataru 2023). However, issues of environmental justice are not captured in post disaster or extreme weather event recovery and restoration mechanisms in the UK. These issues include distributive justice (the socially just allocation of goods and resources), and recognitional justice (e.g. how risk management processes should consider different social groups and communities in implementing housing policies). Also, as exemplified after Hurricane Sandy, it includes procedural justice (the collective and institutional decision-making processes and movements that galvanise the equitable distribution of goods and services) (ibid).

Disadvantaged groups can be further marginalised and socially excluded, exacerbating existing inequalities and increasing the risk of future disasters. An example of a vulnerable community 'falling through the cracks' are some of those impacted by the 2015 floods in the UK. Although damaged infrastructure was repaired and restored, those needing food, shelter and water over a prolonged period of time were neglected and were likely to experience negative long-term impacts from the disaster (ibid).

As the Federation of Community Legal Centres Victoria (2023) report argues, "all legal needs are "compounded by climate change impacts" (24) and socially vulnerable groups in the UK example are subject to having their (human) right to adequate, safe housing violated. Moreover, it opens up questions about land use planning in legal practice discourse concerning human rights and equitable approaches to where housing is built and for who (ibid).

Japan

Japan is a disaster-prone country, vulnerable due to its climate, geography and topography and has faced many earthquakes. Two major disasters in recent memory that reverberated globally were the Kobe Earthquake in 1995 which killed over 6,000 people (Hayashi 2010) and the 2011 Tōhoku Great East Japan Earthquake

and Tsunami where the death toll reached approximately 21,839 (Siawsh, et al. 2023). After several large-scale disasters in recent years, in 2020 the Japanese government revised a 1998 law which provided support grants, with contributions from prefectures, to help people recover. This revision categorises the amount of damage incurred to property on a scale from 'completely destroyed' to 'minor destruction' and details the support fund and the additional grant amounts provided accordingly for the construction and repair.

While the government has extended the support grants to include partially destroyed property it called for a "self-help" approach to preparing for natural disasters. It stated that "it is necessary to promote self-help measures to rebuild livelihoods in the event of a natural disaster, such as by encouraging people to purchase appropriate insurance and mutual aid." The Heavy Rain Event of July 2020 (the Kyushu floods) was the major weather event that invoked the "Disaster Relief Act" by providing emergency temporary housing.

A similar legal system exists to the other case studies, whereby legal assistance is primarily accessed through the private sector and lawyers that specialise in environmental law. However, the Great East Japan Earthquake and subsequent tsunami in 2011 embedded the notion of "humanitarian recovery" into a legislative and policy framework for further disasters (Japan Federation of Bar Associations n.d.). This "recovery" was led by the Japan Federation of Bar Associations (JFBA), the legal peak body which seeks to protect human rights across various issues and advocates for civil legal aid provisions by the state. There is already access to free legal consultation for people impacted by disasters. After the Earthquake, lawyers from local bar associations, under the auspices of the JFBA, made several interventions on behalf of disaster victims. They conducted legal consultations and support in makeshift shelters, provided telephone counselling, assisted in recording damage caused, issued documents with legal information, and attached posters of the same to shelter walls. The lawyers discovered, while undertaking these initiatives, that essential human rights of disaster victims were in the main restricted. It gave rise to several legislative and policy measures, after the JFBA successfully lobbied Japan's House of Representatives, relating to various compensation channels, mortgage relief for damaged property and a special law for victims of the Fukushima nuclear power plant accident (ibid).

Conclusion

Government financial assistance and intervention in post-disaster response and recovery processes in both Australian and international contexts is well established. Despite efforts to use legal assistance in disaster preparedness and recovery however, many legal issues and rights remain unaddressed years after the event and are not necessarily settled as matters of justice. As Taylor (2025) argues "post-disaster legal assistance services help individuals return to their pre-disaster impacted state, by itself this does not necessarily support a more ambitious objective to tackle the root causes of injustice, and will not bring about a climate justice-oriented view of legal assistance". Considerations for improving access to legal assistance in the aftermath of natural disasters include expanding funding for legal assistance services, streamlining access to legal aid, enhancing coordination

between and across agencies and jurisdictions, investing in community legal education, developing tailored support for vulnerable populations, and promoting disaster resilience through legal frameworks.

At worst, legal assistance in post disaster operations have been 'knee-jerk' reactions and at best swift, responsive, and self-organised but running parallel and uncoordinated with government agency and other organisations' interventions and responses. While legal assistance often focuses on specific natural disasters it also should recognise the legal issues arising from slow onset climate change impacts. These include extreme heat and housing, air pollution, high costs of living, food insecurity and coastal erosion and sea level rise. Vulnerable groups that are disproportionately affected include First Nations peoples, individuals with disabilities, low-income individuals and families, and other minority groups due to their social and structural conditions (ibid). In contrast to disaster recovery legal services, slow onset climate change legal issues are afforded the scope for exploring transformative change, for example in land use and planning and equitable housing policies. However, such changes as discussed here are beyond disaster preparedness legal frameworks but, along with the recommendations made by the legal aid community, need to be leveraged to ensure climate change and access to justice are at the forefront of government policy mechanisms.

first nations justice and equity

This chapter can be referenced as "Hoksbergen, E. (2025). First nations justice and equity. In B. Goodsell (Ed.), The State of Policy Report (pp. 302-322). The Climate Centre."

This chapter is presented to support efforts to improve outcomes for First Nations peoples in Australia. The Climate Centre acknowledges the foundational principle of "Nothing About Us Without Us," and recognises that genuine progress requires the direct involvement, guidance, and leadership of First Nations communities. Importantly, we acknowledge that this chapter was developed without consultation of First Nations groups. As such, the recommendations outlined herein should not be interpreted as authoritative or prescriptive. They are offered as contributions to ongoing dialogue and should only be considered by governments and policymakers in full partnership with First Nations peoples, incorporating their voices, values, and lived experiences.

History has shown that technological progress and development do not necessarily lead to equal outcomes across populations, hence policy interventions are required to advance First Nations equity and environmental justice in the clean energy transition. In Australia, this issue is unfolding now and is only set to become more pressing. The clean energy transition is an essential pillar of Australia's decarbonisation strategy, with momentum evident through significant capital investment and large-scale infrastructure developments underway. Done poorly, this transition could engender the appropriation of lands, further concentrate power, and entrench systemic inequities; however, it also offers an opportunity to design a more equitable energy system that offers socioeconomic benefits and self-determination for First Nations peoples (Rioux-Gobeil & Thomassin, 2024).

State/territory and federal governments each have a role in governing First Nations equity in the clean energy transition. State and territory governments influence First Nations equity through jurisdictional responsibilities such as education, housing and electricity. In contrast, the federal government shapes First Nations equity in systemic ways through national-level authority in industrial policy, energy policy, human rights, and climate change. Federal responsibilities include delivering obligations under international climate treaties, determining positions on international Human Rights declarations, and setting national economic agendas. As such federal leadership is critical to direct major industrial investment and align national expectations for First Nations equity in the clean energy transition.

Several recent federal policy developments acknowledge this opportunity, including the Capacity Investment Scheme (CIS), the First Nations Clean Energy Strategy, and the Future Made in Australia Plan. To identify how these policies address First Nations equity in the clean energy transition, the energy justice framework can be employed. This framework consists of three dimensions; distributive justice, which considers the fair distribution of benefits and harms; procedural justice, involving participation in decision-making processes; and recognition justice, encompassing cultural understanding and respect (Schlosberg, 2007).

While these federal policies are progressing energy justice, further action is needed to ensure ongoing meaningful advancements in First Nations equity. In order to understand the policy opportunities for advancing First Nations equity in the clean energy transition, current policy must be considered within the unique historical and cultural context of First Nations peoples in Australia. Further, it is essential to consider guidance from stakeholders including those from civil society, industry and academia; while successful frameworks from other jurisdictions can provide insight and inspiration. These considerations are addressed in the following sections.

Background and context

First Nations context

As the world's oldest continuous living culture, First Nations peoples in Australia have been stewards of the continent for over 65,000 years (Clean Energy Council & KPMG, 2024). They hold a deep connection to 'Country' – a notion extending beyond lands and seas to incorporate all living and inanimate elements of the environment, associated knowledges, and cultural practices (Janke et al., 2021). Country is considered central to identity, culture, and life; involving custodial obligations to preserve and protect traditional territories (Janke et al., 2021).

In 1788, Britain declared Australia a settled colony based on the falsehood of *terra nullius* (Australian Human Rights Commission, 2008). The centuries that followed brought a period of extreme violence to First Nations peoples. The Frontier Wars from the 1780s-1930s involved coordinated massacres (AHRC, 2008); the 1950s brought experimental nuclear bomb testing near First Nations communities (Tynan, 2022); and assimilation policies of the 1870s-1960s forcibly removed children from homes resulting in the Stolen Generations (AHRC, 2008). Throughout this period, many died from intentional spread of diseases which severely impacted First Nations populations; and systematic dispossession from traditional lands disrupted culture and language (Clean Energy Council & KPMG, 2024).

Until the 1990's, First Nations' cultural land ownership and associated rights were disregarded in Australia (Fish & Nehme, 2024). The 1992 *Mabo v Queensland (No. 2)* decision overturned *terra nullius*, leading to the Native Title Act 1993 which established a common law framework for recognising First Nations land rights under customary law (Fish & Nehme, 2024). When granted, Native title rights include access to land, cultural practice entitlements, and the potential for financial benefits from development (Janke et al., 2021). It does not, however, grant First

Nations Peoples with full property ownership rights, limiting their ability to influence clean energy developments on their lands (Fish & Nehme, 2024).

Since colonisation, Australia has grown into a modern global economic power, however development benefits have not been equally shared across society, with stark socioeconomic disparities between First Nations and non-Indigenous Australians. First Nations Australians have lower life expectancy (Productivity Commission, 2024), are underrepresented in the workforce (Minderoo Foundation, 2022), and many First Nations communities lack reliable and affordable electricity access within current energy systems (Australian Government, 2024a). Closing the Gap progress remains slow, with key areas such as education and training not improving fast enough (Productivity Commission, 2024). Addressing these inequities while embracing the strength and resilience of First Nations communities requires a step change in accountability, reform of government systems and cultures, and redistribution of power (Productivity Commission, 2024). However, the Government's silence following the failure of the Voice referendum in 2023 (Gibbs-Muir, 2025) alongside the opposition's limited focus on First Nations rights (Liberal Party, n.d.-a) raises concerns that First Nations equity may lose momentum in Australia's current socio-political climate.

The energy transition in Australia

In accordance with the Paris Agreement, Australia has committed to reaching net zero emissions by 2050 with an interim target of a 43% reduction by 2030 (Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2024d). Transitioning from fossil fuels to renewable energy is central to decarbonisation goals, with an 82% renewable electricity target by 2030 (DCCEEW, 2024). Accordingly, investment in Australia's renewable energy industry is thriving, reaching $6.2 billion in 2022 (Fish & Nehme, 2024). However, the net zero transition will require significant amounts of land for siting wind, solar, and transmission infrastructure – with rapid electrification requiring over 120 thousand square kilometres of land (Pascale et al., 2023). In Australia, First Nations peoples have land rights and interests covering nearly four million square kilometres – representing over 50% of the continent (Norman, 2023). As such, an estimated 43% of the required infrastructure will need to be sited on Indigenous Estate (Net Zero Australia, 2023), hence First Nations communities are critical to the transition. While these projects are expected to deliver nearly $21 billion in capital investment and create 700,000 jobs (Clean Energy Council & KPMG, 2024), efforts must be made to not repeat First Nations experiences with the extractive sector – whereby impacted communities have not necessarily accrued benefits from projects sited on lands to which they hold rights (Maynard, 2022).

The energy transition in Australia presents both risks and opportunities. Done poorly, the transition could trigger environmental harm, continue the appropriation of lands, further concentrate power, negatively impact remote and Indigenous communities, and entrench systemic inequities (Rioux-Gobeil & Thomassin, 2024). On the other hand, the transition offers an opportunity to design and implement a more equitable energy system that offers socioeconomic

benefits, inclusive decision-making processes, and self-determination for First Nations peoples (Rioux-Gobeil & Thomassin, 2024).

Equity and justice in the energy transition

Environmental justice seeks to address the environmental disadvantage experienced by historically marginalised populations due to inequity, exclusion and disrespect (Schlosberg, 2013). In Australia, the concept was first adopted by Aboriginal communities with the intent to address issues beyond equity – including "threats to land, country, resources and culture" as a result of developmentalism and environmental degradation (Schlosberg et al., 2018, p. 592). A subset of environmental justice – energy justice – strives for equal access to clean energy and inclusion in energy-related decision-making processes (Rioux-Gobeil & Thomassin, 2024). It aims to reimagine sustainable production while restoring respect for the autonomy and agency of local communities (Schlosberg, 2013). Framing energy justice as an opportunity for reconstruction and transformation allows for approaches which harness the strength and determination of First Nations communities. Energy justice involves three dimensions – distributive, procedural and recognition justice (Schlosberg, 2007).

Distributive justice involves the equal distribution of benefits and burdens of environmental opportunity and risk (Fish & Nehme, 2024; Schlosberg, 2004). In the context of energy justice for First Nations communities, the distribution of socioeconomic impacts includes issues such as community ownership, employment and training opportunities, clean energy revenue streams, and access to affordable clean energy (Rioux-Gobeil & Thomassin, 2024).

Procedural justice regards the fairness of decision-making and policy development processes (Bell & Carrick, 2018). It requires engaging stakeholders in equitable and meaningful ways (Rioux-Gobeil & Thomassin, 2024) to cultivate support and ownership of decisions and outcomes. Procedural justice contributes to distributive justice – as fair and inclusive decision-making processes are more likely to deliver fair and equitable outcomes (Bell & Carrick, 2018). Procedural justice aligns with the notion of 'free, prior and informed consent' (FPIC) – a guiding principle of the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) (Whyte, 2018).

Recognition justice involves acknowledging cultural identity (Schlosberg, 2004), understanding how historical context has shaped inequalities over time, and appreciating diverse experiences and ways of knowing (Rioux-Gobeil & Thomassin, 2024). It highlights the failure to recognise and respect cultural heritage and environmental identities of nondominant groups as the source of injustice (Whyte, 2018), hence recognition justice is an essential foundation of procedural justice (Bickerstaff, 2018).

Table 1: Core elements of energy justice dimensions

Distributive Justice	***Procedural Justice***	***Recognition Justice***
Equal distribution of energy transition benefits	Access to and participation in energy policy development and decision-	Recognising and respecting cultural heritage and

and outcomes, including First Nations: - Community ownership - Employment and training opportunities - Clean energy revenue streams - Access to affordable clean energy (Rioux-Gobeil & Thomassin, 2024)	making processes, including First Nations: - Inclusion - Consultation over time - Decision-making power or influence (Bell & Carrick, 2018)	environmental identities of First Nations groups, while acknowledging historical context in shaping inequality of energy system outcomes (Rioux-Gobeil & Thomassin, 2024; Whyte, 2018)

The interrelatedness of these energy justice dimensions indicates that the success of one is contingent upon the others – stressing the importance to consider all three elements in policymaking processes (Bell & Carrick, 2018). As a framework for drawing insights through policy analysis, core elements of the three energy justice dimensions are highlighted in Table 1 above.

Current federal government policy

Recent clean energy policy advancements relating to First Nations equity include the Capacity Investment Scheme, the First Nations Clean Energy Strategy, and the Future Made in Australia Plan. One other policy that warrants mention within the context of energy justice, is the First Nations Community Microgrids Program. This program – initiated in 2023 – seeks to improve energy security and affordability for First Nations communities through deployment of renewable energy microgrids. While this program is important, it is scheduled to end this year and will likely be replaced with an initiative from the First Nations Clean Energy Strategy, hence it will not be discussed in this analysis.

Capacity Investment Scheme

The Capacity Investment Scheme (CIS) is a Government initiative intended to accelerate the clean energy transition by attracting private investment for renewable energy generation projects (such as wind and solar) and dispatchable capacity (such as batteries) (DCCEEW 2024c). It functions as a revenue underwriting scheme which reduces financial risk for investors by offering long-term revenue 'safety-nets' for renewable energy projects (DCCEEW, 2024a). The CIS expansion announced in late 2023 seeks $67 billion in private investment to deliver 32 GW of capacity, to be attained through tenders which are rolling out from 2024 to 2027 (DCCEEW, 2024a).

The scheme aims to share economic benefits and foster genuine partnerships with First Nations communities (DCCEEW 2024b) by stipulating expectations for how projects will engage with and deliver outcomes for First Nations communities. Bid criteria specify approaches to engagement with local First Nations communities – encouraging proponents to build trusting relationships, and commitments to improving First Nations economic and social outcomes – encouraging equitable partnerships which deliver benefits such as equity or revenue sharing (DCCEEW, 2024g).

The Government has indicated an intent to continuously improve the program based on lessons learnt from prior tender rounds (DCCEEW, 2024h). Stakeholder feedback has informed merit criteria evolution (DCCEEW, 2024h), with the key First Nations criteria adjustments outlined below:

1. Commitment to upholding First Nations legal protections: Recognised as a gap in Tenders 1-3, Tender 4 includes an eligibility criterion requiring commitment to uphold First Nations legal protections (DCCEEW, 2024h). This relies upon proponents and their associates never having breached racial discrimination, cultural heritage, or environmental laws (DCCEEW, 2024h).
2. Distinct First Nations criteria: Tenders 1 and 2 amalgamated First Nations engagement and equity with the broader community social license criteria (DCCEEW, 2024c, 2024e). In contrast, Tenders 3 and 4 established separate criteria for First Nations engagement and outcomes (DCCEEW, 2024f, 2024i).
3. Elevated expectations for First Nations outcomes: Tenders 1 and 2 encouraged equity sharing and employment opportunities (DCCEEW, 2024c, 2024e). However, Tenders 3 and 4 offered more detailed guidance, encouraging contract target aims of 3% project expenditure for Indigenous enterprises, and alignment with the Indigenous Procurement Policy (IPP) (DCCEEW, 2024f, 2024i).

The Government has announced a plan to develop a "First Nations equity and revenue sharing set aside" for tenders from 2026 (DCCEEW, 2024h, p. 9). This will reserve a capacity allocation for bids with committed First Nations equity agreements (guaranteeing co-ownership) or revenue sharing agreements (guaranteeing economic benefits) (DCCEEW, 2024h). Throughout 2025, this 'set aside' will be co-designed with First Nations and industry stakeholders (DCCEEW, 2024h). This represents the continuation of meaningful stakeholder consultation, which has been integral to the design and development of the CIS (DCCEEW, 2024b). The commitment to continually evolve the tender design and merit criteria indicates genuine intent to enhance First Nations outcomes and inclusion within the scheme. Key strengths of the scheme are summarised in Table 2 below.

Table 2: Summary of the Capacity Investment Scheme's key strengths

Distributive justice	**CIS design** • Requires economic and social outcomes – including the stated aim to "deliver projects that share economic benefits" with First Nations communities (DCCEEW, 2024b, para. 14). • Continuous improvement in outcomes-focused merit criteria **CIS implementation** • Encourages proponents to make revenue sharing or co-ownership agreements (DCCEEW, 2024g). • Encourages proponents to support First Nations businesses through procurement (DCCEEW, 2024g). • Encourages proponents to support First Nations employment and training through work readiness investment and scholarships to support those transitioning from other sectors (DCCEEW, 2024g).

	• Intent to develop 'set aside' from 2026 which will ensure a portion of successful bids go to projects that incorporate equity or revenue sharing agreements (DCCEEW, 2024b).
Procedural justice	**CIS design** • Developed and revised through ongoing consultation and engagement (DCCEEW, 2024b). • First Nations hold influence, with the planned 'set aside' to be co-designed in 2025 (DCCEEW, 2024b). **CIS implementation** • Requires proponents to develop First Nations engagement plans, while encouraging co-design of engagement activities with First Nations communities (DCCEEW, 2024g). • The Tender 3 First Nations Briefing Note encourages proponents to consider and implement free, prior and informed consent (FPIC) (DCCEEW, 2024g).
Recognition justice	**CIS implementation** • Requires proponents not to have breached discrimination and cultural heritage legislation including the *Racial Discrimination Act 1975* (Cth); *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth); *Protection of Movable Cultural Heritage Act 1986* (Cth); and *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act). • Requires proponents to demonstrate an understanding of community impacts (DCCEEW, 2024i). • Encourages proponents to 'build trust' with First Nations communities (DCCEEW, 2024g).

The CIS has been critiqued for missing opportunities to deliver First Nations outcomes through its early stages. Tender 1 represented around 20% of the intended overall CIS capacity, directing billions in investments towards projects that did not include First Nations eligibility criteria or standalone First Nations engagement and outcomes criteria (First Nations Clean Energy Network (FNCEN), 2024d). As such, it is critical that future CIS tenders rapidly address gaps to meet international standards on these issues. Key future considerations for CIS implementation are summarised in Table 3 below.

Table 3: Summary of future considerations for the Capacity Investment Scheme

Distributive justice	**Equity thresholds:** While encouraging equity agreements, equity thresholds for co-ownership are not currently mandated. Minimum thresholds could be designed into the 'set aside' planned for 2026.
Procedural justice	**Stronger FPIC inclusion:** While the Tender 3 First Nations Briefing Note encourages FPIC, it is not a requirement and is not included in the merit criteria guidelines.
Recognition justice	**Minimum requirements:** While Tender 4 eligibility requires cultural heritage and racial discrimination legislative compliance, expectations on cultural heritage and cultural knowledge recognition could be raised through mandatory Cultural Heritage Management Plans and Reconciliation Action Plans.

First Nations Clean Energy Strategy

Released in December 2024, the First Nations Clean Energy Strategy (the Strategy) is the Australian Government's five-year framework for collaborating with First Nations peoples to guide clean energy investment, shape policy design, and improve First Nations outcomes in the energy transition (Australian Government, 2024a). Central goals of the Strategy include providing clean energy access to First Nations communities, fostering equitable partnerships, and generating economic benefits for First Nations peoples (Australian Government, 2024a). This involves striving for structural reforms which prioritise Country and Culture in the energy transition. The Strategy highlights that governments and industry must deepen their understanding of First Nations rights and interests in this sector, particularly regarding cultural heritage protection, environmental management, and economic self-determination (Australian Government, 2024a). It celebrates the creativity, wisdom and resilience of First Nations peoples – emphasising this recognition as essential to support pathways toward self-determination (Australian Government, 2024a).

Developed through extensive consultation, the Strategy is positioned as a bridge between clean energy programs and First Nations rights in Australia (Australian Government, 2024a). While implementation will account for unique contexts within each jurisdiction, the Strategy offers the vision and actions required to maximise opportunities that emerge from a holistic approach (Australian Government, 2024a). All Energy and Climate Ministers have endorsed the Strategy (Australian Government, 2024a), with the government committing $70 million to support implementation (Norman, 2024). The key strengths of the Strategy are summarised below in Table 4.

Table 4: Summary of the First Nations Clean Energy Strategy's key strengths (Australian Government, 2024a)

Distributive justice	• Focus on establishing affordable and reliable energy access. • Focus on economic outcomes, including building workforce opportunities, supporting First Nations businesses, financing First Nations-led projects, and funding equity ownership. • The Strategy explicitly states that it seeks improvement on key Closing the Gap targets.
Procedural justice	• The Strategy itself was developed through significant consultation and leadership from First Nations voices over an extended period of time. • Focus on First Nations inclusion and influence, such as providing adequate information, establishing a 'one-door' information portal, supporting community negotiation potential through access to expertise, and enacting best practice engagement standards. • Supports the *Leading Practice Principles: First Nations and Renewable Energy Projects* guide – a toolkit that offers a lot of guidance on issues relating to procedural justice.
Recognition justice	• The Strategy recognises First Nations people's cultural heritage and environmental values – highlighting the need for governments and industry to better understand these areas.

	• Deploys a future-focused and strength-based approach – emphasising that "intelligence, creativity, wisdom, resilience and initiative are assets to be recognised and celebrated" (p.14). • Endorses *Dhawura Ngilan Business and Investor Initiative* best practice cultural heritage guidelines.

This Strategy effectively addresses the three dimensions of energy justice; however, its impact will ultimately depend on successful implementation. Upcoming priorities must include establishing clear success measures, robust monitoring frameworks, and sustained funding (FNCEN, 2024b; Norman, 2024).

More broadly, this Strategy has been released against the backdrop of a challenging year for First Nations rights, recognition and reconciliation. The failure of the Voice referendum in October 2023 denied First Nations peoples a constitutionally enshrined voice to Parliament, leaving First Nations communities with a sense of rejection while raising concerns about a regression of Indigenous rights (Gibbs-Muir, 2025). Since the referendum, the federal government has remained largely silent, with their momentum on treaty and truth-telling also appearing to have stalled (Crowley, 2024; Gibbs-Muir, 2025). While the First Nations Clean Energy Strategy aligns with Closing the Gap and key policy reforms – including cultural heritage, Indigenous procurement, clean energy workforce development, and economic empowerment (Australian Government, 2024a) – it is not positioned within a broader, coordinated approach to reconciliation, rights and recognition. This contrasts Canada's approach, where the Wah-ila-toos initiative which supports Indigenous participation in the clean energy sector, is embedded within a comprehensive reconciliation approach that has delivered systemic change such as enshrining the UNDRIP into law (Government of Canada, 2022, 2024). Integrating First Nations clean energy policy within systemic rights-based strategy and legislation creates a more stable and resilient policy infrastructure, embedding momentum less vulnerable to shifting political priorities.

The UNDRIP was an issue raised through the Strategy's consultation process. Stakeholders highlighted the importance of aligning legislation with UNDRIP articles (Australian Government, 2024b), while the First Nations Clean Energy Network recommended they be factored into the Strategy as mandatory conditions for accessing government funding (FNCEN, 2024b). The Strategy addresses the government's current stance on the UNDRIP and FPIC, acknowledging that it has yet to respond to the Parliament of Australia's Joint Standing Committee on Aboriginal and Torres Strait Islander Affairs inquiry, which recommended aligning legislation and policy with UNDRIP articles (Australian Government, 2024a). This represents a missed opportunity to formally respond to the inquiry's recommendations and commit to enshrining the UNDRIP principles into law. Future considerations for the Strategy are summarised below in Table 5.

Table 5: Summary of future considerations for the First Nations Clean Energy Strategy

Distributive justice	The Strategy requires ongoing funding and monitoring to ensure delivery of First Nations outcomes. Success measures and a monitoring framework must be developed as a priority for implementation.
Procedural justice	The Strategy would be strengthened if the UNDRIP and FPIC were enshrined into federal law, complemented by a UNDRIP implementation plan.
Recognition justice	The Strategy would be more resilient if it were embedded within a broader reconciliation framework as seen in Canada through the Wah-ila-toos initiative.

Future Made in Australia

The Future Made in Australia (FMA) is the nation's new economic plan designed to support the net zero transition (Australian Government, n.d.). Legislated in December 2024 through the Future Made in Australia Act 2024 (Cth), the plan is supported by $22.7 billion over the next decade to pursue its "renewable energy superpower" ambition (Commonwealth of Australia, 2024, p. 5). While aiming to increase the value of natural resources and enhance economic resilience, the facilitation of private investment will enable Australia to develop competitive new industries and drive local production – generating jobs and economic opportunities (Australian Government, n.d.).

Critically, the FMA Act mandates that any support made through the plan, such as investment, grants or loans, must regard its 'Community Benefit Principles'. Two of the six principles relate to First Nations interests – the first requiring collaborative engagement and delivery of positive outcomes, and the second requiring support for participation in transition activities while sharing in the benefits of these opportunities (Future Made in Australia Act, 2024). Decision-makers granting financial support for policies within the FMA policy agenda must account for these principles. While the legislation is in its infancy, how these principles shape outcomes through implementation is yet to be determined. A summary of the FMA's key strengths are provided in Table 6 below.

Table 6: Summary of the Future Made in Australia Plan's key strengths

Distributive justice	When awarding government support, decision-makers must consider the Community Benefit Principles' First Nations outcomes: "supporting First Nations communities and traditional owners to participate in, and share in the benefits of, the transition to net zero" (Future Made in Australia Act, 2024, s 10(3)(iiia))
Procedural justice	When awarding government support, decision-makers must consider the Community Benefit Principles' requirements for First Nations participation: "engaging collaboratively with and achieving positive outcomes for local communities, such as First Nations communities and communities directly affected by the transition to net zero" (Future Made in Australia Act, 2024, s 10(3)(iii))

While the Community Benefit Principles set high-level requirements aligned with distributive and procedural justice objectives, they lack the detail needed for

effective implementation, and guidance is yet to be developed by the Treasurer (Chalmers et al., 2024). The Coalition has raised concerns that the Community Benefit Principles are unclear, duplicative of existing regulations, and are susceptible to politicisation due to the Treasurer's sole discretion in how they will translate into regulatory requirements (Commonwealth, Parliamentary Debates, Senate, 10 February 2025). Vulnerability to changing political priorities presents a risk for the effective implementation of the Community Benefit Principles. To effectively deliver First Nations outcomes, detailed rules and guidance are essential and must be developed in consultation with First Nations communities.

Recognition justice is not yet reflected within the FMA Plan, however this could be addressed through two entities. The Net Zero Economy Authority (the Authority) is central to the delivery of the FMA Plan; established to support workers, promote inclusive engagement, drive investment, and develop policies that benefit transition communities (PM&C, 2024). It has a mandate to support First Nations peoples to participate in and benefit from the shift to a net zero economy (Net Zero Economy Authority Act, 2024). The First Nations Clean Energy and Climate Change Advisory Committee (the Committee) advises the Government on policy relating to First Nations interests in the clean energy transition (Australian Government, 2024a) – providing perspectives and advice on the Government's clean energy priorities, policy development and implementation, cultural heritage protection, and benefit-sharing opportunities (DCCEEW, 2025). Engagement between these entities could weave recognition justice into the FMA Plan by ensuring that cultural heritage and environmental identities are respected throughout implementation. Future considerations are summarised below in Table 7.

Table 7: Summary of future considerations for the Future Made in Australia Plan

Distributive justice	Detailed rules and guidance must be established for the Community Benefit Principles to effectively deliver First Nations outcomes.
Procedural justice	The detailed rules and guidance developed for the Community Benefit Principles must be established through First Nations consultation.
Recognition justice	Net Zero Economy Authority should establish formal engagement with the First Nations Clean Energy and Climate Change Advisory Committee. The Committee's intent is to elevate First Nations voices through in the net zero transition (DCCEEW, 2024). Their expertise includes First Nations rights and interests, knowledge systems, cultural preservation, and land justice (DCCEEW, 2025) – which should be applied throughout FMA implementation.

Political positions

Government

First Nations equity is not at the forefront of Labor's 2025 election campaign (Labor Party, n.d.), however Prime Minister Anthony Albanese made Labor's position clear during his Closing the Gap speech in February. In reference to Australia's renewable energy superpower ambitions, Albanese (2025) highlighted an intent for clean energy development to bring economic empowerment to communities through

employment, training, and access to finance. He announced plans to establish a First Nations Economic Framework and a First Nations Economic Partnership (Albanese, 2025), indicating an agenda in line with current efforts. However, Albanese (2025, para. 20) emphasised "practical partnerships", potentially indicating a shift away from broader First Nations rights issues.

Opposition

The Liberal-National Coalition have not offered an explicit position on the issue of First Nations equity in the clean energy transition. The Liberal party is focused on supplementing renewables uptake with nuclear energy to deliver a "balanced energy mix" (Liberal Party, n.d.-a, p. 15). While their plan outlines benefits for the seven communities impacted by proposed nuclear facilities, it makes no mention of First Nations engagement or outcomes (Liberal Party, n.d.-b). The Coalition's First Nations policy prioritises "practical action", including a commitment to "[e]mpower Indigenous communities to use their land for economic development" (Liberal Party, n.d.-a, p. 31). More broadly, Peter Dutton voiced his lack of support for truth-telling and Makarrata, indicating that First Nations rights would be unlikely to appear on a Coalition Government's agenda (McKenna, 2024).

Crossbench

While The Greens do not have a specific policy for First Nations equity in the clean energy transition, their position is evident through their principles and priorities. Their climate change and energy plan places equity and justice at the heart of climate action and supports a rapid transition to 100% renewable energy (The Greens, n.d.-a). Their First Nations policies are also highly relevant, including Native Title reform (decoupling compensation rights from consent, and embedding free, prior and informed consent); full implementation of the UNDRIP (co-designing a framework to enshrine into federal law); protecting cultural heritage (co-designing a federal Act with First Nations peoples); and advancing Truth, Treaty, and Justice (establishing a National Truth and Justice Commission and collaborating with communities to develop models for national treaties) (The Greens, n.d.-b).

Stakeholder perspectives

First Nations Clean Energy Network

The First Nations Clean Energy Network are a cross-sectoral partnership dedicated to advancing First Nations interests in the clean energy transition (FNCEN, n.d.-c). The Network's priorities include supporting First Nations community involvement in clean energy projects, catalysing industry partnerships while promoting best practice standards, and advocating for policy reforms that accelerate the energy transition while enhancing First Nations interests (FNCEN, n.d.-b).

Throughout 2024, the Network influenced CIS tender provisions to better reflect First Nations interests, recommending cultural competency eligibility requirements, standalone First Nations merit criteria, and more ambitious outcomes (FNCEN, 2024d) – all of which were implemented in Tender 4. In response to the FMA Bill's Community Benefit Principles, the Network recommended an additional provision strengthening First Nations participation

and benefit-sharing (FNCEN, 2024e). Through collaboration with Parliamentary Members, the amendment was proposed and ultimately adopted by the government (FNCEN, 2024f). Further, the Network was instrumental in shaping the First Nations Clean Energy Strategy – initiating development and supporting consultation (FNCEN, n.d.-a).

The Network have recommended that CIS tenders should enhance First Nations outcomes through a minimum equity ownership requirement of 5% or equivalent revenue sharing arrangement, with incentives for commitments above this threshold (FNCEN, 2024c). They also highlight that the scale of the CIS program offers an opportunity to establish an industry standard for First Nations employment and training – proposing First Nations employment targets which adopt "coordinated flexibility" to account for context (location and type of renewable technology) and impact delivery (preventing tick-box outcomes), while mandating compliance with the Indigenous Procurement Policy (FNCEN, 2024a, p. 65). A summary of the Network's broader policy positions are included below in Table 8.

Table 8: Summary of the First Nations Clean Energy Network's policy positions (Nolan & Kneebone, 2023)

Distributive justice	• Accelerating First Nations ownership of clean energy projects through development of innovative financing solutions such as government-backed loan guarantee programs. • Supporting First Nations-led clean energy projects through targeted financial assistance for milestones such as feasibility assessments and financial analyses. • Embedding participation by extending procurement policies to ensure governments and industry source energy from suppliers that meet minimum First Nations equity ownership thresholds. • Building workforce and entrepreneurship opportunities through mentorship and targeted support.
Procedural justice	• Embedding the UNDRIP's principles of Free, Prior and Informed Consent (FPIC) into policy and legislative systems.
Recognition justice	• Investing in a First Nations' plan for Country, culture, people and aspirations to enable communities to support projects and partnerships best positioned to deliver mutually beneficial outcomes.

Clean Energy Council

The Clean Energy Council (CEC) are Australia's clean energy industry peak body, with an ambition to accelerate the energy transition and establish Australia as a clean energy superpower (Clean Energy Council, n.d.). Their role centres upon advocating for the industry, shaping policy, collaborating with governments, improving standards, and supporting their members (Clean Energy Council, n.d.). The CEC submitted consultation feedback for the Future Made in Australia Bill, raising concerns that the Community Benefit Principles could create ambiguity for investors and decision-makers while setting unrealistic expectations for

communities (Clean Energy Council, 2024). Accordingly, they recommended removal of the particulars of the Community Benefit Principles, opting for the details of these principles to be defined in subordinate legislation and developed through consultation (Clean Energy Council, 2024). This recommendation was not adopted in the final version of the FMA Act.

In 2024, the Clean Energy Council and KPMG co-authored *Leading Practice Principles: First Nations and Renewable Energy Projects* – a guide developed to support the clean energy industry in delivering better engagement and outcomes for First Nations communities. Co-designed with First Nations peoples, it builds upon the First Nations Clean Energy Network's *Best Practice Principles for Clean Energy Projects*. The principles address respectful engagement, accessible information, cultural heritage preservation, protecting Country, socioeconomic benefit sharing, embedding land stewardship, cultural competency, and monitoring progress (Clean Energy Council & KPMG, 2024). The guide intends to facilitate industry adoption of the principles by outlining minimum practices and leading practices, providing insight into what could be considered baseline expectations (outlined in Table 9) and high standards across the three dimensions of energy justice.

Table 9: Baseline expectations for industry engagement with First Nations communities (examples of minimum practice) (Clean Energy Council & KPMG, 2024).

Distributive justice	• Establish a local employment plan. • Develop a First Nations procurement strategy and actively pursue First Nations businesses. • Consult with First Nations communities to understand benefit-sharing priorities.
Procedural justice	• Develop a First Nations engagement plan. • Establish a process for obtaining FPIC through early engagement – e.g. providing comprehensive and clear information, offering flexibility in project design, and acknowledging power imbalances. • Ensure a complaints management process is in place to action concerns of First Nations communities.
Recognition justice	• Voluntarily enter a Cultural Heritage Management Plan. • Conduct cultural competency training for site-based employees and contractors. • Ensure leaders respect and participate in cultural events such as Reconciliation Week. • Establish a Reconciliation Action Plan (RAP) to coordinate organisational commitments.

Academic review

Two notable themes emerged from the literature regarding First Nations equity and environmental justice in the clean energy transition. Firstly, that the Native Title Act offers limited rights hence must be reformed to achieve energy justice,

and secondly that continued colonial dispossession through the clean energy transition must be avoided.

Native Title Act reformation

The Native Title Act 1993 (Cth) (NTA) provides a key mechanism for negotiating development agreements on Indigenous Estate; however, it has significant limitations (O'Neill et al., 2021). The NTAs 'right to negotiate' encourages settlements through Indigenous Land Use Agreements (ILUAs) between Traditional Owners and corporations, however it does not mandate them (Fish & Nehme, 2024). The required six month good-faith negotiation period does not allow Traditional Owners veto rights, hence unresolved negotiations are determined by the National Native Title Tribunal (NNTT) (Rioux-Gobeil & Thomassin, 2024). However, the NNTT has a track record of allowing development, and has no authority to mandate compensation, hence arbitration can undermine compensation outcomes and limit equity in bargaining power for First Nations communities (Rioux-Gobeil & Thomassin, 2024). Further, NNTT decisions can be overruled by the federal government if a project is deemed to be 'in the national interest' (Fish & Nehme, 2024).

Problematically, the 'right to negotiate' under the NTA may not necessarily apply to renewable energy developments (Fish & Nehme, 2024; O'Neill et al., 2021). As of early 2024, less than 0.5% of all ILUAs related to renewable energy development (Fish & Nehme, 2024). In the absence of ILUAs, First Nations communities face weaker procedural rights, limiting their ability to influence renewable energy developments on their lands (Fish & Nehme, 2024). Legal reform is required to address these procedural and recognition justice gaps, ensuring that First Nations communities have stronger mechanisms for engagement and consent (Fish & Nehme, 2024). These reforms could pre-emptively mitigate conflicts while aligning Australia's legislation with the UNDRIP (Fish & Nehme, 2024).

Avoiding continued colonial dispossession

Australia's colonial history has led to systemic inequities in First Nations' legal power, knowledge recognition, and ability to shape the clean energy transition (Rioux-Gobeil & Thomassin, 2024). The ongoing impacts of colonisation affect all three dimensions of energy justice, embedding structural challenges that hinder a just transition (Rioux-Gobeil & Thomassin, 2024). First Nations peoples require stronger representation and political voice to defend and advocate for their interests (Rioux-Gobeil & Thomassin, 2024). While the clean energy transition will require extensive development on Indigenous Estate, past experiences have demonstrated that First Nations communities do not necessarily benefit from developments on their lands (Maynard, 2022). To prevent the energy transition from repeating historical patterns of colonial dispossession, First Nations representation and perspectives on Government policy are critical (Norman, 2023).

While the First Nations Clean Energy Network has been undertaking this critical role, they emerged in the absence of a national representative body (Norman, 2023). The Voice referendum offered First Nations peoples the "power of influence" (Baker & Carrick, 2023, as cited in Norman, 2023, p. 139), while representing their

interests and aspirations for the land estate. Had it succeeded, the Voice would have complemented this specialist advisory group by advocating for Indigenous land rights (Norman, 2023). While Voice, Treaty and Truth reforms would advance energy justice in Australia, the politicisation of the Voice referendum highlights the challenge of constitutional reform in Australia, hence more traditional policy mechanisms may be required.

International Approach

Long considered the "gold standard" of First Nations participation in the clean energy industry (Brown, 2024, para. 21), Canada's Indigenous communities have been at the forefront of the transition for over 20 years, participating in over 150 projects (Fish & Nehme, 2024). By late 2020 Indigenous entities had become one of the most powerful clean energy players in the country (Kneebone, 2023a). Today, they are partners or beneficiaries of nearly 20% of the nation's energy generating infrastructure (Australian Government, 2024a). Influential policies that have driven this result are outlined below, with key strengths summarised in Table 10.

Federal: United Nations Declaration on the Rights of Indigenous Peoples Act

Canada's reconciliation journey involves three pillars; addressing past harms and healing, strong and healthy communities, and advancing self-determination (Government of Canada, 2022). Central to these efforts is implementation of the UNDRIP. Canada enshrined the UNDRIP into law in 2021, with an implementation roadmap released in 2023 outlining key actions to support reconciliation, healing and cooperative relations (Government of Canada, 2021, 2024). These efforts to create a fair, inclusive and equitable society (Government of Canada, 2021) underpin their clean energy endeavours.

Federal: Wah-ila-toos

In 2021, the Canadian government announced $300 million in funding for 'Wah-ila-toos' – an initiative supporting Indigenous, rural, and remote communities to participate in the clean energy transition (Government of Canada, 2023). The initiative aims to increase local expertise, build transition readiness, and increase renewable generation by supporting Indigenous-led projects (Government of Canada, 2023). It addresses participation barriers through a "no-wrong-door" approach, streamlining access to funding and resources, and offering flexible application timelines (Government of Canada, 2024, para. 4). It is part of Canada's reconciliation journey, and supports self-determination.

British Columbia: BC Hydro – Call for Power

BC Hydro is one of Canada's largest electric utilities. In April 2024, they released the Call For Power to obtain clean energy from new privately owned energy resources. The Call For Power included a First Nations economic participation model, which was developed in collaboration with First Nations communities (BC Hydro, 2024). Eligibility requirements included a minimum 25% equity ownership threshold measured on a pass-fail basis (BC Hydro, 2024). Extra credit was granted to proposals exceeding the ownership threshold or offering other non-equity economic benefits (BC Hydro, 2024).

British Columbia: Clean Energy Act (2010) – First Nations Clean Energy Business Fund

British Columbia's Clean Energy Act 2010 enabled development of the provinces' First Nations Clean Energy Business Fund – established to drive Indigenous participation in the sector by providing funds for projects on traditional lands. Funding is designed to support project milestones through capacity funding and offer financial security through equity funding (Government of British Columbia, 2024).

Ontario: Green Energy Act (2009) – Aboriginal Price Adder

Ontario's Green Energy and Green Economy Act 2009 sought to stimulate the province's clean energy sector, while supporting First Nations and Métis communities to develop and own renewable energy projects. It introduced a feed-in-tariff that provided fixed above-market prices for electricity generated by renewables projects, while an 'Aboriginal Price Adder' offered supplementary incentives for projects meeting the minimum Indigenous ownership threshold of 10% (FNCEN, 2024c).

Ontario: Aboriginal Loan Guarantee Program

Established in 2009, the $1 billion Aboriginal Loan Guarantee Program supports Indigenous communities to participate in clean energy infrastructure and transmission projects by providing loan guarantees for up to 75% of the required equity investment (Ontario Financing Authority, n.d.).

Table 10: Summary of the strengths of leading Canadian policies

Distributive justice	Wah-ila-toos (CA): Drives social and economic outcomes through prioritising investment for Indigenous-owned or Indigenous-led projects – supporting job creation and revenue streams for Indigenous communities (Government of Canada, 2023). Enables Indigenous communities to transition away from diesel power consumption by supporting local clean energy generation and access (Government of Canada, 2024). BC Hydro's Call For Power (BC): Requires a minimum 25% First Nations equity ownership or projects are disqualified. Extra credit granted to proposals which exceed this threshold or offer non-equity economic benefits for First Nations (BC Hydro, 2024). Aboriginal Price Adder (ON): Projects with a minimum 10% Indigenous equity ownership are offered an additional $0.015 per kWh on top of the fixed above-market prices of the feed-in-tariff program. Projects with higher Indigenous ownership received higher price adders (FNCEN, 2024c). First Nations Clean Energy Business Fund (BC): Promotes First Nations participation in the clean energy sector through capacity funding and equity funding, while also offering revenue sharing agreements (Government of British Columbia, 2024).

	Aboriginal Loan Guarantee Program (ON): Supports Indigenous ownership of renewables projects, while also stimulating job and training opportunities (Ontario Financing Authority, n.d.).
Procedural justice	UNDRIP Act (CA): Legislating UNDRIP principles underpins the creation of a fair, inclusive and equitable society (Government of Canada, 2021). Wah-ila-toos (CA): Program aligns with the UNDRIP (Government of Canada, 2023). The 'no-wrong-door' approach addresses systemic barriers to participation, streamlining access to funding and resources; adopting a rolling application timeline rather than strict proposal deadlines to accommodate for community readiness; and offering project officers to support communities (Government of Canada, 2024). An Indigenous Council was established to share knowledge, shape program and policy developments, and reduce application complexity (Government of Canada, 2024). BC Hydro's Call For Power (BC): The economic participation model was developed through collaboration with First Nations communities to ensure it delivers to their needs, while also aligning with the organisations' UNDRIP 'Implementation Plan' (BC Hydro, 2024). First Nations Clean Energy Business Fund (BC): The fund is administered by the Ministry of Indigenous Relations and Reconciliation, ensuring the underlying agenda aligns with First Nations interests (Government of British Columbia, 2024).
Recognition justice	Wah-ila-toos (CA): The initiative strives to advance reconciliation and self-determination (Government of Canada, 2023). The name 'Wah-ila-toos' was gifted to the initiative by Indigenous Elders during a ceremony in early 2023, bestowing responsibilities and representing a meaningful relationship with Indigenous communities (Government of Canada, 2024). Further, the Indigenous Council represents Indigenous voices in decisions regarding energy sovereignty while informing federal climate action policies (Government of Canada, 2024). BC Hydro's Call For Power (BC): One of BC Hydro's four strategic objectives is "advancing reconciliation with First Nations" (BC Hydro, 2024, p. 4).

Recommendations

Over the past year, significant progress has been made in policies advancing First Nations equity and environmental justice within the clean energy transition. This momentum must be maintained and strengthened by the federal government. Securing ongoing funding and support for the effective implementation of the First Nations Clean Energy Strategy is essential. While the Strategy provides a comprehensive framework and action plan, the below recommendations complement its objectives.

Recommendations to support distributive justice

Mandate minimum equity ownership thresholds

First Nations equity ownership can reduce risk and increase shareholder value (FNCEN, 2024c), while providing income, wealth generation and employment for Indigenous communities (Kneebone, 2023b). The First Nations Clean Energy Network (2024c) advocates for minimum equity thresholds, a proven model in Canada where policies require 10-25% Indigenous ownership with strict pass-fail eligibility criterion (BC Hydro, 2024). Future CIS tenders will include a 'set aside' for projects with equity or revenue-sharing agreements, however it is not yet clear whether this will include a minimum threshold (DCCEEW, 2024h). To ensure government investment is conditional on First Nations participation, mandatory minimum equity (or revenue sharing) thresholds should be incorporated into CIS tenders and rules emerging from the FMA's Community Benefit Principles.

Provide accessible financing to support First Nations capital investment

Equity ownership in clean energy projects requires substantial capital investment, making access to financing essential for First Nations community participation. The First Nations Clean Energy Strategy will explore the establishment of a First Nations clean energy fund (Australian Government, 2024a), while the First Nations Clean Energy Network advocates for government-backed loan guarantees (Nolan & Kneebone, 2023). Similar models have been successfully deployed in Canada, where loan guarantees and business funds have driven increased Indigenous participation in clean energy projects (Government of British Columbia, 2024; Ontario Financing Authority, n.d.). Accordingly, new policies are needed to expedite accessible and adequate financing in Australia.

Mandate workforce participation targets

Employment and training are essential for a just energy transition. The First Nations Clean Energy Strategy recommends employment targets, enhancing adoption of the Indigenous Procurement Policy (IPP) targets, and mandatory minimum participation requirements (Australian Government, 2024a). The First Nations Clean Energy Network recommends that CIS tenders should include First Nations participation benchmarks (such as a minimum of 1.5%) and mandatory IPP compliance (FNCEN, 2024a). Additionally, the Clean Energy Council and KPMG's (2024) guide recommends project-specific employment targets as a minimum practice. To advance First Nations workforce opportunities, carefully designed participation targets and IPP compliance should be mandated within the next release of CIS tenders and factored into rules emerging from the FMA's Community Benefit Principles.

Recommendations to support procedural justice

Enshrine the United Nations Declaration on the Rights of Indigenous Peoples into Australian law

The UNDRIP establishes global minimum standards to protect the survival, dignity and well-being of Indigenous peoples (United Nations, n.d.). To date, Australia has endorsed but not formally adopted the UNDRIP into law (Janke et al., 2021). First Nations equity and justice are fundamentally rights-based issues, with free, prior and informed consent (FPIC) serving as a critical foundation for ensuring First Nations equity and justice in Australia's clean energy transition. Legal recognition

of FPIC is supported by the First Nations Clean Energy Network (Nolan & Kneebone, 2023) and The Greens (n.d.-b). FPIC is recognised as a minimum expected practice in the Clean Energy Council and KPMG's (2024) industry guide, while Canada has incorporated UNDRIP into federal law (Government of Canada, 2021). Australia must legislate the UNDRIP and develop an associated implementation plan to enshrine FPIC as a fundamental right, advancing procedural justice in the clean energy transition.

Native Title reform

Currently the NTA offers weak procedural rights, limiting the ability of First Nations communities to influence renewable energy developments on their lands. Reform could ensure that First Nations communities have stronger mechanisms for engagement and consent while pre-emptively mitigating conflicts by aligning legislation with the UNDRIP. This would redress the current scenario of minimal legal rights undermining negotiation and decision-making power (Reconciliation Australia, 2024). Reform is supported by the academic literature (Fish & Nehme, 2024), while The Greens (n.d.-b) propose reform that decouples compensation rights from consent and embeds FPIC as a required principle. The Native Title Act 1993 (Cth) should be reformed to strengthen legal rights of Traditional Owners to influence clean energy developments on their lands.

Recommendations to support recognition justice

Embed clean energy policies within a holistic framework of reconciliation and recognition

Clean energy policies that seek to advance First Nations equity would be more resilient if embedded within a broader framework of First Nations rights. To ensure historical patterns of colonial dispossession are not repeated through the energy transition, First Nations perspectives on Government policy are critical, while effectively defending First Nations interests requires stronger representation and political voice (Rioux-Gobeil & Thomassin, 2024). Voice, Treaty and Truth reforms are supported by the academic literature (Norman, 2023), while The Greens (n.d.-b) advocate for a National Truth and Justice Commission and propose development of national treaties. Canada's Wah-ila-toos initiative is embedded within the nation's broader reconciliation journey – working towards an inclusive and equitable society (Government of Canada, 2024). Australia's clean energy policies should be integrated into a holistic reconciliation framework advancing Voice, Truth and Treaty.

Conclusion

Policy intervention is necessary to advance First Nations equity and environmental justice in the clean energy transition in Australia. Recent federal policy developments, including the Capacity Investment Scheme (CIS), the First Nations Clean Energy Strategy, and the Future Made in Australia (FMA) Plan are progressing this agenda. Collectively, they are delivering toward the three dimensions of energy justice, however it is essential that this momentum is maintained and strengthened by the federal government. Securing ongoing

funding and support for the effective implementation of the First Nations Clean Energy Strategy is essential. While the Strategy provides a comprehensive framework and action plan, six key recommendations will complement its objectives. To strengthen distributive justice, minimum expectations for First Nations outcomes should be reinforced in government investment allocations. Further, to overcome procedural justice limitations, legislative gaps must be addressed through reforms to elevate First Nations rights and native title entitlements. Finally, recognition justice can be advanced by embedding existing policies and plans within a broader framework of reconciliation, voice, treaty and truth-telling. The six key recommendations are summarised in Table 11 below.

Table 11: Summary of recommendations

Distributive justice	1. Mandate minimum First Nations equity ownership thresholds for recipients of government funding through programs such as the Capacity Investment Scheme and Future Made in Australia. 2. Provide accessible financing to support First Nations capital investment in clean energy projects. 3. Mandate First Nations workforce participation targets for recipients of government funding through programs such as the Capacity Investment Scheme and Future Made in Australia.
Procedural justice	4. Enshrine the United Nations Declaration on the Rights of Indigenous Peoples into Australian law. 5. Native Title reform to strengthen Traditional Owners' negotiation and decision-making authority over clean energy developments on native title lands.
Recognition justice	6. Embed clean energy policies within a holistic reconciliation and recognition framework incorporating voice, treaty, and truth.

If enacted, these recommendations would improve energy justice for First Nations communities across Australia.

This chapter can be referenced as "Ross, M. (2025). Towards climate adaptation. In B. Goodsell (Ed.), The State of the Policy Report (pp. 323-343). The Climate Centre."

The Australian continent is a geographic area particularly at risk from the observable and quantifiable impacts of a changing global climate. The continent experiences extreme temperatures and heat waves, bringing associated droughts and bushfires which impact large areas of Australia's land mass, particularly the sparsely populated regional and agricultural zones. An increase in cyclonic activity and extreme storm events have brought wind damage and catastrophic floods to the coastal regions, where approximately 87% of Australia's population, or approximately 22 million people, were residing as of 2019 (Cresswell ID, Janke T & Johnston EL, 2021). The '2021 World Economic Forum Global Risks Report' presents a top ten of general global risks assessed over the prior 12 months in terms of likelihood and impact and the top three spots for likelihood were: extreme weather, climate action failure and natural disasters (AECOM/GBCA, 2021). This has markedly increased immediate pressures on our natural disaster preparation and response and recovery efforts, while having impacts on public health and safety, housing security and the stability of the insurance and finance sectors. Longer term shifts in temperature and localised climate impacts are affecting our agriculture, biosecurity, biodiversity and water management practices.

Considering the lived experiences as a result of climate change impacts by nearly all of Australia's inhabitants over the last two decades and the rise in extreme risk exposure, it is surprising that government policies, plans, strategies and programmes related to climate adaptation or climate resilience have not advanced more rapidly.

As a highly developed but climate vulnerable nation, expectations are that Australia would have moved beyond high level frameworks and aspirational strategies, progressing into the implementation of a structured and comprehensive 'National Adaptation Plan' (NAP) that is based on international guidelines; however, as of August 2025 Australia's NAP is still in development with no confirmed release date published by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW). The NAP is to be supported by the first 'National Climate Risk Assessment' (NCRA) which was due for release in late 2024, but it also is still unreleased. Australia's current policy document on adaption remains as the 'National Climate Resilience and Adaptation Strategy 2021-2025' (NCRAS), published by the former Department of Agriculture, Water and the Environment (DAWE) (DCCEEW, 2021).

Roles and responsibilities in climate adaptation

The roles and responsibilities of all levels of Government in relation to climate adaption are cited across numerous past and current documents and websites (including DCCEEW and Department of Agriculture, Fisheries and Forestry (DAF)) as those agreed in 2012 by the Council of Australian Governments (COAG). This includes guiding principles for the management and allocation of climate risks and the roles and responsibilities between government and private parties. Policy success should therefore be assessed against progress on the most relevant issues for the Australian Government, which can be summarised as:

- Provide leadership on national adaptation reform, and manage national science and information resulting in national and regional climate projections.
- Manage Australian Government assets and programs, and work with all governments to manage climate risks to nationally significant public assets.
- Embed climate change impacts into existing risk management frameworks.
- Ensure resources are available to respond to climate change and it does not disproportionately affect vulnerable groups, and provide a well-targeted social safety net.
- Ensure that regulatory arrangements and policy settings do not distort private incentives and market signals, and facilitate climate change adaptation (COAG, 2012).

Legislative context and climate related agencies

Climate policy agenda and the associated legislation and institutions have been greatly impacted by key influential events over the past two decades. On 3 December 2007, the Department of Climate Change (DCC) was established within the Prime Minister and Cabinet portfolio, and 2 weeks later Prime Minister Kevin Rudd ratified the Kyoto Protocol after Australia had previously declined to do so. In March of 2010, the Department of Climate Change and Energy Efficiency replaced the DCC and was established as a separate portfolio agency, but was later disbanded in March 2013. The climate change elements of the portfolio would change hands several times before residing where they do today, under the DCCEEW (Smith and McMaugh, 2023).

The Climate Change Authority Act 2011 established the Climate Change Authority (CCA) as a statutory body to provide expert independent advice to the Australian Government on climate change policy, able to commission their own independent research, and is still operating today despite a Bill to abolish the CCA being brought, but rejected by the Senate in 2014. The Climate Commission was also established in 2011 as another taxpayer-funded independent body, but focusing on public-facing communication and engagement on climate change; however, it was abolished by the government in September of 2013, resulting in the emergence of a non-government crowd-funded organisation which still exists today, the Climate Council (Smith and McMaugh, 2023).

Regarding further international influences, 23 April 2016 marked the day Australia signed the Paris Agreement and later joined the global Adaptation Action Coalition

in March 2021 which had the goal of a climate resilient world by 2030 (Smith and McMaugh, 2023). Finally, in September 2022 the Climate Change Act 2022 was passed, legislating Australia's targets to reduce emissions by 43% on 2005 levels by 2030 and net zero emissions by 2050. The accompanying Climate Change (Consequential Amendments) Act 2022 changed 14 other Acts to focus Government institutions on achieving those targets (DCCEEW, 2022). The Act requires the Minister to submit an Annual Climate Change Statement to Parliament, and the CCA must be consulted during its preparation.

This recent history shows that Australia has suffered from extreme governmental uncertainty stemming from vastly different stances on climate policy by the two major political parties. Leading industry stakeholders commonly cite this policy uncertainty as a negative driver on investment in the key sectors, including energy and electricity. Since the Climate Change Act 2022 passed the senate, new measures introduced have strengthened the nations regulatory influence on our climate mitigation pathway, which in turn benefit adaption policy, and sends a signal to the domestic business community on future policy stability (Prest, 2022).

Commonwealth policy instruments

Current Policy - National Climate Resilience and Adaptation Strategy 2021 to 2025

The current policy instrument, the National Climate Resilience and Adaptation Strategy 2021-2025 (NCRAS) was prepared by the Australian Government's Department of Agriculture, Water and Environment (DAWE) and launched in October 2021 by the then Minister for the Environment, The Hon Sussan Ley MP, with the stated purpose to "support efforts across all levels of government, business and the community, to better anticipate, manage and adapt to the impacts of climate change". It goes on to claim that the strategy supports actions under the Paris Agreement and states how the sharing of skills and expertise will lead to better outcomes in the Indo-Pacific. There are 3 stated objectives of the NCRAS, which are:

- Objective 1 - Drive investment and action through collaboration
- Objective 2 - Improve climate information and services
- Objective 3 - Assess progress and improve over time

The implementation of NCRAS is to be overseen by the National Adaptation Policy Office (NAPO), who are meant to be the central hub for climate adaption information for business and the public. NCRAS references concurrent works which it claims compliments "the ongoing implementation of the National Disaster Risk Reduction Framework and reforms associated with the Government's response to the Royal Commission into National Natural Disaster Arrangements". Overall, the strategy is a relatively short document, with few pages attributed to each chapter of the NCRAS, covering: Adapting to Climate Change, Building on Strong Foundations, Strengthening Australia's Response, Australia Adapts, Implementation Timeframes, and an Annexure on the Four Domains (DAWE, 2021).

Adapting to Climate Change – This section lists eight predicted changes to Australia's climate and acknowledges that extreme weather event trends will

continue to increase, but it does not go into any specific details. It references fewer than five general data points related to future costs taken from an economic prediction report by Deloitte. It states there is an interdependencies of the 'Four Connected Domains' (Natural, Economic, Social, Built) which feature throughout the NCRAS; and the final page lists seven generic examples of adaption that have already occurred.

Building on Strong Foundations – The 6 guiding principles of the previous NCRAS 2015 are carried forward and re-stated, along with a full-page summary of the aforementioned 2012 agreement on roles and responsibilities, neither of which offer any new strategic information. Reference is made to alignment and support of other national plans (e.g. 2021 Intergenerational Report, the 2021 Australian Infrastructure Plan, the 2021 Delivering Ag2030 report); and a graphic depicts each state or territory's respective adaption strategy. Four of the seven pages are consumed presenting examples of major initiatives already implemented with respect to the four connected domains.

Strengthening Australia's Response – This is the main section of the strategy, and describes each of the three objectives in more detail. A range of statements are made in relation to what 'will' be done but often these are in the context of 'enhance', 'support', 'seek to' etc. Over a quarter of the actions are expressed as 'will continue', meaning that a large portion of the NCRAS does not introduce new initiatives or policy updates. Objective 3 contains an action that commits to a 'national assessment of impacts and climate adaption progress' and claims these will be 'regular, robust and reliable'; however, they are to be undertaken by the Australian Government itself and are only expected every 5 years, which is a significant time gap for an issue that necessitates urgent action. NCRAS does describe that the Climate Change Authority (CCA) will be tasked to independently evaluate the implementation of the strategy but offers no further details on how this will occur.

Australia Adapts - Together Not Alone – This half page section claims to "set the path to deeper cooperation with our Indo-Pacific neighbours, international partners, and the global community" but does not elaborate how this will be achieved.

Implementation Timeframes – This section presents a single table with six actions, two per each objective, and a check against 'now', '1-2 years' or '5+ years'. These are all checked, except for both actions for objective 3 under 'now', providing no meaningful basis for the actual timing of delivery of the actions (DAWE, 2021).

Future Policy - National Adaptation Plan

The National Adaptation Plan is set to replace the NCRAS. The Australian Government has invested $27.4M for a 2-year 'National Climate Adaptation and Risk Program', with the outputs to be the first National Climate Risk Assessment (NCRA) and National Adaptation Plan (NAP) and were due in late 2024. These deliverables were still in development at the time of writing; however, in March 2024 the DCCEEW released a NAP Issues Paper for public consultation, which received over 180 submissions from a variety of public and private actors. A targeted First Nations

consultation process is also being conducted. The issues paper includes a draft vision and objectives for the NAP. The proposed vision statement for comment is:

"Australia's economy, society, and natural and built environments are being managed and invested in, to reduce climate impacts and harness any opportunities now and into the future – by all levels of government, business and community."

The following are proposed objectives:

- Drive a substantial uplift in private sector investment.
- 'Mainstream' adaptation action (consideration of climate risk will become business-as-usual across Australia).
- Establish support for people and communities in disproportionately vulnerable situations.

Regarding the structure of the NAP, DCCEEW is inclined to continue using the 'domains' from NCRAS (economic, built, natural and social) which "represent values, assets and systems that may be at risk from climate change". These are also defined within the forthcoming NCRA. Other key messages about the NAP were that adaptation should be "place-based, community-led and values driven" and will have a big focus on First Nations. The issues paper also shows a sample of other international climate policy instruments, indicating a willingness to learn from others who are further along the adaption journey (DCCEEW, 2024).

As of August 2025, the NAP itself is not available to review.

Future Policy - National Climate Risk Assessment & the First Pass Assessment Report

The NCRA uses a phased approach with 3 key stages. Scoping and methodology testing was completed in June 2023. The first pass 'qualitative' assessment process, running July 2023 to December 2023, reviewed climate risks within 8 systems of national importance. The outcomes provide insights into which climate risks are nationally significant. NCRA is designed to deliver:

- a shared understanding of the most important climate change risks.
- an agreed list of the matters which Australia values most as a society that need to be protected.
- a better understanding of where adaptation efforts need to be focused.

The assessment report states "all 56 first pass assessment risks are of national significance. A subset of 11 risks will undergo detailed quantitative analysis in the second pass assessment in 2024". The second pass assessment began in January 2024 and was supposed to be completed by the December 2024, but is also still outstanding. (DCCEEW, 2024).

State and Territory policies and publications

States and Territories all have their own policy instruments in various forms, which include:

- The ACT has developed 'Canberra's Living Infrastructure Plan', focusing on natural assets/urban heat, stating a goal to achieve 30% urban canopy cover and 30% surface permeability (ACT, 2019).
- The 'NSW Climate Change Adaptation Strategy' was released in June 2022, and directly references the NCRAS and claims to be engaging with the Australian Government on its implementation. The NSW Climate Change Adaptation Action Plan 2025-2029 presents actions tables with quarter/year due dates and responsible agency (NSW Government, 2024).
- The 'Northern Territory Climate Change Response' offers very limited actions and specific commitments, and has no clear next steps or timelines. The document commits to a review in 2025, and to report annually to the Legislative Assembly but the last submission was in October 2023 (NT Government, 2020). No evidence could be found of any of referenced strategies and the Climate Change NT website had no content shown in 'updates and announcements' in 2024 at all.
- Queensland's 'Climate Adaptation Strategy (Q-CAS) 2017–2030' was developed and released; however, this is now currently under review following the change of state government in October 2024 and is no longer available on the Queensland Government website after the climate portfolio was amalgamated into the Queensland Treasury. Seven Sector Adaptation Plans have been released, and these are still available online. (Queensland Government, 2024).
- The 'South Australian Government Climate Change Resilience and Adaptation Actions' is a very concise document summarising only a table of numbered actions and the lead agency responsible (South Australia Government, 2024). There are also 5 climate change sector adaptation plans (South Australia Government, 2025).
- Tasmania's 'Climate Change Action Plan 2023-25 – Implementation Plan' contains detailed tables for the delivery of each action in each quarter up to June 2025 (Tasmanian Government, 2023). Tasmania's Climate Change Risk Assessment development was an action delivered in late 2024, and development commenced at the same time as the NCRA in partnership with the Australian Climate Service. They both were meant to be released the same time, but it is claimed they are not directly comparable and will have noticeable differences, given they have different aims, purposes and data inputs. However, it is expected the themes identified will be broadly aligned.
- Victoria's 'Climate Change Act 2017' identified 7 key systems that required an Adaptation Action Plan (Built Environment, Transport etc.), which have all been developed and contain actions, but no lead agency is assigned. In addition, 5-year Regional Climate Change Adaptation Strategies (RASs) have been produced for six regions (Victorian Government, 2022).

- 'Western Australian Climate Policy' was released in November 2020 and the Climate Adaptation Strategy was released in 2023 and replaced Climate Resilient WA 2022. The document expands its four 'directions' into 37 clearly itemised actions and allocates a lead agency and completion date (year) to each. The actions are broad ranging, including: collaborating with agencies and universities, establish a Climate Adaptation Research Hub and delivering 7 sector adaptation plans (DWER, 2023).

Each jurisdiction, while broadly following the basic concepts of a national or regional adaption plan, varies dramatically with no obvious co-ordination from the Federal level and often fail to meet expected guidelines.

Evaluation and Policy Options

As the forthcoming NAP and NCRA are not yet available, inferences are made on what is currently known about them and recommendations presented from various sources on their implementation. Other sources of information provide insight on Government intent and action on wider adaptation policy and implementation instruments, including an outline of the global standard on adaption frameworks, their guidelines and how they should be evaluated in comparison to NCRAS' stated objectives and '4 domains'.

National adaptation plans and 'adcoms' as outlined by the United Nations

The Conference of Parties at its sixteenth session (COP16) in 2010, under the Cancun Adaptation Framework (CAF), established the process for development of National Adaptation Plans with a view to "identifying medium and long-term adaptation needs and developing and implementing strategies and programmes to address those needs" (https://napcentral.org/about-naps). At this time the Adaptation Committee (AC) was established, which went on to form the 'Task Force on National Adaption Plans'. Initial guidelines for the formulation of NAPs were adopted a year later at COP17. The first ever NAP was submitted to the United Nations by Burkina Faso in 2015, and the number climbed to 31 NAPs in January 2022, all from developing nations (https://unfccc.int/national-adaptation-plans). As of the end of May 2025, there have been a total of 72 NAPs submitted and posted on the UNCC NAP Central public website; 63 of these are from developing nations and only 9 are from developed nations, most recently Ireland, Finland and the United Kingdom (https://www.napcentral.org/). Many more are in development, and it is expected most nations will have lodged a submission over the next few years. When considering adaptation planning instruments more broadly (policy, strategy or plan), outside of the prescribed NAPs, 171 countries had at least one instrument in place by 2024, and about half of those had a second instrument (UNEP 2024).

The NAP process was designed with two main objectives, that being to build adaptive capability and resilience to reduce vulnerability to climate change impacts and ensure that climate adaptation is incorporated into a country's policies and programmes at all levels of government and across key sectors, such as agriculture and water. Protection measures are the outputs of the NAPs and should include "people, livelihoods, infrastructure, economic activity and

ecosystems". They must be tailored to the regional climate risks and specific factors important to that country (https://www.napcentral.org). Australia's NCRAS does include '4 domains' which correlate to those protection measures and there is a reference to the existing regional strategies for each State and Territory.

The international community continued to develop resources and commitments needed for a shared trajectory on the uptake of adaptation and resilience-building measures, and so the Global Goal on Adaptation (GGA) was established under the Paris Agreement; this later produced the UAE Framework for Global Climate Resilience. Australia became a signatory to this framework at COP28 in December 2023. The relevant targets can be summarised as:

- Impact, vulnerability and risk assessment: by 2030 all Parties have conducted up-to-date assessments of climate hazards, climate change impacts and exposure to risks and vulnerabilities and have used the outcomes of these assessments to inform their formulation of national adaptation plans, policy instruments, and planning processes and/or strategies, by 2027 all Parties have established multi-hazard early warning systems, climate information services for risk reduction and systematic observation to support improved climate-related data, information and services;
- Planning: by 2030 all Parties have in place country-driven, gender-responsive, participatory and fully transparent national adaptation plans, policy instruments, and planning processes and/or strategies, covering, as appropriate, ecosystems, sectors, people and vulnerable communities, and have mainstreamed adaptation in all relevant strategies and plans;
- Implementation: by 2030 all Parties have progressed in implementing their national adaptation plans, policies and strategies and, as a result, have reduced the social and economic impacts of the key climate hazards identified in the assessments referred to in paragraph 10(a) above;
- Monitoring, evaluation and learning: by 2030 all Parties have designed, established and operationalized a system for monitoring, evaluation and learning for their national adaptation efforts and have built the required institutional capacity to fully implement the system; (UNFCCC, Dec 2023).

Australia's Forthcoming NAP will now have to adhere to the requirements and timelines of this framework, which should be easily achievable as NCRAS Objective 2 is Improve climate information and services and NCRAS Objective 3 is Assess progress and improve over time which align with the targets above.

For a NAP to be successful it must be measurable and subject to review. Adaptation Communications ('Adcoms') were established in 2015 by Article 7 of the Paris Agreement and should detail the implementation of specific priorities and what tools or support is needed for success (Introduction | UNFCCC). It advocates for the inclusion of a range of factors: the progress on implementation and results achieved, challenges and gaps, lessons learned and information-sharing, monitoring and evaluation, economic diversification plans, gender-responsive adaptation action, knowledge of indigenous peoples and their knowledge systems on adaptation (UNFCCC, AC, 2022).

On 29 October 2021, Australia submitted its only documents to the Adaptation Communications Registry: The 'NCRAS', and 'A report to the United Nations Framework Convention on Climate Change October 2021' (DAWE, 2021). The report provides a large list of existing and recently created programmes, initiatives, resources and reports; however, these have limited information on implementation and do not communicate clear results. It often reads like a descriptive bibliography instead of a report on specific priorities. There are lists of meetings, some federal and state legislation, various risk frameworks, and domestic actions such as the National Soil Strategy but these all have limited information relevant for tracking actions. Gender-responsive and socially inclusive adaptation actions are mentioned in several locations, but the Adcom lacks any substantive content on monitoring and evaluation, challenges and lessons learnt. It is recommended that Australia provides an updated Adcom with the launch of the NAP which is comprehensive in both positive and negative progress and complies with the UNFCCC guidelines. This will exhibit international transparency and confidence on the world stage that Australia is committed to adaptation action (Introduction | UNFCCC).

The Adaptation Gap Report

The United Nations Environment Programme (UNEP) each year produces The Adaptation Gap Report (AGR) which assesses progress in adaptation planning, implementation and finance. Primarily the focus is on developing nations, but nevertheless it provides an accurate global picture and shares valuable lessons and guidance for nations drafting their first NAP. It also highlights the global divide between rich and poor nations, exposing the large gap in adaptation finance requirements, resulting in the most vulnerable people continuing to be exposed to the more severe climate impacts. While still falling short of funding targets, international finance flows to developing nations have fluctuated annually and increased by US$6 billion (to a total of US$28 billion) between 2021 and 2022, representing the largest single year increase since 2015 (UNEP 2024). The previous year, however, this declined by 15 per cent during 2020-21 (UNEP 2023). The Glasgow Climate Pact, adopted at COP26 in 2021, recommended developed nations double their adaptation finance to developing countries from 2019 levels by 2025 (UNEP, 2024). According to the Department of Foreign Affairs and Trade, Australia prioritises grant-based funding for adaptation projects in the Pacific, the largest beneficiary of funding, followed by Southeast Asia, and South and West Asia. In 2020-21 this was $348.7M and rising to $912.3M in 2023-24, giving a four-year cumulative total of $2,520.3M (DFAT, 2025).

The AGR 2024 recommends that international financing "shift from reactive, incremental, project-based financing to more anticipatory, strategic and transformational adaptation". Countries should establish quantified goals in global climate finance with more robust adaptation components featuring in climate pledges or Nationally Determined Contributions (NDCs). These NDCs are submitted every five years to the UNFCCC secretariat, and while the primary function relates to climate mitigation efforts to reduce national greenhouse gas (GHG) emissions they should also reflect efforts to adapt to the impacts of climate change (https://unfccc.int).

Australia submitted an NDC communication in 2020. This was a six-page submission that described an "economy-wide target to reduce greenhouse gas emissions by 26 to 28 per cent below 2005 levels by 2030". The document provided a brief update on new polices and measures, with a short paragraph on action to advance adaptation and resilience citing "domestic investments include over $15 billion in natural resource management, water infrastructure, drought and disaster resilience and recovery, including $369 million in climate science and adaptation research and services" (Australian Government, 2020). Since then, Australia has submitted more NDC communications, including it's more recent commitment to reduce greenhouse gas emissions 43% below 2005 levels by 2030, and at the time of writing, Australia's Climate Change Authority was developing advice on the 2035 emissions reduction targets for the 2025 NDC submission (CCA, 2024).

Consultation and lessons learnt

Comparing NCRAS 2015 to NCRAS 2021-25

A submission paper from the Australia Institute in 2021 was highly critical of the preceding National Climate Resilience and Adaptation Strategy (2015), claiming that it did "not align with Paris Agreement objectives. A peer reviewed study of 54 national climate adaptation plans and strategies ranked Australia's strategy last, with a low score of 18 out of a possible 46". It highlighted that Australia did not have the core elements of the UNFCCC recommendations, i.e. a national adaptation plan and a national climate risk assessment. Studies at the time indicated natural disaster funding was significantly biased towards rebuilding efforts, not avoidance. The Commonwealth Governments' approach was claimed to be fragmentary and inconsistent which was problematic for other levels of government seeking alignment. Official government communications and resources were not transparent or detailed with regards to climate change adaptation, and the submission paper stated that the new "National Recovery and Resilience Agency (NRRA), tasked with climate resilience, does not mention 'climate change' in its 26-page strategic direction". The strategy itself used language like 'showcasing' and the paper claimed NCRAS 2015 was viewed by many as more of a marketing tool than an actual implementable strategy. (Melville et al, 2021).

When comparing NCRAS 2015 with NCRAS 2021-25, certain parallels can be seen with the Melville et al review. Most notably the lack of measurable and accountable actions, instead presenting phrases like 'enhance', 'support', 'seek to', 'will continue' and shies away from introducing many robust new initiatives. The strategy is still not based on a national climate risk assessment but describes that as a forthcoming action. The overuse of examples throughout the document are not strategic or contribute to the establishment of a framework, and continues to seem like showcasing at best, and greenwashing at worst. It is essential that Australia's first NAP avoid the pitfalls of its predecessor documents. It is recommended that the new NAP update and expand upon the roles and responsibilities 2012, which is used across Government publications and websites, and supersede this outdated document having all parties recommit to it. The DCCEEW website states that the National Adaption Policy Office coordinates work across governments, but at the time of writing limited information was available regarding the Office or its

operations, not even having a website to consult. It is recommended that whichever agency or actor is selected to show leadership across all levels of government and implement the NAP is far more visible, well-resourced and transparent.

Assessing policy implementation and support in the '4 Key Domains'

There are several initiatives and successes within the 4 key domains outlined in the NCRAS where adaptation policy is to be implemented: Natural, Built, Social, Economic. These broadly align with the protection measures which are regarded by the UNFCCC as the outputs of a NAP - "people, livelihoods, infrastructure, economic activity and ecosystems" (https://www.napcentral.org).

Natural

The natural environment includes both wild ecosystems and the agricultural landscape, and how these interact. Nature-based solutions (NbS) provide benefits to ecosystems and communities simultaneously through restoration and protection (such as coastal ecosystems and soil ecosystems). The Insurance Council of Australia (ICA) indicate that "nature-based solutions can be effective in reducing the impacts of natural hazards (e.g. flooding and storm surge) while providing additional ecosystem and ecosystem benefits ". These solutions have been known to produce good value return on investments; however, measurement of these benefits can be very complex, and it is recommended that future studies undertake a more detailed analysis (Finity, 2022). In 2021, the UNEP released supplementary guidelines for 'Integrating Ecosystem-based Adaptation into National Adaptation Plans', culminating in 7 key recommendations – all of which should be incorporated into Australia's first NAP:

- Use an ecosystem lens to examine possible adaptation options.
- Have the right expertise involved during all stages of the NAP process, noting that different actors may be required at different stages.
- Combine indigenous and scientific knowledge.
- Ensure to articulate co-benefits of EbA compared to infrastructure options, quantifying where possible.
- Include the public at the formulation stage, but also the implementation and review stages.
- Set up baseline data, ecosystem-related targets and results-based adaptive management.
- Monitoring of EbA must be relatively frequent to allow components of the NAP to become a live document.

These guidelines set out a comprehensive approach to the tools available to assess and compare EbA options, and highlights that EbA not only provides co-benefits, but is actually a benefit multiplier adding to environmental, social and economic capital (UNEP, 2021).

DCCEEW is investigating how to increase private sector participation in delivering biodiversity outcomes. One mechanism is through the Nature Repair Market scheme, in which individuals and organisations complete nature repair projects to

attract investors, effectively allowing landholders to obtain biodiversity certificates to sell to interested third parties. The 'Carbon + Biodiversity and Enhancing Remnant Vegetation pilots' now replace the Agriculture Biodiversity Stewardship Package and are test programs for a biodiversity market which could create another way for landholders to be paid to deliver biodiversity outcomes. A review was commissioned by DCCEEW to formally capture the lessons learnt from the C+B and ERV pilots to inform further implementation of the initiative. The recommendations include several in relation to trust and communication with landholders, acknowledging that a tailored approach to each individual is required, and that the scheme should include "shorter, activity-based projects that can be repeated over time, as well as longer term projects that are outcome-focused and not prescriptive" (Jacob et al, 2023). This approach is transferable to most aspects of resilience and climate adaptation actions where public buy-in is required and should feature in ongoing policy instruments.

In the wider agricultural space, adaptation in crop planting choices will be required over the coming decades, as crop yields on species deteriorate. While some crop species will exhibit different levels of resilience, generally this decline is supported by modelling undertaken on the relationship between yields and climate variables indicating negative effects of higher temperatures by 2063 (Australian Government, 2023). Additional publications in this space include the National Soil Action Plan 2023 to 2028 (DAFF) and National Soil Strategy 2021 (DAWE) and Delivering Ag2023 (DAWE), all of which feature resilience and adaption as core themes.

The Australian Government has recognised the importance of 'blue carbon ecosystems' for climate change mitigation and adaptation. These are coastal ecosystems that support mangroves, tidal marshes and seagrasses, and so have the co-benefits of protecting biodiversity, reducing impacts form natural disasters and an improvement in the lives of coastal communities. Australia contains approximately 12% of the planet's blue carbon ecosystems (holding about 5-11% of global blue carbon 'stock'), with the areas surrounding the Great Barrier Reef being a significant contributor. This solution is both an important adaptation and carbon reduction option, being able to sequester carbon 30-50 times faster than terrestrial forests. Australia is represented on the international stage as both a member and the Coordinator of the International Partnership for Blue Carbon (IPBC). The Government has provided funding over 4 years from 2021–22 to 2024–25 through the 'Blue Carbon Ecosystem Restoration Grants', which has funded on-ground restoration activities in five demonstration projects (DCCEEW, 2025). The potential for this adaptation solution cannot be understated, and is recommended that future policies and strategies specifically bolster research, awareness and funding in the field of Blue Carbon Ecosystems.

Built

The built environment sector is increasingly at risk from the impacts of climate change, and asset owners are very aware of this fact. The sector favours the term 'resilience' when referring to an assets ability to endure a range of impacts. Historically, resilience was commonly used to describe ecological systems and the

ability to absorb change. In recent decades, institutions such as the United Nations Office for Disaster Risk Reduction (UNDRR) and the World Development Bank use it in a disaster risk reduction context, and a resilience thinking mindset is used in built urban and community contexts. Frameworks such as the Task Force on Climate-related Financial Disclosures (TCFD), 100 Resilient Cities program, and the Principles for Responsible Investment (UNPRI) all clearly define resilience and incorporate it into their policies and actions (Aecom/GBCA, 2021).

Within the building and infrastructure construction sectors in Australia, several non-governmental sustainability-focused rating schemes have been operating for many years. Components of these schemes are actively increasing participation in adaptation implementation through an uptake of mandated climate risk assessment processes and consideration of resilience measures in planning, design, construction and operation. Three of these schemes used are the IS Rating Scheme, Green Star and NABERS (National Australian Built Environment Rating System). These are 'credit 'focused schemes that cover a range of aspects such as procurement, ecology, materials, and water; but also have a focus on climate risk assessment and resilience. Some government contracts utilise, and some cases mandate, the uptake of one of these schemes. The most widespread scheme, the Infrastructure Sustainability Rating Scheme assesses a project's sustainability performance over a range of aspects and metrics, looking at the entire lifecycle including circular economy and focuses on large infrastructure over $100 million capex (roads, rail, ports, bridges and utilities). A total of 217 projects have now undergone the process and received a certification. Climate-1 and Climate-2 credits require the project to complete a formal climate change risk assessment as early as possible to ensure long term forecasting is built into asset design (ISC, 2024). Green Building Council of Australia (GBCA) developed the Green Star in close consultation with government, primarily used for buildings rather than infrastructure. Within the 'Resilient Category' all projects from 2020 are required to perform a climate change risk assessment to obtain their rating.

Despite the growing industry presence and uptake of these ratings schemes, many government asset projects still do not reflect the whole-of-lifecycle benefits and costs of managing risk. This results in insufficient investment in resilience outcomes from the business case stage onwards, which increases overall expenditure in the long-term as climate influenced risks within projects are somewhat obscured. A common theme across industry organisations delivering these rating tools is the recommendation that improved 'land use planning' is likely the most effective mechanism for preventing future disaster related impacts in the built environment and greatly assists in embedding resilience. This is one area that all levels of governments can exercise some policy influence (Aecom/GBCA, 2021).

Some States have started to produce documents and guidelines that recommend that all government projects conduct assessments on a 'whole-of-life view' and a 'whole-of-system approach' and integrate future trends and resilience analysis. While not mandatory, the guide states that projects should use either fit for purpose, nationally recognised rating and certification schemes, tools and supporting technical expertise (DSDI, 2024). This example highlights how the objectives from the NCARS and the forthcoming NAP can be put into action in the

built sector, and this report recommends that guidance documents such as these should be widely adopted by the Federal Government for projects under their control.

Social

The Social Domain includes how climate impacts upon health and wellbeing, families and community, social welfare services, indigenous and vulnerable groups and emergency services response to extreme climate events. The forthcoming NAP must incorporate equity and social justice, reflecting the obvious fact that climate change impacts are not felt equally, where climate-related disasters disproportionately impact lower socio-economic suburbs, and vulnerable groups are less able to prepare for, respond to, and recover from impacts of storms, bushfires and floods.

The 2024 Annual Climate Change Statement recognises both physical and mental health impacts of climate change on Australia's residents. The document states that the government is developing both a 'Health National Adaption Plan' and a 'National Heat-Health Action Plan', and that both are to compliment the new NAP (Australian Government, 2024). More people in Australia die from extreme heatwaves than any other natural hazard. Hotter conditions are disproportionately likely to impact productivity in construction, agriculture and tourism sectors, and also remote Aboriginal and Torres Strait Islander communities (Australian Government, 2023).

Additionally, we are set to receive new guidance on risk assessment and planning specifically for health and aged care services. Australia launched a 'National Health and Climate Strategy' for the first time in December 2023, which focuses on building community and health system resilience to the impacts of climate change on health and wellbeing, and commits to ongoing programs of work and actions over a 5-year period. The most relevant objective is "Health system resilience is to build a climate-resilient health system and enhance its capacity to protect health and wellbeing from the impacts of climate change" (Australian Government, 2024).

While all well-researched impacts on physical health (such as increased spread of infectious diseases and impacts to air quality) are present, the statement also acknowledges the real threats to food and water security, but most interestingly the emerging mental health aspects. These are not restricted to the emotional stress of dealing with the aftermath of disasters or inability to deal with future disasters, but also the psychological distress related to climate change anxiety especially amongst children and young people (Australian Government, 2024).

It is encouraging to see that targets from the UAE Framework for Global Climate Resilience (COP28) are being integrated into subsidiary policy instruments, namely those related to 'gender-responsiveness' and 'vulnerable people and communities'. It is extremely important in a country like Australia to not only be aware of, but also to incorporate cultural and spiritual world views and knowledge of traditional elders and community leaders of First Nations peoples. Through the National Environmental Science Program, the Australian Government has part-funded the 'National First People's Gathering on Climate Change' which took place in Dubbo

in October 2024. This provides a forum for First Nations peoples to engage on climate issues and have their perspective heard and given recognition by climate scientists (Australian Government, 2024). The report on the Future Drought Fund Act 2019, recommended establishing an Aboriginal and Torres Strait Islander working group to partner with DAFF. This 'First Nations Advisory Group' was established on 28 January 2025, with a term set to be completed on 30 June 2028 (DAFF, 2025).

In addition to impacts on individuals, climate adaptation actions also need to tackle issues faced by communities in a post disaster environment, where specialist knowledge and skills are needed to navigate effectively and compassionately. The Australian Institute for Disaster Resilience (AIDR) released the Australian Disaster Resilience Community Recovery Handbook in 2018 (replacing an earlier 1996 version) to provide a guide to community recovery in Australia (AIDR, 2018).

The issue of intergenerational and social justice of future generations has rapidly been gaining prominence in recent years. The Commonwealth Government has produced six Intergenerational Reports, the most recent ones were released in 2015, 2021 and 2023. These reports cover all important issues of the government's remit and reflect overall policy focus and direction. The 2015 Report contained only 4 pages out of 145 that were related to 'Climate Change' and several sparse references elsewhere in the document, with only one reference to 'adaptation'. The subsequent report in 2023 expanded on this to create a chapter on 'Environment' (Section 5), where climate adaption featured more heavily; however, still only made up a small fraction of the document. The Report from 2023, substantially enhanced itsfocus on climate change and energy, including through cross-referencing and mention of climate impacts in the 'Participation' and 'Productivity' sections. It is encouraging that this Intergenerational Report, both acknowledges the role of the changing climate and incorporates more information and recommendations related to adaptation measures but still has progress to be made to address intergenerational climate justice (Australian Government, 2015, 2021, 2023).

Economic

One responsibility of the federal Government that is stated in the agreed '2012 Roles and Responsibilities' is to maintain a strong, flexible economy which will ensure that "resources are available to respond to climate change and can be deployed efficiently" and ensure that "price signals – such as through insurance markets – are able to drive efficient decision making". Additionally, a "strong social safety net is essential to assist those who may otherwise have difficulty in adapting, especially for vulnerable groups, such as the aged, the poor and Indigenous communities".

The Australian Government Disaster Recovery Funding Arrangements (DRFA) are an example of Federal government policy designed to support communities from natural disasters and has been operating since November 2018. Projections of the cost of DRFA payouts relative to the historic average show the growing frequency and severity of natural disasters may increase the Government's DRFA expenditure to between 3 to 3.6 times over the next 40 years (or to about a cumulative $130 billion) assuming global temperature increases are limited to 3°C.

Beyond impacts due to natural disasters, climate change is expected to have impacts across most industries of the economy. According to the Intergenerational Report 2023, within the next 40 years Australia's economic growth is projected to rise, but will be slower than in the past 40 years, or 2.2% per year compared to 3.1% per year. The report describes that impacts from a changing climate on farming, including higher temperatures and changing rainfall, have likely been masked over the last 30 years, as other factors in farm productivity have offset the impacts felt from climate change; and economic losses in tourism after the 2019–20 bushfires resulted in an estimated 80,000 tourists cancelling or postponing trips. On average, severe climate events in advanced economies reduce productivity by about 0.5% in the year of occurrence (data from 1960-2018); but the most extreme disasters are estimated to impact labour productivity by approximately 7% for three years. The report calls for effective investment in adaptation measures to reduce overall impact on productivity from extreme events (Australian Government, 2023).

The Insurance Council of Australia (ICA) has also called for urgent action to develop a greater understanding of coastal risks and solutions with respect to the economic impacts of insurance in coastal areas. An ICA study called 'Reaping the rewards of resilience' proposed "a five-year program of resilience measures totalling $2 billion in investment, with a $200 million annual investment by the Australian Government and matching contributions from states and territories", spread over 7 resilience measures to save at least $19 billion by 2050 – a return on investment (ROI) exceeding 9.6 (Finity, 2022). This includes to develop a Coastal Hazard Information Database, a Coastal Defence Register, and for the Australian Government to create and release an Australian Historical Flood Depth and Extent database, replacing the outdated Australian Flood Risk Information Portal (AFRIP) managed by Geosciences Australia which was a one-off project completed in 2018. The ICA claim this will alleviate the considerable data and risk assessment barriers (ICA, 2022). Economic impacts of this are being felt as it is not standard practice for insurance coverage to include flood impacts from tides, king tides and wave impacts. Without measures like those recommended, insurance companies won't be able to adequately assess, quantify and underwrite policies to vulnerable communities.

Land use planning is a common theme drawn out across the literature developed by the insurance industry, in particular to flooding risks, being very clear that it must consider flood risks beyond the 100-year event and projected changes from the latest models, and review these to the very end of the building or project life cycle. Insufficient or outdated documents exist to advise the industry in this space, such as the ABCB Standard: Construction of buildings in flood hazard areas 2012, which focuses on preventing building collapse, and nothing on liveability after a climate event. Some regional documents, such as the Queensland Reconstruction Authority's Flood Resilient Building 2019, are considered useful documents but must be updated more frequently to keep pace with the changing impacts and developments in the industry (ICA, 2022). Whilst these are only guidelines, government action on improving design standards and planning regulations should be the primary driver of resilience incorporation.

The Australian Government (via the Australian Reinsurance Pool Corporation ARPC) and industry have been required to work together on delivering the Cyclone Reinsurance Pool since July 2022, for insurance companies to transfer direct and indirect cyclone risks, through a $10 billion Government guarantee. At the direction of government, the Australian Competition and Consumer Commission (ACCC) is monitoring insurers pricing schemes if they are under the umbrella of the cyclone pool to protect policy holders (Australian Government, 2025). The ICA claim that overseas examples show reliance on an expanding reinsurance pool's coverage alone can exacerbate the problem by encouraging people to remain in heavily impacted areas, and that proper resilience and mitigation planning must be rolled out concurrently (ICA, 2025).

Policy relationship with select referenced Government publications

While there are several other relevant publications that drive policy which must be considered by the Australian Government's NAP, some are particularly notable. This includes the National Disaster Risk Reduction Framework (NDRRF), which was released in April 2019, and was co-designed by government and non-government stakeholders and acts as a guide to reduce risk posed by natural disasters, and mirrors the four key domains mentioned in NCRAS: built, social, natural, and economic. Within these are 5-year outcomes presented in 'strategies for action 2019-2023' (NEMA, 2025). National Action Plans support implementation of the NDRRF and are developed by NEMA, and the current plan went live in August 2023, and continues the 4 priority areas of the NDRRF; and includes 24 stated national actions, each with 'Implementation Ideas' but no timeframe or evaluation allocation (NEMA, 2023). As the framework has set (now expired) 5-year outcomes, it is recommended that this strategy is updated in parallel with the release of the NAP and NCRA to continue to provide guidance on the third National Action Plan or sectoral action plans. While providing guidance on ideas for implementation, it is useful for decision makers to also have recommended time-evaluated minimum commitments stated, and implemented by NEMA or other agencies.

The Annual Climate Change Statements have been released in 2022, 2023 and 2024 providing Australia's progress towards the GHG reduction targets and adaptation goals. Both the 2023 and 2024 reports talk about policy developments per sector, and a range of adaption topics and international developments (DCCEEW, 2024). The main relevant recommendation of the CCA in 2024 is that we still lack governance arrangements or evaluation and the Government should "legislate and resource the Climate Change Authority to implement the monitoring and evaluation framework for the National Adaptation Plan" (Commonwealth of Australia Climate Change Authority, 2024).

The National Audit Office Performance Audit 2023-24 produced by Australian National Audit Office reviews DCCEEW's governance arrangements to support climate change commitments (The Auditor General, 2024). Australia's Strategy for Nature 2024–2030, which establishes national targets in several priority areas of the Global Biodiversity Framework. This strategy is clear and well thought out and has stated metrics against the success of its performance measures, and it is

recommended that the NAP have a strong correlation and synergy with this document (Australian Government, 2024).

Policy impacts on international reputation

The passing of the Climate Change Act 2022 legislation has assisted in building Australia's international reputation following several years being viewed as lagging in climate leadership. The Climate Change Performance Index (CCPI) has been an internationally published tool since 2005 and uses a standardised framework to compare the performance of 63 countries on climate change action across four categories relevant to climate policy: GHG Emissions, Renewable Energy, Energy Use and Climate Policy (CCPI, 2025). The CPPI rates Australia as 52nd, receiving a 'low' rating in Renewable Energy and Climate Policy, and ranking amongst the 'low-performing countries'. However, it is noted that Australia's participation at COPs and the Pacific Island Forum have shifted positively, even officially bidding to co-host COP31 in 2026 in partnership with the Pacific (https://ccpi.org). This would present an extremely good opportunity to launch a raft of implementation initiatives from the forthcoming NAP and raise awareness and education across the country on matters of resilience through a high-profile international event. However, Australia's international reputation has been damaged through the recent approval by the federal Government to extend one of the world's largest gas facilities, Woodside's North West Shelf plant, until 2070. This facility is the third-largest emitter in Australia, and may jeopardise the bid to host the COP. Pacific leaders have expressed their concerns very publicly on the decision (ABC, 2025).

There are examples of international cooperation that sit outside of the Australian Government and provide regional areas an opportunity to connect and work with global partners, such as the Mediterranean Climate Action Partnership, which South Australia joined after COP28 in 2023. This is a global alliance with 15 other sub-national governments from across five continents that possess a mediterranean climate. This forum shares approaches and enables strategies to be developed jointly via technical work groups on issues such as drought, wildfire and heat (South Australian Government, 2025). It is recommended that other States and Territories seek similar arrangements where they exist.

Case Study Evaluation - Spain

Spain and Australia are regions which share many similarities in geography and conditions. Spain faces many of the same adaptation challenges: an increase in sea water temperatures and mean sea level, the duration of heat waves, maximum and minimum temperatures, and localised decreases in average rainfall and river flow despite the rise in extreme rainfall and flood events. Spain is also impacted by depopulation of inland areas, resulting in a concentration of population and economic activity in large urban areas. Compared to Australia in 52nd place, Spain ranks 19th in this year's CCPI and is a medium performer across all four categories relevant to climate policy.

Spain's Ministry for the Ecological Transition and the Demographic Challenge (MITECO) produced the National Climate Change Adaption Plan (2021-2030) [hereafter referred to as the PNACC], with a general goal to promote coor¬dinated,

coherent action through 9 specific goals. The process began with an evaluation of the first PNACC and its three work programmes and in-depth interviews of experts in the adaptation sector, producing a report with 38 specific recommendations for the new PNACC. The document starts with guid¬ing principles to steer adaptation policy measures, then describes 4 strategic com¬ponents that facilitate the development of initiatives: "knowledge generation, integra¬tion of adaptation into sectoral plans, pro¬grammes and regulations, mobilisation of actors, monitoring and evaluation". The PNACC aims to integrate adaptation into different public and private fields by defining 18 areas of work with corresponding objectives (health forestry, education, tourism, coasts etc.) and lines of action have fact sheets that specify: Responsible entities and collaborators, Compliance indicators, Regulatory instruments required and Funding.

The lines of action are presented in the form of fact sheets that include a justification for the interest and a brief description of the line of action. The PNACC itself notes that since the initial development of Spain's adaption policy instruments, there have been significant developments in many areas related to adaptation including advances in the understand¬ing of Spain's impacts and vulnerabil¬ities, increased social perception of the problem, inclusion in broader public policies, and new commitments at the international level (MITECO, 2020).

An evaluation report on the PNACC was undertaken by a partnership of entities: Spanish Office for Climate Change, Fundación Biodiversidad (Biodiversity Foundation), the National Parks Autonomous Agency, the Spanish Meteorological Agency (AEMET). It is claimed that the evaluation process was consistent with obligations established under the UNFCCC, and uses the criteria set forth in the document 'Environment and climate policy evaluation' (EEA Report No 18/2016) for evaluating environmental policies: relevance, effectiveness, efficiency, coherence and added value. All three Work Programmes and the four Monitoring Reports were included in the evaluation, drilling down into the implementation of the actions, and featured more than 300 consultations with individuals and institutions directly involved (MITECO, 2021)

The report makes clear that the reason the implementation of the PNACC has been successful is that it achieved what its stated aims were and had widespread and consistent buy-in from all actors, especially the public. They have succeeded in normalising 'adaptation' to the point it occupies its own space, and could be considered business as usual. A collective technical awareness was raised, not just with select groups but across the political, educational and socio-economic demographics, through well-resourced communication channels that tailored approaches to different groups and using web-based platforms accessible by all to make available the well-funded resources, tools and climate projections.

Recommendations from this evaluation that are transferrable and should be considered in the development of Australia's NAP and all related delivery instruments are:

- Plan the policy instrument with an open and flexible approach that allows new adaptation needs to be incorporated into the delivery mechanisms.

- 'Work planning' plan must be to a defined budget allocation, and each action/ programme must detail the exact funding requirements estimated and, if possible, compare information against the cost of inaction.
- It is essential to be open to innovative approaches and perspectives that emerge as progress is made.
- Integrate a human rights perspective and social obligations within design and implementation.
- Identify relationships between mitigation and adaptation measures, demonstrating the co-benefits that occur or what they call 'collateral benefits (environmental, economic or social)'.
- Enable seminars, conferences and workshops for knowledge shares, both intra- sectoral and inter-sectoral.
- Integrate a diverse range of actors, with at least one that is far removed from the conventional sector expert.
- Future studies into Nature-based Solutions should be undertaken to provide a more detailed analysis on the measurement of complex system return on investments (Finity, 2022).

Recommendations

The recommendations presented below relate to improvements on the shortcomings of previous Australian Government climate adaptation policy and publications, opportunities for the forthcoming National Adaption Plan and the governance aspects surrounding the longer-term implementation of actions.

Climate adaptation and implementation recommendations:

- Future policies and strategies specifically bolster research, awareness and funding in the area of Blue Carbon Ecosystems.
- All government projects must conduct a sustainability assessment on a 'whole-of-life view' and a 'whole-of-system approach' and integrate future trends and resilience analysis, if practicable then use a fit for purpose, nationally recognised rating and certification scheme, tools and supporting technical expertise.
- Be flexible with implementation measures and include shorter, activity-based projects that can be repeated over time, as well as longer term projects that are outcome-focussed and not prescriptive.
- Ensure that a tailored approach to each individual is required when dealing with communicating with landholders and stakeholders to build trust and increase public buy-in.

Cross-cutting policy integration recommendations:

- Adhere to the commitments of the UAE Frameworks for Global Climate Resilience (i.e. by 2027 all Parties have established multi-hazard early warning systems, climate information services for risk reduction…and progressed in implementing their national adaptation plans, policies and strategies by 2030).

- The NAP should have a strong correlation with Australia's Strategy for Nature 2024–2030 and synergy with the stated metrics against the success of its performance measures.
- The National Disaster Risk Reduction Framework (NDRRF) is updated in parallel with the release of the NAP and NCRA to continue to provide guidance on the third National Action Plan or potential sectoral action plans.
- Include time evaluated minimum commitments within NDRRF to be implemented by NEMA, or other agencies.
- Incorporate the 7 key recommendations of the UNEP document 'Integrating Ecosystem-based Adaptation into the NAP.

Governance recommendations:

- Climate adaption, resilience and disaster preparedness must become a non-partisan issue, if uncertainty is to be removed and move towards adaption being business as usual.
- Provide an updated Adaption Communication with the launch of the NAP which is comprehensive in both positive and negative progress and is compliant to the UNFCC guidelines.
- States and Territories seek similar arrangements to the Mediterranean Climate Action Partnership where they exist and are appropriate/relevant to State and Territory specific circumstances.
- Update and expand upon the COAG roles and responsibilities 2012 as part of the launch of the new NAP and supersede this outdated document with all parties recommitting to it.
- Whichever agency or actor (e.g. NAPO) is selected to implement the NAP must be far more visible, well-resourced and transparent.
- Legislate and resource the Climate Change Authority to implement the monitoring and evaluation framework for the National Adaptation Plan every 2 years.
- Take inspiration from international examples where they are deemed to be appropriate and relevant to Australian Government policy framework.

This review has shown that Australia's climate adaptation policies have suffered from a long period of stagnation and uncertainty resulting in a negative international reputation. While recent years have seen Australia rapidly improve the instruments of governance, a greater degree of integration and measurable evaluation are needed. The National Adaption Plan has not achieved its scheduled release date; however, evidence compiled within this report suggests that significant consultation and evidence gathering has been completed that shall hopefully result in our NAP being a policy instrument to shape our climate adaption over the next crucial decade.

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