

Chapter 7

Australia

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Chapter 7

Australia

Usha Iyer-Raniga and Akvan Gajanayake

1. Introduction

Australia is a highly developed country with a population of over 25 million (ABS, 2020). Its economy is strongly integrated with high levels of international trade. Resources and energy exports comprise approximately 60% of exports by value, with more than half of the energy produced exported (OECD, 2020). The average household disposable income per capita is US\$32,759 per year, less than the average of the Organisation of Economic Co-operation and Development (OECD). There is also a considerable gap in equity, with the top 20% of the population earning nearly six times as much as the bottom 20% (OECD, 2020).

Per capita greenhouse gas emissions are 20.8 tonnes and 0.3 kilograms per US dollar of real gross domestic product (GDP), and the electricity and energy sector accounts for more than half of these emissions (DISER, 2020). The emissions generated by Australian consumption is 17.7% less than emissions from production, due to high levels of energy and resources exports (DISER, 2020).

Australia is characterised by many unique geographic and demographic factors. It is one of the driest inhabited continents and has one of the lowest population densities per arable land area. It also has one of the highest population growth rates for OECD countries with a highly urbanised coastal population. Indeed, Australia's population has one of the most geographically distinctive distributions of any country, with 90% of people living in just 0.22% of the country's land area (Jackson et al., 2017). More than 85% of Australians live within 50 kilometres of the shoreline, and the coastal region generates most of the country's economic activity (Clark and Johnston, 2017).

Australia's environment is one of extremes – the vast land mass of the country leads to wide-ranging climate zones from the tropics in the north to the arid interior and temperate regions in the south. Australia's climate has warmed by over 1°C since 1910, leading to an increase in the frequency of extreme heat events and an increase in extreme fire weather (DEE, 2017). Rainfall and streamflow across Southern Australia have decreased, leading to water shortages, while rainfall has increased across parts of Northern Australia with evidence that some are becoming more intense (DEE, 2017). This variability in climate across the country results in different types of weather extremes like droughts, floods, cyclones, heatwaves, and bushfires, which affect different regions of the country to various degrees.

The governing structure of Australia is a federal system, with the federal government having legislative power over areas that affect the entire nation like defence, external affairs, fiscal and monetary policy, and interstate affairs (e.g. banking and insurance). All other powers rest with state governments, while some cascade down to local governments.

This chapter provides the context of climate change and infrastructure financing in Australia. It commences with its climate-change and -adaptation policies, followed by an understanding of infrastructure in the country and related climate impacts. Financing infrastructure for climate-change adaptation is discussed next, with internal funding mechanisms used in the country across various levels of government as well as overseas financing. An analysis of infrastructure-financing mechanisms for climate change leads to a discussion of the challenges in implementing such mechanisms. The impact of the COVID-19 pandemic on infrastructure financing is discussed next, and then the chapter concludes.

2. Climate-Change Adaptation Policies

With less than 2°C of warming, Australia is more likely to be able to adapt to impacts of climate change (Cleugh et al., 2011). However, if impacts become more severe, adaptation can be expected to become increasingly challenging and costly. The increased intensity and frequency of natural disasters across the country in recent years have led to a wider acceptance of climate impacts by the public, politicians, and industry practitioners. However, climate-mitigation and -adaptation actions are considered to lag behind those of other OECD countries, especially those in Europe.

In Australia, all levels of government develop and implement climate-change policies and measures. At the national level, the Department of the Environment and Energy (DEE) develops and implements the national response to climate change. State and territory governments also develop and implement climate-change policies relevant to their region. Policies at this level include land-use controls, waste recovery, energy-efficiency, and renewable energy programmes, and include renewable energy targets and emissions reduction goals. The national, state, and territory governments maintain direct links amongst their departmental counterparts to share knowledge, resolve policy issues, and collaborate on industry and community engagement. Ministerial discussions on climate change occur regularly through two forums: the COAG (i.e. Council of Australian Governments) Energy Council and Meeting of Environment Ministers (DEE, 2017).

Climate-change adaptation in Australia is underpinned by a series of agreements made amongst the federal, state, and territory governments through the COAG. These agreements set priority areas for adaptation actions and clarify roles and responsibilities for adaptation. The COAG agreed on the *National Climate Change Adaptation Framework* in 2007, which established priorities for adaptation actions and initiated a range of activities to build resilience and to adapt to climate-change impacts. A major aspect of this framework aimed to enhance national climate-change science and adaptation research capacity (DCCEE, 2007).

The National Climate Change Adaptation Research Facility (NCCARF) was established in 2008 to develop and to deliver the knowledge needed by decision-makers to effectively adapt Australia to the impacts of climate change (NCCARF, 2013). Settlements and infrastructure were one of nine priority themes under this facility, which focussed on the impacts of climate change on coastal settlements; infrastructure, including buildings, facility design, and construction; urban water security; and flooding and stormwater overflow. As part of this programme, funding support for these four research networks was available. This programme was primarily funded

through the government, while partner organisations contributed. However, government commitment to these programmes has been less than certain in recent years, and some – such as the Commonwealth Scientific and Industrial Research Organisation Climate Adaptation Flagship – have been decommissioned (DEHP, 2017).

The *National Climate Resilience and Adaptation Strategy 2015* (Government of Australia, 2015b) is the overarching strategy governing climate-change adaptation in Australia. The strategy identifies guiding principles, outlines the government’s vision for climate resilience, and illustrates how Australia is managing and adapting to climate-change challenges at the national level. However, it does not articulate any specific goals or actions that need to be taken to achieve resilience; instead, such goals and actions are expected to be set and implemented by state and local governments.

Most state, territory, and local governments have their own adaptation plans and strategies in place and are managing their climate risks across a range of sectors and in government decision-making. Such various levels of adaptation policies seem suitable for Australia given the diverse climate-change challenges across the country. The South Australia Government has regional adaptation plans in place for each of its 12 government regions. In 2017, the Queensland, South Australia, Tasmania, and Victoria governments revised or implemented their state adaptation plans or strategies. For instance, the *Queensland Climate Adaptation Strategy* outlines how the state will prepare for current and future impacts of climate change in a way that reduces risk and increases resilience (DEHP, 2017).

In addition to governmental climate-change adaptation policies, industry bodies have developed adaptation policies and guidelines, focussing on specific industries and sectors. These include position statements and policies by a wide range of professional bodies like the Australian Institute of Architects (2008), Australian Institute of Landscape Architects (2017), Engineers Australia (2014), and Planning Institute of Australia (2015), as well as guidelines and frameworks developed by industry bodies like the Australian Green Infrastructure Council (2011), Australian Sustainable Built Environmental Council (2012), and Green Building Council of Australia (2019).

The lack of clear climate-change adaptation policy directions by the national government has led to multipronged policies being implemented across the country and industry sectors. These policies are developed typically from the ground up, where the importance of implementing adaptation actions in the long term has been identified by practitioners. Adaptation will also play a significant role for communities, as climate-change mitigation efforts at a national level have lagged behind other developed nations. This makes investment in climate adaptation and restructuring of economic activities essential elements in moving towards a more resilient society (Infrastructure Australia, 2019).

3. Infrastructure in Australia

Infrastructure plays a significant role in the Australian economy, with infrastructure industries accounting for 9.4% of the GDP and nearly half of new construction in the transport sector (BITRE, 2019). Australia has close to 900,000 kilometres of roads, 35,000 kilometres of rail track, over 40 airports, and 25 ports (BITRE, 2019). As a high proportion of the population lives on the coast, most of the transport infrastructure is situated there; therefore, it is more prone to

hydrometeorological disasters. Australia has a high reliance on automobile use with an elevated level of fuel consumption, in turn impacting emissions. In the year to March 2020, transport accounted for 18.9% of Australia's greenhouse gas emissions, with a steady decrease in the consumption of petrol and an increase in diesel consumption (DISER, 2020).

The ownership and management of public infrastructure fall under the different national, state, and local governments. The government finances the national rail network, partially funds major interstate roads, and regulates airports. State and territory governments own and manage some metropolitan rail networks, state roads, international ports, and airports, while local governments have control over access and facilities for local infrastructure, with the ability to impose restrictions on operations (Infrastructure Australia, 2016).

In some cases, ownership and management of public infrastructure – such as water supply, energy, and transport infrastructure – have been transferred to state-owned enterprises, which are ultimately owned by the respective state or federal government. Typically, building, maintenance, and adaptation measures for specific infrastructure are the responsibility of asset owners, and diverse funding mechanisms for these purposes are used. Some examples are grants from state and national governments, balance sheet financing through retained earnings, user charges or government revenues (e.g. rates or taxes), public–private partnerships (PPPs), and external financing through banks or issuance of bonds. The diversity of infrastructure financing mechanisms adopted in Australia provide a good opportunity to assess the applicability of these methods for climate-change adaptation projects in other countries.

The vulnerability of infrastructure to climate change depends on several variables such as the type of infrastructure; its location, design, age, and/or relative usage; and climate risks that the infrastructure faces. Key climate risks to Australian infrastructure include gradual impacts like sea-level and temperature rise and extreme events like floods, heatwaves, and bushfires. In the coastal zone, more intense storms, cyclones, and rising sea levels may cause or worsen storm surges, coastal inundation, and erosion. Table 7.1 summarises potential impacts to infrastructure due to climate risks in Australia.

Table 7.1. Potential Impacts to Infrastructure due to Climate Risks

Climate Risk	Risk Scenario	Infrastructure Systems Affected	Impacts
Increased extreme rainfall and wind intensity	Storm and floods	Transport, buildings, electricity, water, telecommunications	Damage to infrastructure assets, degradation of roads, overcapacity for sewage treatment, tunnel flooding
Sea-level rise	Coastal flooding	Transport, water	Damage to infrastructure assets, salt-water intrusion to water supply
Increased temperature and heat waves	Increased user demand	Electricity, transport, telecommunications	Increased peak-load demand, degradation and buckling of rail tracks, tarmac degradation, damage to infrastructure assets
Increased bushfire risk and lightning	Bushfires	Electricity	Damage to transmission lines
Decreased rainfall	Water shortages	Electricity, water	Lack of water for hydroelectricity and coal generation, decrease in water capacity

Source: Adapted from Maddocks (2011).

Although risks to infrastructure due to climate change have been highlighted, the level of adaptation practices at a national level seem to be minimal. This is evident in the national-level *Critical Infrastructure Resilience Strategy*, as it does not account for any climate-related risks to infrastructure (Government of Australia, 2015a). A reason may be that adapting to climate change is considered the responsibility of infrastructure planners, owners, and operators, which most often fall within the purview of state and local governments (Infrastructure Australia, 2015). However, the lack of a national strategy can be an impediment to effective climate-change adaptation in the infrastructure sector.

4. Financing Infrastructure for Climate-Change Adaptation

Climate finance has two main components, as articulated in the Lima Call for Climate Action (UNFCCC, 2014): (i) mobilisation of public and private finance towards mitigation and adaptation measures, and (ii) provision of public finance from developed to developing countries (also known as the North-South transfer). This section will explore both these types of climate finance, as Australia provides development assistance to East Asian countries.

4.1. Domestic Funding

The mechanisms used to finance climate-change adaptation infrastructure in Australia are different from those in the East Asian region due to Australia's high level of government revenue, international financial independence, access to competitive government finance options (i.e. government securities), and condition of infrastructure assets. The different mechanisms used to finance adaptation are discussed below.

4.1.1. Grant Funding

The majority of climate-change mitigation and adaptation measures in Australia have traditionally been funded by national, state, and local governments alone or in partnership (Banhalimi-Zakar et al., 2016). This funding is typically set aside in budgets and then allocated for a variety of climate-related projects. As recovery from natural disasters and adaptation to climate hazards is the responsibility of state governments, national government funding is allocated only in extreme cases of disasters or through national-level adaptation policies.

Protection from climate change is increasingly falling within the purview of local governments, creating new costs through such projects as building seawalls and increasing costs of existing responsibilities like upgrading roads, drainage, and water supply (Banhalimi-Zakar et al., 2016). Disbursement of such grant funding is generally administered through a separate organisation, at times specifically set up for this purpose.

One of the major national government-funded projects focussing on adaptation is water security in the Murray–Darling Basin, the largest and most complex river system in Australia. It covers 1 million square kilometres of South-Eastern Australia and spans across 5 states. The programme is thus funded at a national level, as individual state-level programmes would not be practical.

The Sustainable Rural Water Use and Infrastructure Program is another major climate-change adaptation-related programme funded by the national government. This programme is investing A\$10 billion in rural water use, management, and efficiency; improved water knowledge; and market reform. Most of the projects are linked to, and focus on, the Murray-Darling Basin and include on- and off-farm irrigation upgrades and projects supporting rivers and wetlands.

The government has also committed A\$2.5 billion towards two national programmes to fast-track the construction of various water infrastructure components: the National Water Infrastructure Development Fund (A\$500 million) and the National Water Infrastructure Loan Facility (A\$2 billion) (Parliament of Australia, 2017).

In addition to these national-level programmes, the government funds state-level programmes to improve water quality and sustainability issues. For example, the Basin Priority Project provided funding of up to A\$85 million to the Australia Capital Territory to improve the long-term water quality in the territory and the Murrumbidgee River system.

Funding through the Australian Renewable Energy Agency (ARENA) and Clean Energy Finance Corporation (CEFC) supports clean energy innovation across the spectrum of research and development, demonstration, and deployment at the national level (DEE, 2017). In 2016, three separate funds were established for the CEFC to invest in nationally significant clean-energy projects targeting cities and the built environment, Great Barrier Reef, and emerging technologies.

ARENA and the Australian Energy Market Operator jointly funded 10 pilot projects from 2017 to 2020 under the demand response initiative to manage electricity supply during extreme peaks. The project objective was to free up temporary supply during extreme weather – such as prolonged summer heatwaves – and unplanned outages. Funding of A\$35.7 million was provided, with the government committing A\$28.6 million through ARENA to fund set-up and

operational costs, with A\$7.2 million matched by the New South Wales (NSW) government for NSW-based projects.

The Natural Disaster Relief and Recovery Arrangements (NDRRA) initiative provides funding to state and territory governments for certain relief and recovery assistance measures in response to natural disasters such as bushfires, floods, and cyclones. Following the outcomes of the Productivity Commission (2012) inquiry into natural disaster funding arrangements, the national government has been consulting with state and territory governments to reform current arrangements as they relate to the reconstruction of disaster-damaged public infrastructure. The reforms give greater autonomy to state and territory governments to deliver practical reconstruction that best suits the needs of their communities. Where applicable, it enables them to apply funding towards disaster-mitigation activities that align with a set of overarching principles.

As previously mentioned, infrastructure adaptation is primarily funded by state governments as the infrastructure asset owners. State government funds can be allocated through adaptation strategies, where potential areas of investment are targeted or through requirements identified by relevant state government departments (DEHP, 2017). In most cases, the funds are allocated to local councils that are responsible for using them for the respective adaptation projects. Although much of such funding is allocated through state governments, national-level funding is also provided for some projects, which are typically delivered through state governments or other funding agencies.

Funded by the national government and delivered by the South Australia government, the A\$265-million South Australian River Murray Sustainability Program includes A\$120 million for irrigation-efficiency improvements and water purchase and A\$120 million towards irrigation industry assistance. The remaining A\$25 million is for regional economic development.

Building Resilience to Climate Change is a partnership between the NSW government and NSW Office of Environment and Heritage (OEH) to address identified climate-change risks and vulnerabilities. Two rounds, jointly funded by OEH and the NSW Environmental Trust, were awarded in 2014 and 2015. The third round in 2016 and further funding rounds over 2019–2020 were available through the Increasing Resilience to Climate Change grant funded by the Climate Change Fund (NSW Government, 2020). Jointly, these projects have funded over A\$4 million worth of adaptation efforts in NSW.

The NSW government also invested A\$1.4 billion from 2017 to 2022 through the NSW Climate Change Fund (DPIE, 2019). One of the key programmes under this fund is to increase resilience to climate change, with A\$181 million invested in FY2018 and A\$248 million invested in FY2019. During FY2019, through the fund, almost A\$192 million was invested to enhance resilience to climate impacts. The fund's Coastal and Estuary Grants Program provides up to 50% funding to local councils for coastal management. The Floodplain Management Program typically funds A\$2 for every A\$1 contributed by the local council or land manager.

The fund's revenue is raised through annual contributions from utility providers, such as electricity and water distributors, and its costs are passed on to customers. The electricity distributors are requested to recover no more than 25% of costs from household customers; commercial, business, and industrial customers cover the remainder. Water distributors, such

as Sydney Water and Hunter Water, may also be asked to raise funds for water-related programmes, depending on the NSW government's priorities. The fund's FY2019 revenue was A\$289 million (DPIE, 2019).

In addition, the NSW government coastal management programmes are investing around A\$63 million to support local governments to implement actions that reduce exposure to coastal hazards. Local governments can receive up to 50% funding to implement coastal zone management plans, hazard assessments, and coastal management tools and to undertake environmental repairs and construction.

QCoast2100 is a Queensland government commitment to a A\$13.234-million fund to assist local councils in advancing coastal hazard adaptation planning.¹ The Queensland government, in partnership with the Local Government Association of Queensland, is investing A\$12 million over a 5-year period. The programme represents an opportunity for local governments impacted by coastal hazards to use adaptation planning to implement cost-effective mitigation measures over the medium and long term, plan for development and growth, budget for higher costs, collaborate regionally, and seek investment opportunities. A coastal hazard adaptation strategy is designed to assess risks from projected climate-change effects, propose adaptation measures, and establish an implementation programme. The Department of Environment and Science has committed a further A\$1.234 million to QCoast2100 to support local councils that previously applied and missed out on required funding to complete their coastal hazard adaptation strategies. The councils who receive the funds are required to provide a co-contribution, although there is no requirement to match the approved funding.

Table 7.2 provides a summary of state and territory priorities for climate change across Australia.

¹ QCoast2100, <https://www.qcoast2100.com.au/>

Table 7.2. Climate Priorities for State Governments and Territories in Australia

State/Territory	Priority Areas
Australian Capital Territory	Disaster and emergency planning, community health and well-being, settlements and infrastructure, water, natural resources, and ecosystems
New South Wales	Energy-efficiency, advanced energy, transport, carbon farming, impacts on infrastructure
Northern Territory	Low-emissions transport, transition to low-emissions energy, heat in the urban environment
Queensland	Human health, biodiversity and ecosystems, tourism, business and industry, agriculture, human settlements and infrastructure, emergency services
South Australia	Building coastal resilience, implementing water-sensitive urban design, managing bushfire risk
Tasmania	Renewable energy, reducing transport emissions, climate-ready businesses, resilient communities
Victoria	Resilient transport, heat in the urban environment, water resources, land-use planning
Western Australia	Clean manufacturing, transforming energy generation and use, carbon storage, lower-carbon transport

Sources: DEWNR (2016), DWER (2020), Environment and Planning Directorate (2016), DEHP (2017), OEH (2016), Tasmanian Climate Change Office (2017).

4.1.2. Balance Sheet Financing

Another approach to finance infrastructure to prepare for climate change is balance sheet financing. Brisbane Airport Corporation, a private company that runs the Brisbane International Airport, factored in climate-change impacts on a new runway design and thus built in adaptation measures. Due to expected sea-level rise and increased frequency of cyclones, the site was raised above the projected 1-in-100-year flood level, building a new seawall and tidal channels. Consideration of temperature increases in future decades was accounted for by providing significant additional runway lengths available to be added in the future (ICAO, 2016). A large proportion – 75% of this project – was funded through shareholder funds and loans obtained by the Brisbane Airport Corporation, while 25% was funded through additional landing fees. In 2013, the airlines' contribution was an extra A\$0.35 per domestic passenger, with a gradual increase per year to A\$3.15 per international passenger in 2017 (BAC, 2013).

4.1.3. Financing through Revenue Streams

Following widespread damage to infrastructure due to floods in 2011, the national government imposed a flood levy to raise funds. It announced it would invest about A\$5.6 billion to rebuild flood-affected communities, with most directed to rebuilding infrastructure. This was to be financed through three components: A\$1.8 billion through a progressive flood levy on people

earning over A\$50,000, A\$2.8 billion in spending cuts, and A\$1.0 billion by delaying specific infrastructure projects (Parliament of Australia, 2011).

The Gold Coast City Council financed the construction of a seawall adjacent to public land, mostly from general revenue through council rates, together with grant assistance from the state government. The city council has not taken responsibility for the construction and financing of the seawall where it would be adjacent to private property, however, leaving it to individual property owners to complete such work to approved design standards to protect their property (Ware and Banhalmi-Zakar, 2017).

Also in Queensland, a similar financing model was adopted by the Fraser Coast Regional Council to build the Toogoom Seawall Project in 2014. This seawall provides erosion protection for 15 properties through the construction of a rock-boulder revetment wall along 370 metres of shoreline. The council amended its FY2014 budget and sought additional borrowing to finance the costs of the project. However, it decided – as the benefits of the project accrue to a definable group of private property owners – that these property owners should also be responsible for funding the project. The council undertook the project through external debt finance, and the property owners were charged a special rate levy payable over 10 years to cover the costs (Ware and Banhalmi-Zakar, 2017).

There are also examples of private property owners pooling resources to self-fund the construction of coastal protection works, such as seawalls. Private property owners at the Belongil Spit in Byron Bay, NSW have taken legal action against the government to establish their rights to undertake coastal protection works.

4.1.4. Financial Incentivisation

Financial incentives have also been used to improve climate-change resilience, especially for housing-related infrastructure. The Australian Capital Territory government introduced a 10% to 25% reduction in lease variation charges for new developments and upgrades for commercial buildings built to the Green Building Council of Australia's Greenstar rating of more than 5 stars and for residential buildings with an average NatHERS rating of more than 6.5 stars. Although such incentives are not directly related to climate-change adaptation, Green Building Council of Australia ratings provide credits for climate adaptation and resilience plans.

Larger insurers, with substantial assets, can directly finance customer-side adaptation measures that improve the resilience of properties to natural disasters and climate hazards (Herweijer et al., 2009). However, such examples are sparse in Australia. One example is Suncorp announcing that it will contribute up to A\$10,000 towards fittings that improve extreme weather resilience for strata insurance in North Queensland (Government of Australia, 2015a).

4.1.5. Financing at the Planning Stage

Another method of financing climate-change adaptation is to factor in adaptation mechanisms at the initial planning stages. This allows for funding requirements for adaptation mechanisms to be obtained with overall project funding. Including adaptation at the planning stage has, in some cases, been regulated through government guidelines. For example, in Queensland, new state roads and major road upgrades require a climate-change impact statement for submission

to the Queensland Cabinet. Furthermore, all projects requiring an environmental impact statement must accommodate adaptation responses (DTMR, 2014).

The NSW Treasury has prepared guidelines for the economic appraisal of assets and infrastructure assessments in terms of climate change. Potential risks to public assets from climate change should be assessed like any other risk factor that affects the economic life cycle of assets, as part of an agency's ongoing risk management and decision-making for both existing and new assets (NSW Treasury, 2017). Such policies and guidelines allow for the project proponent to build in adaptation at an early stage and thereby include the financing for such activities within the entire project financing strategy.

The Torres Strait Islands received A\$26.2 million in 2014 to progress the installation of coastal defences. Lack of adequate external funding had been a barrier to adaptation; strategies often require funding partnerships with external stakeholders that are complex or unattainable. Seawalls were approved and construction is progressing, subject to funding, for priority communities under the Torres Strait Seawall Program, jointly funded by the Queensland government and national government (TSRA, 2016).

4.2. Overseas Financing

Australia's climate financing also includes that provided to other countries through official aid programmes. Official development assistance (ODA) is commonly used to identify development-related aid provided from developed to developing countries. ODA is defined as flows of official financing administered with the promotion of the economic development and welfare of developing countries as the main objective, which are concessional with a grant element of at least 25% (IMF, 2003). International aid typically includes ODA as well as official aid and other official flows that do not fall under development assistance.

Australia's international climate support is largely drawn from its development assistance programme and is tracked through AidWorks of the Department of Foreign Affairs and Trade (DFAT). Australia sources its overseas climate finance from new and additional aid budget appropriations from the Parliament's annual budget process. This finance flows to developing countries through targeted bilateral and multilateral climate investments.

The priority given to climate change in Australia's aid programme has varied over recent years. Since 2013, Australia has not provided dedicated additional climate financing, although climate financing was included along with other aid priorities in the budget process (ODE, 2018). Specific climate funding is directly linked to international agreements rather than internal decisions and is similar to building climate risk and adaptation at the planning stage.

The *Climate Change Action Strategy* outlines the DFAT approach to responding to climate change in its development assistance programme and recognises the need for further integration of climate-change adaptation and disaster resilience and for stronger engagement with the private sector in finding solutions (DFAT, 2019). The strategy sets three key objectives to make the best use of development assistance: (i) support partner countries to adapt to climate change, and to plan, prepare for, and respond to climate-related impacts; (ii) promote the shift to lower-emissions development in the Indo-Pacific region; and (iii) support innovative solutions to climate change, including those that engage private sector investment.

All of Australia’s overseas climate finance is categorised as ODA. In FY2016, Australia budgeted A\$4.051 billion for ODA, amounting to 0.25% of gross national income, well below the internationally agreed target of 0.70% (DFAT, 2017). Papua New Guinea and the Pacific received 48% of all Australian bilateral aid, a total of A\$925 million. The government has pledged A\$1 billion in climate development assistance from 2015 to 2020 and a further A\$500 million from 2020 to 2025 to build Pacific climate change and disaster resilience. This is an increase in spending in the Pacific region, which was initially pledged at A\$300 million from 2016 to 2020.

Developed countries pledged to mobilise A\$100 billion in climate finance per year by 2020 (OECD, 2022). This includes a commitment of A\$200 million to the Green Climate Fund (GCF) from 2014 to 2018 and A\$300 million to address climate change in Pacific island countries over 4 years, comprising A\$150 million in bilateral aid investments, A\$75 million in disaster-resilience investments, and A\$75 million in regional investments.

ODA related to climate-change investments was rebranded in 2014, some as food security, water security, or disaster preparedness, as climate was de-emphasised in the Australian policy context. This was due to change in the political climate as a more right-wing government came to power in late 2013. Climate-change investments were internally re-branded; reporting on climate-related outcomes was hindered, as these objectives and indicators were removed. Many other investments lost impetus and were closed early (ODE, 2018).

From 2016 to 2018, 74% of climate-specific funds through bilateral, regional, and other channels was for adaptation activities, while 18% was for mitigation and 8% was for both mitigation and adaptation measures (DEE, 2019). This was an increase in the funds allocated for adaptation measures from the previous 2 years, which totalled 61% (DEE 2017). Australia’s climate finance through ODA was US\$360,334,000 in FY2019, out of which US\$100,132,000 was for economic infrastructure services (DFAT, 2019). Table 7.3 provides a summary of Australia’s climate finance through ODA.

Table 7.3. Australia’s Climate Finance through Overseas Development Assistance

Fiscal Year	Economic Infrastructure and Services Portion of Climate Finance (US\$ '000)	Total Climate Finance (US\$ '000)	Total Overseas Development Assistance (US\$ '000)
2015	31,088	222,256	5,027,933
2016	41,713	249,471	4,032,558
2017	61,593	248,963	4,030,654
2018	72,269	267,880	4,082,328
2019	100,132	360,334	4,379,057

Source: DFAT (2019a).

Australia is placed approximately mid-range on the spectrum of OECD donor commitments to 2020. The allocation of Australia’s climate-change finance between mitigation and adaptation is broadly in line with other OECD countries, although with a somewhat greater focus on

adaptation, reflecting the priorities of its developing partner countries. Australia tends to channel a much greater share of its climate-change finance through multilateral mechanisms relative to comparable OECD countries (ODE, 2018).

Reviewing 26 investments of DFAT that were targeted and mainstreamed as climate-change objectives representing a total value of US\$641.2 million, the Office of Development Effectiveness found that around one-third of investments demonstrated outcomes relating to reduced vulnerability or increased resilience (ODE, 2018). Of the investments that commenced between 2006 and 2014, 35% demonstrated significant climate-related outcomes (ODE, 2018). Most of the benefits were delivered in a range of adaptation areas, with some on mitigation.

Climate-change outcomes can be improved by linking internal outcomes to partner country needs and having explicit climate- or disaster-related outcomes, which are supported by appropriate technical expertise during the whole project investment cycle (ODE, 2018).

5. Synthesis of Climate-Change Adaptation Financing

The analysis of infrastructure financing for climate-change adaptation mechanisms in Australia show that the majority is obtained through federal and state government funding. These funds are typically provided through budgetary allocations and dispersed through a separate organisation, which has technical capabilities. The funds are allocated mainly to local government authorities who are responsible for the implementation of the projects. This is in line with the fact that the use of debt by Australian local governments was low when compared to other sectors with similar income stability and asset ownership (Comrie, 2014).

The analysis shows that the majority of climate-related financing is for mitigation rather than adaptation (Table 7.4). This contrasts with Australia's approach for overseas aid. For example, all projects financed through the CEFC focus on mitigation. Similarly, out of 566 projects funded by ARENA, worth A\$1.63 billion, only 2% of the projects are adaptation-related (ARENA, 2020).

The lack of focus on adaptation is visible even at a policy level. The national review of climate change policies does not include adaptation in its terms of reference and only focusses on mitigation measures. With approximately 30% of Australia's national income vulnerable to economic disruptions due to climate-change impacts, it is estimated that the economic cost of doing nothing could cost close to A\$3.4 trillion in GDP in present value terms and an additional 880,000 jobs (Deloitte, 2020). The focus on mitigation may be considered 'too little too late', given that impacts of climate change are being felt across Australia currently as well.

Recent scholarship on infrastructure financing for climate-change adaptation has focussed on the use of capital markets and the insurance sector to incentivise adaptation mechanisms. However, this type of financing is not common in Australia, at least in the infrastructure sector. One reason for this may be that financing public sector infrastructure does not bring in profits for companies. Market capitalist policies may not be the most effective in managing sustainability-related impacts, as they are mainly interested in profit motives (Colic-Peisker, 2011).

Regarding overseas climate financing, public reporting is largely dominated by the amount of climate-change financing it is providing rather than what outcomes have been achieved from

the aid investment portfolio. DFAT climate-change monitoring and public reporting systems do not effectively report on Australia’s contribution to the efforts of developing countries to adapt to climate change and specific outcomes achieved (ODE, 2018).

Given that only 1% of climate-finance flows from developed to developing countries can be tracked to adaptation (Buchner et al., 2014), it is important to interrogate how Australia’s climate-change financing has performed over the years. Although Australia ranks 12th in donor countries, ODA fell by 2.5% between 2018 and 2019, leading to a decrease in bilateral assistance. Australia’s ODA has been cut annually for 6 years, with budget documents from FY2020 indicating a 28% decline in ODA since its peak in FY2014 (DFAT, 2019).

Table 7.4. Financing Mechanisms in Australia

Type	Infrastructure	Recipient(s)	Allocation	Funded
National government grants	Energy	National-level	Administered through ARENA	National and state government funds
National government grants	Overall infrastructure (mainly roads)	Disaster-affected regions	Disaster recovery authority	Special on-off income tax for individuals earning over A\$50,000
National government grants	Water	State governments		Government department funding
State department funding	Overall adaptation projects	Local councils	Administered through state environmental trusts	Departmental funding
State climate change funds	Coastal adaptation	Local councils	50% of total project cost	Annual contributions from utility providers
State climate change funds	Floodplain management	Local councils	Funds A\$2 for every A\$1 contributed by the local council	Annual contributions from utility providers
Balance sheet financing	Airport	International airport operated by private company		75% from shareholder funds and loans; 25% additional landing fees
Reduction in government charges	Housing and commercial buildings	Individual developers in territory	Reduction of 10%–25% lease variation charge	
Direct private sector financing	Housing	Owners’ corporation for common property	Contribute up to A\$10,000 towards fittings that improve extreme weather resilience	

Type	Infrastructure	Recipient(s)	Allocation	Funded
Own revenue	Coastal protection infrastructure	Public land		Council rates and state government funding
Debt finance paid back through increase in rates	Coastal protection infrastructure	Coastal protection for private properties	Initial cost borne by council through debt finance	Debt paid back by charging a special rate levy

ARENA = Australian Renewable Energy Agency.

Source: Authors.

6. Challenges for Implementation

The first point in relation to challenges for better implementation is political commitment. A multipronged policy and strategy-setting approach like that adopted in Australia is mainly due to a lack of a clear direction at the national government level, however. As various state jurisdictions can develop the most suitable adaptation strategies, this benefits a country like Australia, where climate impacts vary drastically across the country. Yet for such localised policies to be effective, state and local governments need to have well-developed capacity on technical knowledge and have a good financial foundation.

This approach also leaves such strategies to the discretion of the states and territories, which can lead to non-action in some jurisdictions or in specific climate adaptation areas. The lack of harmonisation and fragmentation of approaches across jurisdictions can lead to less-than-optimal actions at a broader national level. The lack of political leadership and action at the national level have an even bigger impact, as Australia is seen as a world leader and can influence non-action from less-developed countries who are not as financially secure. The inertia to commit at a national level is also significant in relation to climate change, as it has impacts not only at the national level but at global scales where international cooperation is required.

Second, engaging the financial sector to develop financial and insurance mechanisms that incentivise the provision of climate-resilient products and services from the built environment and infrastructure sector has not been successful. The current disconnect amongst developer finance, owner insurance, and infrastructure assets creates a significant barrier to the infrastructure sector providing climate-adaptation mechanisms (Edwards, 2017).

Third, alignment of policy, planning, and implementation across all levels is needed. Most Pacific island countries have adaptation plans and policies in place, but few have clearly articulated lists of prioritised investments and technical assistance needs. This, when combined with the significant climate-change investment of other donors, tends to give rise to a situation characterised by short-term projects rather than strategic programming.

The strongest evidence of sustainable and strategic climate-change outcomes is found in Viet Nam (ODE, 2018). Twenty-two key attributes are in alignment with Viet Nam's climate policy, there is strong engagement in the climate-change policy dialogue process with the Government of Viet Nam (along with other donors), and there is good integration of climate and disaster risk reduction approaches under a single implementation strategy.

Beyond Viet Nam, no post-investment evaluations providing strong insights into impacts and sustainability are found. Where evaluations indicated evidence of enduring benefits, the common factors are sufficient time for delivery (i.e. over 5 years of engagement); the building of longer-term, enduring relationships; and working across the right parts of government. Alignment with national action plans and integrating disaster risk reduction and climate-change approaches are likely to enhance ongoing policy engagement and support more sustainable approaches (ODE, 2018). The strengthening of messaging and leadership from the highest levels through DFAT will be an important driver for effective integration.

The Productivity Commission (2012) identified that the most common capacity issues impacting climate-change adaptation are related to local councils having insufficient financial resources to implement adaptation actions, such as creating capital works to protect against the effects of sea-level rise or extreme weather events; potentially acquiring property in high-risk areas; and preparing for and responding to natural disasters. Several inquiry participants noted that competitive funding programmes are resource-intensive and disadvantage smaller councils that have fewer professional staff members to prepare grant applications and to implement funded programmes.

Local governments receive revenue from a range of sources, including own sources (e.g. municipal rates, user fees and charges, fines, and developer contributions) and recurrent grants from the national, state, and territory governments. There is considerable variation in the proportion of revenue received from the different sources across local governments, however. Councils, therefore, need to decide which revenue sources that they will use to fund council services. Moreover, if the local government service provides benefits to identifiable individuals or groups, then the costs of that service could be charged those who receive the benefit. However, if the service benefits are non-excludable (i.e. public goods), they may need to be financed through local rates and taxes or borrowings.

Fourth, national government funding for disaster recovery may also give rise to a barrier to effective adaptation to climate change by distorting the incentives that state and territory governments need to reduce their risks through disaster-mitigation measures (Productivity Commission, 2012). Such funding may lower the incentives to adequately maintain infrastructure and to manage climate-related risks — a form of ‘moral hazard’ — which can lead to a poor balance of disaster prevention, preparedness, response, and recovery. This arises because state and territory governments do not bear the full cost of rebuilding infrastructure after a disaster. Such funding typically encourages damaged infrastructure to be rebuilt without requiring an assessment of the costs and benefits to the community. This may also be a barrier to effective adaptation by discouraging states and territories from changing the design, location, or objectives of infrastructure to make it more resilient to future disasters.

7. COVID-19 Pandemic

The COVID-19 pandemic has had major implications on Australian society. The reduction in domestic demand and international travel pushed Australia into a recession for the first time in 3 decades, with unemployment reaching a record high of 7% (ABS, 2020). Both the national and state governments took measures to reduce the impact on the economy by increasing

government spending during this time. The government increased unemployment benefits and provided subsidies to keep businesses operating. Such measures were possible given that government budgets were in surplus and that Australia had the economic and political stability to take measures to curb the spread of the virus.

The state of Victoria was one of the hardest affected economically due to restrictions adopted by the state government due to a second wave of the virus. The implementation of stage 4 restrictions is estimated to have cost the Victorian state economy around A\$25 billion (*Ibis World*, 2020). Victoria's gross state product is estimated to be about 14% lower in the June and September quarters relative to forecasts in the FY2020 state budget, dropping A\$55 billion over an 18-month period (*Ibis World*, 2020). Increased government debt and business lockdowns also brought about a reduction in the credit ratings for both Victoria and NSW to AA and AA+. This was the first time since 2003 that either state did not receive the top-tier AAA rating held by the national government (Cranston, Shapiro, Kehoe, 2020).

The economic recovery has catalysed an infrastructure-led strategy. The national government maintained its A\$100 billion spending for a 10-year infrastructure pipeline, while the Victoria government expedited some of its expenditure on infrastructure projects (Frydenberg, 2020). The national government unveiled HomeBuilder grants, which assist the residential construction sector by encouraging the commencement of new home builds and renovations. Similarly, the Victoria government announced a building works programme of A\$2.7 billion and a combustible cladding replacement project (Premier of Victoria, 2020). Under the latter project, the government is accelerating the replacement of cladding from 100 buildings per year to 400 buildings in 2 years to generate more employment to help support the local economy.

Although an infrastructure sector recovery emphasises climate-change adaptation, the sustainability of these investments is lacking. For example, of the A\$2.7 billion building works programme of the Victoria government, only A\$129 million has been allocated to the state department of environment for projects.

This lack of climate action during the pandemic is not only visible in the allocation of funds but also in legislative action. Victoria's Climate Change Act 2017 requires the state government to develop a climate-change strategy every 5 years, setting out how Victoria will meet its targets and adapt to the impacts of climate change. As per the act, the first emissions reduction targets were supposed to be set in 2020. However, given the passing of emergency laws for the pandemic, the setting of these targets was delayed twice within 2020. Such a response illustrates that at a policy level, climate change is viewed as a separate 'nice-to-have policy' while the restoration of the economy in a business-as-usual context is given the highest priority.

Although emissions and environmental impacts could have been reduced during the pandemic due to depressed economic activity, as the economy rebounds, emissions can indeed increase. This shows similarities with the 2008–2009 global financial crisis; although carbon emissions declined by 400 million tonnes in 2009, they rebounded by 1.7 billion tonnes in 2010 (IEA, 2020). Therefore, it is imperative that smart policy decisions made post-pandemic will reduce emissions and improve adaptability to climate-change impacts.

8. Conclusions

Australia's response to climate change can be covered under four major areas: from a governance perspective, infrastructure ownership, financing infrastructure within the country, and providing overseas aid for climate change.

From a governance perspective, the country has a lack of leadership to deal with climate change, as there is no synchronised approach to proactively deal with associated impacts. This has led to many instances where local governments have responded to concerns of residents to respond quickly within their jurisdictions, particularly to deal with coastal erosion and storm surges. However, funding of coastal protection must also recognise the several significant non-governmental actors involved, including owners of properties exposed to coastal hazards as well as residents, tourists, and businesses.

Infrastructure plays a significant role in the Australian economy, as it contributes approximately 10% to the GDP. Infrastructure owned by the national government includes rail, airports, and some state roads. The state and territory governments manage state-owned rail, roads, and ports. Local governments have control over access and facilities for local infrastructure. Building, maintaining, and adapting these assets are in the hands of the relevant government authority. The level of adaptation policies at a national level is minimal, and there is limited coordination between national and state/local governments as discussed earlier.

To date, financing for infrastructure adaptation for climate change has typically been a combination of national, state, and local governments alone, or in the form of a partnership. Grants are usually set aside by the national government in cases of mass disaster, as in the instance of the COVID-19 pandemic. However, there is a lack of a coherent and coordinated strategy to prepare for climate change-related events across the country. Some specific cases, such as rural water use and infrastructure programmes, have been funded by the national government. Other instances include national agencies, such as ARENA and Australian Energy Market Operator, working with funding from the national government for specific projects, such as those for summer heatwaves impacting electricity demands. Some of these projects focus more on the mitigation of climate change rather than adaptation.

Some state and territory governments have also addressed identified climate-change and risk vulnerabilities, such as OEH in NSW, to enhance resilience due to heat or coastal management, or the Queensland government assisting its local councils with coastal hazard adaptation planning. There are also examples of private operators responding to climate impacts using a combination of funding approaches, including private sector funding. Other examples include incentivisation, especially for residential and commercial buildings, to meet certain energy-efficiency measures and climate-change adaptation plans.

When protection works provide a benefit to private landowners, the process for reaching an agreement to fund such projects can be a source of significant tension between state and local governments and between property owners who directly benefit from the project and other residents. For local governments, the relatively large cost of coastal protection projects can introduce the political risk of accusation of bias towards foreshore property owners and places a strain on available capital. State governments can be equally reluctant to provide funding, fearing that this may establish a precedent that could become unfeasible across large stretches

of coastline. These tensions can cause delays and add planning costs, compounding the already contested nature of many coastal protection and such similar projects.

The lack of clarity regarding roles and responsibilities has been widely recognised as a barrier to adaptation with attention directed at the national government to clarify roles. In the absence of this top-down approach, certain roles and responsibilities are emerging through practice. The responsibility of climate-change adaptation is deemed to be largely with local governments.

While the proportion of Australia's climate-change finance between mitigation and adaptation is broadly in line with other OECD countries, there is greater focus on adaptation, reflecting the priorities of its developing partner countries. Australia tends to provide a greater proportion of its climate-change finance through multilateral mechanisms compared to other OECD countries. Australia has provided support to its neighbours, with the most recent pledge of A\$500 million from 2020 to 2025 to build Pacific climate change and disaster resilience, a measured increase from its previous funding by 40%.

The COVID-19 pandemic put a strain on Australia's economic trajectory over the last 30 years with high unemployment numbers, particularly in the worst pandemic-affected state, Victoria. This has provided some infrastructure-led opportunities for the state and the country. The Victoria government has expedited some of its infrastructure projects that continued to be operational during the pandemic, such as the Melbourne Metro Rail, with restrictions on the numbers of people operating at a given site to maintain social distancing and other pandemic-related measures. In addition, the national government provided incentives in the form of HomeBuilder grants to catalyse the economy. However, such examples demonstrate that the focus is on economic recovery rather than on climate change-related impacts. That said, the anniversary of the bushfires that took place in 2018 and 2019 provide a stark reminder of the very high temperatures during the previous summer directly related to climate change.

Going forwards, it is difficult to predict whether there will be any immediate impacts on Australia's response to climate change. As the political cycle in the United States changes to a new administration that recognises the importance of climate change and supporting more sustainable lifestyles, Australia's lack of leadership in this area is expected to be a focus, particularly as the next election cycle looms closer.

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