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Mobilising Investment For Climate Adaptation

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About this Report

This report has been prepared as part of the Actuaries Institute's Public Policy and Thought Leadership program. Reports prepared in this program involve the Institute Public Policy staff working closely with the lead authors and the Institute's volunteer network in order for the report to present the Institute's contribution, on behalf of its membership, to the discussion of an important societal topic.

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Acknowledgement of Country

The Actuaries Institute acknowledges the traditional custodians of the lands and waters where we live and work, travel and trade. We pay our respect to the members of those communities, Elders past and present, and recognise and celebrate their continuing custodianship and culture.

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Executive Summary

Australia faces increasing damage and disruption from intensifying extreme weather and disaster risk. Disasters currently cost the Australian economy $38 billion per year, with this cost forecast to rise to at least $73 billion per year by 2060.[1]

More frequent and severe heatwaves, floods, bushfires, storms and a range of other hazards are predicted to continue to cause significant risks to every part of Australian society – from the economy, trade and finance to health, education and social support systems.[2]

Beyond disasters and extreme weather, chronic climate change impacts – such as the impacts of rising temperatures, shifting rainfall patterns, and sea level rise – are also going to increase over coming decades.[3] These chronic changes in climate are already having negative economic and social impacts, including on health, labour productivity and agricultural output.[4]

While we cannot eliminate climate change impacts, it is possible to reduce the risks and costs from a changing climate. The physical damage from persistently higher temperatures, more extreme weather events and rising sea levels and coastal inundation can be reduced by investments in adaptation – for example, cooling systems, more resilient infrastructure, better flood defences or relocating vulnerable communities.

The physical damage from persistently higher temperatures, more extreme weather events, and rising sea levels and coastal inundation can be reduced by investments in adaptation.

The challenges

Adaptation[i] is crucial to protect Australia's people, communities, infrastructure, economy and environment from the escalating risks associated with climate change and to create a more resilient and prosperous future for Australia. To adapt and achieve resilience, Australia needs consistent and comprehensive policy, frameworks and incentives that fairly recognise the unique complexities of adaptation investment, including:

- **Lack of market recognition for resilience and undervaluing the benefits of adaptation:** Many types of adaptation investment have benefits that accrue over long time periods in the form of avoided costs, such as avoided loss from extreme weather. Avoided costs have high uncertainty and are best quantified by probabilistic techniques that can be challenging for stakeholders and the wider public to engage with. Adaptation investments also usually have a wide range of social and environmental co-benefits that are not fully valued. Together these challenges mean traditional decision-making approaches can fail to adequately account for, or undervalue, adaptation investments.[5]
- **Adaptation cost and benefits are spread across stakeholders and whole-of-system resilience matters:** Almost every household, asset and business is, to some degree, reliant on a complex system of supply chains, shared infrastructure, and workforces integrated with communities. For a household, asset or business to be resilient, each part of the system – and the interlinkages between them, such as transport, energy and telecommunication systems – must also be resilient. Related to this, when making investments in assets and infrastructure used by many parts of the system, the costs and benefits tend to be spread across stakeholders. This makes decision-making more complex, requiring effective coordination and clear roles and responsibilities.
- **Building resilience to escalating climate risks will require significant investment across all sectors but funding is finite:** Unconstrained spending is not sustainable. It can raise borrowing costs, increase inflationary pressures, decrease credibility and investor confidence, and in the medium to long term risk cuts to other vital public services. Private entities also face constraints from debt and equity markets.

i The Intergovernmental Panel on Climate Change defines adaptation as the process taken to "adjust to the actual or expected climate and its effects". Adaptation is sometimes seen as a sub-category of resilience. Resilience describes the capacity to anticipate, absorb and cope with shocks and/or to be able to adapt or transform to recover from the impacts of shocks. See: *What is the difference between climate change and adaptation and resilience?*

The solutions

This paper proposes solutions to help overcome the challenges of meeting Australia's need to invest more in climate adaptation noted above, while boosting productivity and delivering a safer and more prosperous future for Australians.

- **Valuing adaptation: Enabling better decisions**

In both the public and private sector, investment decision-making tools (such as cost benefit analysis frameworks) have a strong influence on investment decisions. Many current tools and frameworks do not adequately allow for climate change and fall short when it comes to valuing the benefits of adaptation projects. We propose clear and simple changes to enhance investment decision-making.

→ Read more in **Section 2**

- **Coordinating adaptation: A national framework for adaptation investment**

The size, scale and long-term nature of the adaptation challenge mean Australia needs a nationally coordinated framework to support adaptation investment. We recommend a National Adaptation Investment Framework co-ordinated by the Australian Government, co-developed with states and territories and other major stakeholders and linked to the National Adaptation Plan (NAP)[ii]. The framework would identify adaptation programs that produce the best value for money and support the efficient and equitable allocation of the costs of adaptation across society, as well as recognising other demands on public financing.

→ Read more in **Section 3**

- **Financing adaptation: Growing and diversifying revenue streams for adaptation investment**

There is a need for significant scaling up of investment in adaptation across Australia. There is a clear rationale for the public and private sectors to contribute to this challenge. A co-developed private climate adaptation finance strategy should be developed to complement the National Adaptation Plan and crowd-in private investment in adaptation.

→ Read more in **Section 4**

ii The National Adaptation Plan sets out how the Australian Government will respond to the risks identified in the National Climate Risk Assessment.

Our recommendations

Acting on these recommendations would help to reduce future damage to the economy caused by climate change and deploy capital into adaptation and disaster risk reduction as efficiently and equitably as possible, drawing on appropriate and diversified sources of finance.

Challenge	Recommendations
Valuing adaptation: Enabling better decisions	1.1 The Commonwealth Treasury and state and territory treasuries should review their cost benefit analysis (CBA) methodology to ensure the costs and benefits of adaptation projects are fairly valued. This review should consider whether guidance needs to be modified to include: a. Reducing the central social discount rate for cost-benefit analyses from 7% to 5% (as already done by NSW Treasury) and requiring that sensitivity analysis be performed at a lower discount rate of 2% to 3% b. Using probabilistic methods to assess the costs of extreme weather or disaster occurring, and calculate expected costs (for example using probabilistic average annual loss estimates) c. Using suitably long-term appraisal periods for adaptation projects of at least 30 years d. Including material social and environmental impacts in the assessment of public investments, for example by extending guidance by providing simple and easy to implement adjustments (such as multipliers) to allow for the wider benefits of adaptation projects e. Regularly reviewing guidance so it keeps pace with best practice methods to value relevant social and environmental impacts and provide guidance on methodologies to robustly value these impacts in CBA.
Coordinating adaptation: A national framework for adaptation investment	2.1 The Australian Government should, alongside state and territory governments and other key stakeholders, establish a National Adaptation Investment Framework, aligned with the National Adaptation Plan, to support investment in adaptation, improving outcomes and reducing damages and costs from climate change. 2.2 The National Adaptation Policy Office should commission a review and updating of advice on the roles and responsibilities of different levels of government and non-government stakeholders in adaptation to ensure that governance structures are fit for purpose to address changing climate risks and support adaptation action. The scope of this review should include: a. Analysis of how effective existing principles and frameworks have been at incentivising adaptation activities b. Analysis of international examples of alternative principles and frameworks for roles and responsibilities for climate adaptation c. Consideration of how the action agenda for the National Adaptation Plan (to be developed by the Australian Government by the end of 2026) can be integrated into existing governance structures efficiently and effectively, including identification of any required changes to the governance, resourcing or capacity of different levels of government and non-government stakeholders in adaptation. 2.3 The Australian Government should amend the *Climate Change Authority Act 2011* to give the Climate Change Authority responsibilities to monitor, evaluate and support learning processes regarding adaptation policy and public spending. Best practice would include regular progress reports being published with recommendations about how to improve adaptation policy, including which adaptation programs should continue to be funded.
Financing adaptation: Growing and diversifying revenue streams for adaptation investment	3.1 The Australian Sustainable Finance Taxonomy should be extended to include clear definitions of “adaptation” to support private investment in adaptation. 3.2 The Australian Government should co-develop with the private sector a private adaptation finance strategy to attract private investment into adaptation including: a. How government will engage and collaborate with the private sector on adaptation financing b. Clear principles and mechanisms for public-private partnerships to co-invest in new or upgraded infrastructure.

1

The adaptation challenge

Weather-related events are costly, and these costs will continue to increase under a changing climate

Australia has experienced many acute disasters in recent years – among the most-expensive in our history – including the Black Summer bushfires in 2019-2020 and the devastating floods in NSW and south-east Queensland in February 2022. In addition, chronic hotter temperatures and changes to rainfall are having a vast array of impacts that disrupt the economy and people's lives. Hot weather worsens physical and mental-health and lowers labour productivity.[6 7] Extreme heat is also associated with worsening children's learning and memory.[8] Rainfall is also changing. Adelaide is suffering a severe water crisis due to a prolonged drought that has seen rainfall and flows into Adelaide's reservoirs fall to their lowest levels in 40 years.[9]

Climate science shows that weather and climate extremes are expected to behave differently in the future compared to the past.[10] As noted in Australia's National Climate Risk Assessment (NCRA), in the future "seasonal and spatial changes will shift, and the nature of the hazards, such as their timing, scale and location, may change, potentially impacting Australians in new ways".[11] Hazards may affect previously unaffected regions. For example, evidence exists that cyclone tracks are migrating towards the poles.[12]

Adaptation involves ensuring the things Australians value are more resilient to climate events

The Intergovernmental Panel on Climate Change (IPCC) defines adaptation as the process taken to "adjust to the actual or expected climate and its effects". Adaptation involves changing the way we build, live and work to be resilient to climate and its effects. Resilient institutions, businesses, communities and economies are prepared for the impacts of climate change and are less damaged and disrupted by them.

Adaptation activities are already happening all around Australia, including:

- **Adaptation targeting housing** – For example, through Queensland's Resilient Homes Fund eligible homeowners can apply for funding to enhance resilience, raise, or demolish and rebuild or relocate their flood-affected homes. Voluntary Home Buy-Back was also available for the most severely impacted homes and those at the greatest risk of future flooding.[13]
- **Adaptation targeting sectors** – For example, the Future Drought Fund aims to boost drought and climate resilience by helping farmers, producers and communities to plan, sharing best practice on resilient farming practices, and fostering rural and regional leaders and networks.[14]
- **Adaptation targeting places** – For example, many coastal councils, such as Whitsunday Regional Council and councils on the NSW Central Coast, are taking steps to adapt to sea level rise, storm surge, and coastal inundation through hazard assessments, community engagement, and long-term adaptation planning.[15 16] Cities are also adapting. The Barangaroo urban renewal project in Sydney CBD has an adaptation plan which contains adaptation activities such as upgrading stormwater systems to cope with increased extreme events, improving water efficiency to deal with decreases in annual rainfall, and establishing the ground level of the precinct to allow for 0.9m sea level rise by 2100.[17]

The business case for adaptation is strong ...

There is strong evidence that well-designed adaptation projects deliver a strong return on investment. In addition to cost savings from avoided losses, adaptation projects can deliver other direct benefits like savings on ongoing operation and maintenance expenditure, lower finance costs because the asset is more creditworthy, reduced insurance premiums and non-financial benefits like enhanced social license to operate for businesses.

Many adaptation investments have positive indirect economic benefits through reducing risk, increasing productivity and driving innovation, as well as social and environmental benefits.[18] The World Resources Institute found that the induced economic benefits and additional social and environmental benefits of adaptation actions are often highly significant – and larger than the avoided losses that accrue when disaster does strike – meaning that the investment makes economic sense even before considering the probabilities of disaster risk.[19]

Furthermore, investing in resilient housing, buildings and critical infrastructure such as hospitals, roads, bridges, energy and water is fundamental to creating prosperous communities and economies. Infrastructure needs to be designed to withstand the climate over its full lifespan – which spans decades and can be 50 years or more. There is substantial evidence that the benefits of resilient infrastructure – even if more expensive upfront – greatly outweigh the repair and restoration costs of rebuilding.[20] It is important to understand that the costs of adaptation investments can be marginal, in the economic sense, in some cases. For example, where assets that have reached end-of-life are being replaced or rebuilt, the cost of adaptation is the marginal cost from the additional resilience actions involved, which in some cases can be zero cost (like building and window orientation).

... but challenges persist that hold back adaptation investment ...

There is broad recognition that structural, institutional and financial barriers limit the scale and pace of adaptation investment. These include:

1. **Lack of market recognition for resilience and undervaluing the benefits of adaptation:** Many types of adaptation investment have benefits that accrue over long time periods in the form of avoided costs, such as avoided loss from extreme weather. Avoided costs have high uncertainty and are best quantified by probabilistic techniques that can be more challenging for stakeholders and the wider public to engage with. Adaptation investments also usually have a wide range of social and environmental co-benefits that are often not valued. Together these challenges mean traditional decision-making approaches can fail to adequately account for, or undervalue, adaptation investments.[21]
2. **Adaptation cost and benefits are spread across stakeholders and whole-of-system resilience matters:** Almost every household, asset and business is, to some degree, reliant on a complex system of supply chains, shared infrastructure and workforces integrated with communities. For a household, asset or business to be resilient, each part of the system – and the interlinkages between them, such as transport, energy and telecommunication systems – must also be resilient. Related to this, when making investments in assets and infrastructure used by many parts of the system, the costs and benefits tend to be spread across stakeholders. This makes decision-making more complex, requiring effective coordination and clear roles and responsibilities.
3. **Building resilience to escalating climate risks will require significant investment across all sectors but funding is finite:** Unconstrained spending is not sustainable. It can raise borrowing costs, increase inflationary pressures, decrease credibility and investor confidence, and in the medium to long term risk cuts to other vital public services. Private entities also face constraints from debt and equity markets.

… and care needs to be taken to avoid adaptation solutions inadvertently worsening impacts

There is a risk that activities to ensure climate change is less harmful in one part of society makes climate change impacts worse for other parts. This is known as maladaptation. Adaptation activity can be maladaptive if it increases the vulnerability of other systems, sectors or groups – for example, over-reliance on air conditioning during a heatwave leading to power network disruption or blackouts.[22]

Now is the time to scale, target and diversify adaptation activities

To keep the Australian economy as vibrant and productive as possible, Australia will need tens of billions of dollars of adaptation and resilience investment over coming decades.[23] Because of the scale of the costs involved, increases in both public and private adaptation investment are needed.

To adapt and achieve resilience cost-effectively, Australia needs consistent and comprehensive policies, frameworks and incentives that fairly recognise the unique complexities of adaptation investment. Much of the national conversation over the past couple of years has been on resilient housing. While critically important, our focus needs to be bigger than the household sector. A resilient economy also needs resilient businesses, public assets and services, including schools, roads, hospitals and workplaces.

To scale up adaptation to the level required and avoid the risks of maladaptation, a data-driven, nationally co-ordinated approach is needed.

In the following sections, we cover **practical actions that would significantly scale up much needed adaptation investment in Australia**, through:

- Better quantifying the costs and benefits of adaptation investment and adjusting existing investment tools and frameworks to support better adaptation decisions (Section 2)
- Developing a national framework for adaptation investment to help guide better adaptation spending across all sectors and levels of government (Section 3)
- Growing and diversifying revenue streams for adaptation streams for adaptation finance in Australia (Section 4).

Australia will need tens of billions of dollars of adaptation and resilience investment over coming decades

2

Valuing adaptation: Enabling better decisions

Accurate forecasts of climate-related costs are key to more resilient policy action

Climate change and extreme weather are often not factored into major decisions such as where new buildings are located or constructed. This needs to change.

Having a strong understanding of the costs of climate change – broken down by geography, time, sector and hazard – is a fundamental starting point to tackling the adaptation challenge.

The costs and benefits of adaptation actions are measured relative to what would be expected to happen in the absence of the action. For example, the costs and benefits of raising a road or a building above the 1-in-100-year flood line[iii] need to be assessed relative to the baseline of taking no action.[iv]

So properly accounting for the future costs of climate change is necessary to create incentives for greater investment in disaster resilience and adaptation. If the costs of climate change and/or disasters are understated in decision-making, this erodes the case for adaptation action.

And techniques already exist to forecast a wide range of climate-related costs

Techniques already exist to forecast disaster costs and climate-related costs, many of which originated within the insurance sector. While forecasting the future impacts of climate change presents challenges, climate change and disasters are known to cause substantial damage and costs worldwide. Extensive work has been done to quantify these potential future costs. Techniques include catastrophe modelling, engineering assessments and damage functions.

Catastrophe modelling and engineering assessments

Catastrophe modelling involves producing localised (asset-level or portfolio-level) assessments of the direct damages from disasters (acute climate risk). It requires asset-level data as an input (e.g., features of building construction) and cannot be used to model chronic climate risk.

Engineering assessments are most often used for evaluating site-specific risk exposures for buildings and infrastructure. They can be used to assess and quantify the direct damages from disasters (acute and chronic climate risks).

Damage functions

Damage functions are simplified expressions that translate weather-related or climate-related inputs (e.g., temperatures, height of flood water) into damage costs (when used within the insurance sector) or economic costs.

The Network for Greening the Financial System (NGFS) outlines five distinct methodologies to calibrate climate damage functions for economic costs drawn from the literature: enumeration of climate impacts, surveys, computable general equilibrium (CGE) models, econometrics and meta-analysis, each with its own pros and cons.[24]

Compared to catastrophe modelling and engineering assessments, damage functions:

- require data on the actual historic impacts of weather-related events
- can extrapolate the results to broader sectors or the entire economy
- can capture the costs of both acute and chronic climate impacts.

iii At 1-in-100 annual exceedance probability there is a 1% chance of occurring in any given year or 9% chance of being flooded once in 10 years.
iv Similarly, the Australian Government's Cost Benefit Analysis guidance notes "the costs and benefits of a proposed policy properly relate to changes compared to what would have happened in the absence of the policy".

While the accuracy of any estimate depends on the availability and quality of data underlying it,[25] a combination of these approaches could be used to provide decision-makers and the public with a more realistic range of potential likely costs of climate change and disasters. Most notably, this could be adopted in budget processes to inform the costs to government from disasters and climate change over the forward estimates period and beyond.

Example of how improved reporting of the costs of climate change could create better incentives for adaptation in government budgets

The Centre for Policy Development's 2025 paper *Budgeting for Natural Disasters: Transparency and accuracy in the fiscal treatment of disaster recovery*[26], for example, noted that on average the Australian Government spends $1.6 billion each year on disaster recovery, yet only budgets for $215 million. This is because currently the Budget only includes expected costs for disasters that have already occurred when the Budget is published and excludes expected cost for disasters that will occur over the forward estimates period. The authors estimate this creates a gap of around $6 billion across the forward estimate period.

The paper advocates quantifying likely disaster-related payments across the forward estimates period, arguing it is sound, transparent fiscal policy and helps to recognise the full value of disaster risk mitigation efforts. Forward-looking estimates are already feasible – for instance, Australian Government expenditure under the Disaster Recovery Funding Arrangements was projected 40 years ahead in the *2023 Intergenerational Report*, using a combination of catastrophe modelling and damage function approaches.[27]

While such a step would increase budgeted expenditure (not actual costs) in the short-term, it would also create the incentives and signals needed to drive adaptation by government, business, communities and households – ultimately helping to reduce long-term actual costs. Conversely, in the absence of this approach, it may be hard for new unbudgeted projects to be approved, even with a compelling business case.

But traditional methods of economic and business decision-making have limitations for assessing adaptation initiatives

Traditional methods of appraising new expenditure are not well-suited to supporting decisions about adaptation activities.

In this section we explore the challenges involved in appraising adaptation initiatives and suggest how existing frameworks could be adjusted accordingly.

In government, new policy proposals are required to include financial implications. It is common practice that proposals only proceed where the project benefits exceed the costs based on a CBA. Rules exist for preparing business cases and CBA strongly influences government decision-making regarding investments and public spending.

CBA is also a mainstream tool used in the private sector to support decision-making.

As traditionally undertaken, however, CBA has several limitations that make it not fit-for-purpose for assessing adaptation activities because CBA can understate the valuation of adaptation benefits, leading to systematic underinvestment in resilience.[28]

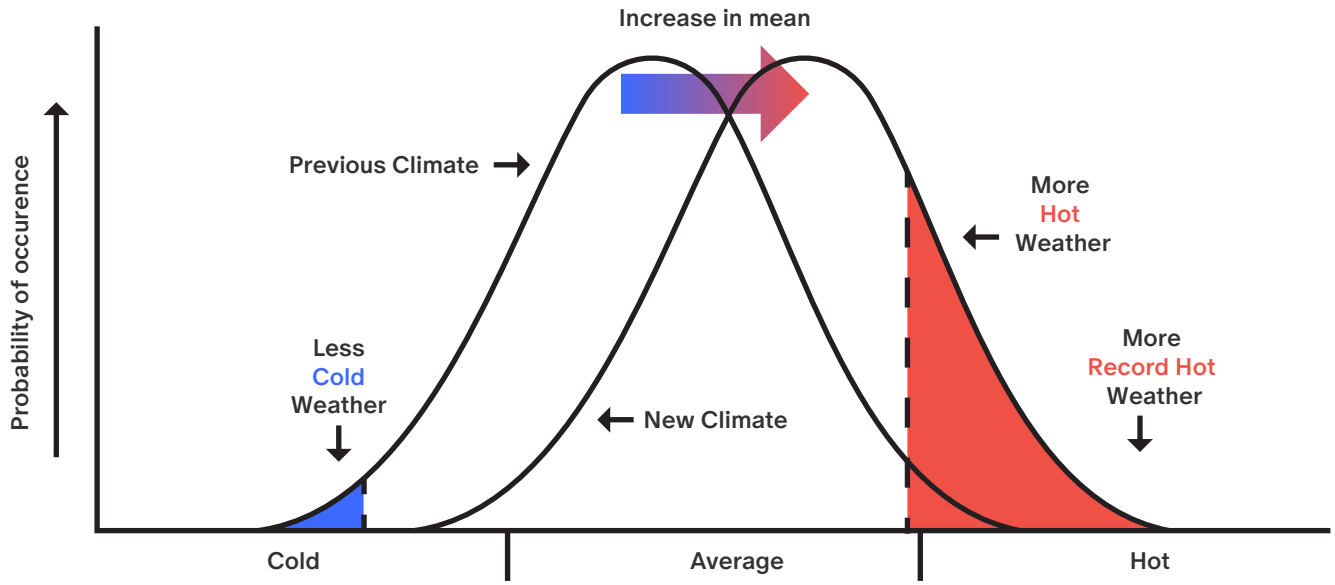
Cost benefit analysis is not set up to value "tail" events

Firstly, CBA requires a long-term expectation of the costs and benefits of a project to be derived over a future "appraisal" period. Traditional CBA frameworks typically rely on deterministic projections of costs and benefits over long time horizons. Deterministic projections typically assume a single number for costs and benefits expected in each future time point, often the central estimate of future costs. This means CBA often fails to adequately account for low-probability, high-impact events (as the impact of rare but high-impact catastrophes is smoothed out in deterministic approaches).[v]

Disasters and acute climate risks are low-probability, high-impact events. Ideally, such risk requires probabilistic analysis to adequately represent the potential for impacts of events that sit further out in the tail. Due to methodological challenges, this is not often done in CBA assessments.[29]

But as formerly once-in-a-generation events – such as devastating flooding witnessed in many parts of Australia in recent years – happen increasingly frequently it becomes more important to allow for tail events. As climate change continues, tail risk (that is, the risk of rare, high-impact events) is expected to increase non-linearly. For example, Figure 1 shows that as temperatures increase (shifting the curve to the right) the result is a significant increase in extremely hot weather or tail risk.

Figure 1: Changes in the extremes of the temperature distribution linked to an increase in mean temperatures[30]



@IPCC 2007:WG1-AR4

Mechler (2016)[31] provides a clear summary of ways to allow for low-probability, high-impact events in CBA, by including a probabilistic representation of natural disaster risk derived from loss-exceedance curves. A loss-exceedance curve indicates the probability of an event not exceeding a certain level of damages (exceedance probability). The area under the loss-exceedance curve represents the expected annual damages, i.e., the average annual damages[vi] (AAD), that can be expected to occur over a longer time horizon. These concepts allow for infrequent events and damage values in an annual number that can be used for CBA and planning (i.e., linking the long-term expectation of the costs of disasters and benefits of adaptation to AAD). The NSW Government Disaster Cost-Benefit Framework (explained in **Box 1**) adopts this approach.

Limitations and extensions of this approach include:

- For acute climate risks, where a catastrophe model is used to derive the AAD, for projects with long appraisal periods it may be necessary to ensure the catastrophe model incorporates climate change by updating traditional event sets, which are based on historical data, to reflect future climate conditions by incorporating climate science
- For chronic hazards, such as extreme temperatures - while it is possible to probabilistically model today's temperature and future temperatures, a damage function approach needs to be used to derive the AAD, as catastrophe models are not set-up to model chronic climate risks.

v CBA also struggles to incorporate the uncertainties associated with climate change, including non-linear impacts, systemic risks, and long-term variability.
vi In the insurance industry the equivalent term is average annual loss, or AAL, which is the same concept as AAD.

Box 1: NSW Government Disaster Cost-Benefit Framework

The NSW Government Disaster Cost-Benefit Framework[32] notes that forecast benefits (primarily avoided and reduced losses and damages) depend on the likelihood of a disaster occurring and its severity, the expected damage should a disaster occur, and the effectiveness of any mitigation strategies implemented.

It recommends using annual exceedance probability (AEP) to assess the likelihood of a disaster occurring. AEP estimates the probability of a particular type of disaster, equal to or larger than a given magnitude, occurring in any year. AEPs can also be expressed as an average return interval (ARI) which is the long-term average time between events of a certain magnitude (e.g., a 0.5% AEP is a 1 in 200 years ARI).

It also recommends expressing the yearly costs of a given natural hazard as an AAD[vii] as this enables a like-for-like comparison between different risk mitigation options.

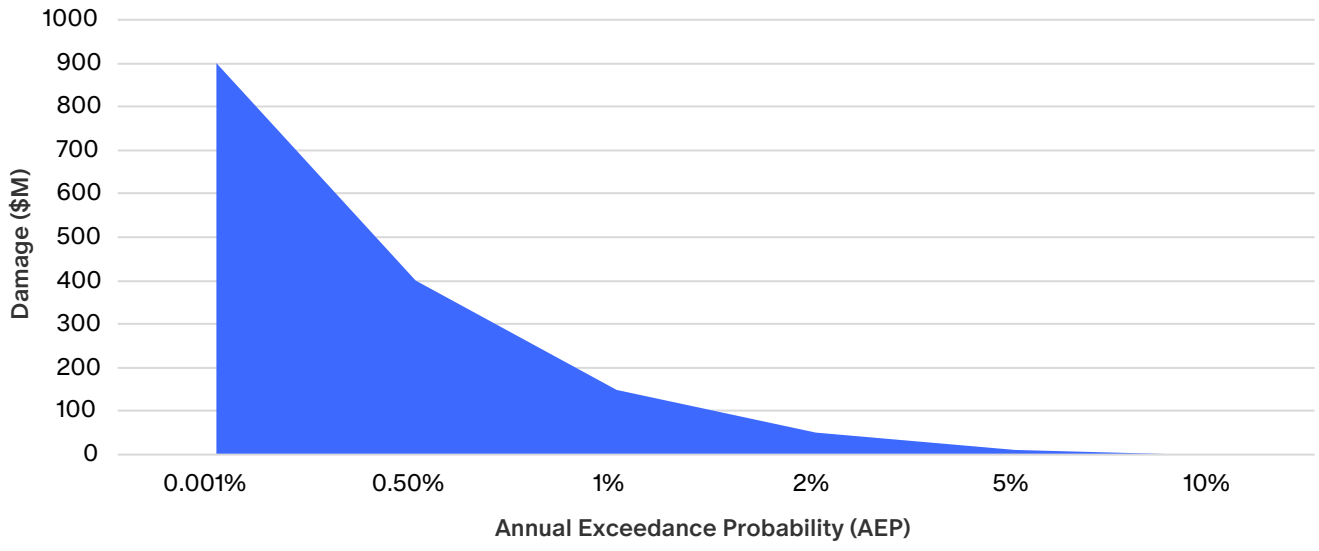
A damage probability curve is used to illustrate the relationship between the potential damage from a hazard and the AEP. The blue area under the damage-probability curve (i.e., the sum of all damages weighed by their probabilities) represents the AAD for a given natural hazard. This is shown in Figure 2.

Table 1: Average annual damage (AAD) calculation example[33]

AEP	ARI (1 in X years)	Damage ($M)	Contribution to AAD ($M)
0.001%	PMF* (~100,000)	$900	$3.24
0.5%	200	$400	$1.38
1%	100	$150	$1.00
2%	50	$50	$0.90
5%	20	$10	$0.25
10%	10	$0	-
		Average annual damage (AAD)	**$6.77**

*Probable Maximum Flood

Figure 2: AAD calculation example – area under the damage probability curve

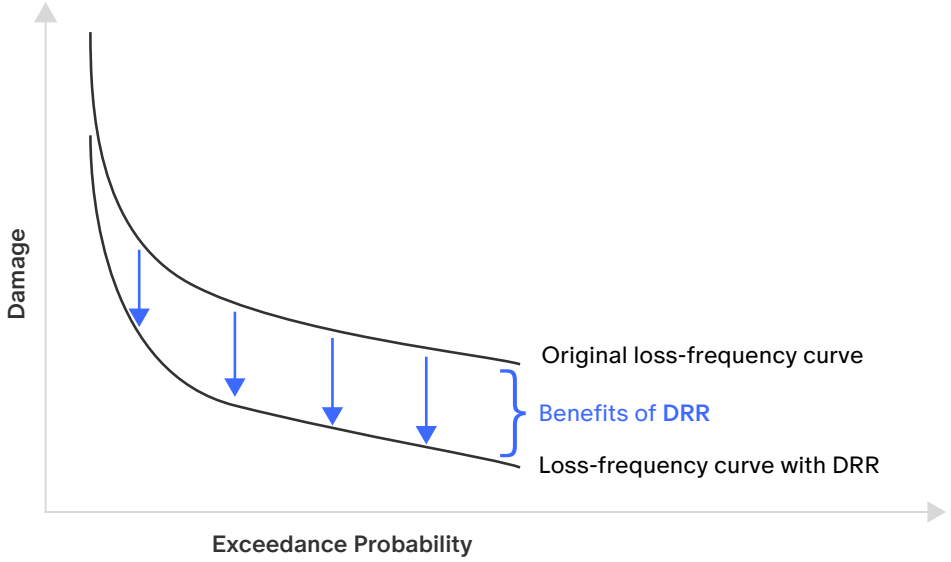


vii The NSW Government's Disaster Cost-Benefit Framework includes a Flood CBA Tool designed to calculate average annual damages for flood resilience initiatives. This tool uses Monte Carlo analysis and allows for sensitivity analysis to estimate average annual damage by considering flood depth, asset location and floor heights to calculate a loss distribution over time.

Box 1: NSW Government Disaster Cost-Benefit Framework (continued)

The benefits of different risk mitigation options can be calculated as the change in the AAD before and after an intervention. Visually, the area between the two curves in Figure 3 represents the reduction in AAD for a given disaster risk mitigation project – that is, the expected long-term annual value of the benefits of the disaster risk reduction (DRR) project.

Figure 3: Valuing the benefits of disaster risk mitigation using AAD curves[34]



Source: NSW Treasury

A common alternative approach to understand and communicate the costs and benefits of climate change is scenario analysis, see for example the IPCC body of work and the Australian Government's *2023 Intergenerational Report*.[35] However, a major limitation of scenario analysis is that the likelihoods of different future climate scenarios are not yet agreed upon on. Without a probabilistic dimension to climate scenario analysis, it is not possible to derive a discounted expected cashflow. Discounted expected cashflows underpin CBA as well as pricing for most financial market securities, so without a probabilistic dimension to climate scenario analysis its application in pricing and project valuation is not possible.[36]

CBA can also undervalue the benefits of adaptation projects if appraisal periods are too short ...

Infrastructure Australia uses a default appraisal period of 30 years, but a 2022 review of the CBA methodology in the Infrastructure Australia Assessment Framework[37 38] noted that for assets where the primary objective relates to climate adaptation, longer appraisal periods (for example, 40 to 60 years) may be appropriate.

Other users of CBA often use an appraisal period shorter than 30 years (and not tied to asset life) for a range of reasons:

- for assessing policy and regulatory proposals, the Office of Impact Analysis recommends aligning the appraisal period with the life of the proposed regulation, citing common periods of 10 or 20 years[39]
- similarly, local governments might only make assessments over 10 to 20 years due to limited forecasting capacity or if their funding is tied to shorter cycles
- private sector or public private partnerships (PPPs) often choose an appraisal term aligned to contract length (e.g., 10 to 20 years) when the investment horizon is not tied to asset life.

For adaptation projects, short appraisal periods may not fully recognise the benefits of adaptation projects.

... or discount rates are too high ...

For monetised flows to be directly comparable in a CBA, costs and benefits incurred in the future are discounted back to current dollar terms. The chosen discount rate used in the CBA can significantly influence its outcomes.

For example, an Insurance Council of Australia report using a 2% discount rate calculated that every $1 invested through resilience initiatives could result in an estimated $9.60 return on investment. When the same calculation used a 4% discount rate, the estimated return on investment dropped 28% to $6.90 for every $1 invested.[40]

In government investment frameworks, cost benefit analyses must use a "central" discount rate of 5% in NSW[41] or 7% in most other jurisdictions[42]. Most guidance also requires a sensitivity analysis where the project net present value (NPV) is calculated at a real discount rate of 3%.

When it comes to adaptation investments there are several strong arguments that the discount rate should be lower than 7%, including:

- There have been considerable falls in interest rates over the past 30 years since the Australian Government's central discount rate of 7% was set. As the discount rate represents an opportunity cost of capital, this could support a lower central discount rate. A 2018 Grattan Institute report[43] considered discount rates for cost-benefit analyses of transport infrastructure projects which, like climate risk related projects, also have long time horizons spanning more than one generation. That report put forward a rate of:
  - 3.5% where there is low systematic risk citing bus, urban road and urban passenger rail projects as examples; and
  - 5% where systematic risk is a little higher, citing ferry and freight rail projects as examples.
- Using a higher discount rate devalues impacts further in the future (including impacts primarily borne by future generations) relative to present day impacts.[44] Acknowledging this, a 2018 survey[45] of about 200 academics put forward a median social discount rate for intergenerational discounting of 2% a year and concluded that current policy guidance on the evaluation of long-term public projects – such as climate change mitigation and long-lived infrastructure – requires substantial revision.
- International best practice uses discount rates well below 7% for longer-term adaptation investments. For example, in the UK since 2003 the discount rate for use in government appraisal has been set at 3.5% in real terms, declining to 3% in real terms from the 31st year onwards.[46] The Australian Government Office of Impact Analysis suggest that for analyses involving very long timeframes, uncertainty means that it is appropriate to use a time declining discount rate.[47]

To support well-informed decision making we recommend:

- using a lower central social discount rate for CBA (such as 5% as done by NSW Treasury) plus
- requiring that sensitivity analysis be performed at a lower social discount rate of 2% to 3%, in addition to the central discount rate and
- disclosing the NPV results under both discount rates.

If the ranking of alternative project options varies depending on the discount rate used, this sensitivity to the discount rate should be disclosed and additional actions should be considered depending on the project's scale, uncertainty and/or strategic importance.[48 49] Actions may include augmenting CBA with other analysis and modelling, further scenario analysis or targeted assurance processes. This is particularly important for building and infrastructure decisions with long-term consequences, including issues of path dependency, escalating maintenance costs and intergenerational equity impacts.[50]

... and any broader benefits are not incorporated

Finally, CBA for adaptation projects should account for the wider benefits and value created by investing in resilience, not just the future costs avoided.

It is broadly acknowledged that investments in transport infrastructure have wider economic impacts (or wider economic benefits) beyond the benefits captured in conventional CBA, including effects relating to returns to scale, agglomeration and thickening of labour markets. There is therefore a large body of guidance on how to account for these wider economic impacts in CBA for transport projects.[51]

Similarly, adaptation projects for buildings or infrastructure often create value for a wider set of beneficiaries than just the owners, operators, or investors in the building or infrastructure.[52] But non-financial benefits of adaptation (such as health, social and environmental benefits) are not traditionally factored into CBA. A key challenge is keeping pace with emerging methods to value relevant wider economic benefits, and social and environmental impacts, including community resilience and social value.[53]

While there are some useful sources for valuing social and environmental impacts in CBA, consistent parameter values and guidance for applying accepted methodologies is lacking. Guidance could be strengthened in this respect by providing simple and easy to implement adjustments to allow for the wider benefits of adaptation projects. Multipliers are commonly used in CBA to allow for distributional effects[54] [55], second-round or input-output effects[56] and other effects. Future guidance could include multiplier values or simple formulae and/or parameters (e.g., derived from quantitative modelling and/or literature review) to provide reasonable approximations of the broader benefits of adaptation investment.

Box 2 shows an example of how allowing for a longer project appraisal period or the wider economic benefits of a project or a lower discount rate can reverse the outcomes of a CBA.

Box 2: Common pitfalls of cost benefit analysis for adaptation decision making

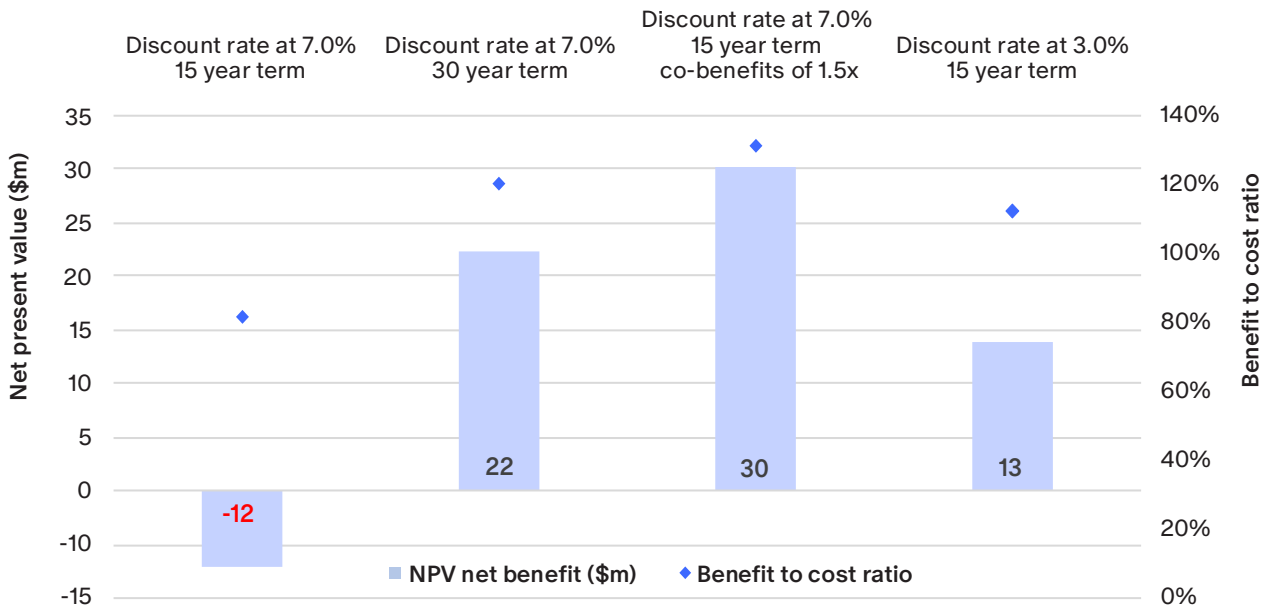
As a hypothetical example, we consider a project requiring an outlay of $100,000 in the first year to raise a bridge above the 1-in-100-year flood line. Each year there is a 1% chance of a flood occurring above this level.

The yearly costs of a flooding expressed as an average annual damage (AAD) are $20,000 before raising the bridge, and $10,000 after. Therefore, raising the bridge provides direct "avoided loss" benefits of $10,000 a year from year two on.

Here we compare the impact of varying key assumptions, one at a time, in this simple example:

1. 7% discount rate, 15 year term, no environmental/social multiplier
2. 7% discount rate, 30 year term, no environmental/social multiplier
3. 7% discount rate, 15 year term, 1.5x environmental/social multiplier
4. 3% discount rate, 15 year term, no environmental/social multiplier

Figure 4: Example cost benefit analysis for a fictional $100,000 adaptation project



NB the NPV is read from the LHS vertical axis and the Benefit to cost ratio is read from the RHS vertical axis

These variations show that a CBA can pass or fail depending on the assumptions used. A key reason for a nationally consistent approach to CBA is to ensure the costs and benefits of adaptation projects are fairly valued.

Recommendation

1.1 The Commonwealth Treasury and state and territory treasuries should review their cost benefit analysis (CBA) methodology to ensure the costs and benefits of adaptation projects are fairly valued. This review should consider whether guidance needs to be modified to include:

a. Reducing the central social discount rate for cost-benefit analyses from 7% to 5% (as already done by NSW Treasury) and requiring that sensitivity analysis be performed at a lower discount rate of 2% to 3%

b. Using probabilistic methods to assess the costs of extreme weather or disaster occurring, and calculate expected costs (for example using probabilistic average annual loss estimates)

c. Using suitably long-term appraisal periods for adaptation projects of at least 30 years

d. Including material social and environmental impacts in the assessment of public investments, for example by extending guidance by providing simple and easy to implement adjustments (such as multipliers) to allow for the wider benefits of adaptation projects

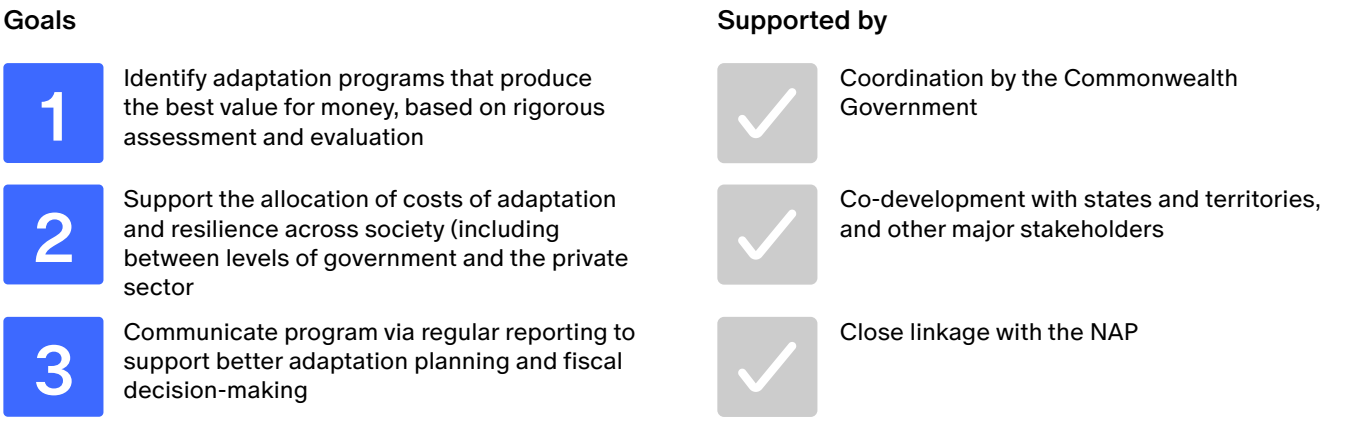
e. Regularly reviewing guidance so it keeps pace with best practice methods to value relevant social and environmental impacts and provide guidance on methodologies to robustly value these impacts in CBA.

3

Coordinating adaptation: A national framework for adaptation investment

The size, scale and long-term nature of the adaptation challenge mean Australia needs a nationally coordinated framework to support adaptation investment. In this section, we discuss key elements this framework should consider.

Figure 5: Overview of the key components of a national framework to support adaptation investment



The framework should be coordinated by the Australian Government, co-developed with key stakeholders and linked to the NAP

To achieve resilience cost effectively, Australia needs a nationally coordinated approach to integrate climate adaptation into long-term investment planning. This requires consistent and comprehensive policy frameworks, analytical tools, and financial incentives that recognise the long-term and system-wide nature of climate risk. The Australian Government must play a central coordinating role to:

- Align investment incentives across jurisdictions and sectors
- Enable long-term adaptation planning
- Avoid fragmented and siloed decision-making that focuses on a narrow set of benefits[viii], in favour of adaptation planning that takes a long-term, cross-sectoral view.

For other long-term, cross-jurisdictional challenges, national strategic investment frameworks already exist and are delivering results. For example:

- The Australian Energy Market Operator's Integrated System Plan (ISP) provides a 20-year strategic roadmap for the National Electricity Market, identifying the least-cost, resilient, pragmatic infrastructure pathway to deliver reliable, affordable and net-zero energy by 2050. The ISP is updated biennially and serves as a central planning tool to align public and private energy investments across the economy.
- Recently, the Productivity Commission has proposed a National Prevention Investment Framework to guide coordinated, long-term public health investments. This framework would identify the most cost-effective prevention programs based on rigorous assessment and evaluation, and provide a stable, long-term basis for funding interventions that reduce future care costs.[57]

A National Adaptation Investment Framework would serve a similar function for climate resilience. It would guide adaptation spending across all levels of government, prioritise high-value investment opportunities and create the conditions for private sector participation. Like the ISP and the proposed National Prevention Investment Framework, it would enable Australia to manage long-term risks with clarity, consistency, and cost-effectiveness.

The Australian Government recently released Australia's first NAP which sets out how the Australian Government will respond to the risks identified in the NCRA. The NAP establishes a framework for Australian Government action to adapt to climate risks and build national resilience to climate impacts, outlines existing roles and responsibilities for adaptation across all levels of government and private stakeholders and details current and future steps to support adaptation (including a commitment that the Australian Government will work with states, territories, and local governments to create an action agenda for the NAP by the end of 2026). The proposed National Adaptation Investment Framework should be aligned with the NAP.

viii Fragmented decision making increases the risk of maladaptation.

The framework should identify adaptation programs that produce the best value for money...

A National Adaptation Investment Framework would support public and private investment in adaptation programs, by:

- systematically monitoring and evaluating adaptation initiatives using a whole-of-society perspective and learning-by-doing to improve the cost-effectiveness of adaptation programs
- using the outcomes from evaluations to inform future adaptation interventions, driving learning-by-doing and increasing cost effectiveness e.g., by identifying the types of adaptation programs that produce the best value for money and work best in different locations and contexts
- taking an investment-based approach, shifting from reactive spending post disaster to proactive, evidence-informed allocation of adaptation funding.

Recommendation

2.1 The Australian Government should, alongside state and territory governments and other key stakeholders, establish a National Adaptation Investment Framework, aligned with the NAP, to support investment in adaptation, improving outcomes and reducing damages and costs from climate change.

... clarify roles and responsibilities among stakeholders for funding and delivering adaptation

The framework should provide guidance on what types of activities will be funded by which groups – across both the public and private sectors – in which contexts and over what timeframes. While difficult trade-offs will need to be made, clear, early policy signals are needed to support sustainable funding for adaptation. The NCRA highlighted the risk to adaptation from governance structures not fit to address changing climate risks. To avoid delays, maladaptation and fragmented decision-making, adaptation will require strong coordination, regulation and governance frameworks.[58]

Currently the roles and responsibilities between different levels of government for adaptation activity are guided by principles and policy frameworks such as the 2012 agreement by the Council of Australian Governments' (COAG) Select Council on Climate Change's statement *Roles and Responsibilities for Climate Change Adaptation in Australia* (the COAG principles), the *National Climate Resilience and Adaptation Strategy 2021–2025* and the NAP.[ix] These documents outline high-level complementary and differentiated roles for all levels of government, and include roles for businesses, communities and individuals. The NAP notes, however, that there is scope to further clarify and evolve the application of the COAG principles in response to the evolving nature and severity of climate risks and impacts.

ix We are not aware of any legal responsibilities that guide roles and responsibilities aside from Australia's commitment, as a signatory to the UN Framework Convention on Climate Change (UNFCCC) and the Paris Agreement which impose binding obligations on signatories [member states], to carry out climate adaptation planning and implement adaptation actions in line with the best available science.

Example of adaptation decision requiring coordination across levels of government: Building codes and land use planning

A contemporary example of a difficult trade-off requiring coordination across levels of government is how to best meet Australia's growing need for more housing that is also resilient to climate change impacts, an outcome that will require smart, coordinated decision-making to ensure long-term affordability. The COAG principles note the role for government in setting regulations that promote effective adaptation, citing examples including building codes and land use planning, and standards for the design of infrastructure.[59] At the conclusion of the August 2025 Economic Reform Roundtable, the Australian Government announced it would work with the states and territories to pause changes to the National Construction Code (NCC) to help improve housing supply. Then in September, the NCRA laid out the importance of increasing the resilience of the building stock to disasters and extreme weather.[60] Given the multi-decade life span of building structures, it will be critically important that the details of the NCC pause (which include an exclusion for essential safety and quality changes) be reconciled with the NCRA.

It is also important to establish clear expectations and principles for funding and delivering adaptation across the private sector. While there is no widely accepted view on the "best" way to allocate the costs of adaptation, several principles exist including the polluter-pays, beneficiary-pays, public-pays and ability-to-pay principles.[61] New Zealand's Independent Reference Group on Climate Adaptation (established to hear insights on making decisions on adaptation challenges and to advise on a new national adaptation framework) recently recommended developing a new adaptation system primarily guided by the beneficiary-pays principle.[62] It also recommended the Government should invest "where there are wider national benefits", including for particularly vulnerable areas with less ability to pay for adaptation.

In the Australian context the COAG principles include maintaining a well-targeted social safety net, and recent adaptation activity at the state level has also included means-testing or similar features to factor ability-to-pay into funding programs (e.g., Queensland's Household Resilience Program).[63]

Recommendation

2.2 The National Adaptation Policy Office should commission a review and updating of the COAG 2012 principles on the roles and responsibilities of different levels of government and non-government stakeholders in adaptation, to ensure that governance structures are fit for purpose to address changing climate risks and support adaptation action.[x]

The scope of this review should include:

a. Analysis of how effective the existing principles and framework have been (e.g., by collecting feedback from within government on whether roles and responsibilities are sufficiently clear)

b. Analysis of international examples of alternative principles and frameworks for management of climate adaptation

c. Consideration of how the action agenda for the NAP (to be developed by the Australian Government by the end of 2026) can be integrated into existing governance structures efficiently and effectively, including identification of any required changes to the governance, resourcing or capacity of different levels of government and non-government stakeholders in adaptation

Australia does not currently have a specific statutory progress reporting mechanism for the NAP under the *Climate Change Act 2022*. Comparable economies like the UK and New Zealand do have such mechanisms – which support better adaptation planning and fiscal decision making, to reduce the long-term costs of climate change on the economy. For example:

- In the UK under the *Climate Change Act 2008*, the Climate Change Committee must report every two years to Parliament on the progress made towards implementing the "objectives, proposals and policies" laid out in the previous NAP. These biennial progress reports assess the extent to which the NAP's content is being implemented and its effectiveness in advancing UK climate adaptation goals.

x i.e. Recommendation of an updating of Council of Australian Governments' Select Council on Climate Change's statement *Roles and Responsibilities for Climate Change Adaptation in Australia.*

- In New Zealand, under the *Climate Change Response Act 2002*, the He Pou a Rangi – Climate Change Commission (the Commission) must provide progress reports evaluating the NAP's implementation and effectiveness two years, four years, and six years after the plan is made publicly available. These reports must assess both how the NAP is being implemented and how effective it is in achieving its adaptation objectives. In practice, the Commission regularly publishes every two years to form a continuous series of adjustments and assessments. The Minister for Climate Change must respond to each report within six months, providing an opportunity for real-time policy adjustments.[64]
- In Germany, under the *Federal Climate Adaptation Act*, the adaptation strategy must be updated every four years, and a monitoring system must be used to measure progress against the targets.[65]

In Australia, the Climate Change Authority is the independent statutory body established under the *Climate Change Authority Act 2011* to provide expert advice to the Australian Government on climate change policy, but their legislative mandate does not currently include adaptation.

The Productivity Commission has recommended the Climate Change Authority be given responsibility for monitoring, evaluation and learning regarding adaptation policy as it has expertise in adaptation, is a body independent of government, and performs similar functions for mitigation[66]. Following the lead of the UK and NZ, we recommend the Australian Government legislate this role for the Climate Change Authority and require that progress reports should be published every two years and include recommendations about how to improve adaptation policy, including which adaptation programs should continue to be funded.

Recommendation

2.3 The Australian Government should amend the *Climate Change Authority Act 2011* to give the Climate Change Authority responsibilities to monitor, evaluate and support learning processes regarding adaptation policy and public spending. Best practice would include regular progress reports being published with recommendations about how to improve adaptation policy, including which adaptation programs should continue to be funded.

4

Financing adaptation: Growing and diversifying revenue streams for adaptation investment

Australia will need to scale the amount of funding required to meet the adaptation challenge. In this section we explore growing and diversifying revenue streams across the public and private sectors.

There is a strong rationale in several areas for government leading adaptation finance activities...

There is a clear role for public investment at all levels of government (Commonwealth, state and territory, city and local). The following areas where public finance can be beneficial are relevant, but not exclusive, to climate adaptation.

Areas where public finance can beneficial, but not exclusive, to climate adaption	
Where services and assets can only be funded by the public system	Adaptation costs related to common goods, essential services and those with broad societal benefits are appropriately funded by the public sector. Examples include access to clean drinking water, public health measures and other systems that benefit almost all Australians. Public funding also often supports research, development and implementation of climate-resilient technologies – which at their early stages do not have a risk-return profile suitable for private investors.
Where the public sector has comparative or competitive advantages that could be monetised	In some cases, public sector organisations might have comparative or competitive advantages that allow them to realise more value from a project than would be the case if assets (including intellectual property) were sold into the private sector. For example, public sector entities may retain greater value through integrated service delivery or long-term stewardship of assets.
Where private businesses rely on publicly-owned assets and services	Private business activity can be disrupted when essential public assets and services are disrupted. Private businesses are generally supported by broader systems that combine public and privately owned elements. For example, a business might be technically "operational" but climate damages disrupt access to inputs or markets via roads, the national broadband network or other essential public assets.
Where well-designed public investment can "crowd-in" private investment	Private and public sources of finance can be highly complementary, for example when public funding plays a strategic role in catalysing investment, addressing distributional issues or protecting disadvantaged groups.[67] Public sector involvement can also create enabling environments, de-risk investments and provide initial funding, while the private sector brings expertise, innovation and efficiency to project implementation.

… and government funding sources will be necessary to finance adaptation activities

In cases where it makes sense for the public sector to lead on financing adaptation activities, this can be done through revenue generation or reallocation of current expenditure.

Excluding intergovernmental transfers, governments typically raise funds for adaptation through one or more of these main revenue options:

- **taxation** (including targeted and broad-based duties, e.g., land tax and GST)
- **non-tax revenue** (including licensing, registrations, service fees and fines)
- **borrowing** (issuing government bonds).

Many Australian and international reviews and experts worldwide have concluded that carbon pricing is the most cost-effective and economically efficient way to generate revenue to fund climate action, including adaptation activities.[68] [69] As this issue has been well studied, we do not repeat this detailed analysis here.

As a complement to revenue raising, governments may also decide to reallocate funds within their current funding envelope. For example, a gradual phase down of the roughly $15 billion a year in subsidies (in the form of spending and tax concessions) to fossil fuel producers and major fossil fuel users[70] could create savings that could be reallocated to resilience upgrades within the sectors that may need support, such as agriculture and/or transport networks.

Reconciling competing demands on limited government revenue is a difficult problem, but doing so will be crucial to budget sustainability and Australia's future prosperity.

The private sector can, and needs to, play a significant complementary role in financing adaptation…

It is widely accepted that the private sector should fund adaptation for their own actions, assets, investments and risks. The beneficiary-pays principle suggests the private sector should also lead funding investments where it can effectively and fairly create a revenue stream from the asset's users, subject to government actions and policies that assist vulnerable groups and support investments being socially inclusive.

Adaptations can have simultaneous positive effects in many different parts of a business' balance sheet, income statement and cash flow:

- increases to revenue, from selling goods and services that assist consumers to adapt
- protections from increased costs, namely:
  - avoiding increased capital expenditure on repairing assets damaged by climate impacts
  - avoiding lower profits because of disrupted operations, higher costs of goods and services sold or other operating expenses
- improved cost of capital, namely:
  - lower cost of debt, because of better credit rating reflecting the asset quality or meeting other risk-linked lending criteria
  - higher values for equity, because of lower risks to revenue or expenses
- savings from lower than otherwise insurance costs, including:
  - lower premiums because of lower risks
  - better access to insurance solutions, including innovative structures, including parametric or microinsurance.

The commercial benefits of adaptation are relevant for stakeholders in the public sector and the private sector considering how to engage with each other. They may also help managers of public sector-led adaptations to consider how their project may have financial benefits for private businesses or investors, which could justify private stakeholders investing in a joint public-private adaptation project.

Case study – Investing in resilience at the Port of Brisbane.

Aurecon and Queensland Investment Corporation (QIC) focused on resilience and adaptation at the Port of Brisbane.

What was done

The Port of Brisbane is vital to Queensland's economy and responsible for nearly all container trade and a large proportion of Australia's agricultural exports. It was therefore selected by QIC and Aurecon for a robust resilience assessment. Following significant disruption in the 2022 floods – when vessel movement was suspended, resulting in a notable portion of the floods' $4.4 billion in economic losses – the project's goal was to assess and strengthen the port's capacity to withstand future climate and disaster shocks.[71]

The initiative used the United Nations Office for Disaster Risk Reduction (UNDRR) Principles of Resilient Infrastructure Scorecard, adapting a global methodology for a local asset. This included:

- benchmarking vulnerabilities, not only of port-owned infrastructure but also exposures arising from third-party assets such as council-owned access roads prone to flooding
- demonstrating how assessment of external risk factors – often overlooked in traditional asset management – can enable smarter investment decisions, encourage collaboration, and improve long-term resilience[72]
- establishing a guided framework for partnerships between asset owners, local governments and other stakeholders to reduce systemic risk.

The project was the top business entry at the 2024 Queensland Resilient Australia Awards.[73]

How the project was funded

Resources came through several channels: private sector capital, technical advisory and targeted public grant support. QIC, as the asset owner and major investor in Port of Brisbane, initiated and resourced the assessment as part of its infrastructure portfolio management. Aurecon provided technical expertise in resilience benchmarking and project leadership. The project was supported by grant funding awarded from the Disaster Ready Fund – a Federal Government initiative designed to catalyse investment in infrastructure resilience and adaptation.[74]

The project underscores the need for both independent investment and aligned government programs to address increasingly complex climate risks facing Australia's infrastructure finance sector.[75]

… and government can strengthen the architecture to support private sector adaptation investment …

Another key role of government, which supports private sector adaptation investment, is addressing market and regulatory impediments that undermine the capacity of, and incentives for, the private sector to make and manage adaptation investments.

A common call, including by the Australian Sustainable Finance Institute (ASFI)[76], Actuaries Institute[77], the World Resources Institute[78] and Insurance Council of Australia[79], and supported by the recent NAP[80], is including adaption investments in sustainable finance taxonomies. In the European Union, adaptation activities are covered under the sustainable finance taxonomies, sending clear signals to investors.

Currently Australia's sustainable finance taxonomy does not cover resilience and adaptation in detail.[81] Expanding the taxonomy to include adaptation and resilience would provide a robust standard definition of eligible activities. This is particularly important where government needs to incentivise adaptation activities by providing specific treatment in taxation, subsidies, financing or cost-benefit analysis. This would provide institutional investors with the opportunity to issue financial instruments specifically designed for adaptation and could help to "crowd-in" private sector capital. Such definitions would also enhance investor confidence by clearly defining eligible activities, reducing the risk of misallocation and promoting transparency.

Recommendation

3.1 The Australian Sustainable Finance Taxonomy should be extended to include clear definitions of "adaptation" to support private investment in adaptation.

… and collaboration with the public sector

Public budgets alone cannot meet adaptation needs and there is a need to unlock capital from Australia's $4+ trillion superannuation sector and other private investors. This should be coordinated between the government and investor community to help overcome barriers such as unclear valuations, fragmented data and cost-sharing challenges.

Government-instigated adaptation projects may be able to access private sector finance through a range of structures (assuming the risk/return profile meets financiers' mandates)[82] [83] such as:

- **Sovereign and sub-sovereign bonds, including green and/or resilience bonds:** Governments (sovereign level) and state or local governments (sub-sovereign level) issue bonds in domestic or international markets to raise funds from private investors, with repayment guaranteed by future tax revenues or government budgets
- **Bank loans:** Governments or project Special Purpose Vehicles (SPVs) can borrow directly from commercial banks, commonly used in PPP projects to finance construction and repaid over time
- **Equity finance:** Private investors or institutional funds take ownership stakes in government-backed projects or state-owned enterprises, earning returns from profits or asset appreciation
- **Hybrid instruments:** Instruments including convertible debt, preference shares and mezzanine finance blend debt and equity features to suit project risks and investor appetite
- **PPPs:** Governments collaborate with private partners to finance, build and operate infrastructure, with repayment via availability payments or user charges
- **Concessional loans and guarantees:** Governments offer guarantees or support subsidised loans to reduce risk for private lenders, drawing private sector capital into large or risky projects
- **Value capture:** Mechanisms such as developer contributions or land tax increments link private investment to public infrastructure, leveraging increases in asset values to help fund projects
- **User charging:** Private investors recover their capital through user fees for services such as toll roads or utilities
- **Asset recycling:** Governments sell or lease existing public assets to private investors and re-invest the raised capital into current priorities (such as resilience activities).

Resilience Bonds and Green Bonds

Resilience bonds

Resilience bonds have funded projects that strengthen the ability of communities and infrastructure to withstand and recover from climate shocks, protecting assets and reducing costs for businesses, governments and insurers. They may also be appropriate for building resilience to chronic impacts.

Unlike traditional bonds, resilience bonds monetise avoided losses from disasters or chronic impacts, meaning the savings generated by proactive risk reduction are used to finance the bond. The bond structure typically connects investors, governments, and independent evaluators, incentivising resilience upgrades by offering rebated premiums based on verified risk reduction achieved through the funded infrastructure.[84] [85]

We have found no specific, widely accepted estimate for the size of the resilience bond market alone as of 2025. However, the broader sustainable and climate finance bond market, which includes green, social, sustainability, and sustainability-linked bonds, has surpassed US$6 trillion, according to the Climate Bonds Initiative.[86]

Resilience Bond Example 1: EBRD Resilience Bond, 2019

The European Bank for Reconstruction and Development (EBRD) issued the first dedicated resilience bond in 2019, raising US$700 million from commercial banks and investors. Proceeds supported projects like the Qairokkum hydropower plant in Tajikistan, which received a US$196 million financing package to upgrade and climate-proof ageing electricity infrastructure. The project aims to boost energy security, reduce vulnerability to water-related climate risks and set a benchmark for adaptation-oriented investment in the region. The bond received a AAA rating, attracting a diverse pool of institutional investors focused on climate resilience.[87]

Resilience Bond Example 2: New York City Metropolitan Transportation Authority Catastrophe Bonds

Although technically structured as a catastrophe bond, the New York City MTA bond arrangement in 2013 pioneered resilience-linked financing in the public sector. The US$200 million bond provided the transit authority with rapid payouts if specified severe storm criteria were met, enabling quicker disaster recovery and infrastructure upgrades. Its insurance-linked structure inspired future resilience bonds by showing how proactive planning and premium rebates could fund pre-disaster mitigation for critical public assets, leading to stronger resilience against future climate events.[88]

Resilience Bonds and Green Bonds (continued)

Green bonds

Green bonds enable capital-raising and investment for new and existing projects with environmental benefits. The International Capital Market Association's *Green Bond Principles* seek to support issuers (including banks, corporates, governments) in financing environmentally sound and sustainable projects that foster a net-zero emissions economy and protect the environment. There has been significant demand for green bonds from global investors, including institutional investors, asset management firms and pension funds.

Green Bond Example: Green Treasury Bonds

The Australian Office of Financial Management priced its inaugural sovereign Green Treasury Bond in 2024 at an average yield of 4.295%, maturing in 2034. Potential uses of proceeds will be assessed with green expenditure criteria:

- alignment with one or more of the program's Green Goals (climate change mitigation, adaptation and improved environmental outcomes)
- low risk that the project will not proceed as expected
- measurable performance indicators
- government commitment to significant funding.

There is currently around $10 billion in Green Treasury Bonds on issue.[89]

Australia's current Budget Process Operation Rules (2023) state that "the Green Bonds team at Treasury must be consulted on all climate change, energy transition and environmental new policy proposals (NPPs), which involve a new commitment of $250 million or more to determine whether the NPP is suitable for financing through green bonds".

While Australian green sovereign bonds do not of themselves create additional funding for adaptation actions by government[xi], they may create greater investor confidence in the assets and activities being financed, both in terms of pricing and classification. Green bonds therefore play a role in meeting expectations of significant investment in adaptation.

Recommendation

3.2 The Australian Government should co-develop with the private sector a private adaptation finance strategy to attract private investment into adaptation including:

a. How government will engage and collaborate with the private sector on adaptation financing

b. Clear principles and mechanisms for public-private partnerships to co-invest in new or upgraded infrastructure.

xi Because the decision to issue green bonds occurs after the decision on any NPP.

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