Response Options

SELECTION OF KEY GLOBAL FINDINGS RELEVANT TO AUSTRALIA
From the United Nations **Intergovernmental Panel on Climate Change's (IPCC's)** Synthesis Report. This is the final report in the IPCC's Sixth Assessment Cycle (AR6), integrating all IPCC reports from the past 7 years.

Feasible, effective, and low-cost options already exist

for both mitigation and adaptation

Early actions bring benefits in both the near and long-term.

The effectiveness of known adaptation options declines as temperatures rise.

The benefits of limiting global warming to 2°C over the 21st century are greater than the costs of limiting global warming.

There is a gap between current levels of adaptation and levels needed to respond to impacts and reduce climate risks.

Ambitious mitigation is enabled by climate-focused laws and policies at national and sub-national levels.

Some possible adaptation and mitigation responses are:

- Diversifying energy production
- Reducing consumer demand
- Supporting increased R&D
- Protecting and restoring ecosystems
- Strengthening social safety net

Including civil society actors, First Nations Australians, youth, local communities, media, labour, businesses and political actors will influence support for options and outcomes.

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Immediate global actions to accelerate adaptation and mitigation will reduce the growing risks of climate change for humans and ecosystems.***[1]

Many feasible, effective and low-cost options exist for both mitigation and adaptation in the near-term, and some would have immediate positive impacts.[2] The systemic change required to achieve rapid and deep emissions reductions and transformative adaptation to climate change is unprecedented in terms of scale, but not necessarily in terms of speed.

Early action brings benefits in both the near- and long-term.[3] **Despite the higher up-front investment, the benefits of limiting global warming to 2°C over the 21st century are greater than the costs of limiting global warming.** Long-term benefits of mitigation action include reduced risk, avoided impacts and damages and reduced adaptation needs.[4]

The Paris Agreement, adopted under the UNFCCC, has led to policy development and target-setting at national and sub-national levels, in particular in relation to mitigation, as well as enhanced transparency of climate action and support.*[5]

Reducing GHG emissions from the energy sector requires substantially reducing overall fossil fuel use, deploying low-emission energy sources, increasing electrification and switching to alternative energy carriers (e.g., sustainable biofuels).**[6] Diversifying energy sources via wind, solar energy and small-scale hydroelectric can reduce vulnerabilities to climate change, especially in rural populations.**

Incorporating Indigenous, local, and scientific knowledge and cultural values, can build capacity and ensure that solutions are socially appropriate and acceptable.[7]

The extent to which civil society actors, First Nations Australians, youth, local communities, media, labour, businesses and local political actors are engaged will influence political support for options and policy outcomes*[8]. For example, solar energy, urban greening and reducing food waste are options mostly supported by the public, enabling expansion in many regions.**[9]

Behavioural and socio-cultural change can reduce global GHG emissions if combined with improved infrastructure design and access, with the most potential in developed countries[10] like Australia.** For example, designing walkable urban areas combined with electrification and renewable energy can create health co-benefits from cleaner air and benefits from more active mobility.**

Solar Radiation Modification approaches have the potential to offset warming and ameliorate some climate hazards but introduce a widespread range of new risks to people and ecosystems, which are not well understood.[11]

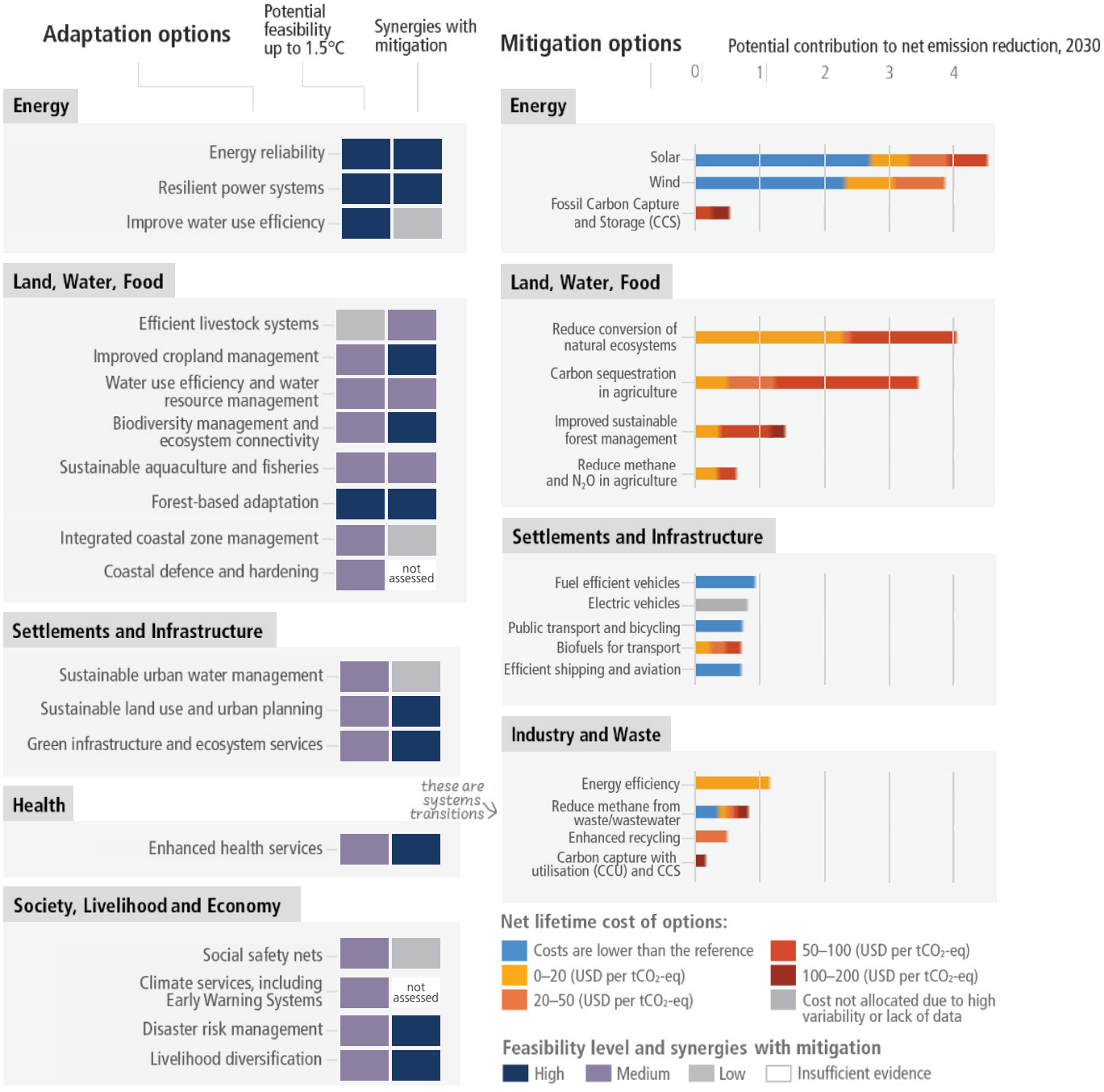
International cooperation is essential to achieving ambitious climate change mitigation and adaptation goals. Enhancing international collaboration on finance and technology can enable greater ambition and can act as a catalyst for accelerating mitigation and shifting development pathways. International cooperation and transnational partnerships can also stimulate domestic policy development, the deployment of low-emissions technology, and emission reductions.**[12]

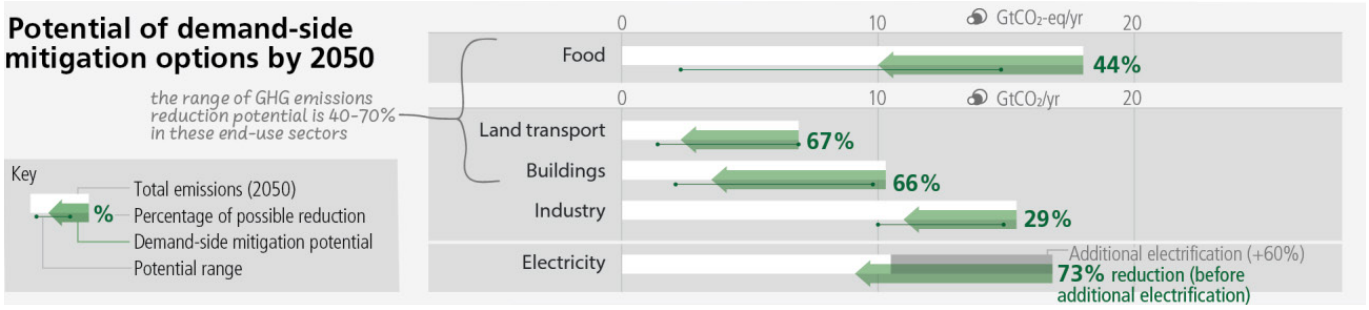
Climate action requires political commitment, institutional frameworks, laws, policies and strategies. It needs clear goals, adequate financing, coordination across multiple policy domains, and inclusive governance processes.[13]

1 Summary for Policymakers (SPM) C.2.1
2 SPM C.3
3 SPM C.2
4 SPM C.2.4
5 SPM A.4.1
6 SPM C.3.2
7 SPM C.6.5
8 SPM C.6.2
9 Longer Report Section 2.2.2
10 Section 3.3.3
11 Section 3.1.2
12 SPM C.7.6
13 SPM C.6

* = medium confidence
** = high confidence
*** = very high confidence

There are multiple opportunities for scaling up climate action globally





Adapted from Figure SPM.7 (a)

The top figure highlights a selection of mitigation options from a longer list in Figure SPM.7 (a) that could be relevant to Australia, and their estimate ranges of costs in 2030. It also highlights a selection of adaptation options that could be relevant to Australia, and the level of feasibility and co-benefits with mitigation. The bottom figure shows the potential of demand-side mitigation options by 2050.

SECTOR RESPONSES

Rapid and far-reaching transitions across all sectors and systems are critical to achieve deep and sustained emissions reductions and secure a liveable and sustainable future for all.[14]

ENERGY SYSTEMS[15]

Net zero CO_2 energy systems entail: a substantial reduction in overall fossil fuel use, minimal use of unabated fossil fuels, and use of carbon capture and storage in the remaining fossil fuel systems; electricity systems that emit no net CO_2; widespread electrification; alternative energy carriers where electrification is less feasible; energy conservation and efficiency; and greater integration across the energy system.

Large contributions to emissions reductions can come from low-cost options including solar and wind energy, energy efficiency improvements and methane emissions reductions.

Climate responsive energy markets, updated design standards on energy assets according to current and projected climate change, smart-grid technologies, robust transmission systems and improved capacity to respond to supply deficits have high feasibility in the medium to long-term, with mitigation co-benefits.***

INDUSTRY[16]

Reducing industry GHG emissions entails coordinated action throughout value chains to promote all mitigation options, including demand management, energy and materials efficiency, circular material flows, as well as abatement technologies and transformational changes in production processes.**

In transport, sustainable biofuels, low-emissions hydrogen, and derivatives (including ammonia and synthetic fuels) can support mitigation of CO_2 emissions from shipping, aviation, and heavy-duty land transport but require production process improvements and cost reductions. Electric vehicles powered by low-GHG emissions electricity have large potential to reduce land-based transport GHG emissions, on a life cycle basis.**

CITIES, SETTLEMENTS AND INFRASTRUCTURE[17]

Urbanisation can be an opportunity to progress climate resilient development in the near-term.** There is a range of options that jointly meet mitigation and adaptation needs when designing, constructing and using buildings and infrastructure.** Examples include: co-location of jobs and housing, efficient energy in buildings and reallocating street space for cycling and walking.

Key infrastructure systems including sanitation, water, health, transport, communications and energy will be increasingly vulnerable if design standards do not account for changing climate conditions.** Natural infrastructure[18] such as urban forestry and river restoration can both reduce emissions and the risk from events such as heatwaves and floods, while also benefiting health, wellbeing and livelihoods.* Combining natural and physical infrastructure[19] can reduce adaptation costs and contribute to flood control, landslide prevention and coastal protection.*

Flood risks can be reduced in the near-term by protecting upstream forests, restoring wetlands and rivers, and land use planning such as no build zones.* For inland flooding, management measures like early warning systems and structural measures (e.g. levees) have saved lives.

LAND, WATER AND FOOD PRODUCTION[20]

Many agriculture, forestry, and other land use (AFOLU) options provide adaptation and mitigation benefits that could be scaled up in the near-term across most regions. For example, conservation, improvement, and restoration of forests and other ecosystems offer the largest share of economic mitigation potential, with reduced deforestation in tropical regions having the highest total mitigation potential. **However, ecosystem restoration, reforestation, and afforestation can lead to trade-offs** due to competing demands on land. Minimizing trade-offs requires integrated approaches to meet multiple objectives including food security.

Effective agricultural adaptation options include: agroforestry, community-based adaptation, farm and landscape diversification, and urban agriculture.** Furthermore, sustainable agricultural intensification can reduce ecosystem conversion, and methane and nitrous oxide emissions, and free up land for reforestation and ecosystem restoration.

Cooperation, and inclusive decision making, with Indigenous Peoples and local communities, as well as recognition of inherent rights of Indigenous Peoples, is integral to successful adaptation and mitigation across forests and other ecosystems.**

14 SPM C.3
15 SPM C.3.2
16 SPM C.3.3
17 SPM C.3.4
18 Also referred to as 'green' infrastructure
19 Also referred to as 'grey' infrastructure
20 SPM C.3.5

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** = high confidence
*** = very high confidence

OCEANS[21]

Maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30% to 50% of Earth's land, freshwater and ocean areas.**
Conservation, protection and restoration of terrestrial, freshwater, coastal and ocean ecosystems, together with targeted management to adapt to unavoidable impacts of climate change reduces the vulnerability of biodiversity and ecosystem services to climate change** and reduces coastal erosion and flooding.**

Protecting and restoring 'blue carbon' ecosystems (e.g. mangroves and seagrass meadows) can increase carbon uptake and storage* and protect against coastal erosion and flooding,*** noting their contribution to global net emission-reduction is likely to be very small.[22]

Rebuilding overexploited or depleted fisheries can reduce negative climate impacts on fisheries* and support food security, biodiversity, human health and well-being.**

HEALTH AND NUTRITION[23]

Human health would benefit from integrating health in food, infrastructure, social protection, and water policies.***

Effective adaptation actions to help protect human health and wellbeing include: strengthening public health programs related to climate-sensitive diseases, increasing health systems resilience, improving ecosystem health, reducing exposure of water and sanitation systems to flooding, improving surveillance and early warning systems, vaccine development, improving access to mental healthcare, and Heat Health Action Plans that include early warning and response systems.

Adaptation strategies which reduce food loss and waste or support balanced, sustainable healthy diets contribute to nutrition, health, biodiversity and other environmental benefits.**

SOCIETY, LIVELIHOODS, AND ECONOMIES[24]

Policy mixes that include weather and health insurance, social protection and adaptive social safety nets, contingent finance and reserve funds, and universal access to early warning systems combined with effective contingency plans, can reduce vulnerability and exposure of human systems.

Increasing education including capacity building, climate literacy, and information provided through climate services and community approaches **can facilitate heightened risk perception and accelerate behavioural changes and planning**.

ADAPTATION CHALLENGES

Adaptation actions can be effective[25] at reducing climate-related risk, especially in the near-term.[26] However, there are widespread gaps between current levels of adaptation and the levels needed to respond to impacts and reduce risk.[27]**

The effectiveness of known adaptation options declines as temperatures rise. Above 1.5°C warming, many adaptation options reach limits[28] and become less effective.*[29]** Key barriers to adaptation are limited resources, lack of private sector and citizen engagement, insufficient mobilization of finance (including for research), low climate literacy, lack of political commitment, limited research and/or slow and low uptake of adaptation science, and low sense of urgency.[30]

Some adaptation limits have already been reached.**
Households in low-lying coastal areas in Australia have faced soft limits to adaptation*[31], and globally some warm water coral reefs, coastal wetlands and rainforests have reached hard adaptation limits.**[32]

Transitioning from incremental to transformational adaptation can help overcome soft adaptation limits[33].**
Integrated, multi-sectoral solutions that address social inequities and adjust responses based on climate risks that cut across systems, increase the effectiveness of adaptation in multiple sectors.**[34] Systems transitions include: deployment of low- or zero-emission technologies; reducing and changing demand through infrastructure design and access, socio-cultural and behavioural changes, and increased technological efficiency and adoption; social protection, climate services or other services; and protecting and restoring ecosystems.[35]

There is increased evidence of maladaptation in various sectors and regions.[36] This is where actions unintentionally lead to increased risk of adverse climate-related outcomes, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future. Maladaptation can be avoided by flexible, multi-sectoral, inclusive, long-term planning and implementation of adaptation actions, with co-benefits to many sectors and systems.[37]

* = medium confidence ** = high confidence *** = very high confidence

21 SPM C.3.6
22 SPM B.6.4
23 SPM C.3.7
24 SPM C.3.8
25 Section 2.2.3; Effectiveness refers to the extent to which an adaptation option is anticipated or observed to reduce climate-related risk (Footnote #42 SPM Working Group II (WGII))
26 SPM A.3.2
27 SPM A.3.4
28 Adaptation options can have hard and/or soft limits. **Soft limits** arise when no adaptation options are currently available but they might be in the future. These can arise from financial, governance, or knowledge constraints. **Hard limits** are when existing adaptation options are no longer effective and additional options are not possible.
29 SPM B.4
30 SPM A.3.6
31 WGII SPM C.3.1
32 SPM A.3.5
33 Section 3.2
34 Section 2.2.2
35 SPM C.3.1
36 SPM A.3.4
37 SPM B.4

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