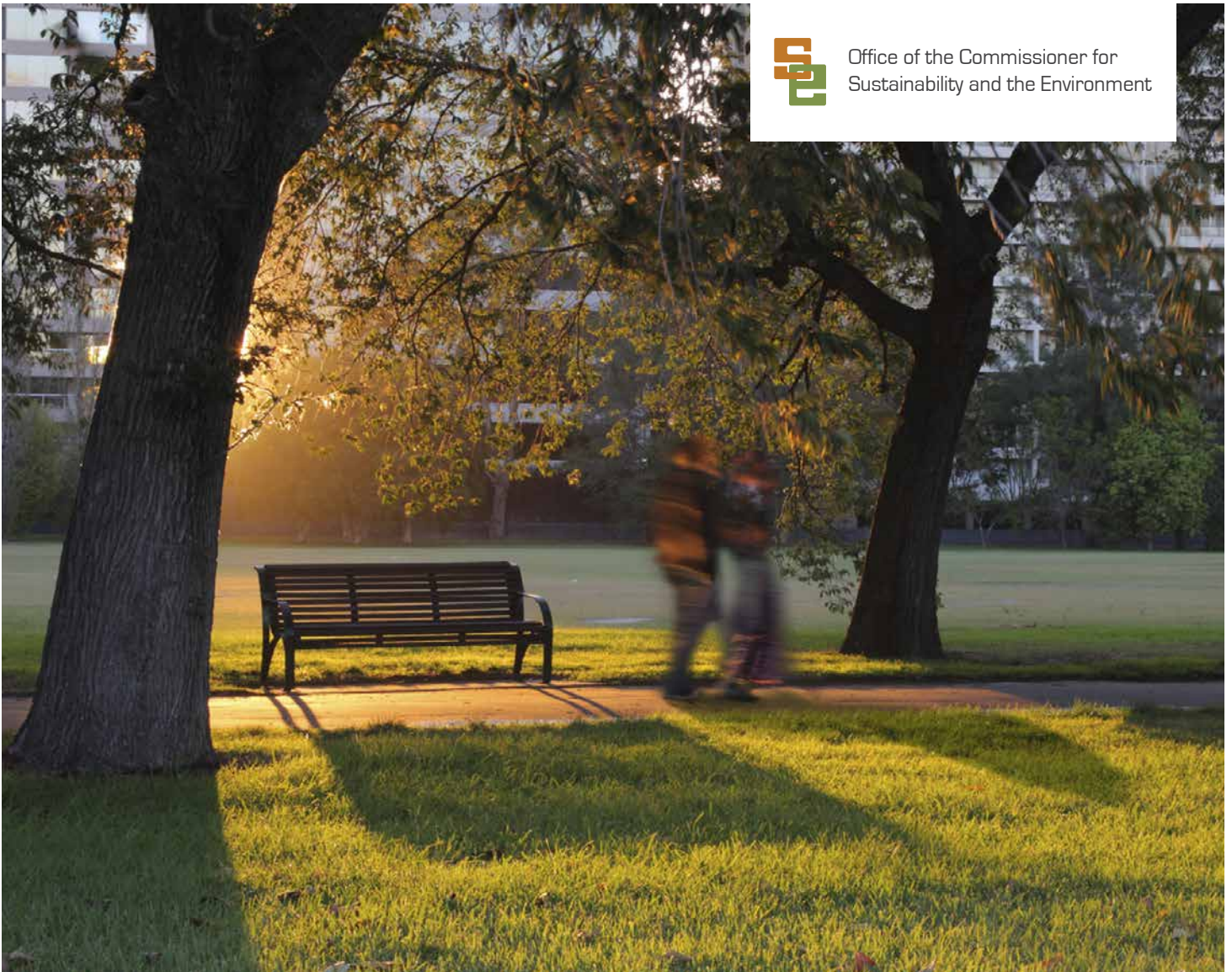

Implementation Status Report

A report on the implementation of AP2: a new climate change strategy and action plan for the Australian Capital Territory



Office of the Commissioner for
Sustainability and the Environment



living sustainably

Implementation Status Report

A report on the implementation of *AP2: a new climate change strategy and action plan for the Australian Capital Territory*



living sustainably

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Commissioner's foreword

The evidence is overwhelming. Levels of greenhouse gases in the atmosphere are rising. Temperatures are going up. Spring is arriving earlier, and summers in both hemispheres are hotter. Ice sheets are melting. Sea level is rising. The patterns of rainfall and drought are changing. Heatwaves are getting worse, as are extreme storm events. The oceans are acidifying. The problem is not just about melting ice, and threatened animals and plants. It is about the human problems of hunger, disease, drought, flooding, refugees and wars all worsening.

The latest report published by the Intergovernmental Panel on Climate Change (IPCC) paints a bleak picture, stating that 'things are worse than predicted in 2007' (IPCC 2013). The IPCC report states that the risk from a changing climate is increasing because of a lack of preparedness and exposure to overlapping hazards that trigger climate events or trends.

Although climate change action can only be effective if addressed at local, regional and national levels, it is cities that are best positioned to take direct action and play a leadership role in the reduction of greenhouse gases.

The ACT Government is responding to these challenges and the opportunities that are posed by climate change. It is responding robustly and constructively, by prescribing legislative greenhouse gas emissions reduction targets (the *Climate Change and Greenhouse Gas Reduction Act 2010*) that are not only consistent with the IPCC's recommendations but are also the most ambitious targets in Australia.

AP2: a new climate change strategy and action plan for the Australian Capital Territory is the second ACT action plan and update to the *ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)*. It contains a set of actions designed to achieve the ACT's legislated 2020 greenhouse gas emissions reduction targets and to progress the strategy to the next government review point in 2015.

As Commissioner for Sustainability and the Environment, I am pleased to present the first of three Implementation Status Reports. These reports provide an independent assessment of our progress towards the climate change mitigation and adaptation outcomes defined in AP2.

AP2 was driven by the ACT's commitment, as a community, to address climate change. It demonstrates that we, as a community working together, can make a positive contribution to the global climate change mitigation effort by demonstrating that the move to a less carbon-intensive society is feasible.

With advances in climate mitigation and adaptation science happening so rapidly, this first independent review of AP2 provides the ACT Government with real opportunities to respond to the assessment and continue to address the challenges posed by a changing climate.

I congratulate the community and the ACT Government for leading the way in showing the rest of the country what can be done to progress the sustainability and resilience of our territory.



Mr Robert Neil
Commissioner for Sustainability and the Environment,
Australian Capital Territory



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Acronyms and abbreviations

ACT	Australian Capital Territory
AP1	<i>ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)</i>
AP2	<i>AP2: a new climate change strategy and action plan for the Australian Capital Territory</i>
BAU	business as usual
BCA	Building Code of Australia
CDP	Carbon Disclosure Project
CO _{2-e}	carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DV306	<i>Draft variation 306 to the Territory Plan</i>
EDP	estate development plan
EIS	environmental impact statement
ERT	emissions reduction target
ESDD	Environment and Sustainable Development Directorate (now the Environment and Planning Directorate)
GGI	Greenhouse Gas Inventory
GGP	Greenhouse Gas Protocol
GHG	greenhouse gas
GPC	Global Protocol for Community-Scale Emissions
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardization
ISR	Implementation Status Report
kt	kilotonne
NARClIM	NSW/ACT Regional Climate Modelling project
NCCARF	National Climate Change Adaptation Research Facility
NSW	New South Wales
OCSE	ACT Office of the Commissioner for Sustainability and the Environment
RET	renewable energy target
TAMS	ACT Territory and Municipal Services
UK	United Kingdom
UNFCCC	United Nations Framework Convention on Climate Change
US	United States of America

Glossary

A1B	<p>One of six scenarios used for climate models.</p> <p>The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and a balanced spread of technology using a range of energy sources.</p>
A1FI	<p>One of six scenarios used for climate models.</p> <p>The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and an emphasis on fossil fuel technologies (ie a fossil fuel–intensive technological world).</p>
AP1	<p><i>ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011).</i></p> <p>The ACT Government’s first action plan and strategy on climate change for the territory.</p>
AP2	<p><i>AP2: a new climate change strategy and action plan for the Australian Capital Territory.</i></p> <p>The ACT Government’s second action plan and strategy on climate change for the territory.</p>
AR4	<p><i>IPCC fourth assessment report: climate change 2007.</i></p> <p>The Intergovernmental Panel on Climate Change’s (IPCC’s) fourth in a series of reports that assess climate change and its effects, using scientific and technical information. The report was released in 2007, and its main finding was that increased global average temperatures since the mid-20th century were very likely due to the increase in greenhouse gas concentrations from human activity.</p>
AR5	<p><i>IPCC fifth assessment report: climate change 2013.</i></p> <p>The IPCC’s fifth in a series of reports that assess climate change and its effects, using scientific and technical information. The first part of AR5 was released in 2013, and the three remaining parts are to be released in 2014.</p>
ISR	<p>Implementation Status Report.</p> <p>As part of the review of the ACT’s action plans, Implementation Status Reports will review the implementation of the government’s climate change policies. These will be undertaken in 2014, 2017 and 2020.</p>
NARClIM	<p>NSW/ACT Regional Climate Modelling project.</p> <p>The project is currently producing a range of regional climate projections for south-east Australia, in collaboration with the New South Wales Government.</p>
SEACI	<p>South Eastern Australian Climate Initiative.</p> <p>SEACI was established in 2005 to improve understanding of the nature and causes of climate variability and change in south-east Australia, to better manage climate impacts. SEACI was a partnership between the Commonwealth Scientific and Industrial Research Organisation, the Australian Government Department of Climate Change and Energy Efficiency, the Murray–Darling Basin Authority, the Australian Government Bureau of Meteorology, and the Victorian Department of Sustainability and Environment.</p>

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This 2014 Implementation Status Report has been developed independently by the Office of the Commissioner for Sustainability and the Environment, assisted by the views of a wide range of experts who provided analysis and advice on the complexities associated with the measurement of greenhouse gas emissions, and mitigation and adaptation actions in responding to climate change.

I am pleased to acknowledge the vital contributions of those involved in providing advice and feedback.

Robert Neil
ACT Commissioner for Sustainability and the Environment

ACT Climate Change Council

- Professor Barbara Norman (Chair)
- Ms Lynne Harwood (Deputy Chair)
- Ms Maria Efkarpidis
- Ms Dorte Ekelund
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ACT Government agencies

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Commissioned reports

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- Canberra Urban and Regional Futures, Barbara Norman, Director
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- Crawford School of Public Policy, Australian National University, Professor Quentin Grafton and Dr Hang To
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Executive summary



Executive summary

AP2: a new climate change strategy and action plan for the Australian Capital Territory (AP2) is designed to achieve the ACT's legislated 2020 greenhouse gas (GHG) emissions reduction targets.

AP2 provides for the Office of the Commissioner for Sustainability and the Environment (OCSE) to assess, every three years, whether the ACT Government is reducing GHG emissions, adapting to climate change and leading a sustainable future. AP2 prescribes that the assessment be conducted by answering the following questions:

- How are we tracking against sector GHG emissions reduction targets?
- What are the implications for the ACT of developments in climate science?
- How 'fit for purpose' are the ACT's climate change adaptation policies?
- How do the ACT's targets and actions stand against national and international developments?
- What new opportunities or challenges have emerged?

In addition to providing the results of this assessment, this Implementation Status Report (ISR) includes an analysis of the ACT's statutory planning mechanisms and the extent to which they address climate change. The rationale for this analysis is that planning is integral to the design and management of climate change mitigation and adaptation measures.

The 2014 ISR contains:

- the methodologies or analytical processes used for measuring and reporting on the effectiveness of AP2 in relation to the questions above
- the findings resulting from the application of these methodologies or analytical processes
- the challenges facing the ACT in each of these areas
- the opportunities or options available to the ACT Government to overcome or address these challenges.

The ISR found that AP2, combined with the GHG reduction targets prescribed by the *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act), positions the ACT among the world's most progressive jurisdictions in terms of mitigating the impacts of climate change.

For the ACT to continue adapting to climate change and leading a sustainable future, it is vital that climate change policies, including AP2 and the actions it contains, are continually reviewed and updated. The findings, challenges and opportunities presented in the ISR provide the basis for this review.

In addition, the 2014 ISR provides the basis for any future iterations of AP2 and AP3, and for the OCSE to work with the ACT Government to design terms of reference that ensure that the next ISR is relevant, effective and clear.



How are we tracking against sector greenhouse gas emissions reduction targets? (Chapter 1)

Answering the question of how the ACT is tracking against sector GHG emissions targets posed a number of challenges. The reasons for this include the following:

- The sectors for GHG emissions reporting in the ACT (energy; industrial processes; agriculture; land use, land-use change and forestry; waste) do not align with the emissions sectors in AP2 (residential energy use, nonresidential energy use, transport, waste, energy supply).
- The release of the ACT's emissions report (the Greenhouse Gas Inventory), as well as national data currently necessary to calculate emissions, do not accord with the timing of the ISR.
- There are challenges involved in ascertaining the effects of AP2 actions on the GHG emissions reduction targets prescribed under the Act.
- The setting of emissions reductions targets and the methodologies used to set the targets are complex. A variety of methods can be used, which each have benefits and disadvantages.

The primary opportunity to address these challenges is the adoption of the Greenhouse Gas Protocol, which is the most widely used international accounting tool for government and business leaders to understand, quantify and manage GHG emissions.

What are the implications for the ACT of developments in climate science? (Chapter 2)

This question was answered through a comparative analysis of the science that underpinned AP2 and the latest comparable scientific developments since the 2012 release of AP2.

The analysis concluded that AP2 was underpinned by rigorous and current climate science, the majority of which remains relevant in October 2014.

The challenge for the ACT is to maintain this rigour and currency by ensuring that effective channels for communication and coordination between policy makers, the scientific community and the broader community are designed and implemented. In particular, the ACT would benefit from examining the progress that has been made in adaptation science and strategies.

How ‘fit for purpose’ are the ACT’s climate change adaptation policies? (Chapter 3)

This question was answered by rating ACT adaptation policies and strategies from ineffective to very effective. The assessment looked at both general adaptation needs, which represent a series of key requirements to facilitate successful adaptation strategies, and specific adaptation needs, which address specific identified vulnerabilities for the ACT.

The assessment found that, for general adaptation needs:

- political commitment was very effective
- funding, strategy and action plans, and knowledge management and data were effective
- governance, and communication and awareness were partially effective.

Specific adaptation needs were also assessed.

Plans for:

- water, heat management and bushfires were considered very effective
- urban planning, emergency management, the health system, social and mental health services, and environmental management were considered effective
- government services and infrastructure were considered partially effective.

The assessment found that many of the ACT’s climate change adaptation mechanisms are currently addressed somewhat incidentally and within policies or plans that have other, nonadaptation goals. However, this is being redressed through the recently released first stage of the government’s *Adapting to a changing climate: directions for the ACT* (ACT Government 2014). This will provide new opportunities to incorporate adaptation responses into all relevant policies or programs and to coordinate approaches across government.

How do the ACT’s targets and actions stand against national and international developments? (Chapter 4)

This question was answered by comparing national and international jurisdictional GHG emissions reduction and renewable energy targets, and the actions developed to effect these targets.

The analysis concluded that the ACT is at least on par with, and in some cases leading, other Australian and international cities in mitigating and adapting to climate change.

The OCSE also found that continued analysis of the approaches of other national and international jurisdictions could be used to inform recommendations to further develop ACT GHG emissions reduction targets, energy efficiency goals and climate change adaptation action plans.

Information from the Carbon Disclosure Project (CDP) could also be used in future analyses. The CDP collects self-reported data on climate change, and water- and forest-risk data from companies and cities around the world. It provides a uniform reporting framework to allow data to be easily reported and compared on an international scale. These data are used to improve environmental risk management and decision making. The ACT is reporting through the CDP.

How does ACT planning take account of climate change? (Chapter 5)

The OCSE determined that the most constructive approach for the 2014 ISR would be to consider the ACT's planning system by assessing the statutory approvals process, and the extent to which this process addresses the ACT's climate and adaptation needs.

This analysis concluded that planning processes, governed by the provisions of the *Planning and Development Act 2007*, all had important roles in mitigation and adaptation by encouraging more efficient housing and a more compact city. Processes included estate development plans, development applications and exemptions, and environmental impact statements.

The Building Code of Australia and the Nationwide House Energy Rating Scheme, both of which embody energy efficiency measures for all building classifications, are also important. Energy efficiency measures have reduced the growth in GHG emissions, and improvement will be cumulative as more new houses are built and older houses are renovated. However, the overall increase in the population and in the average size of new dwellings has limited the effects.

In terms of adaptation, areas that will require focus in the ACT include stormwater flows and bushfire risk. Many of the planning processes designed to reduce the generation of GHGs, such as installing insulation in dwellings and implementing water-sensitive urban design measures, will also contribute to better climate change adaptation.

Future planning for climate change mitigation and adaptation would benefit from a whole-of-government approach, as well as the translation of urban strategic planning directions at a local level. Involving industry will also be important, particularly with regard to climate-responsive building design. Continued monitoring of planning implementation will help to influence future policy and strategies.

What new opportunities or challenges have emerged? (Chapter 6)

A number of challenges arose in the assessment of AP2, particularly around the specific aims and actions to be measured, and the methodology of measurement. These present opportunities for improvement. In addition, new strategies, tools and information that have been developed since the launch of AP2 provide opportunities for the ACT to improve its climate change mitigation and adaptation activities.

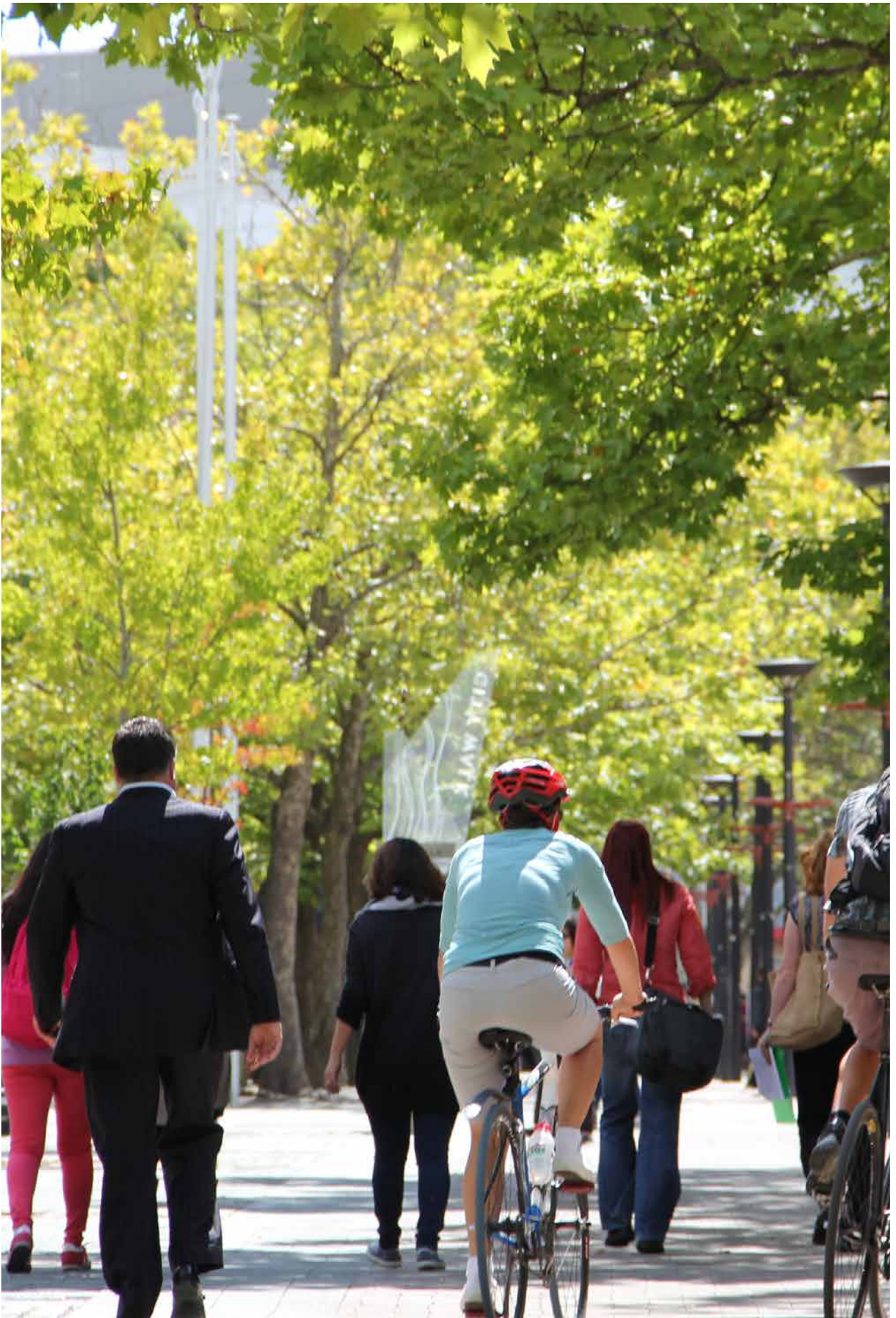
Challenges and accompanying opportunities are highlighted in boxes throughout the report.

Challenge

Challenges arising around specific aims and actions to be measured, and the methodology of measurement.

Opportunity

Opportunities to improve climate change mitigation and adaptation activities.





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Introduction

The global climate is changing, and we are already seeing the effects in Australia. Australia's climate has warmed by 0.9 °C since 1910, and the frequency of extreme weather events, including storms and heatwaves, has increased.

The future climate of the Australian Capital Territory (ACT) is likely to be hotter, with more extreme rainfall events, days of extreme heat and extreme fire-danger days. This will affect a wide range of issues, including public health, water resources, emergency management, infrastructure and community services, agriculture and forestry, business and industry, government and governance, and the environment.

The Intergovernmental Panel on Climate Change has identified the need for both mitigation to reduce the severity of climate change, and adaptation to manage unavoidable climate change.

The ACT has established ambitious greenhouse gas (GHG) emissions reduction targets through the *Climate Change and Greenhouse Gas Reduction Act 2010*, and has developed the *ACT Climate Change Policy: weathering the change (Action Plan 1 2007–2011)* (ESDD 2007) and *AP2: a new climate change strategy and action plan for the Australian Capital Territory* to implement the Act.

AP2 identifies and targets emissions reductions across the ACT community, with actions in five key sectors, which correspond to the major emissions sources in our community:

- residential sector energy use
- nonresidential sector energy use
- transport sector
- waste sector
- energy supply sector.

AP2 also provides for the Office of the Commissioner for Sustainability and the Environment (OCSE) to assess every three years whether the ACT Government is reducing GHG emissions, adapting to climate change and leading a sustainable future. This assessment, to be published in an Implementation Status Report (ISR), is to be conducted by answering the following questions:

- How are we tracking against sector GHG emissions reduction targets?

- What are the implications for the ACT of developments in climate science?
- How 'fit for purpose' are the ACT's climate change adaptation policies?
- How do the ACT's targets and actions stand against national and international developments?
- What new opportunities or challenges have emerged?

AP2 further prescribes that these questions be answered with reference to the ACT's achievements in:

- reducing GHG emissions
- adapting to a changing climate
- leading a sustainable future.¹

I.1 Introduction to the legislation

The *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act) was enacted by the ACT Legislative Assembly on 5 November 2010. The Act sets targets for reducing GHG emissions in the ACT, provides for monitoring and reporting in relation to targets and functions performed by the Minister for the Environment and Sustainable Development, and promotes community and business engagement in climate change mitigation and adaptation through the establishment of the Climate Change Council and sector agreements.

The Act prescribes the following:

- The principal target is to reduce GHG emissions in the ACT to achieve zero net emissions by 30 June 2060.
- The interim targets are to reduce GHG emissions in the ACT to
 - 40 per cent less than 1990 emissions by 30 June 2020 (the total emissions target set by AP2 is to be 1905 kt by 2020)
 - 80 per cent less than 1990 emissions by 30 June 2050.
- The average amount of GHG emissions produced per person in the ACT each year is to peak by 30 June 2013.

¹ In the context of the ISR, the OCSE has adopted the definition of sustainability contained in the ACT Sustainability Policy 2009: 'sustainability recognises the need for a long-term perspective, the need for responsibilities and benefits to be shared equitably, and the interdependence of our economy, environment and society'.



The Act also allows for renewable energy targets for the ACT to be prescribed in regulation.

The legislated targets are the framework within which AP2's sectoral targets and actions operate. The legislated targets form the basis and rationale for the development of subsidiary targets, including those in AP2, as well as the implementation of individual AP2 actions and other ACT Government climate change policies.

Although the government and community are not bound by offence or enforcement penalties to meeting targets, and sector agreements are voluntary, the Act does mandate regular reporting to the ACT Legislative Assembly on progress in meeting targets.

The Act provides authority for the Minister to establish a Climate Change Council to advise the Minister on policies related to reducing GHG emissions and adapting to climate change. The council's role is to strengthen collaboration between the government, community and business through consultation and cooperation to identify actions or strategies for reducing GHG emissions and addressing climate change.

The Act also facilitates government working with business and the community to develop and establish strategies that will put the ACT in a position to take early action to reduce GHG emissions and adapt to climate change. This includes provisions that enable

the government to enter into sector agreements with a particular person, entity, and industry or business group on a voluntary basis to encourage private entities to take action and adopt strategies to reduce GHG emissions or to adapt to climate change.

I.2 Introduction to AP2

AP2 contains the framework and actions to give effect to the legislated GHG emissions reduction and renewable energy targets. It also endeavours to ensure that these targets are reached in a way that is sustainable, fair and equitable.

AP2 was designed as the ACT's guide to meeting the 2020 GHG emissions reduction target prescribed by the Act. AP2 was released in September 2012.

For each major emissions source sector (see above), actions have been identified that are designed to achieve specific emissions reductions (Box I.1).

Box I.1 AP2: a new climate change strategy and action plan for the Australian Capital Territory actions to reduce emissions and mitigate the effects of climate change

Reducing residential sector emissions

**Six actions Emissions reduction by 2020
(tonnes of carbon dioxide
equivalents [CO₂-e]): 218 000**

Action 1: The ACT Government's Energy Efficiency Improvement Scheme will commence from 1 January 2013, requiring retailers to implement energy efficiency improvements to ACT homes, with a focus on low-income households. The scheme will be extended to 2020, subject to outcomes of the scheme review in 2014, regulatory impact assessment and developments at the national level.

Action 2: Subject to a regulatory impact assessment, the ACT Government will introduce legislation to restrict the replacement and installation of high-emissions water heaters in houses and townhouses in gas-reticulated areas, and will investigate the expansion of emissions standards for hot water heaters to all new residential buildings by June 2014, with a view to introducing new standards in the 2015 revisions of the ACT building code if found to be cost-effective.

Action 3: Subject to a regulatory impact assessment, the ACT Government will introduce legislation to require landlords to provide information to tenants on the energy efficiency of homes and fixed appliances, and major energy uses. Regulatory impact assessment and stakeholder consultation will be completed in 2013.

Action 4: By 2015, the ACT Government will publish a 'pathway to zero emissions buildings' policy, informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013, covering residential and nonresidential building types.

Action 5: The ACT Government will continue to build on the experience of its successful ACTSmart programs to develop a comprehensive

strategy to engage the community on climate change matters, and to provide integrated information, advice and support to Canberra households on reducing energy bills and cutting emissions. This will be guided by a community engagement strategy to be published in early 2013.

Action 6: The ACT Government will conduct a trial of advanced energy technology systems, in partnership with the Australian National University and the Canberra Institute of Technology, aimed at increasing the technical and economic potential for intermittent energy sources on the ACT network.

Reducing nonresidential sector emissions

**Three actions Emissions reduction by 2020
(tonnes CO₂-e): 181 000**

Action 7: The ACT Government will complete a regulatory impact assessment by the end of 2012 considering the impacts of, and opportunities for, extending the Energy Efficiency Improvement Scheme to include fuller business participation.

Action 8: The ACT Government will establish ACTSmart Energy Advice to provide up-to-date practical advice and support to small and medium-sized businesses, community groups and representative organisations.

Action 9: The ACT Government will survey buildings in major commercial districts to develop a map of heating and cooling loads across the territory, to facilitate private investment in low-carbon energy networks.

The government will look for opportunities to streamline regulatory processes through its review of the *Utilities Act 2000*.

Reducing transport sector emissions

One action **Emissions reduction by 2020**
(tonnes CO_{2-e}): 138 000

Action 10: The ACT Government will implement the Transport for Canberra policy and develop a Low Emissions Vehicle Strategy.

Reducing waste sector emissions

One action **Emissions reduction by 2020**
(tonnes CO_{2-e}): 16 000

Action 11: The ACT Government will implement the ACT Waste Management Strategy 2011–25 and achieve a carbon neutral waste sector by 2020.

Reducing energy supply sector emissions

Three actions **Emissions reduction by 2020**
(tonnes CO_{2-e}): 1 471 000

Action 12: The ACT Government will, subject to an evaluation of the 40-megawatt solar auction and ongoing policy review, develop large-scale renewable energy generation capacity for the purposes of reducing emissions from electricity use and achieving our 2020 emissions reduction targets.

Action 13: The ACT Government will determine a new renewable electricity consumption target of 90 per cent renewable by 2020 and, in 2013, publish an accounting methodology for renewable energy consumption and reporting against this target.

Action 14: The ACT Government will develop detailed mapping of the ACT electricity distribution network, providing up-to-date information on the capacity of feeders and substations to absorb additional renewable energy generation.

Adapting to a changing climate

Three actions **Emissions reduction by 2020**
(tonnes CO_{2-e}): not applicable

Action 15: The ACT Government will assess the potential risks of climate change to community health, and territory life and property, including

through acute weather and fire impacts in the ACT and the surrounding region, through a new ACT-wide risk assessment. This knowledge will be integrated into future health system planning, and natural disaster and emergency risk management and planning.

Action 16: By the end of 2013, the ACT Government will publish a ministerial statement on how, from a whole-of-government perspective, the built environment and urban open spaces will be developed to respond to climate change and the ACT's long-term mitigation objectives. This will incorporate a review of the Territory Plan's development codes and design standards.

Action 17: The ACT Government will continue to assess the potential impacts of climate change on ecological systems in the ACT and the surrounding region, and integrate this knowledge into environmental management and development planning decisions to ensure that our natural environment is conserved and enhanced.

Monitoring, reporting and future decision making

One action **Emissions reduction by 2020**
(tonnes CO_{2-e}): not applicable

Action 18: The ACT Government will respond to Implementation Status Reports on AP2 published in 2014, 2017 and 2020 that will set out progress against actions and targets, and move to more timely and transparent Greenhouse Gas Inventory reporting. An assessment of potential social equity impacts will be completed each year and reported to the ACT Legislative Assembly as part of annual reporting under the *Climate Change and Greenhouse Gas Reduction Act 2010*. Each measure introduced as part of AP2 will be subject to a cost-of-living assessment. The assessments will look at the overall increases in cost of energy to consumers and will guide the ACT Government's consideration of the pace of AP2's staged implementation.

I.3 Structure of the ISR

As described above, the ISR must answer five questions. The first four chapters of this report answer the first four questions:

- Chapter 1 How are we tracking against sector GHG emissions reduction targets?
- Chapter 2 What are the implications for the ACT of developments in climate science?
- Chapter 3 How 'fit for purpose' are the ACT's climate change adaptation policies?
- Chapter 4 How do the ACT's climate change targets and actions stand against national and international developments?

In conducting this assessment, the OCSE found that policy and strategies were interlinked with planning. This report therefore also includes:

- Chapter 5 How does ACT planning take account of climate change?

The final question this report needs to answer – What new opportunities or challenges have emerged? – has been answered throughout the report in 'Challenge' boxes. These are then matched with 'Opportunity' boxes, which contain details of the options the government may consider to address the challenges. These boxes are summarised in Chapter 6.

The information collected and analysed in the 2014 ISR was correct as at 18 November 2014. The OCSE notes that the Environment and Sustainable Development Directorate continues to implement actions, both within and additional to AP2, in response to extra and updated information around climate change mitigation and adaptation.

Report cards

The ISR has used report cards, or graded assessment summaries, to provide snapshots of key information and identify areas for continued or more concentrated attention (Figure I.1).

The OCSE has used report cards to assess:

- the extent to which recent developments in climate science affect the actions contained in the five AP2 sectors
- how appropriate are the ACT's adaptation policies.

Case studies

The ISR contains short case studies on relevant or topical issues. These case studies were selected to highlight jurisdictional differences, or to illustrate best practice in climate change mitigation or adaptation.





Figure I.1 Structure of assessment summaries used throughout the Implementation Status Report

Areas beyond the scope of the ISR

The OCSE acknowledges that AP2 makes reference to other policies, such as the Carbon Neutral ACT Government Framework, the Transport for Canberra policy 2012, and the ACT Waste Management Strategy 2011–25; however, it is beyond the scope of the ISR to make any assessment of these policies.

The Environment and Sustainable Development Directorate provides reports twice each year on the

implementation of the 18 sector GHG emissions reduction actions contained in AP2, as well as the supporting actions. The OCSE has considered these reports and found that the implementation of the majority of actions is occurring in a timely and efficient manner. In addition, the OCSE found that, where actions were not proceeding as planned, there were adequate reasons for this. As a result, the ISR made no further assessment of these reports.



Chapter 1

How are we tracking against sector greenhouse gas emissions reduction targets?

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1 How are we tracking against sector greenhouse gas emissions reduction targets?

AP2: a new climate change strategy and action plan for the Australian Capital Territory (AP2) was designed to guide the Australian Capital Territory's (ACT's) strategy to meet the legislated 2020 GHG reduction targets.²

It is imperative that the territory is able to track the levels of greenhouse gas (GHG) emissions; regular tracking and monitoring of progress towards meeting emissions targets allows policies to be adjusted, or even redesigned, and implemented in response to tracking data.

For this first Implementation Status Report (ISR), the question of how the ACT is tracking against sector GHG emissions raised a number of challenges. These are summarised as follows:

- Under the *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act), an independent entity must prepare an annual report – currently known as the Greenhouse Gas Inventory (GGI) – about the ACT's GHG emissions and targets. The report must include
 - the amount of GHG emissions in the ACT each financial year
 - an analysis of the ACT's progress in meeting the legislated targets, including a comparison of the annual emissions amount with the legislated targets, identification of the main sources of GHG emissions in the ACT, and identification of possible reasons for changes in GHG emissions from previous years.

The GGI is the standard by which AP2 sector targets are tracked. The challenge for this ISR in tracking the AP2 sector targets is that the current 2011–12 GGI reporting does not directly align with the emissions sectors in AP2. This is due to some mismatches between emissions sources in the GGI and the sectors in AP2.

- The GGI is released annually, two years after the relevant reporting period (eg the 2011–12 ACT GGI was published in September 2014). Since AP2 was released in 2012, this means that it is not possible for the 2014 ISR to make any assessment of how the ACT is tracking in relation to meeting the AP2 GHG emissions reduction targets, as the AP2 actions had not yet commenced during the 2011–12 ACT GGI reporting period.
- AP2 has 16 actions designed to reduce sector GHG emissions. There are currently some challenges involved in determining the effect(s) of these actions on the GHG emissions reduction targets prescribed under the Act, because there are no clear causal or relational links between the actions and the targets. The OCSE notes, however, that this issue only becomes challenging where it is clearly stated that the goal of any given action is to reduce GHG emissions; this need not always be the case – actions may have other goals, such as addressing sustainability or improving social equity.
- The setting of emissions reductions targets and the methodologies used to set these targets are complex. A variety of methods can be used, which each have benefits and disadvantages.

These anomalies are not restricted to the ACT. All governments – local, national and international – are currently negotiating and designing ways of overcoming or dealing with these issues.

This chapter analyses the above four challenges and proposes opportunities or options for overcoming or addressing them. The primary opportunity is through the adoption of international best practice principles, tools and methodologies for measuring, accounting for and designing GHG emissions reductions actions and policies. The Greenhouse Gas Protocol (GGP) contains such principles, tools and methodologies.

² Note that AP2 was designed to meet both the legislated targets and the sector targets contained in AP2.

1.1 Greenhouse Gas Protocol

The GGP³ is the most widely used international accounting tool for government and business leaders to understand, quantify and manage GHG emissions. The GGP represents a decade-long partnership between the World Resources Institute and the World Business Council for Sustainable Development, which have worked with businesses, governments and environmental groups around the world.

The GGP provides the accounting framework for nearly every GHG standard and program in the world – from the International Organization for Standardization (ISO)⁴ to the Climate Registry – as well as hundreds of GHG inventories prepared by governments and the corporate sector.

A number of standards, protocols and guidelines sit within the framework of the GGP. These have been developed in consultation with multiple stakeholders, including the World Bank, the United Nations Environment Programme and the United Nations Habitat Programme, as well as the community, business and nongovernment sectors.

The GGP recognises that cities are major contributors to GHG emissions. The *2008 world energy outlook* (IEA 2008) estimated that cities accounted for more than 70 per cent of global emissions from energy consumption. In addition, 51 per cent of the world's population – approximately 3.5 billion people – reside in urban areas. To address growing urban GHG emissions, it is necessary to understand each city's emissions patterns, and to identify the major sources of emissions and reduction opportunities from both direct and indirect sources.

The GGP has produced a number of standards and protocols that are of particular relevance to the ACT. The territory's geopolitical and socioeconomic features, combined with its commitment to addressing the effects of climate change, make it well placed to consider the implementation of these standards and protocols.

It is worth noting that AP2 was developed before the release of the GGP. The OCSE has found that the following individual GGP standards provide the ACT

Government with tangible options for redressing the majority of challenges identified in the ISR:

- GGP Policy and Actions Accounting and Reporting Standard, which provides a methodology for estimating and reporting the change in GHG emissions and removals resulting from the implementation of policies and actions
- Global Protocol for Community-Scale Emissions Standard, which provides a methodology for cities to prepare and publicly report a GHG inventory; this standard is currently in draft and is due to be finalised in December 2014
- Mitigation and Goals Accounting and Reporting Standard, which provides a methodology for assessing and reporting progress towards national and regional mitigation goals.

1.2 Measuring greenhouse gases in the ACT

Under s.12 of the *Climate Change and Greenhouse Gas Reduction Act 2010* (the Act), an 'independent entity' is responsible for the emissions monitoring and reporting regime. The Act requires the entity to produce an annual report on the ACT's GHG emissions and its progress towards the legislated climate change targets.

Challenge

The sectors used in current ACT GHG emissions reporting do not directly align with the emissions sectors in AP2.

The entity is also tasked with:

- assisting the Minister to determine the method for measuring GHG emissions
- as far as practicable, ensuring consistency with the best national and international practices in relation to measuring GHG emissions.

The methodology for measuring emissions is prescribed by the Climate Change and Greenhouse Gas Reduction (Greenhouse Gas Emissions Measurement Method) Determination 2013 (GHG Measurement Determination).

The GHG Measurement Determination categorises emissions on a source basis (Table 1.1), consistent with the National Greenhouse and Energy Reporting

³ www.ghgprotocol.org/about-ghgp

⁴ ISO 14064:2006 was published in 2006 as part of the ISO 14000 series of International Standards for Environmental Management. AS/ISO 14064 indicates that the standard has been approved on behalf of the council of Standards Australia as an Australian Standard.

Scheme legislated by the Australian Government. The source categories for the GGI are:

- energy
- industrial processes
- agriculture
- land use, land-use change and forestry
- waste.

Table 1.1 Greenhouse gas emissions in source sectors, 2011–12

Source sector	Source	Emissions in 2011 (kt CO _{2-e})
Energy	Electricity	2753.4
	Natural gas	386.1
	Transport fuels	1022.7
	Fuel wood	11.7
	Total fuel-combustion activities	4173.8
	Natural gas leakage	28.6
	Total fugitive emissions from fuels	28.6
	Total energy	4202.4
Industrial processes	Production of halocarbons and SF6	0.0
	Consumption of halocarbons and SF6	128.3
	Other	5.0
	Total	133.9
Agriculture	Enteric fermentation	18.6
	Manure management	0.1
	Agricultural soils	3.6
	Total	22.4
Land use, land-use change and forestry		-16.5
Waste		116.0
Total CO_{2-e} emissions, including net CO_{2-e} from LULUCF		4458.2
Total CO_{2-e} emissions, excluding net CO_{2-e} from LULUCF		4474.7

CO_{2-e} = carbon dioxide equivalent; kt = kilotonnes; LULUCF = land use, land-use change and forestry; SF6 = sulfur hexafluoride
Source: ICRC (2014)

The sectors used for setting emissions reduction targets in AP2 are different from those used for measuring the volume of emissions in the GGI. Rather than using source sectors as defined under the GHG Measurement Determination, AP2 is organised by policy measure category or action sectors. These are used in AP2 to establish sectoral targets for the reduction of GHG emissions in the ACT. The sectoral targets identify the emissions reductions required by the ACT to meet the legislated targets under the Act.

The AP2 action sectors are:

- residential energy use
- nonresidential energy use
- transport
- waste
- energy supply.

The AP2 targets in each sector are presented in Table 1.2.

Table 1.2 AP2 emissions reduction targets in action sectors by 2019–20

Action sector	Emissions reductions by 2020 (kt CO _{2-e}) ^a
Residential energy use	218.0
Nonresidential energy use	181.0
Transport	138.0
Waste	16.0
Energy supply ^b	1471.0
Total	2024.0

CO_{2-e} = carbon dioxide equivalent; kt = kilotonnes

a The Office of the Commissioner for Sustainability and the Environment has assumed this column title to mean projected emissions reductions in 2019–20 compared with emissions levels in 2011–12.

b Energy supply means gas and electricity.

As Tables 1.1 and 1.2 illustrate, the source categories used in the GGI do not match the sector categories used in AP2. This makes reporting against AP2 targets difficult.

ACT Greenhouse Gas Inventory methodology

The current GGI methodology uses a hybrid production and consumption approach. This approach uses emissions from scope 1 and 2 sources, and limited scope 3 emissions. Scope 1 and 2 emissions are

attributable to production activities and consumption activities in the ACT. Scope 3 emissions are indirect emissions that occur outside the ACT's geographic region; however, they are directly attributable to ACT consumption activity.

Figure 1.1 shows the sources from the three emission scopes.

It is increasingly being seen by governments, and environmental and scientific groups, including the World Resources Institute and the Intergovernmental Panel on Climate Change, that increasing the level of scope 3 emissions in GHG emissions reporting inventories contributes to the principles of transparency, accountability, and sustainability more generally.

International best practice in greenhouse gas emissions methodologies

The Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC) is part of the GGP. The GPC is to be finalised at the end of 2014. It takes into account a significant level of scope 3 emissions.

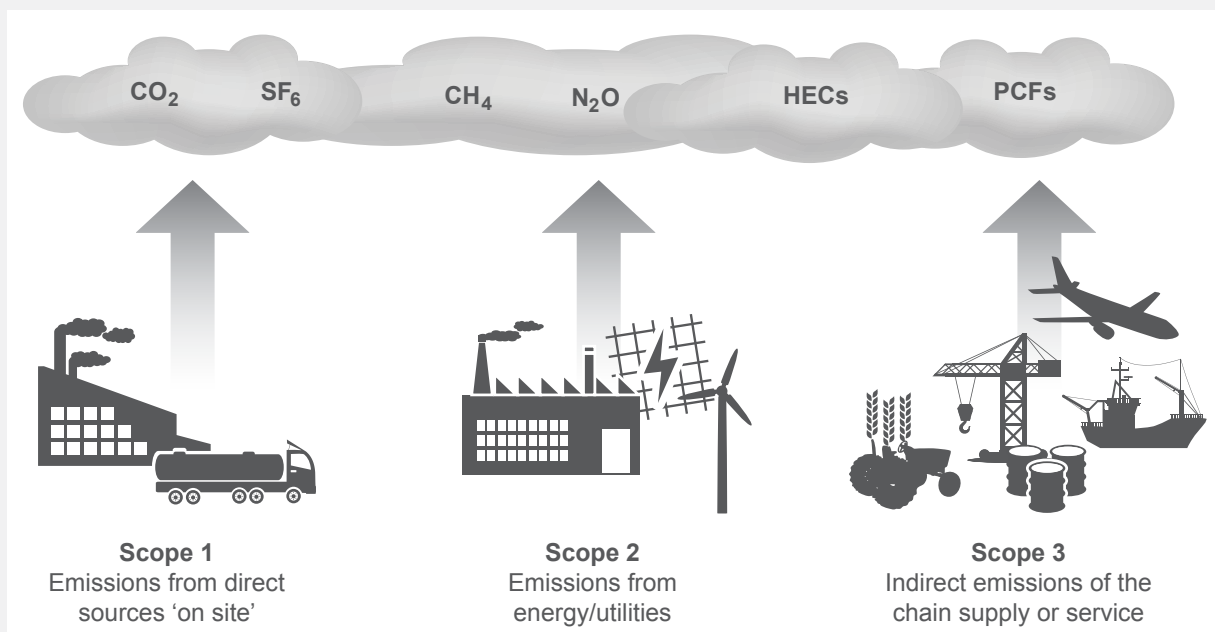
Development of the GPC has been primarily in response to the fact that, although many cities have GHG inventories and reduction targets, there is currently no consistent global guidance for conducting

a city-level inventory. The resulting inconsistent inventories cannot be easily communicated between local, subnational and national governments; financing institutions; and the private sector. The lack of a consistent approach also prevents comparison between cities and reduces the ability of cities to demonstrate the global impact of collective local actions.

The GPC attempts to resolve the differences between existing protocols. It is a joint project between all interested stakeholders to develop an open, global protocol for community-scale accounting and reporting.

The GPC provides requirements and guidance for cities on preparing and publicly reporting a GHG emissions inventory. The primary goal is to provide a standardised and prescriptive step-by-step approach to help cities quantify their GHG emissions, in order to manage and reduce their GHG impacts.

Under the GPC inventory, boundaries are set according to the geopolitical territory where the respective local authority (or local government) has full jurisdictional authority (generally the city's or community's boundary). One of the main challenges of this approach is that some activities within the boundary may result in emissions outside the boundary. To manage this, direct and indirect GHG emissions of communities need to be addressed. Direct emissions are emissions from



Source: Adapted from DSEWPac (2011).

Figure 1.1 Emission scopes

sources within the city boundary; indirect emissions are emissions that are a consequence of the activities within the city boundary but occur at sources outside the city.

To help delineate the distinction between direct and indirect emissions, the GPC adopts the GGP's scope framework, as follows:

- scope 1 – all direct emissions from sources within the geopolitical boundary of the community
- scope 2 – energy-related indirect emissions that occur outside the community boundary as a consequence of consumption or use of grid-supplied electricity, heating and cooling within the community boundary
- scope 3 – all other indirect emissions that occur outside the boundary as a result of activities within the community's geopolitical boundary, as well as transboundary emissions due to exchange, use and consumption of goods and services.

Opportunities

- The discrepancies between the current GGI emissions sources and AP2 sectors can be resolved through the design of a new methodology. This methodology would be designed by the independent entity and prescribed as a Greenhouse Gas Emissions Measurement Method Determination under the Act.
- In designing this new methodology, the ACT could consider the Global Protocol for Community-Scale Greenhouse Gas Emissions. This protocol is due to be finalised in December 2014. It provides international best practice requirements and guidance for cities on preparing and publicly reporting a GHG emissions inventory.

Any consideration of the accounting principles in the GPC would require the ACT to also consider the effect that an increased component of scope 3 emissions may have on both the legislated GHG emissions reduction targets and the sector emissions targets in AP2.

1.3 Tracking our progress against AP2 targets

The GGI is released annually, two years after the relevant reporting period (eg the 2011–12 ACT GGI was published in September 2014). As described above, this schedule means that it is not possible for the 2014 ISR to make any assessment of how the ACT is tracking in relation to AP2 actions and targets. However, the OCSE notes that the 2011–12 GGI will provide the baseline from which to track progress against AP2 targets, given that AP2 itself only came into effect in 2012.

The calculation of the ACT GGI involves measuring emissions using a hybrid production and consumption approach. The majority of emissions data comes from the ACT itself. These data are available each year. However, the methodology also requires data from the Australian Government Department of the Environment. These data, from the National Greenhouse Accounts and the National Greenhouse Account Factors, are not available until at least 20 months after the ACT data become available. This necessitates a two-year time lag between the GGI reporting period and the actual release of the GGI – a significant period that impedes the assessment of policy measures in a timely manner.

Table 1.3 illustrates these timing issues and the flow-on effects. The lack of availability of GGI data means that the 2014 ISR is unable to report on how the ACT is tracking against AP2 sector GHG emissions reduction targets.

Setting aside the other challenges involved with AP2 sector GHG reporting, the second ISR, due in 2017, may be able to make some assessment of GHG emissions abatement. However, the 2017 GHG emissions figures will also be almost two years old. This will make it difficult, even in 2017, to provide an assessment of how the ACT is tracking in relation to AP2's sector GHG emissions.

However, the OCSE notes that a two-year reporting time lag is standard and accepted internationally by all signatories to the Kyoto Protocol.

Table 1.3 Timing of greenhouse gas emissions reporting for the Implementation Status Report 2014

Data or report	2010–11	2011–12	2012–13
Reporting period for the GGI – ACT emissions data available	2010–11		
National Greenhouse Accounts (Australian Government)			April
National Greenhouse Account Factors			July
AP2 released			September
GGI for 2010–11 released			September

AP2 = AP2: a new climate change strategy and action plan for the Australian Capital Territory; GGI = Greenhouse Gas Inventory

Challenge

Along with the difficulties of using the current GGI to assess emissions changes for AP2 sectors, the lack of availability of GGI data also means that the 2014 ISR is unable to report on how the ACT is tracking against AP2 sector GHG emissions reduction targets.

Opportunity

There is the potential to at least partially address the timing issue through the use of an interim measure. Although this measure may not necessarily represent the GGI, it could be used to provide information on the effectiveness of AP2 policy measures. This is important given that the legislated target of a 40 per cent reduction from 1990 levels must be achieved by 30 June 2020. The agency responsible for preparing the GGI should also be responsible for determining the methodology for such an interim measure.

1.4 Assessing the effectiveness of AP2 actions on the legislated targets

AP2: a new climate change strategy and action plan for the Australian Capital Territory (ESDD 2012a) was designed to address multiple outcomes. The actions, policy considerations, initiatives and strategies in AP2 are commendable in terms of contributing to sustainability in all its realms – social, environmental and economic.

Challenge

Although AP2's actions are commendable in terms of their contribution to sustainability, it is currently not possible to establish whether there is a causal or correlational link between any of the actions in AP2 and the legislated target(s).

This means that, with the exception of one of the renewable energy actions set by AP2, it is currently not possible to answer the following:

- Before policy implementation: What effect is a given policy or action likely to have on GHG emissions?
- During policy implementation: How will progress of a policy or action be tracked over time?
- During and after policy implementation: What effect has a given policy or action had on GHG emissions?

It is important for governments to be able to quantify and communicate the effects of policies and actions on actual GHG levels. This is to achieve a variety of objectives, particularly around adaptive management, such as:

- assessing different policy options
- designing more effective policies
- evaluating policy effectiveness
- tracking and reporting progress over time
- carrying out cost-effectiveness or cost–benefit analyses
- reporting to stakeholders.

Policy and Action Standard

The GGP Policy and Actions Accounting and Reporting Standard (the Policy and Actions Standard) was finalised in November 2014. The Policy and Actions Standard was developed to:

- help users assess the GHG effects of specific policies and actions in an accurate, consistent, transparent, complete and relevant way, to support more effective decision making
- help policy makers and other decision makers develop effective strategies for managing and reducing GHG emissions
- support consistent and transparent public reporting of emissions impacts and policy effectiveness
- create more international consistency and transparency in the way organisations estimate and report GHG emissions reductions from policies and actions.

The Policy and Actions Standard could also assist in redressing the ambiguity around the purpose or objective(s) of the AP2 actions. This ambiguity is problematic not only from an assessment and reporting perspective but also because it makes analysis of cost-effectiveness difficult. This issue also relates to s.15(1)(c) of the Act, which requires the Minister to prepare an annual report on the findings of any cost–benefit analysis of policies or programs implemented to meet the legislated targets.

The methodology is policy neutral. It does not provide guidance on what type of policy or action to implement, but only how to estimate the emissions effects resulting from any policy or action that is implemented.

Opportunity

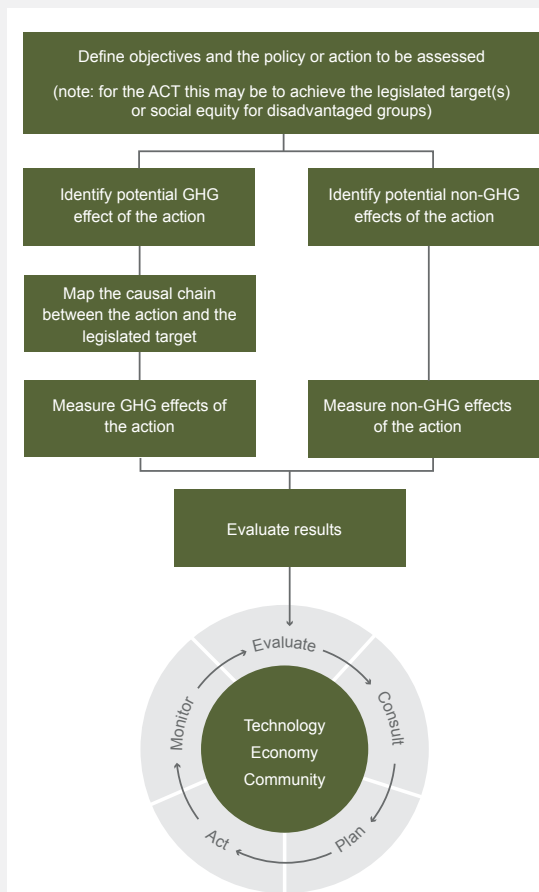
The Policy and Actions Standard could be used to guide the ACT in answering:

- What effect is any given action likely to have on GHG emissions?
- How will the progress of a given action be tracked over time?
- What effect has the action had on GHG emissions?



Steps to design mitigation actions

Figure 1.2 describes the steps the ACT Government could follow in designing its climate change mitigation actions.



Note: Greenhouse gas (GHG) effects are changes in GHG emissions or removals that result from the effects of the action. Non-GHG effects are changes in relevant environmental, social and/or economic conditions (other than GHG emissions or climate change mitigation) that result from the action (eg changes in economic activity, employment, health, air quality, energy security).

Figure 1.2 Opportunities provided by the Greenhouse Gas Protocol for the ACT Government's climate change mitigation actions under AP2

1.5 Target setting

Robust GHG accounting methods are needed for governments to track their progress towards goals and ensure that targets are being met. Transparency is also needed around how goals have been designed, to inform mitigation strategies and provide transparency to stakeholders.

Four main types of goals are used by governments around the world (Table 1.4).

AP2 targets

AP2's sector emissions reductions goals or targets were set against a baseline or 'business-as-usual' (BAU) scenario.

A baseline scenario is a reference case of reasonable assumptions and data describing the most likely events or conditions expected to occur in the absence of mitigation activities. The assumptions are often related to emissions drivers such as economic activity, energy prices, population growth, and policies and measures, and can be referred to as BAU if this is what the baseline scenario depicts. They can be 'static' or 'dynamic'. The static scenario is developed and fixed at the start, and not updated over time; the target is set, and progress is tracked, but it may not follow a BAU scenario. The fixed emissions level offers an unchanging target, but does not reflect changes in emissions due to mitigation efforts versus those caused by changes in emissions drivers.

A dynamic scenario is updated as emissions drivers change and is intended to represent BAU. It is unable to provide a fixed reference case against which a goal is set and progress is tracked, and does not guarantee that a certain emissions level will be met in the target year.

Targets set under the Act

The ACT's legislation has specified the use of three different types of GHG targets to achieve its climate change goals. These are:

- base-year targets
- intensity targets
- fixed-level targets.

Note the difference between the base-year, intensity and fixed-level targets used in the Act and the BAU targets used in AP2.

Table 1.4 Types of mitigation goals

Goal type	Description	Reduction in what?	Reductions relative to what?
Base-year goal	Reduce or control the increase in emissions by a specified quantity relative to a historical base year	Emissions	Historical base year
Fixed-level goal	Reduce or control the increase in emissions to an absolute emissions level in a target year. The most common type of fixed-level goal is a carbon neutrality goal, which aims to reach zero net emissions by a specified date	Emissions	No reference level
Intensity goal	Reduce or control the increase in emissions intensity (emissions per unit of another variable, typically gross domestic product) by a specified quantity relative to a historical base year	Emissions intensity	Historical base year
Baseline scenario goal	Reduce or control the increase in emissions by a specified quantity relative to a projected emissions baseline scenario. Baseline scenario goals are sometimes referred to as 'business-as-usual' goals, especially when they include the greenhouse gas effects of implemented and adopted policies	Emissions	Projected baseline scenario

These targets are incorporated into the Act as follows:

- **Base-year targets.** These represent a reduction in emissions relative to an emissions level in a historical base year (a specific year against which the target is referenced over time). Typically, they are framed in terms of a percentage reduction in emissions, as opposed to an absolute reduction in emissions.
Two of the legislated targets in the Act (clauses 7(1)a and 7(1)b) are base-year targets, being interim targets of a 40 per cent reduction in emissions by 2020 from the historical base year of 1990, and an 80 per cent reduction below 1990 levels by 2050.
- **Intensity targets.** These represent a reduction in emissions intensity relative to an emissions intensity in a historical base year, and are usually expressed in terms of emissions per unit of output. This can include gross domestic product, energy use and, for the ACT, population (per capita).
Clause 8 of the Act sets a target of the average annual per-person emissions level to peak by 30 June 2013. Typically, intensity goals consist of a percentage reduction in emissions intensity, rather than an absolute reduction in emissions intensity. The ACT's target is atypical in that it sets a target of achieving an undefined maximum per-capita emissions intensity by a set date, but does not refer to any other intensity target.

- **Fixed-level targets.** These represent an emissions reduction to an absolute emissions level in a target year and do not reference an emissions level in a baseline scenario or historical base year. The most common type of fixed-level target is a carbon neutrality goal, in which zero net emissions will be achieved by a certain date.

Clause 6(1) of the Act, the ACT's principal target, is a fixed-level target that the ACT will achieve zero net emissions by 30 June 2060.

Which type of target is best?

Targets designed to achieve an absolute GHG emissions reduction are considered to be the most environmentally robust.

From a GHG accounting perspective, baseline scenario targets can pose a significant risk of low environmental integrity. This is because baseline scenarios can be very uncertain, often being inaccurate projections of future emissions levels. A major risk is that, if the baseline scenario's emissions are overestimated, the associated target will be likely to be compromised.

Targets that translate into an absolute emissions reduction should be adopted to ensure environmental effectiveness. Interestingly, the ACT has adopted a fixed-level target (clause 6(1)) as its primary goal and base-year targets (clauses 7(1)a and 7(1)b) for its interim goals.

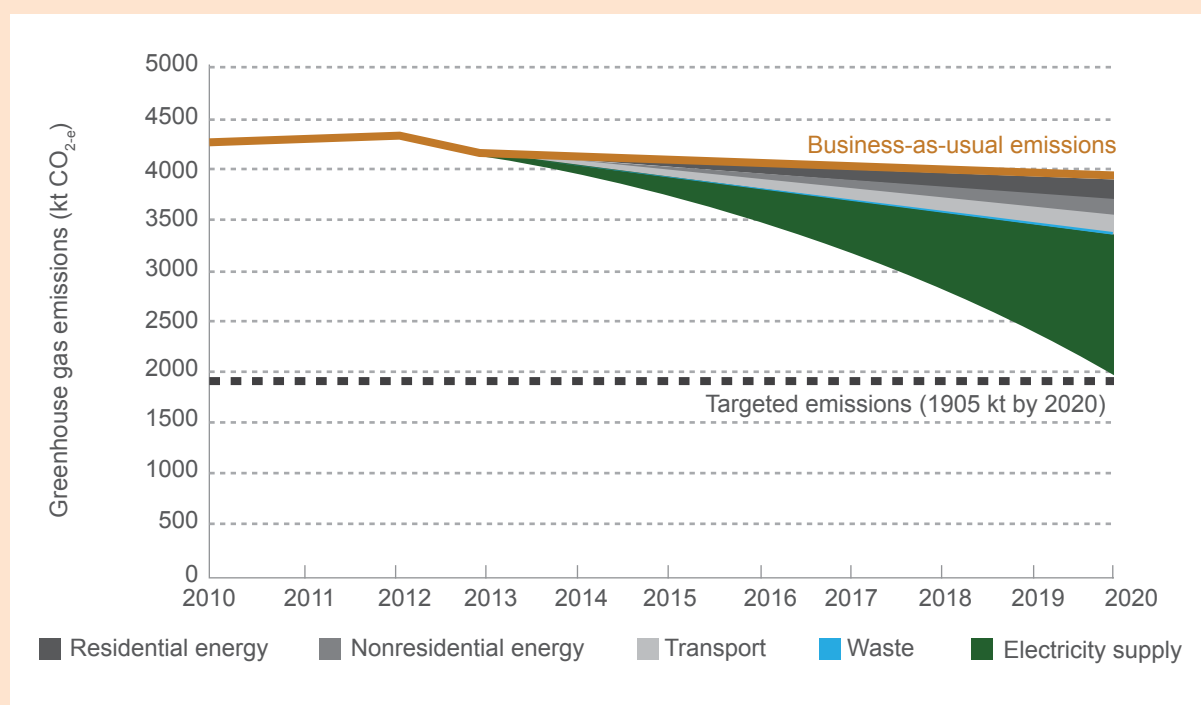
Challenge

From a GHG accounting perspective, baseline scenario targets may compromise environmental integrity. This is because baseline scenarios can be uncertain, often being inaccurate projections of future emissions levels. One of the major risks, for instance, is that, if the baseline scenario's emissions are either overestimated or underestimated, the associated target is likely to be compromised.

AP2 was designed and written in the context of the previous Australian Government's climate change policies. It therefore presupposed that there would be, among other things, a carbon tax, an emissions trading scheme and renewable energy targets. These schemes are now to be abolished, are under threat of abolition or have been significantly downgraded.

Should AP2's BAU emissions reductions targets remain static, they will cease to reflect changes in mitigation efforts, or lack thereof, as well as changes in emissions drivers.

Figure 1.3 shows the existing AP2 modelling. However, the BAU emissions level may change from that projected in this graph. Differences in the amount of emissions reductions required from what is presented in Figure 1.3 may arise if BAU emissions are either higher or lower than projected. For example, larger emissions reductions may be required where the Australian Government has withdrawn a major mitigation program or there has been an increase in emissions-intensive economic activities. Alternatively, BAU emissions may be lower than projected under AP2 modelling, thereby requiring less emissions reductions. This would be the case if initiatives such as a significant large-scale national renewable scheme and/or increased subsidies for industry compliance with voluntary GHG emissions reduction targets were implemented.



CO_{2-e} = carbon dioxide equivalent; kt = kilotonne

Figure 1.3 Existing AP2 modelling

To accommodate growth in either an economy or a population, an intensity target should be chosen in preference to a baseline scenario (BAU) target. Because an intensity target contains only one independent variable (population, in the case of the ACT), there is considerably less uncertainty than for baseline projections, which typically contain assumptions about several variable and potentially interrelated inputs into the model used to generate the projection.

The ACT legislated GHG targets are the more robust types of targets against which progress and success can be quantified. The one weakness in the suite of GHG targets is the atypical intensity target (clause 8), which establishes a goal of per-capita emissions peaking in 2013 but no further target for the ACT population's emissions intensity.

Key considerations for setting targets

When setting targets, whether within AP2's sectors or for those emissions sources it excludes, various issues should be considered. These include the types of target to use, the application of internationally accepted principles for GHG accounting and reporting (see below), what to actually measure, and the use of performance indicators in conjunction with absolute targets.

Key principles for GHG accounting and reporting

The key common principles for GHG accounting and reporting are endorsed by the ISO,⁵ the developers of the GGP and Standards Australia. These principles are:

- relevance
- consistency
- accuracy
- transparency
- completeness
- target types.

As discussed above, the use of the most environmentally effective types of targets (base year, intensity and fixed level) should be considered. These will help to create the ability to measure and report on any changes in emissions that have occurred. By using these types of targets rather than BAU projections, the assessment of the effectiveness of actions undertaken can be based on real emissions movements, rather

than arbitrary projections that shift depending on the interplay between numerous factors.

Using a mix of these three target types enables more nuanced expectations to be established, allowing a clearer picture of what has actually been achieved. For instance, targeting an emissions reduction of a certain amount could be combined with an intensity target (eg per capita) that is set at a level that will help achieve the targeted emissions reduction even if the denominator (eg population) changes at a greater rate than expected. Although the setting of a combined set of targets will require greater effort initially, it has the benefit of improving the ability to assess a target's achievement over time.

Application of principles

The application of at least the high-level principles of accuracy, consistency, transparency, completeness and relevance to the development and setting of targets is vital to the creation of meaningful and effective targets for emissions reductions. Of particular importance to the setting and assessment of targets is the ability to understand what the target is setting out to achieve. Although in AP2 it is possible to know what the target amount of emissions is for a certain sector, it is very difficult to understand how the target will be measured and assessed for success, other than whether a certain tonnage reduction has been achieved. Essentially, a number is stated as a target, but very little information is provided to place that number in context for either the sector or the overall ACT target. The following highlights one of the principles that should be applied.

Transparency

Where a target is expressed in tonnes without any reference to the emissions level that this is a reduction from, how the emissions reduction is calculated, or what the quanta of actual units (GWh, GJ, kL, etc) being reduced is, it fails to meet the fundamental principle of transparency. This principle is vital if the target is to be understandable and effective in addressing emissions in the way expected. Information specifically detailing underlying variables and expected conditions is required; a single number does not contain enough information to be transparent.

Take electricity consumption as an example. A sectoral target is set that states that 'x' number of tonnes will be saved in a certain year from a suite of actions that target electricity consumption. Without stating the assumptions about what converts electricity into emissions using the GGI equation (eg consumption of national electricity

⁵ ISO 14064:2006 was published in 2006 as part of the ISO 14000 series of International Standards for Environmental Management. AS/ISO 14064 indicates that the standard has been approved on behalf of the council of Standards Australia as an Australian Standard.

market electricity and GreenPower, network losses and the emission factor), there is no transparency in how the target is to be measured and assessed.

No context is provided for whether overall electricity use has increased or decreased, let alone to enable assessment of how these changes have been impacted by the suite of actions. Did consumption go down only to be countered by an increase in emissions intensity or network losses, or vice versa? Does the target count emissions reductions that are also claimed elsewhere, such as on the energy supply side? These and other questions are all valid, yet a single number does not enable enough understanding to allow them to be answered.

Combined use of absolute targets and performance indicators

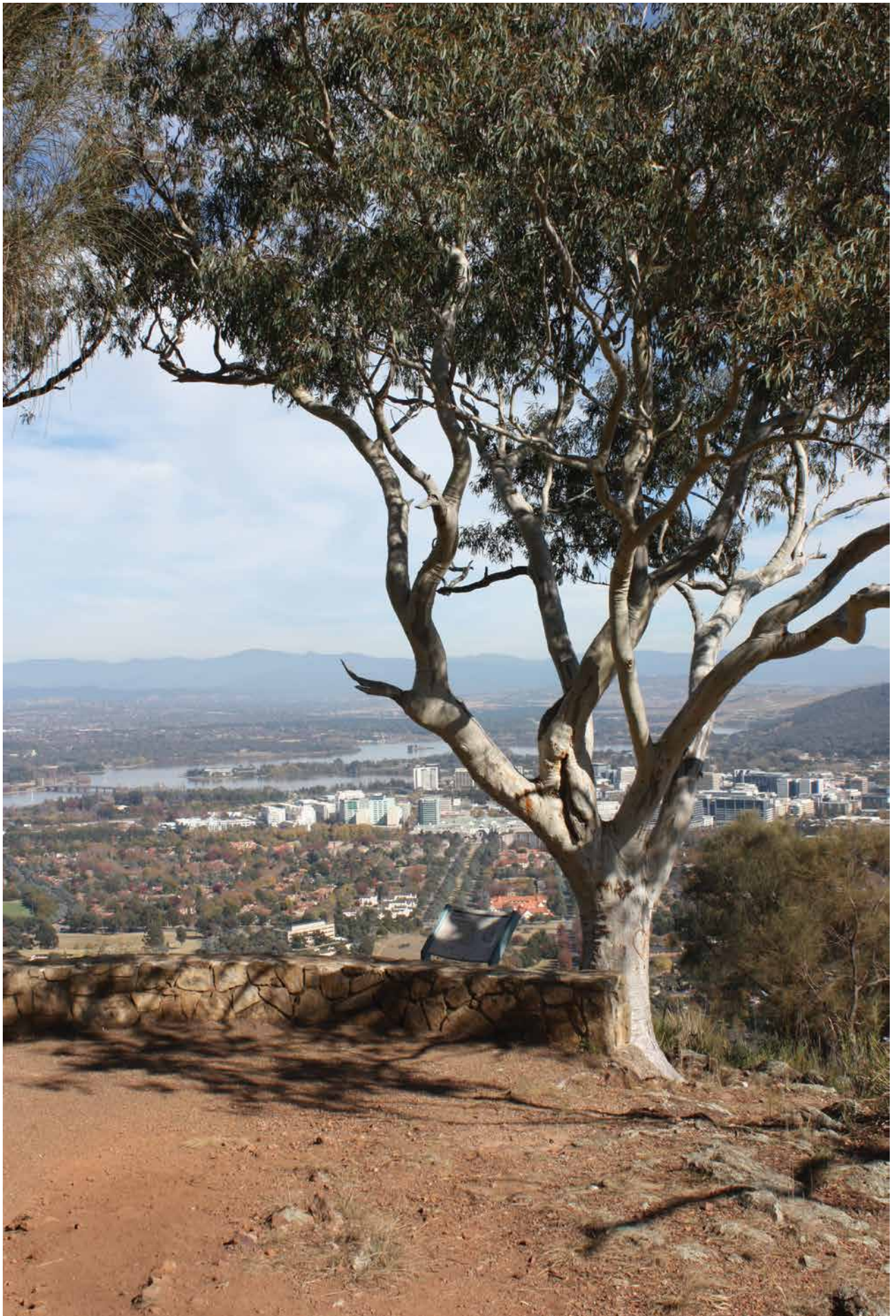
The use of an absolute target ('x' tonnes reduction) should be combined with a set of performance indicators to aid understanding of whether the suite of actions taken is environmentally effective and economically efficient. Although AP2 identifies an absolute target reduction for each sector, it does not provide any context for what this value means in terms of the performance of the sector. Without contextual information associated with the setting of a target, the assessment of progress, success or otherwise is made very difficult.

Opportunity

The Mitigation Goals Accounting and Reporting Standard (MGS) could be used to give guidance when setting, assessing and reporting on the progress towards meeting the ACT's GHG targets. This applies to both legislated and sectoral targets.

The MGS contains internationally recognised best practice methods for designing ambitious, measurable and comprehensive mitigation targets. It contains the following key principles for consideration in designing GHG emissions targets:

- Leakage can be minimised by including significant out-of-jurisdiction emissions in the goal boundary, which may be especially relevant for subnational jurisdictions.
- Base-year goals and fixed-level goals are simpler to account for, more certain and more transparent than intensity goals and baseline scenario goals, because allowable emissions in the target year(s) can be easily calculated at the beginning of the goal period, and progress can be tracked using the GGI alone, without the need for additional models, socioeconomic data or assumptions. Users seeking to accommodate short-term emissions increases should consider adopting base-year goals or fixed-level goals that are framed as a controlled increase in emissions from a base year.
- Multi-year goals have a better chance of limiting cumulative emissions over the goal period than single-year goals, and enable an understanding of anticipated emissions levels over multiple years, rather than only a single year. This can better reveal whether cumulative emissions reductions are aligned with meeting global temperature targets.
- Adopting a combination of short-term and long-term goals provides more clarity for long-term planning and better ensures a decreasing emissions pathway.
- It is important to ensure that any transferable emissions units applied towards a goal
 - meet the highest-quality principles of environmental integrity
 - are generated in the target year or period
 - enable consistent accounting.
- Mechanisms for tracking units between buyers and sellers that prevent double counting strengthen the environmental integrity of mitigation goals.
- Goals that achieve an absolute reduction in GHG emissions are the most environmentally robust and can best address stakeholder concerns regarding the need to reduce emissions.





Chapter 2

What are the implications for the ACT of developments in climate science?

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2 What are the implications for the ACT of developments in climate science?

For governments to make informed and transformative choices concerning climate change, they require the best and most up-to-date science. The United Nations Environment Programme has reported that insights into the rapidly developing realm of climate science are vital to keep pace with the scale of climate change acceleration, and to give policy makers the confidence that their decisions are based on the most rigorous and advanced science available.

Since the development of *AP2: a new climate change strategy and action plan for the Australian Capital Territory* (AP2), climate science and the understanding of climate change impacts in Australia have continued to develop. This section of the report considers the implications for the Australian Capital Territory (ACT) of developments in climate change science that have occurred since the development of AP2.

This chapter examines the following questions:

- What developments in climate science have emerged since the release of AP2?
- What are the implications for the ACT of the developments in climate science? In particular, is there any need to revise or reconsider any of the 18 actions contained in AP2 as a result of developments in climate change science?
 - For mitigation actions, should the ACT review its AP2 actions in light of the current scientific understanding? If so, how?
 - For adaptation actions, what actions should the ACT be taking to prepare for the likely impacts of climate change? Are the existing AP2 actions sufficient?

Challenge

Research and information are key elements of climate change mitigation and adaptation decision-making processes, especially when decisions are to be made under uncertainty. Although it is not possible to eliminate uncertainty, the identification of trends and effective strategies can facilitate the definition of more suitable responses to climate change impacts.

Adaptively managing for climate change depends on the ACT Government making responsible and well-informed decisions. The challenge in making these decisions lies in creating and consolidating strong links with the scientific and expert community on one side, and with the stakeholders that are directly and indirectly affected by decisions, on the other.

2.1 Climate science considered in the development of AP2

The research and analysis upon which AP2 is based was predominantly released before 2010. However, AP2 was also informed by several reports released during 2011 and 2012, in the lead-up to its release in 2012.

A number of key documents underpin AP2 by providing information on climate science, greenhouse gas (GHG) emissions projections, and potential reductions from mitigation actions and other supporting government policies (Table 2.1). AP2 was informed by the original action plan for the ACT – *ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)* (AP1; ESDD 2007). AP1 includes a series of references to climate change projections and impacts. For completeness, these references were also reviewed.

Table 2.1 Key AP2 climate science documents

Document	Description
ACT Government (2007). <i>Weathering the change: ACT Climate Change Strategy 2007–2025</i> , Department of Territory and Municipal Services, Canberra.	<p>The full ACT Government strategy for climate change.</p> <p>The strategy sets a long-term target of reducing emissions by 60% of 2000 levels by 2050.</p> <p>The OCSE notes that this strategy is no longer the basis for climate change policy in the ACT and has been completely replaced by AP2.</p>
ACT Government (2007). <i>ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)</i> , Department of Territory and Municipal Services, Canberra.	<p>The original climate change action plan for the ACT.</p> <p>This document provides a summary of climate change actions and initiatives set by the ACT Government for 2007–11.</p>
ACT Government (2011). <i>ACT Waste Management Strategy 2011–2025: towards a sustainable Canberra</i> , Environment and Sustainable Development Directorate, Canberra.	A strategy for the management of waste in the ACT until 2025, covering waste from the household, commercial, industrial, construction and demolition sectors, and biomass from wood and garden waste.
ACT Government (2012). <i>Transport for Canberra: transport for a sustainable city, 2012–2031</i> , Environment and Sustainable Development Directorate, Canberra.	<p>A government-developed transport strategy for the ACT for the next 20 years.</p> <p>The strategy focuses on integration with land-use planning, active travel, sustainable travel options, safety, accessibility, and efficient and cost-effective travel.</p>
Australian Government Department of Climate Change and Energy Efficiency (2011). <i>Climate change – potential impacts and costs: Australian Capital Territory</i> , DCCEE, Canberra.	<p>Reference document for AP2.</p> <p>The factsheet discusses impacts and potential costs, extreme events, bushfire risk, electricity production, agriculture and human health.</p>
Baker BL, Austin MD, Barnett G, Kearns AJ & Shugart H (2000). <i>Global change, local consequences: can we predict the likely impacts of climate change for the ACT region</i> , CSIRO Wildlife and Ecology, Canberra.	<p>Reference document for AP1.</p> <p>The document studies the projected impacts of climate change specifically for the ACT. AP1 references the conditions that the ACT region may face across all seasons regarding rainfall patterns.</p>
CSIRO & Bureau of Meteorology (2012). <i>State of the climate 2012: Australia continues to warm</i> , Bureau of Meteorology, Melbourne.	<p>Referenced media release article in AP2.</p> <p>The article summarises the key points of the 2012 state of the climate report regarding temperature, rainfall, oceans, GHGs and future climatic changes.</p>
Climate Commission (2011). <i>The critical decade: climate change and health</i> , Australian Government Department of Climate Change and Energy Efficiency, Canberra.	<p>Referenced document in AP2.</p> <p>The report examines the effects that climate change has on human health and wellbeing. The report summarises up-to-date information on climate change–induced health impacts in Australia.</p>
Hennessy K, Macadam I & Whetton P (2006). <i>Climate change scenarios for initial assessment of risk in accordance with risk management guidance</i> , CSIRO consultancy for the Australian Greenhouse Office, Department of the Environment and Heritage, Canberra.	<p>Reference document for AP1.</p> <p>The document assesses the risks associated with climate change, with a particular focus on impacts on Australia. AP1 references the risk of extreme fire danger in 2020.</p>
Hennessy K, McInnes K, Abbs D, Jones R, Bathols J, Suppiah R, Ricketts J, Rafter T, Collins D & Jones D (2004). <i>Climate change in New South Wales. Part 2: Projected changes in climate extremes</i> , CSIRO, Canberra.	<p>Reference document for AP1.</p> <p>The document is a study of the projected changes in climate extremes in NSW. The ACT is within the region studied. AP1 references the projected temperature conditions for 2030 and 2070, as well as the projected reduction of snow cover in 2020.</p>

continued

Table 2.1 *continued*

Document	Description
Heuris Partners Pty Ltd (2010). <i>ACT greenhouse gas emissions: existing policy baseline projections to 2050</i> , ACT Department of the Environment, Climate Change, Energy and Water, Canberra.	A report projecting ACT GHG emissions out to 2050, based on 2007 emissions, and projections for economic growth and population. It accounts for two scenarios of energy efficiency: static efficiency and autonomous efficiency improvements.
<i>Intergovernmental Panel on Climate Change (2007). IPCC fourth assessment report: climate change 2007</i> , IPCC, Geneva.	The report describes the IPCC's integrated view of climate change in a series of topics: <ul style="list-style-type: none"> • climate change and effect on systems • causes of observed changes • projections of future climate change and its impacts • adaptation and mitigation options. The report also includes low-, medium- and high-risk scenarios.
Kinesis (2009). <i>Action Plan 2 primer</i> , ACT Department of the Environment, Climate Change, Energy and Water, Canberra.	Report to inform appropriate interim targets for the ACT's target of zero net emissions by 2060. The report describes two scenarios: conservative (growth of GHG emissions by 28% by 2020) and progressive (decrease of GHG emissions by 40% by 2020).
McMichael AJ, Woodruff RE, Whetton P, Hennessy K, Nicholls N, Hales S, Woodward A & Kjellstrom T (2003). <i>Human health and climate change in Oceania: a risk assessment</i> , Australian Government Department of Health and Ageing, Canberra.	Reference document for AP1. The study is an assessment of the impacts of climate change on human health. AP1 references the projected impacts that Canberra may face regarding heat-related deaths.
pitt&sherry (2011). <i>AP2 underlying assumptions: carbon price impacts and costs of measures</i> , prepared for the Environment and Sustainable Development Directorate, Canberra.	The report presents a model of expected energy use, GHG emissions, abatement opportunities, and the economic costs and benefits associated with specific abatement measures in the ACT to 2060.
pitt&sherry (2011). <i>AP2 underlying assumptions: an analysis of pathways, costs and benefits</i> , prepared for the Environment and Sustainable Development Directorate, Canberra.	A report to engage the community and businesses about the differing policy choices that the ACT Government can use to meet established targets (40% of 1990 emissions levels by 2020, 80% by 2050, zero by 2060).
Suppiah R, Hennessy KJ, Whetton PH, McInnes K, Macadam I, Bathols J, Ricketts J & Page CM (2007). Australian climate change projections derived from simulations performed for the IPCC 4th Assessment Report, <i>Australian Meteorological Magazine</i> 56(3):131–152.	Reference document for AP1. The study provides Australia-specific projections based on the global climate models in the IPCC's fourth assessment report. AP1 references the number of days Canberra is projected to experience above 35 °C and below 0 °C.

ACT = Australian Capital Territory; AP1 = *ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)*; AP2 = *AP2: a new climate change strategy and action plan for the Australian Capital Territory*; GHG = greenhouse gas; IPCC = Intergovernmental Panel on Climate Change; NSW = New South Wales; OCSE = Office of the Commissioner for Sustainability and the Environment

2.2 Methodology

The focus of this assessment is a gap analysis based on the climate science available at the time of preparation of AP2 and the science available to the end of 2013.

To undertake this task, the latest information published by the Intergovernmental Panel on Climate Change (IPCC), the NSW/ACT Regional Climate Modelling project, and the South Eastern Australian Climate Initiative (SEACI) was reviewed. The review included analysis and insights from the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Bureau of Meteorology, the Centre for Australian Weather and Climate Research, the Climate Commission, the National Climate Change Adaptation Research Facility (NCCARF) and the Victorian Centre for Climate Change Adaptation Research.

This up-to-date information was compared with the information used in the preparation of AP2, and the AP2 actions were assessed in light of that comparison.

2.3 Current climate change science

The projected climate change impacts referenced in AP1 and underpinning the development of AP2 were compared with the updated background data and reports described in Section 2.1.

Much of the climate science referenced in AP2 remains relevant in 2014. However, the development of the science has led to revised results or additional detail for projections. Appendix 1 compares the referenced background documents in AP1 and AP2 with updated background documents (up to 2013).

For the ACT, two developments in climate change science are of particular interest:

- The completion of Phase 2 of SEACI in 2012. Some of this work highlights the specific impacts of climate change on the region.
- The publication of the *IPCC fifth assessment report: climate change 2013* (AR5). The report provides a view of the current state of global scientific knowledge relevant to climate change. Two other reports have since been released by the IPCC
 - *Summary for policymakers* (IPCC 2009a)
 - the IPCC Working Group I contribution to AR5, *Climate change 2013: the physical science basis* (IPCC 2009b).

As part of AR5, three additional reports have recently been released: Working Group II (March 2014), Working Group III (April 2014) and the synthesis report (October 2014). Updated regional climate change projections for the Australasian region will be incorporated in Part B of the Working Group III report.

Several other ongoing climate projection projects are currently under way:

- The NSW/ACT Regional Climate Modelling project, being conducted by the University of New South Wales, the Climate Change Research Centre and the NSW Department of Environment and Heritage. The project will produce regional climate projections for south-eastern Australia, for a range of likely future changes in climate. The project is in development, and no data or results from the project have yet been fully published.
- The CSIRO NRM Climate Projections project, under the Regional Natural Resource Management Planning for Climate Change Fund. The project will provide the projections from new analyses across a range of variables, including temperature, precipitation, relative humidity, solar radiation, potential evaporation, wind speed, sea surface temperature, sea level rise (mean change and extremes), fire danger and run-off.

Recent or updated background data

Recent or updated background data and reports applicable to the ACT were reviewed by the Office of the Commissioner for Sustainability and the Environment (OCSE).

Some of the reports and data reviewed were published earlier than 2009. These have been included for completeness, as they may contain additional information on climate change impacts that may be useful in developing the next action plan.

The following sources were reviewed:

- AECOM (2012). *Climate change vulnerability assessment framework for infrastructure*, report produced for the ACT Government, Canberra.
- Australian Government Department of the Environment (2014). *Climate change impacts in the Australian Capital Territory*, Department of the Environment, Canberra. www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/australian-capital-territory

- Blong R (2005). *Natural hazards risk assessment: an Australian perspective*, Issues in Risk Science 4, Benfield Hazard Research Centre, London.
- Chiew FHS, Teng J, Wang B & Marvanek S (2012). *Projected changes in climate and run-off for south-eastern Australia under 1 °C and 2 °C of global warming*, SEACI Phase 2 special report, South Eastern Australian Climate Initiative, Canberra.
- CSIRO & Bureau of Meteorology (2007). Regional climate. In: *Climate change in Australia*, Bureau of Meteorology, Melbourne.
- CSIRO & Bureau of Meteorology (2007). Appendix B: City summaries. In: *Climate change in Australia*, Bureau of Meteorology, Melbourne.
- CSIRO & Bureau of Meteorology (2012). Change projections: temperature and precipitation. In: *State of the climate 2012*, Bureau of Meteorology, Melbourne.
- Intergovernmental Panel on Climate Change (2009). *Fifth assessment report: climate change 2013, summary for policymakers*, IPCC, Geneva.
- Intergovernmental Panel on Climate Change (2009). *Fifth assessment report: climate change 2013, IPCC Working Group I contribution to AR5, the physical science basis*, IPCC, Geneva.
- NSW Department of Environment, Climate Change and Water (2010). *NSW climate impact profile: the impacts of climate change on the biophysical environment of NSW*, DECCW, Sydney.
- Pickering CM, Good RA & Green K (2004). *The ecological impacts of global warming: potential effects of global warming on the biota of the Australian Alps*, Australian Greenhouse Office, Canberra.
- South Eastern Australian Climate Initiative (2010). *Climate variability and change in south-eastern Australia: a synthesis of findings from Phase 1 of SEACI*, SEACI, Canberra.
- South Eastern Australian Climate Initiative (2012). *Climate and water availability in south-eastern Australia: a synthesis of findings from Phase 2 of SEACI*, SEACI, Canberra.
- Rotstein J & Webb B (2009). *Australian Capital Territory and Region Climate Change Vulnerability and Adaptation Project: knowledge status and future issues report – human health*, cited in *Australia state of the environment 2011*, Australian Government Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Webb B (2011). *Impacts of climate on the Canberra Nature Park – risks and responses*, report by the Australian National University produced for the Office of the Commissioner for Sustainability and the Environment, Canberra.

Projected climate change impacts

From these sources, the OCSE derived a range of climate change projections and impacts relating to the ACT (Table 2.2).



Table 2.2 Projected ACT-specific climate change impacts

Impact category	Climate change projections and impacts	Data source
Global average temperature	<p>The global average temperature is expected to increase. In 2011, the global average air temperature had already risen by around 0.85 °C since 1880.</p> <p>By the end of the century, the average global temperature could rise by between 3.2 °C and 5.4 °C (high IPCC emissions scenarios) or between 0.9 °C and 2.3 °C (low IPCC emissions scenarios).</p>	IPCC (2013)
Australian average temperature	<p>By 2030, Australian average temperatures are projected to rise by 0.6–1.5 °C (compared with recent decades).</p> <p>By 2070, Australian average temperatures are projected to rise by 1.0–5.0 °C (compared with recent decades).</p>	CSIRO & Bureau of Meteorology (2012)
ACT average temperature	<p>In south-eastern NSW, it is expected that average daily maximum and minimum temperatures will increase in all seasons.</p> <p>Average daily maximum temperatures are very likely to increase by 2.0–3.0 °C in autumn, winter and spring, and by 1.5–2.0 °C in summer.</p> <p>Average daily minimum temperatures are very likely to increase by 1.0–3.0 °C.</p> <p>For the ACT, it is expected that there will be an increase in occurrences of extreme temperatures, including:</p> <ul style="list-style-type: none"> • more extreme hot days (exceeding 35 °C), from 5 in 2007 to 8 in 2030 (A1B median) and 12–26 in 2079 (A1FI low, A1FI high scenarios) • more hot spells (exceeding 35 °C), from 1 in 2007 to 1–2 in 2030 and 1–9 in 2070 • more days exceeding 40 °C, from 0 in 2007 to 0–1 in 2030 and 0–10 in 2070 • fewer days below 0 °C, from 62 in 2007 to 39–60 in 2030 and 9–52 in 2070 • fewer cold spells (below 0 °C), from 12 in 2007 to 7–12 in 2030 and 1–10 in 2070. 	<p>Hennessey et al (2004)</p> <p>CSIRO & Bureau of Meteorology (2007)</p> <p>NSW Department of Environment, Climate Change and Water (2010)</p>
Rainfall and run-off	<p>The ACT is expected to have reduced rainfall and run-off.</p> <p>By 2030, for south-eastern Australia, for a 1 °C global warming scenario:</p> <ul style="list-style-type: none"> • mean annual rainfall is projected to decrease by 0–9% (median of 4%) • mean annual run-off is projected to decrease by 2–22% (median of 12%). <p>These impacts will double for 2 °C of global warming.</p>	SEACI (2012)
Water supply and security	<p>Reductions of annual rainfall and run-off will affect the security of water supply, particularly for the ACT's Cotter and Googong catchments. Water resources will be further stressed by population growth.</p>	DoE (2014)
Snow cover and frost	<p>The ACT is likely to experience a reduction in snow cover and frost days.</p> <p>By 2020, a 10–40% reduction in snow cover is projected.</p> <p>By 2030, a 14% reduction in frost days in Canberra (A1B median; compared with the current 63.8 frost days) is projected.</p> <p>By 2070, an 8–27% reduction in frost days (A1FI low and high scenarios) is projected.</p>	<p>Hennessey et al (2004)</p> <p>CSIRO & Bureau of Meteorology (2007)</p>

continued

Table 2.2 *continued*

Impact category	Climate change projections and impacts	Data source
Bushfires	<p>The ACT is expected to see an increase in the risk of bushfires due to increased temperature and evaporation.</p> <p>Currently in Canberra, the average number of days each year with very high or extreme fire danger is 23.</p> <p>By 2020, the predicted average number of days each year with very high or extreme fire danger is 26–29.</p>	<p>Hennessy et al (2006)</p> <p>DCCEE (2011)</p>
Natural environment	<p>Climate change will affect biodiversity, particularly in reserves in the ACT and surrounding regions.</p> <p>It is expected that there will be growing numbers of extinctions, functional extinctions and threatened species.</p> <p>It is expected that the physiological characteristics of ecosystems will be changed (eg through heat stress, and changed growth and water use in plants).</p>	Webb (2011)
Population health and wellbeing	<p>The increase in very hot days and extreme weather will increase the number of cases of heat-related illnesses and death. In the ACT, the number is expected to double, particularly for older people, who are the most vulnerable.</p> <p>Currently, an average of 14 people over 65 die annually in Canberra from heat-related deaths.</p> <p>By 2020, this is projected to increase to 37–41 deaths a year.</p> <p>By 2050, it is projected to increase to 62–92 deaths a year.</p> <p>The impact of severe weather events (bushfires and heatwaves) may also lead to increases in foodborne infectious diseases, air pollution and mental health problems. The most vulnerable population will be low-income people, rural communities, older people and sick people.</p>	DoE (2014)
Emergency management	<p>As extreme weather, increased bushfires, and increases in heatwaves and extreme hot days are projected, there will be increased stress on emergency and disaster services.</p>	DoE (2014)
Built environment	<p>The built environment and infrastructure will be affected by higher temperatures and extreme weather. Impacts may include increased deterioration of roads and pavement, changing of stormwater sizing requirements, increases in the cost of operating buildings, and loss of amenity.</p> <p>The risk of increased bushfires will also affect buildings and infrastructure.</p>	<p>AECOM (2012)</p> <p>DoE (2014)</p>
Business and industry	<p>As the ACT faces greater extents of extreme weather, and as the built environment is exposed to further deterioration, business and industry will be affected by rising costs of operation and insurance.</p> <p>Climate change will also affect specific industries (eg the reduction in snow cover will affect tourism; reduced rainfall will affect agriculture).</p>	<p>Pickering et al (2004)</p> <p>Blong (2005)</p>

ACT = Australian Capital Territory; IPCC = Intergovernmental Panel on Climate Change; NSW = New South Wales

Notes:

1. A1B: One of six scenarios used for climate models. The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and a balanced spread of technology using a wide range of energy sources.
2. A1FI: One of six scenarios used for climate models. The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and an emphasis on fossil fuel technologies (ie a fossil fuel–intensive technological world).

2.4 Implications for mitigation

There have been no significant changes to projected climate change globally or for Australia. The most significant observation in overall climate change is that, by 2012, global average air temperature had already risen by around 0.85 °C (since 1880). This is significant given that there is a general consensus that the global average temperature must be prevented from increasing by more than 2 °C by the end of the century. In AR5, the IPCC presented targets that are needed to avoid catastrophic impacts of climate change:

- average global temperature must not rise by more than 2 °C
- 80 per cent reduction in GHG emissions levels by 2050 compared with 1990 levels
- 40 per cent reduction in GHG emissions by 2020 compared with 1990 levels.

The ACT's current carbon emissions reduction target of 40 per cent below 1990 levels by 2020 meets the global target.

Given this, and that climate change projections used in AP2 remain largely current (although more rapid change may be seen), this assessment concluded that AP2 mitigation actions were still appropriate. Table 2.3 provides an assessment of AP2 mitigation actions, considering the latest climate change projections.

Table 2.3 Impact of updated climate science on mitigation actions in AP2

AP2 mitigation action	Negligible impact	Little impact	Moderate impact	Substantial impact
Action 1: Energy Efficiency Improvement Scheme		✓		
Action 2: Inefficient water heater phase-out		✓		
Action 3: Energy efficiency information to tenants		✓		
Action 4: Zero emissions buildings		✓		
Action 5: Community engagement strategy			✓	
Action 6: Trial advanced energy technology systems		✓		
Action 7: Business Energy Efficiency Improvement Scheme		✓		
Action 8: ACTSmart Energy Assist		✓		
Action 9: Distributed energy mapping project		✓		
Action 10: Low Emissions Vehicle Strategy		✓		
Action 11: ACT Waste Management Strategy		✓		
Action 12: Large-scale renewable energy		✓		
Action 13: Renewable energy target		✓		
Action 14: Electricity distribution network mapping		✓		

AP2 = AP2: a new climate change strategy and action plan for the Australian Capital Territory

2.5 Implications for adaptation

To minimise the impact of climate change, we will need both mitigation to reduce GHG emissions, and adaptation to plan for and manage inevitable change.

Even with strong global mitigation, the future climate may be more challenging than we prefer. Adaptation is therefore necessary to limit environmental, social and economic damage.

Implications for AP2 adaptation actions

The AP2 adaptation actions, although not significantly affected by changes in climate science at this time, will need to be expanded as the science around vulnerability, risk assessment and adaptation planning progresses. The OCSE notes that the scope and opportunity for this to occur are built into three AP2 adaptation actions (actions 15–17). Table 2.4 provides an assessment of AP2 mitigation actions, considering the latest climate change projections.

Action 15 provides for an assessment of the potential risks of climate change to community health, territory life and property through an ACT-wide risk assessment, which was completed by the Justice and Community Services Directorate in 2012. The risk assessment identifies the potential risks from climate change to territory life and property, including through acute weather and fire impacts in the ACT and the surrounding region, and integrates this knowledge into natural disaster and emergency risk management and planning. A process to update and expand the assessment based on new information from the NSW/ACT Regional Climate Modelling project is being developed.

Action 16 requires the ACT Government to publish a ministerial statement on how, from a whole-of-government perspective, the built environment and urban open spaces will be developed to respond to climate change and the ACT's long-term mitigation objectives. This will incorporate a review of the Territory Plan development codes and design standards. A ministerial statement was delivered on 21 May 2014. The statement directs that further research and policy development on adaptation in the ACT region is required to inform a review of the Territory Plan development codes and design standards.

Action 17 states that the ACT Government will continue to assess the potential impacts of climate change on ecological systems in the ACT and the surrounding region, and integrate this knowledge into environmental management and development planning decisions to ensure that our natural environment is conserved and improved. Work in this area includes completion of the Nature Conservation Strategy. Reviews of action plans for threatened species and ecological communities will incorporate climate-related risks. This action is part of ongoing natural resource management review processes. Projects to collect baseline information to enable impact assessment are under way. A draft management plan for the ACT sphagnum bogs (moss habitat of the critically endangered corroboree frog) has been prepared and will be released for public comment early in 2014. Vegetation mapping is continuing, currently in the south-east Murrumbidgee area.

Table 2.4 Impact of updated climate science on adaptation actions in AP2

AP2 adaptation action	Negligible impact	Little impact	Moderate impact	Substantial impact
Action 15: Territory-wide risk assessment ^a		✓		
Action 16: Planning ministerial statement		✓		
Action 17: Impact assessment on the natural environment ^b		✓		

AP2 = AP2: a new climate change strategy and action plan for the Australian Capital Territory

- a The risk assessment has been completed. Updated projections of impacts from climate change may be included in the assessment, as it highlights the increased risk the Australian Capital Territory (ACT) faces from extreme weather events.
- b The update in climate science and the ongoing research into specific regional projected impacts in the ACT should further support this action.

Implications for ACT Government policy

Although the assessment found that developments in climate science have little impact on the AP2 adaptation actions, it also found that considerable resources and research could be drawn on in the development of future policy and actions.

As the science and knowledge in this field deepen, there is an increasing interest in the area of climate change adaptation. During the past decade in Australia, many government bodies, cities and organisations have begun to focus on climate change adaptation.

It may be useful to conduct an ACT-wide assessment of climate change impacts to synthesise the research and findings from the current literature. This could be informed by the findings of the NSW/ACT Regional Climate Modelling project.

In developing future policy and actions, the ACT Government should also consider the findings of the NCCARF Climate Change Adaptation Framework, and the activities of other state and local governments, as detailed below.

Climate Change Adaptation Framework

The NCCARF was developed to investigate climate change adaptation science more fully for Australia. The NCCARF recently completed its first phase (2008–13) of operation, and products from the first phase are now publicly available. These reports and plans aim to assist planning and policy making in this area.

In 2012, the NCCARF engaged AECOM to research climate change adaptation. The resulting report, *Supporting evidence-based adaptation decision making in the Australian Capital Territory* (AECOM 2013), is a comprehensive synthesis of climate change adaptation work relevant to the ACT up to late 2012. The report also states that at least 29 published climate change adaptation studies have been produced specifically for the ACT.



2.6 Overall assessment

The science of climate change is continuing to develop. The major development has been that climate science projections have become more specific, and there is now an increased focus on adaptation.

On the basis of this analysis, this assessment concluded that, for the purpose of ensuring that AP2 is based on the latest developments in climate science, the AP2 **mitigation** actions do not need to be expanded at this time.

However, analysis of the updated climate science does suggest that the AP2 **adaptation** actions could be expanded to take into account the work completed in recent years.

Figure 2.1 provides a summary of this analysis with respect to the five sectors of AP2 and to the ACT's adaptation actions.

The climate change science in relation to the five mitigation areas (residential, nonresidential, waste, transport and energy supply) is broadly accepted by the scientific community. It has increased in specificity in recent years; however, because of the nature of forecasting, there will always be a degree of uncertainty. The assessment of a 'good' grade has been made on the basis of:

- the broad acceptance of the expected outcomes of climate change
- a trend of 'stable'.

The climate science in relation to adaptation has increased in volume, detail and potential application to the ACT. This is likely to continue in the future. Therefore, a grade of 'good' and a trend of 'improving' were considered to be appropriate.

Opportunity

Building and managing information, knowledge, tools and strategies is crucial for adaptively managing climate change. Although it may not be possible to eliminate uncertainty, the identification of trends and effective strategies can facilitate the definition of more suitable responses to climate change impacts.

Adaptive management relies on the creation and consolidation of strong links with the scientific and expert community on one side, and with the stakeholders that are directly and indirectly affected by decisions, on the other.

To ensure the effectiveness of adaptive management, specific mechanisms and channels for communication and coordination between policy makers, the scientific community and the community should be designed and implemented. This would enable the ACT Government to draw on the considerable resources and research that are available to support the development of future adaptation policy and actions.

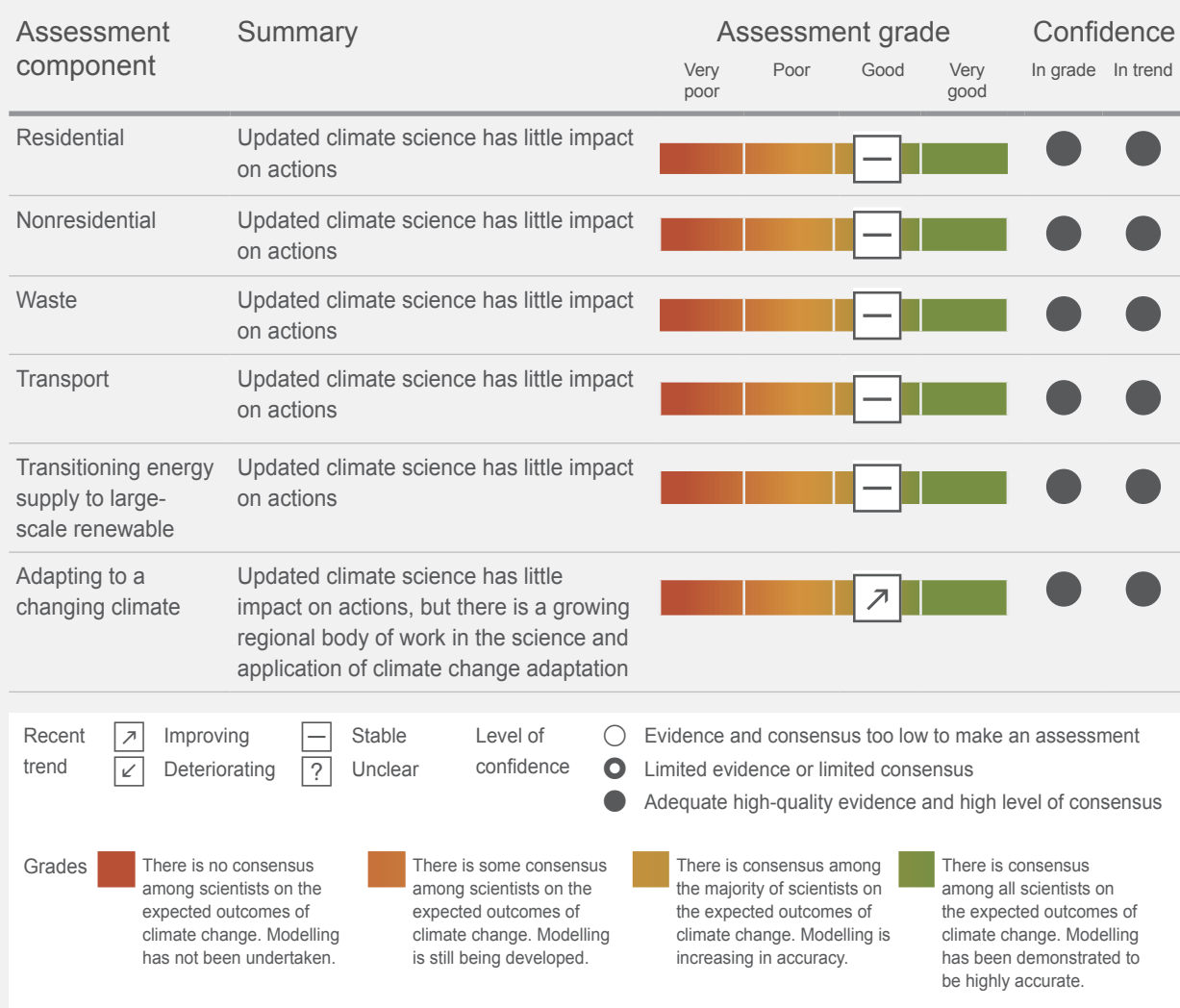
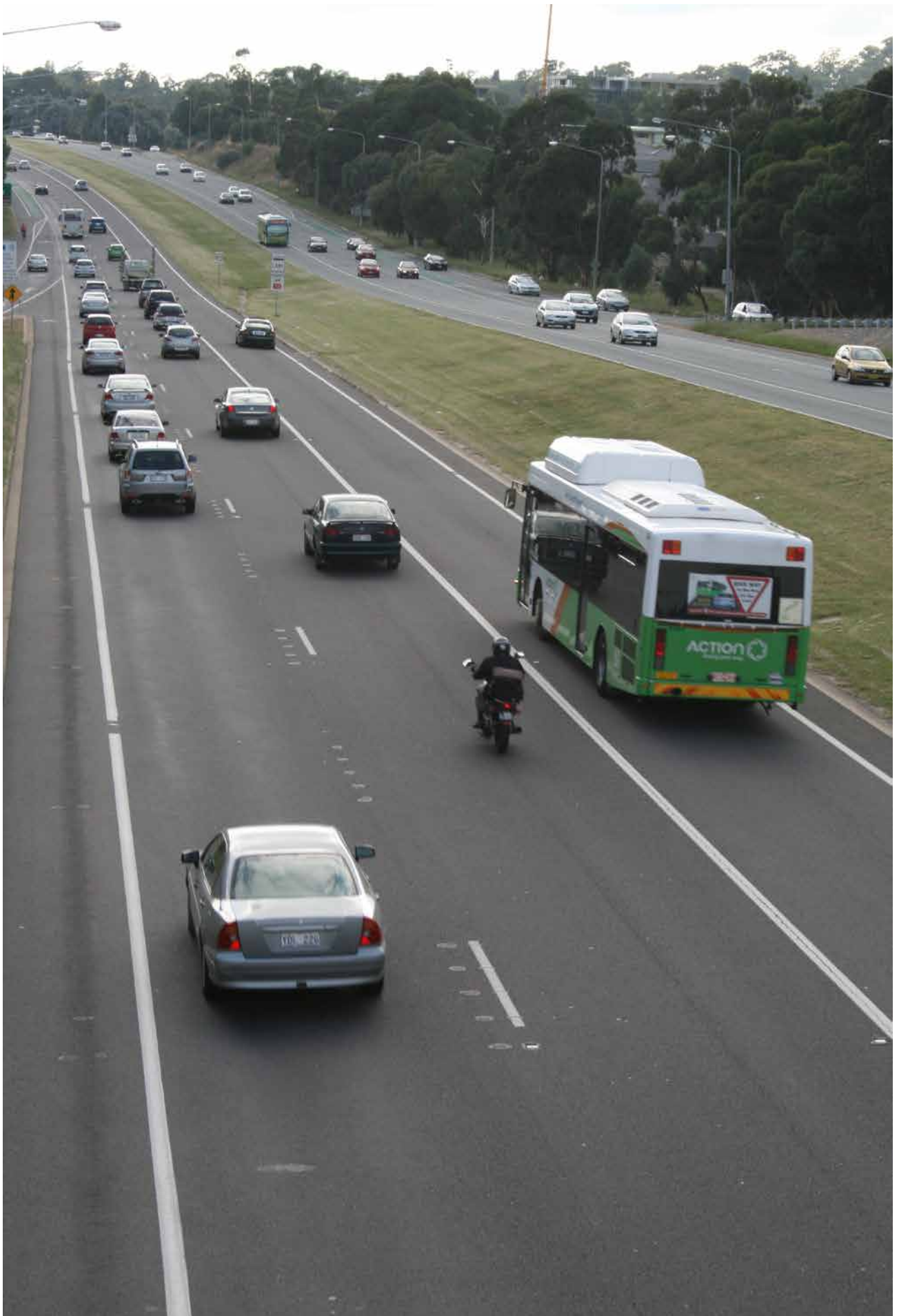


Figure 2.1 Report card on whether developments in climate science have implications for the ACT





Chapter 3

How ‘fit for purpose’ are the ACT’s climate change adaptation policies?

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3 How ‘fit for purpose’ are the ACT’s climate change adaptation policies?

To determine how ‘fit for purpose’ are the Australian Capital Territory’s (ACT’s) adaptation policies, the Office of the Commissioner for Sustainability and the Environment (OCSE):

- devised an assessment methodology for qualitatively measuring and reporting on the effectiveness of any given policy in adapting to climate change
- used this methodology to assess the key areas of adaptive need (funding, governance, political commitment and strategy, knowledge management and data, and communication and awareness).

This chapter presents the results of this analysis and identifies the main challenges for the future.

Challenge

The findings of the fit-for-purpose assessment or gap analysis show that the ACT is addressing climate change adaptation relatively effectively and in the majority of key areas of need (funding, governance, political commitment and strategy, knowledge management and data, and communication and awareness). However, many of the ACT’s current climate change adaptation mechanisms are addressed somewhat incidentally and within policies or plans that have other, nonadaptation goals.

The main challenge for the future is to ensure that a holistic approach is adopted that takes account of within- and cross-sector interdependencies (leading to potential synergies and trade-offs), and has broader stakeholder engagement.*

* The OCSE notes that this issue is in the process of redress. On 21 May 2014, the ACT Government launched *Adapting to a changing climate: directions for the ACT* (ACT Government 2014), the first stage in adopting a climate change adaptation strategy for the territory. The strategy commits to the assessment of risk, the setting of targets and actions, and the implementation of a review process to ensure that the city’s infrastructure and community become more resilient to climate change.

3.1 The importance of adaptation

Australia’s climate is changing, and the weight of scientific evidence suggests that it will continue to change for the foreseeable future, even with global climate change mitigation. Responding effectively to climate change therefore requires both adaptation and mitigation to fortify infrastructure and services. This will increase resilience against, and allow adaptation to, the impacts of climate change.

In contrast to climate change mitigation, which requires cooperation at a global level, most climate change adaptation occurs at a local level through the actions of individuals, businesses and communities in response to locally specific climate change impacts.

The level of adaptation needed will depend, to some extent, on the success of mitigation. If mitigation is successful in limiting climate change, less adaptation will be needed. But if mitigation is not successful, all communities will need to adopt stringent adaptation measures.

Adaptation is about effectively managing the short- and long-term risks that climate change poses for households, businesses, governments and the natural environment. These risks may relate to the potential consequences of changes in the frequency, intensity or location of extreme weather events (such as heatwaves), or the effects of changes in other climate variables (such as average temperatures or rainfall, or both).

Effective adaptation is not just about managing exposure to specific climate change risks – it is also about reducing underlying vulnerability by building adaptive capacity. Adaptive capacity is the ability to adjust to new ways of doing things in the face of climate change, such as moderating the potential damages, taking advantage of opportunities and coping with consequences. Adaptive capacity relies on financial, physical, social, human and natural capital or resources. It further depends on how well these resources can be used – in particular, the degree of flexibility in resource use, the capacity to organise resources and the capacity to learn from experience about the best use of resources. For example, the

adaptive capacity of a community to respond to a bushfire depends on how easily people, vehicles and water can be deployed to different locations, how well people are organised to fight a fire, and how well they have learnt from experience about the best ways to fight or escape a fire.

Some specific benefits of adaptation planning, as outlined by the New South Wales (NSW) Office of Environment and Heritage (OEH 2013), include:

- minimising the impacts of climate change-related events in local communities
- comprehensively addressing climate risks while reducing the cost and extent of remedial action
- addressing cost-cutting issues across local government
- implementing cost-effective risk management
- building an understanding of the shared vision for the future the community would like
- building partnerships across local government to help it function more effectively now and in the future
- meeting community expectations for service provision.

Box 3.1 summarises a recent action by the City of Chicago to aid in climate adaptation.

Box 3.1 Case study: Chicago, United States of America

Using satellite mapping, the City of Chicago has identified heat island hot spots and, in response, has planted more than 500 000 trees and introduced reflective roof standards to reduce heat impacts. The city has also introduced a green urban design plan to manage flooding through projects that use permeable pavements and rooftop gardens.

3.2 Climate change adaptation in the ACT

AP2: a new climate change strategy and action plan for the Australian Capital Territory (AP2) contains three relevant actions for climate change adaptation:

- Action 15: The ACT Government will assess the potential risks of climate change to community health, and territory life and property, including through acute weather and fire impacts in the ACT and the surrounding region, through a new ACT-wide risk assessment. This knowledge will be integrated into future health system planning, and natural disaster and emergency risk management and planning.
- Action 16: By the end of 2013, the ACT Government will publish a ministerial statement on how, from a whole-of-government perspective, the built environment and urban open spaces will be developed to respond to climate change, and the ACT's long-term mitigation objectives. This will incorporate a review of the Territory Plan's development codes and design standards.
- Action 17: The ACT Government will continue to assess the potential impacts of climate change on ecological systems in the ACT and the surrounding region, and integrate this knowledge into environmental management and development planning decisions to ensure that our natural environment is conserved and enhanced.

It is important to note that, at the time of drafting this Implementation Status Report (ISR), the ACT had no explicit climate change adaptation policies. The OCSE therefore had to identify adaptation risks and vulnerabilities, and assess the extent to which they were implicitly addressed by existing policies.

This issue is in the process of redress. On 21 May 2014, the ACT Government launched *Adapting to a changing climate: directions for the ACT* (ACT Government 2014), the first stage in adopting a climate change adaptation strategy for the territory. The strategy commits to the assessment of risk, the setting of targets and actions, and the implementation of a review process to ensure that the city's infrastructure and community become more resilient to climate change.

The ACT Government has a limited number of resources available to dedicate to adaptation, and it is therefore essential that the territory's adaptation needs are prioritised to ensure that the adaptation strategies are appropriate and cost-effective, and that their potential impact is maximised.

3.3 Methodology

Many adaptation strategies are identified in climate literature, but few tools have been identified to evaluate their effectiveness.

In assessing the effectiveness of adaptation measures, it is important to consider local adaptation needs, since the requirements and importance of adaptation vary between jurisdictions. For example, sea level rise is less relevant for inland cities than for coastal cities, whereas the effects of urban heat islands are likely to affect both coastal and inland cities. Adaptation also depends on the state of existing infrastructure, funding and governance.

To investigate and assess the ACT's adaptation policies and strategies, the OCSE has devised a methodology based on the assessment summaries in *Australia state of the environment 2011* (DSEWPac 2011; Section I.3).

The tool for assessing the appropriateness and effectiveness of adaptation policies and procedures in the ACT is qualitative, rather than quantitative. It was determined that a qualitative assessment was sufficiently robust to provide the ACT Government with the information it would require to make appropriate decisions regarding its adaptation priorities. In addition, since qualitative measurements are more cost-effective, this method allows additional funds to be allocated to undertaking adaptation rather than undertaking adaptation assessments. A quantitative assessment would allow statistical analyses and generalisations across the population; however, such an analysis would be significantly more onerous and costly.

The analysis was based on a desktop review of relevant documentation, including:

- *Human settlement vulnerability and adaptive capacity assessment: spatial plan evaluation* (ACT Government 2010)
- *Climate Change Vulnerability Assessment Framework for infrastructure* (CMD 2012)
- state of the environment reports
- other relevant ACT Government documentation.

Targeted consultation was also undertaken with the following ACT Government departments and agencies between January and April 2014:

- Chief Minister and Treasury Directorate – Strategic Policy
- Environment and Sustainable Development Directorate (ESDD) – Climate Change Division, Strategic Planning Division, and Nature Conservation Policy
- Health Directorate – Office of the Chief Health Officer
- Justice and Community Services Directorate – Emergency Services Agency
- Territory and Municipal Services Directorate – Parks and City Services.

The analysis included an assessment of the complex relationship between projected climate impacts (see Section 2.3), ACT vulnerabilities, and specific and general adaptation needs (Figure 3.1):

- Unmitigated vulnerabilities. The Intergovernmental Panel on Climate Change defines climate vulnerability as 'the degree to which geophysical, biological and socioeconomic systems are

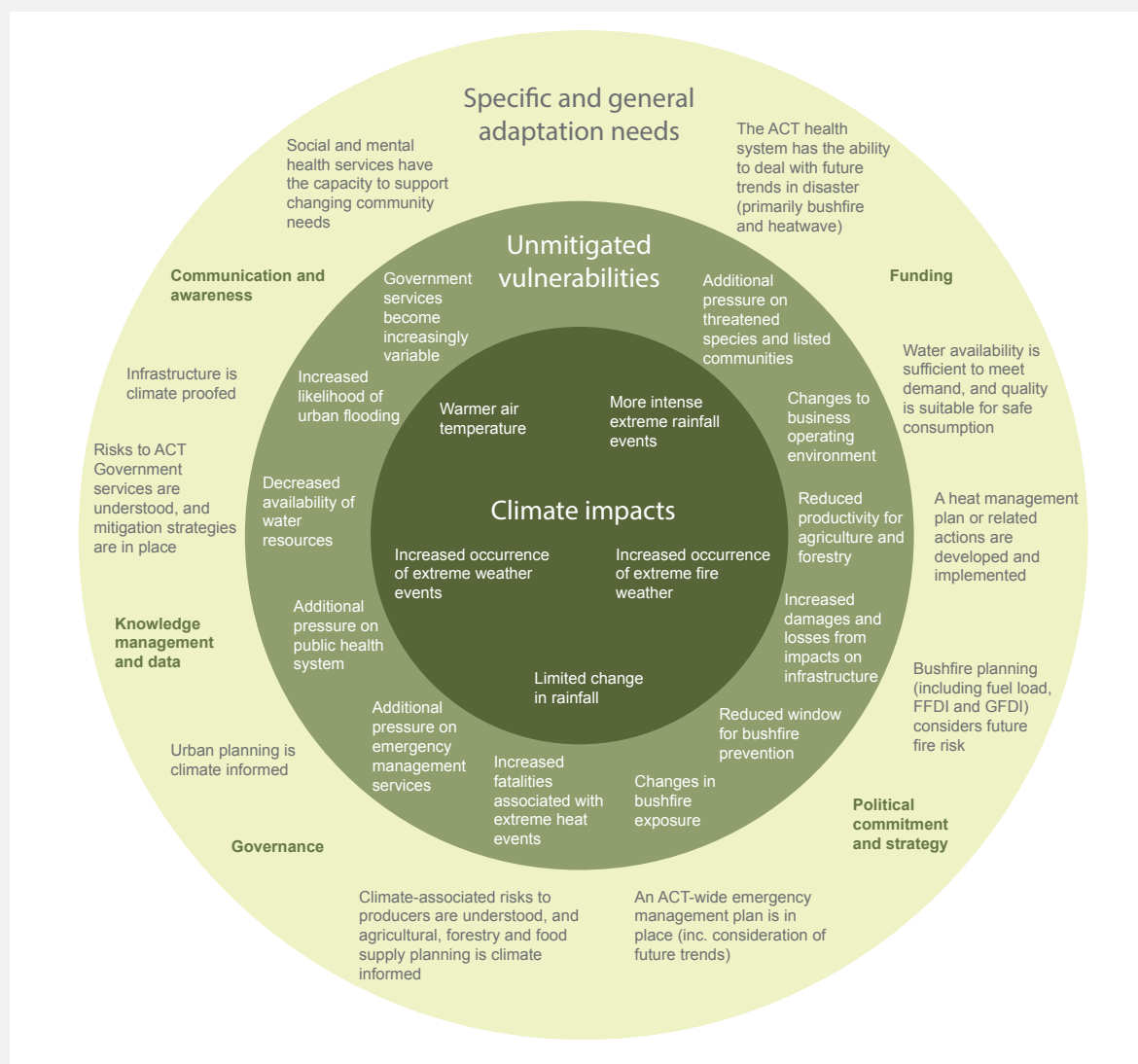


susceptible to, and unable to cope with, adverse impacts of climate change' (IPCC 2007). A full list of the vulnerabilities relevant to the ACT is provided in Figure 3.1. It is important to note that, at this stage in the assessment process, the identified vulnerabilities have not been assessed against government measures, such as existing policies and procedures, and are therefore identified as 'unmitigated'.

- Specific adaptation needs. The specific adaptation needs are directly linked to one or a number of the ACT's vulnerabilities. To ensure that they are outcome oriented, and that success in meeting the requirements can be assessed easily, they are listed

in such a way that they represent a performance benchmark. For example, the ACT is vulnerable to government services becoming increasingly variable, and one performance benchmark that would correspond to the specific adaptation need being addressed is that 'risks to ACT Government services are understood, and mitigation strategies are in place'.

- General adaptation needs. General adaptation needs are not specifically linked to any vulnerabilities; rather, they represent a series of key requirements to facilitate successful adaptation strategies.



ACT = Australian Capital Territory; FFDI = Forest Fire Danger Index; GFDI = Grassland Fire Danger Index

Figure 3.1 Relationships between key climate impacts, unmitigated vulnerabilities and adaptation needs for the ACT

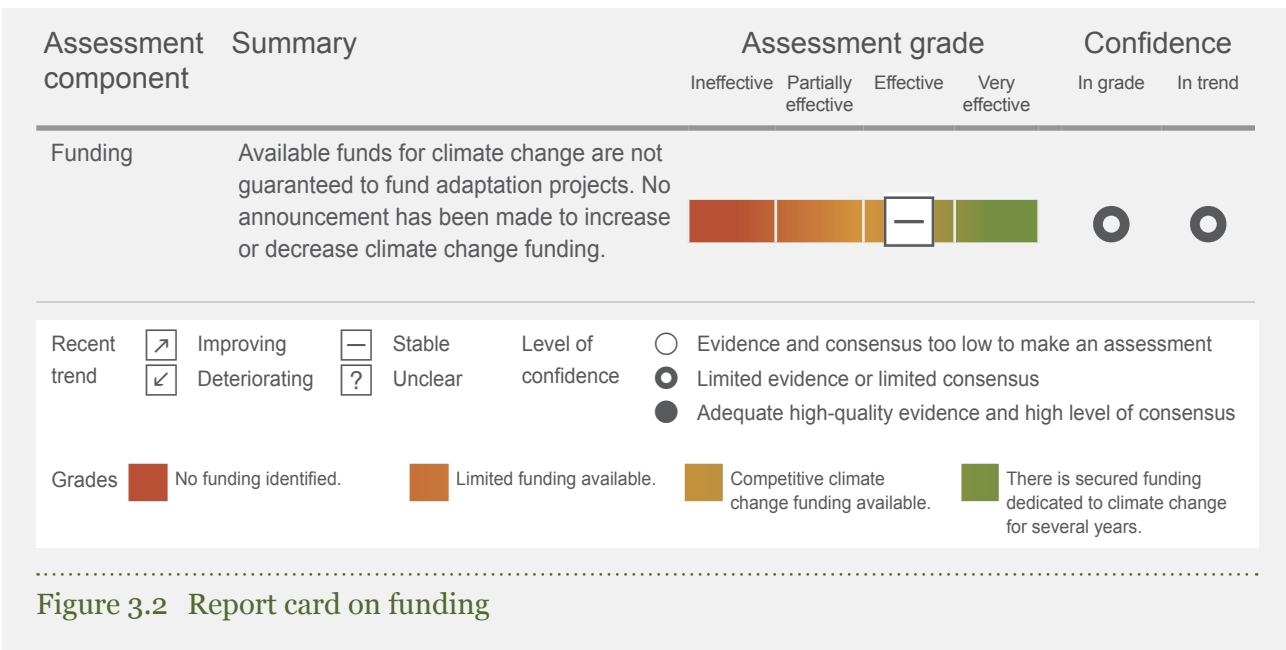
3.4 Assessment of adaptation policies and strategies

The results of the analysis of policies and strategies were summarised in report cards, which provide a graded assessment for the identified general (Figures 3.2–3.7) and specific (Figures 3.8–3.17) adaptation needs.

General adaptation needs

Funding

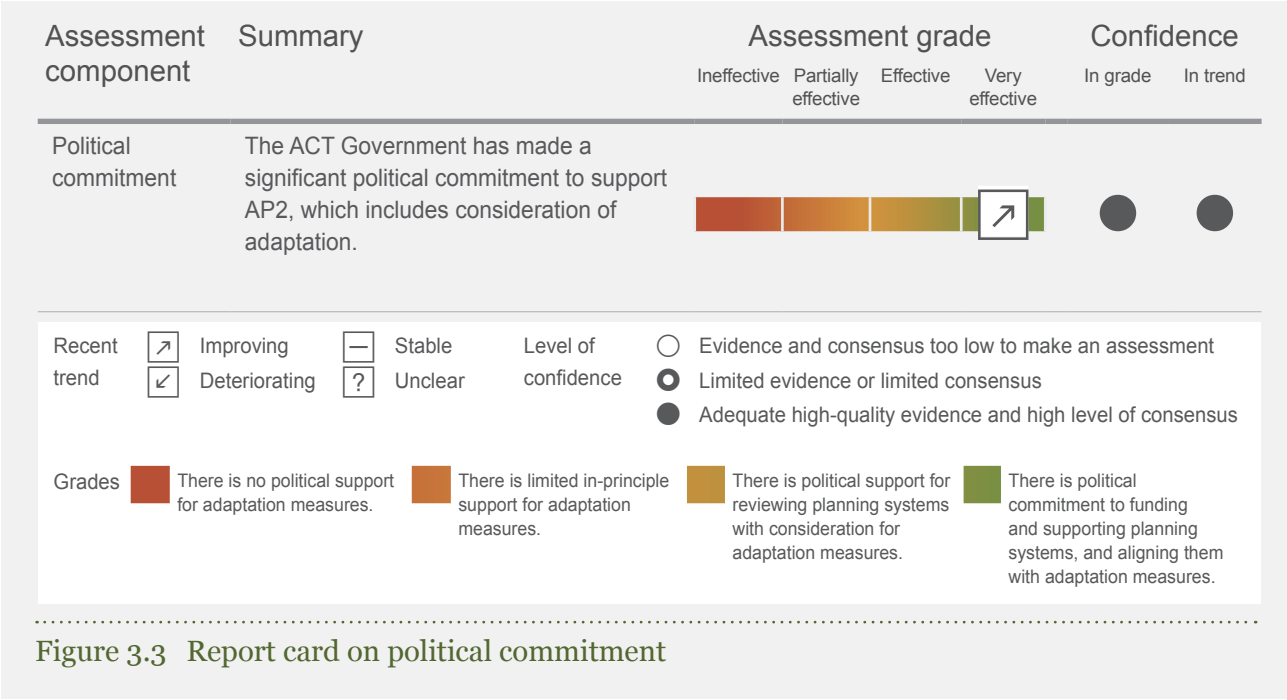
Climate change funding is available in the ACT; however, it is not guaranteed to fund adaptation projects. Depending on the budget allocation and government priority at the time, climate change funding may be diverted from adaptation to other climate change-related projects. For example, in 2014, a significant portion of available climate change funding was apportioned to support the allocation of 200 megawatts of wind energy through a reverse auction planned for late 2014. There has been no announcement to increase or decrease climate change funding.



Political commitment

The ACT Government's Mr Simon Corbell, MLA, Minister for the Environment and Sustainable Development, made a significant political commitment to support AP2 in an introduction to the document,

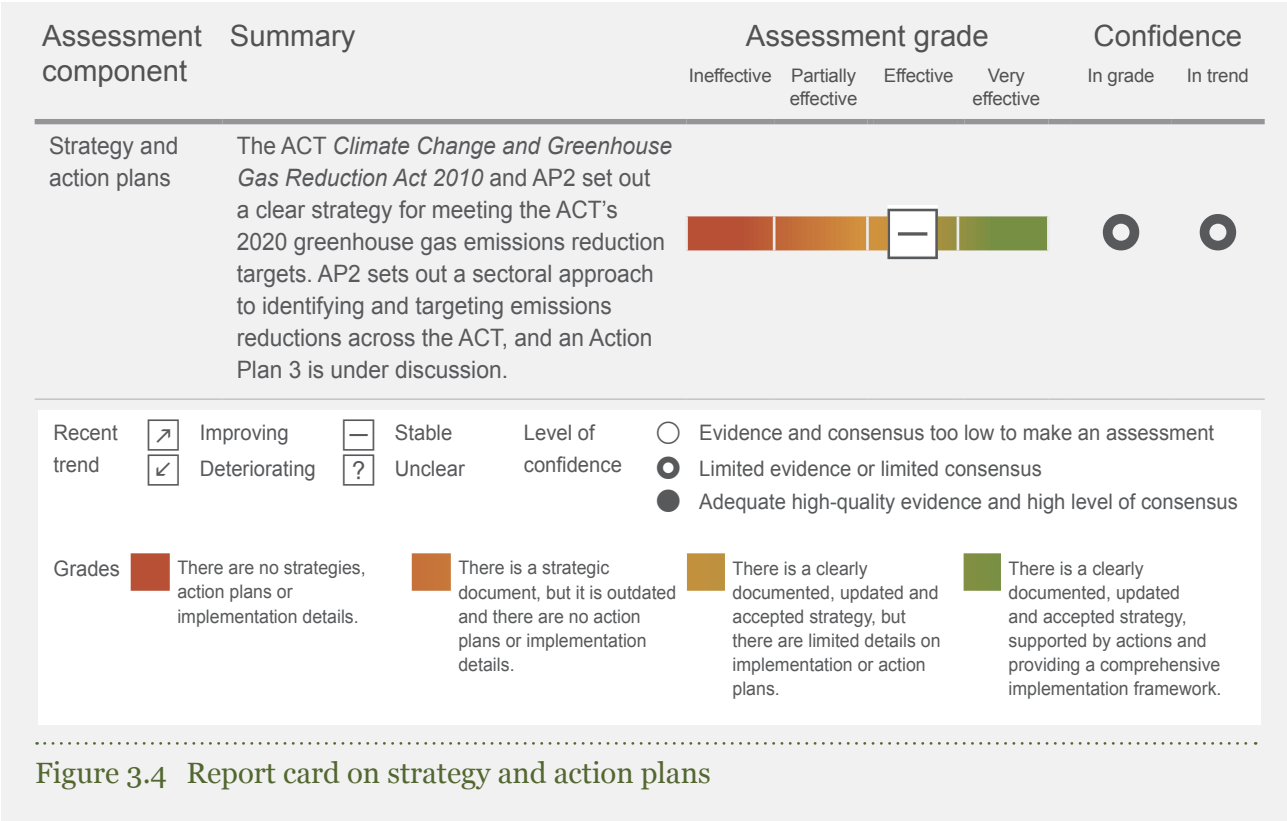
which includes consideration of adaptation. The Minister has made multiple public speeches supporting climate change adaptation (eg Climate change adaptation information-sharing forum 2009, COAG Communique 2012, Department of Climate Change and Energy Efficiency 2012).



Strategy and action plans

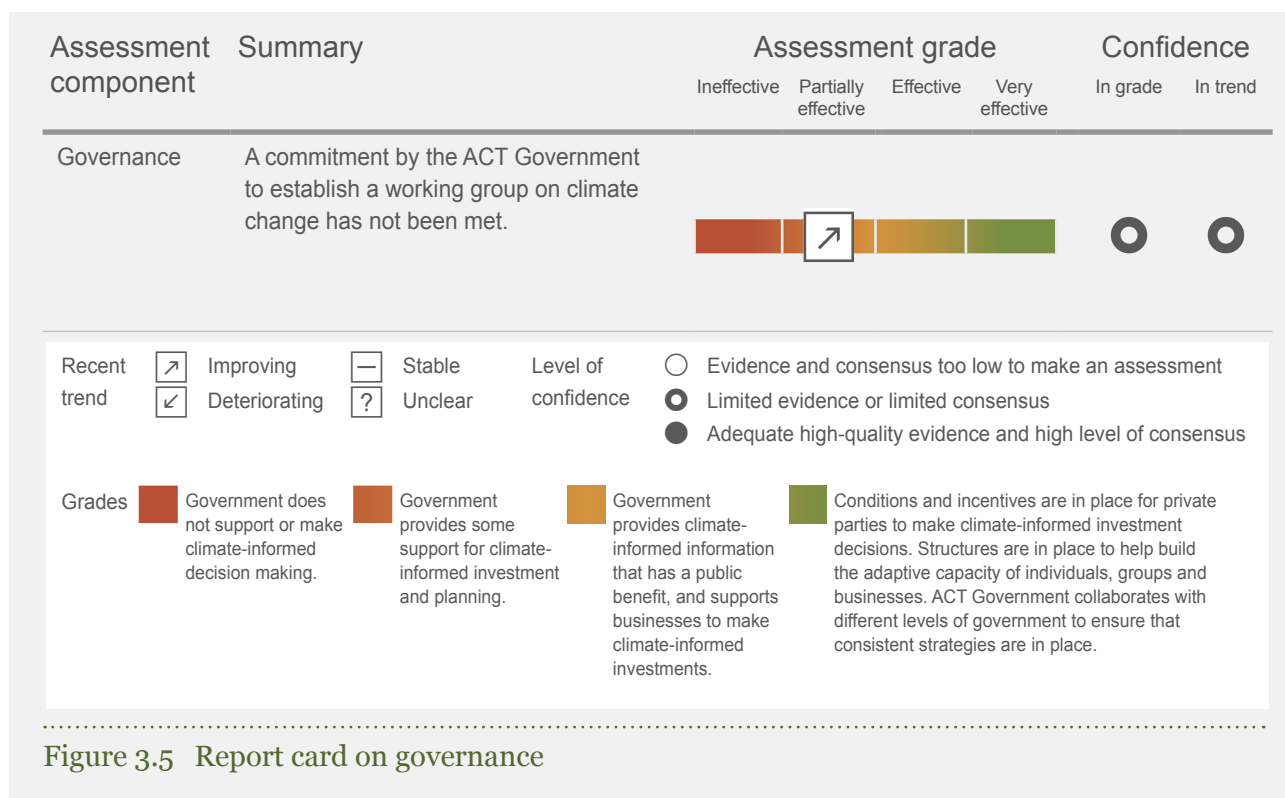
The ACT *Climate Change and Greenhouse Gas Reduction Act 2010* and AP2 set out a clear strategy for meeting the ACT’s 2020 greenhouse gas emissions reduction targets. AP2 sets out a sectoral approach to identifying and targeting emissions reductions across

the ACT. AP2 is the second iteration of the strategy, and an Action Plan 3 is under discussion; this demonstrates a long-term approach to the implementation of climate change activities, and a link between policy, strategy and action plans.



The ACT Government has stated that it is working towards creating a working group on climate change, which will represent the different branches of

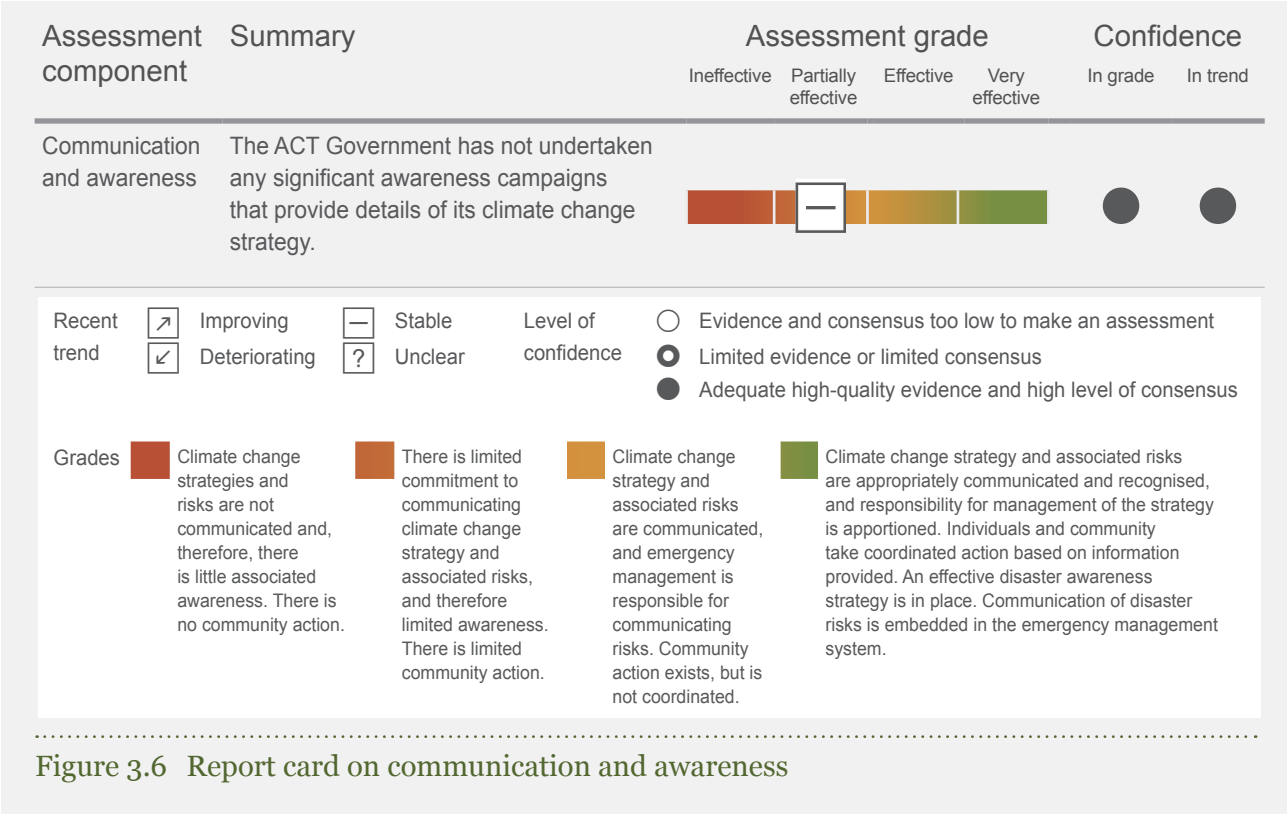
government. To date, this commitment has not been met. There are no incentives (financial, technical or otherwise) to stimulate or support the adaptive capacity and adaptation actions from individuals or the private sector.



Communication and awareness

The ACT Government has a climate change strategy (AP2); however, it has not undertaken any significant awareness campaigns or distributed factsheets to

the community that convey details of the climate change strategy or the risks associated with a changing climate.

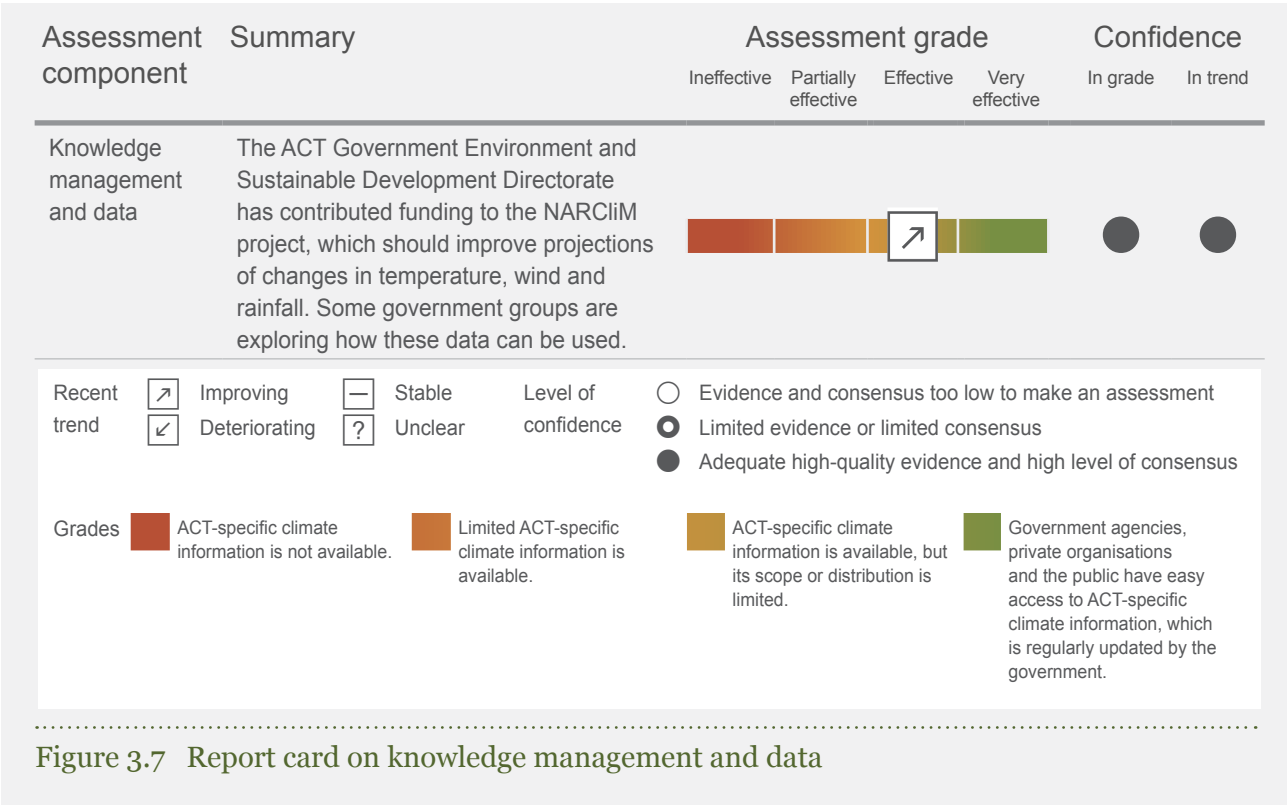


Knowledge management and data

The ESDD has contributed funding to the development of fine-scale climate projections as part of the NSW/ ACT Regional Climate Modelling (NARClIM) project. NARClIM should improve projections of future changes in temperature, wind and rainfall across NSW and the ACT, and hence provide information for managing the impacts of climate change on health, settlements, agriculture, weather extremes and services, such

as water and energy supplies. It is anticipated that NARClIM will be available for public and private use in the ACT by late 2014 or early 2015. (This was originally due by 2013 but has been significantly delayed by technical and project delivery challenges.)

Some groups within the ACT Government are exploring how to use this high-resolution data to inform future assessment.



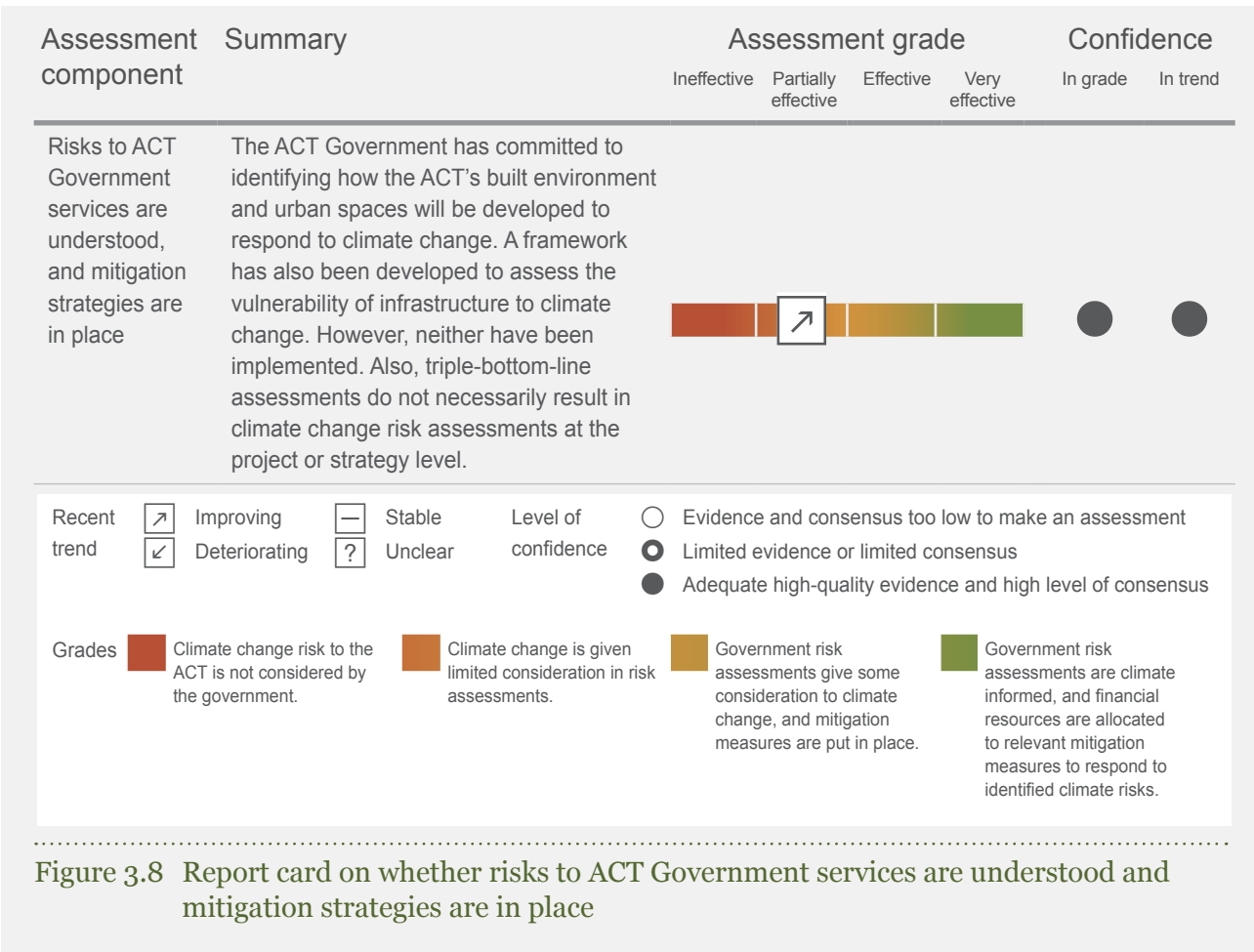
Specific adaptation needs

Risks to ACT Government services are understood, and mitigation strategies are in place

In AP2, Action 16 committed the ACT Government to publishing a ministerial statement on how, from a whole-of-government perspective, the built environment and urban open spaces will be developed to respond to climate change, and the ACT's long-term mitigation objectives. This commitment was also a component of *ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)* (AP1). At the time of assessment, this commitment had not been implemented (although there has been discussion about commencing it).

In August 2012, the Chief Minister and Cabinet Directorate released the *Climate Change Vulnerability Assessment Framework for infrastructure* (CMD 2012). The paper sets out a framework for assessing the vulnerability of the ACT's infrastructure to climate change. Based on consultation undertaken with ACT Government agencies as part of this assessment, there is no comprehensive and systematic consideration of this framework in ACT infrastructure activities. This has contributed to the 'partially effective' rating.

Triple-bottom-line assessments are undertaken by ACT Government agencies; however, this does not necessarily result in climate change risk assessment at a project or strategy level. Further, some stakeholders have noted that the triple-bottom-line assessments that are done are not completed in a systematic fashion and do not translate to actions at the project level.



Water availability is sufficient to meet demand, and quality is suitable for safe consumption

Adaptation to climate change in relation to water issues is about better managing the resource from both the supply side (in terms of quantity and quality) and the demand side. The largest water vulnerability in the ACT has been identified as water scarcity and the risks to water security.

In October 2013, ACTEW completed construction of an upgrade to the Cotter Dam, which is the source of potable water for Canberra and its environs. The new dam has a capacity of 78 gigalitres, nearly 20 times its original size, and the new reservoir will increase the ACT's water storage capacity by 35 per cent. This project was undertaken to improve water security and meet future water demand in the ACT. The Cotter Dam extension has addressed the issue of supply-side water security, with climate change identified as one of the key justifications for the project.

The ACT Government's long-term water strategy, *ACT Water Strategy 2014–44: striking the balance* sets out how the ACT Government will manage the territory's water resources over the next 30 years to meet our urban and environmental needs, and regional responsibilities. This strategy builds on the previous strategy, *Think water, act water*, that addressed the

demand-side challenges. *Think water, act water* was effective in reducing water demand in the ACT; the Canberra community is largely water-wise, and water restrictions were largely respected when they were in place.

The new strategy maintains that:

The current water supply system is considered secure ... for at least the next 20 years (ICRC 2012). Construction of the enlarged Cotter Dam and Murrumbidgee to Googong water transfer pipeline has ensured the ACT has secured adequate supply sources for its consumption needs even during drought.

In relation to long-term water availability, Strategy 4 of the ACT Water Strategy 2014–44 targets 'secure long-term water supplies' through actions including planning for long-term water security, strengthening water trading arrangements, and investigating the benefits and costs of more diverse water supply options. Further, the strategy targets economically efficient water, wastewater, and recycling and reuse services, to maximise net benefits to the community and the environment while maintaining public health. Actions include establishing an integrated water service provider, and actively monitoring and optimising the performance of water service providers.



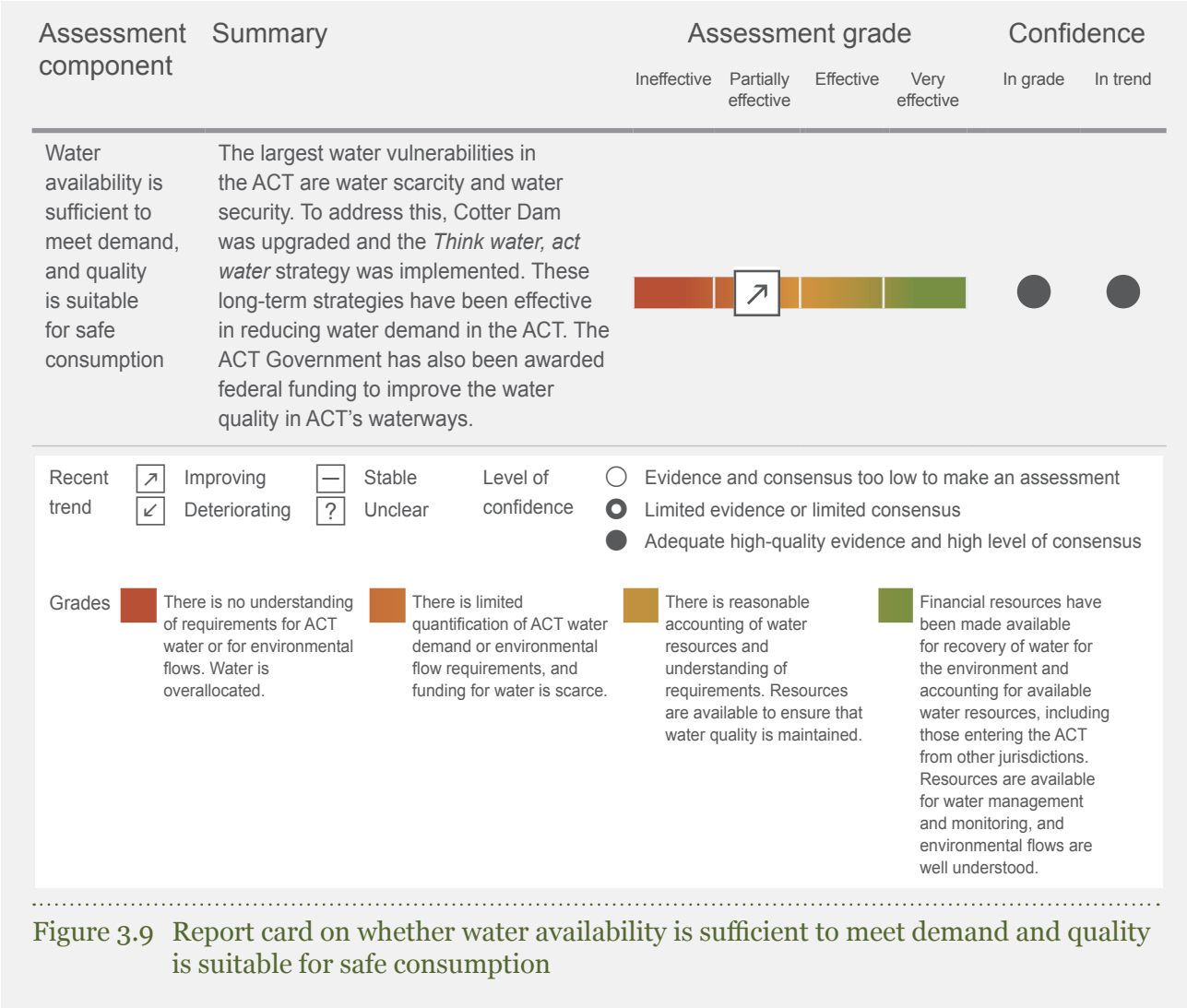
In relation to climate change, the ACT Water Strategy 2014–44 aims to achieve:

An integrated and efficient water supply system that provides for the optimal mix of supply options, encourages efficient use of water, and is resilient to climate variability, and supports the social, economic and environmental needs of the ACT community.

The ACT Water Strategy 2014–44 states that, although the ACT is secure in terms of its water supply system, the Murray–Darling Basin sustainable diversion limit (SDL) for the ACT will require the ACT to investigate options to stay within the SDL as the population grows. Modelling indicates that, because the SDL does not account for population growth, additional action by the ACT may be required within the lifetime of the strategy.

The ACT Government was allocated \$85 million in federal funding in February 2014 to improve water quality in ACT waterways over the next four years. Mr Corbell has stated that this project will be a catalyst for dramatically changing the way the ACT manages its catchments. The funding will support improving water quality within priority ACT catchments.

These actions demonstrate a strong approach by the ACT Government on all aspects relating to water management (in terms of both quantity and quality) and the ACT’s preparedness for potential climate change impacts on water resources. This combination of actions has reduced, and will continue to reduce, Canberra’s vulnerability to climate change impacts on water.



A heat management plan or related actions are developed and implemented

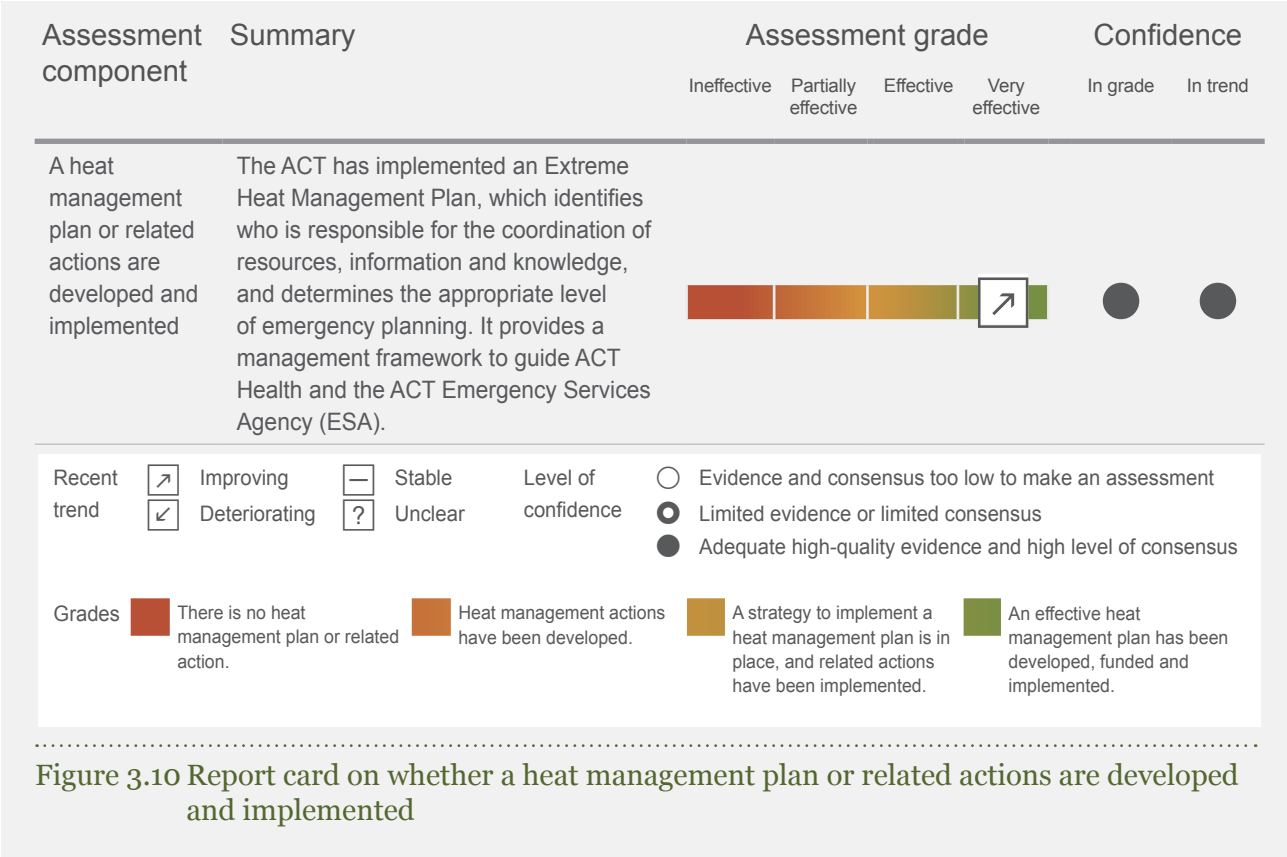
The ACT has implemented an Extreme Heat Management Plan (which is a Hazard Specific Plan of the ACT Emergency Plan) that ‘supports the community at risk to undertake coordinated measures to prepare and respond to extreme heat events when they occur’. The plan identifies who is responsible for the coordination of resources, information and knowledge, and determines the appropriate level of emergency planning.

Hazard Specific Plans of the ACT Emergency Plan deal with hazards such as extreme heat in situations that:

- differ from the routine operational and coordination arrangements of agencies

- have the potential to have a significant impact on life, property or the environment of the ACT
- require the application of the resources and capability of multiple ACT directorates or cross-jurisdictional resources.

ACT Health explicitly considers future needs within the Extreme Heat Management Plan and the Health Directorate. The Extreme Heat Management Plan itself does not have a source of funding; rather, it provides a management framework to guide a number of actions that are implemented by ACT Health and the ACT Emergency Services Agency (ESA).

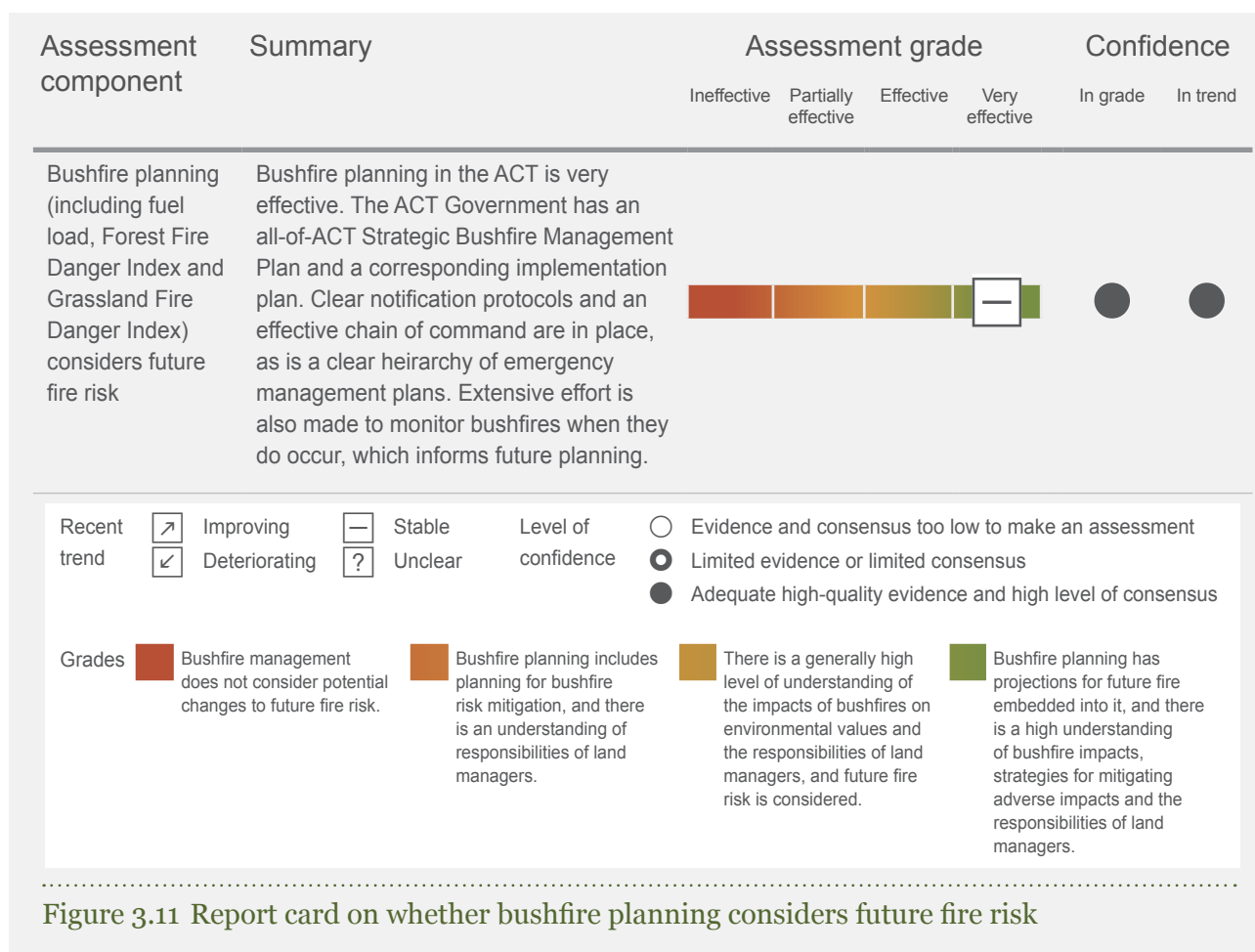


The ACT Government has an all-of-ACT Strategic Bushfire Management Plan that is designed to assist the government and community 'to work together to more effectively suppress bushfires and reduce their consequences' (ESA 2009). Further, the ACT has projections of future bushfire capability and fuel load up to 2023, the details of which are incorporated into bushfire management. Version 2 of the Strategic Bushfire Management Plan is currently being reviewed and is scheduled for release in 2014.

clear hierarchy of emergency management plans, which are triggered depending on the severity of the bushfire emergency.

Consequently, bushfire planning in the ACT is considered very effective. The ACT ESA is well prepared and can deal with changes in the hazard profile. Furthermore, it considers future fuel loads and future access requirements; this is above and beyond what other jurisdictions (eg NSW) are doing. Further, Territory and Municipal Services (TAMS; the largest landholder within the ACT Government's portfolio) has a very detailed implementation plan for the Strategic Bushfire Management Plan, which has been developed in collaboration with the ESA.

An extensive effort is made in terms of bushfire monitoring; the breadth of data provides a good basis to inform implementation effort and revisions to bushfire management planning.



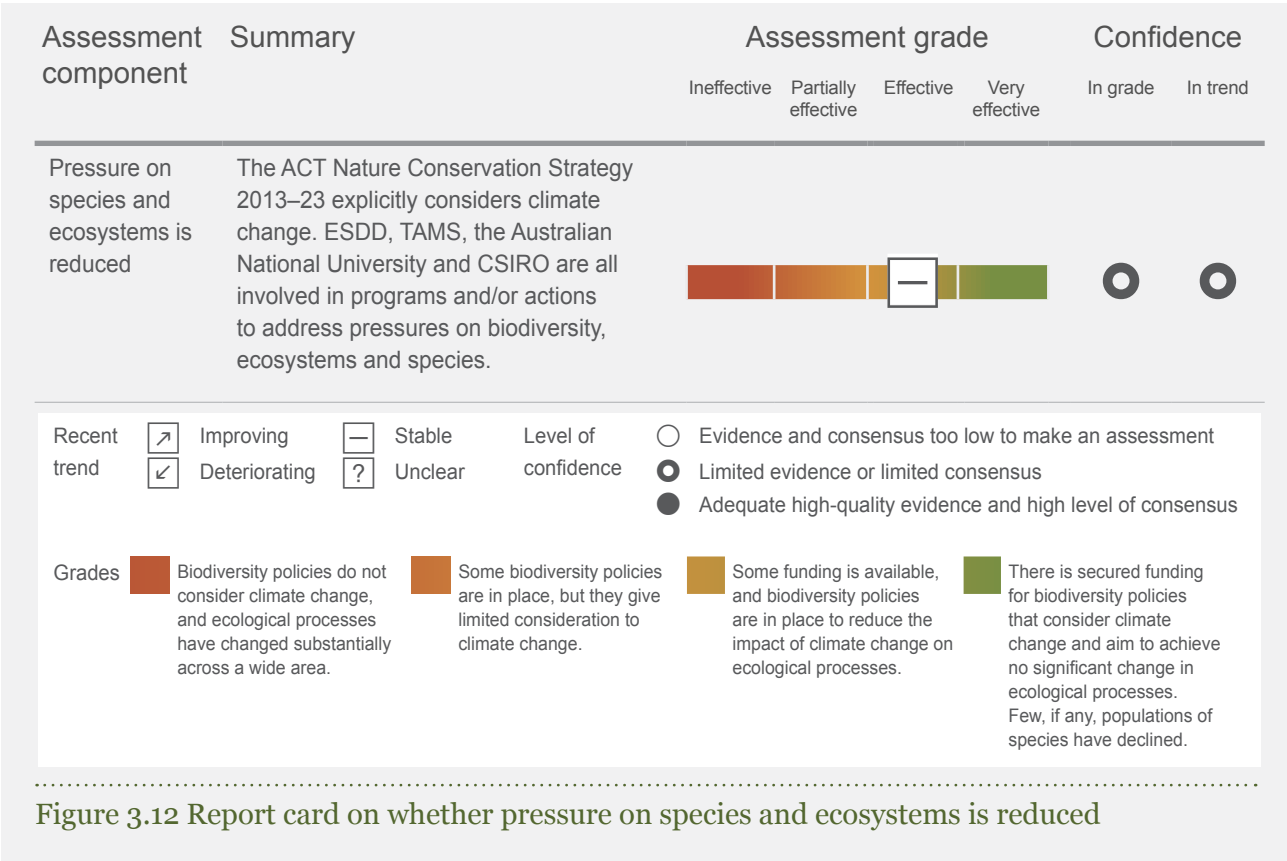
Pressure on species and ecosystems is reduced

The ACT Nature Conservation Strategy 2013–23 explicitly considers climate change, with a vision for ‘biodiversity-rich, resilient landscapes stretching from the inner city to the mountains, where well-functioning ecosystems can meet the needs of people and the environment’ (EPD 2013). One of the outcomes related to this vision is that ‘landscapes are more resilient, including to climate change’ (EPD 2013).

The ESDD, which undertakes a range of programs for nature conservation in the ACT, is considering using the

outputs of the NARcliM project in its work. At the time of writing, the ESDD had allocated resources to the use of NARcliM, but did not have funding allocated.

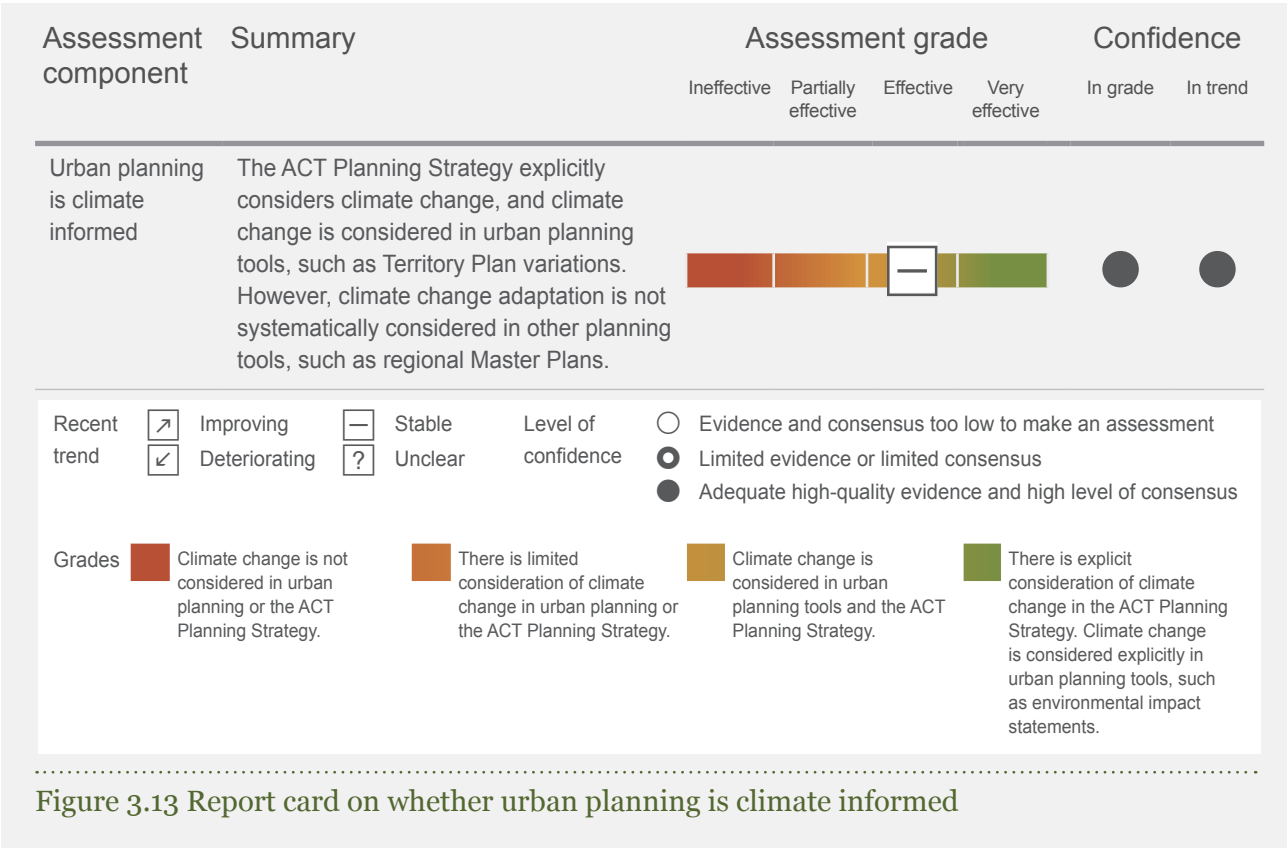
TAMS is implementing a number of actions to reduce existing pressure on ecosystems and species; this includes work on threatening processes (eg weeds, pests), connectivity of nature reserves and control of overabundant native species. There is also an agreement with the Australian National University and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) for innovation research in relation to ecosystem management.



Urban planning is climate informed

The ACT Planning Strategy explicitly considers climate change, and climate change is considered in urban planning tools, such as Territory Plan variations. The ACT Planning and Land Authority commissioned an investigation into the vulnerability of Canberra's

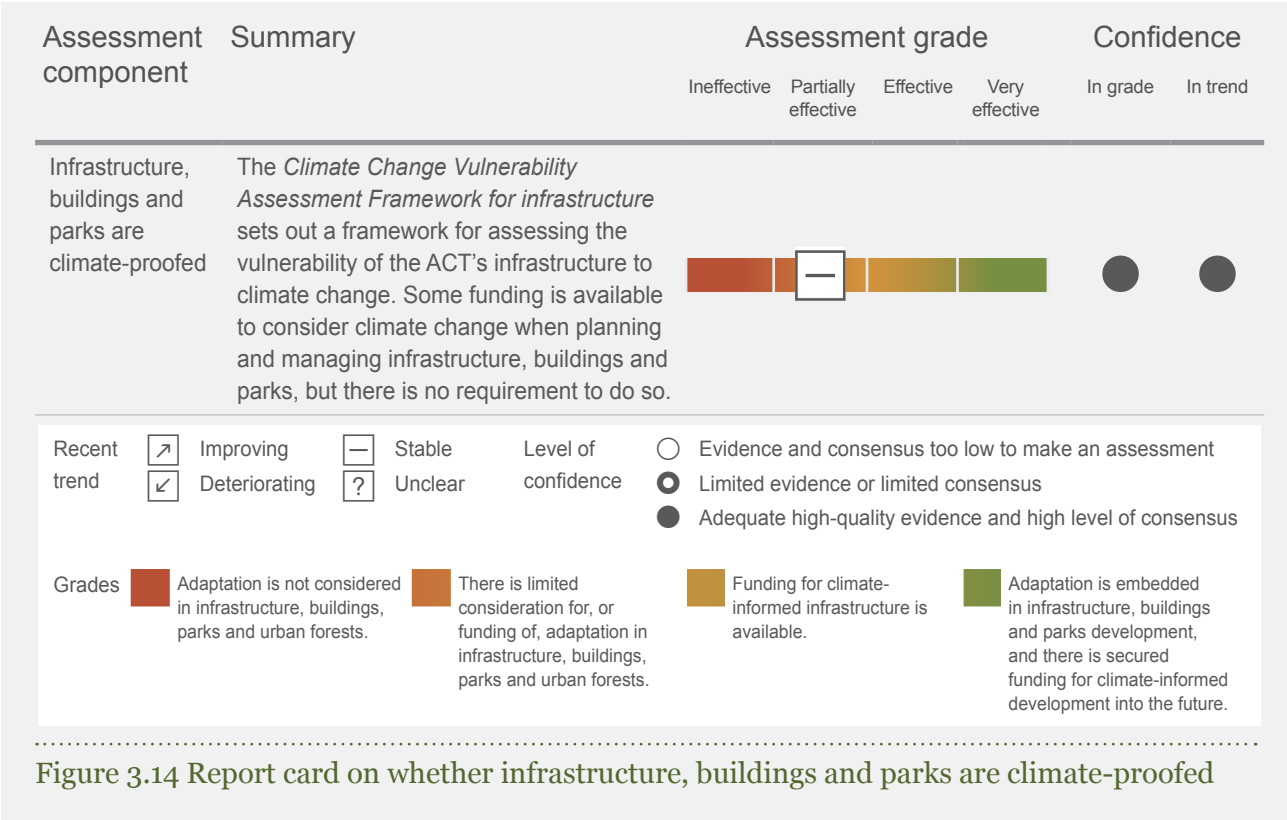
population to projected climate change, the outcome of which was *Human settlement vulnerability and adaptive capacity assessment: spatial plan evaluation* (ACT Government 2010). This aspect relates to planning policy. However, climate change adaptation is not systematically considered in other planning tools, such as regional master plans.



Infrastructure, buildings and parks are climate-proofed

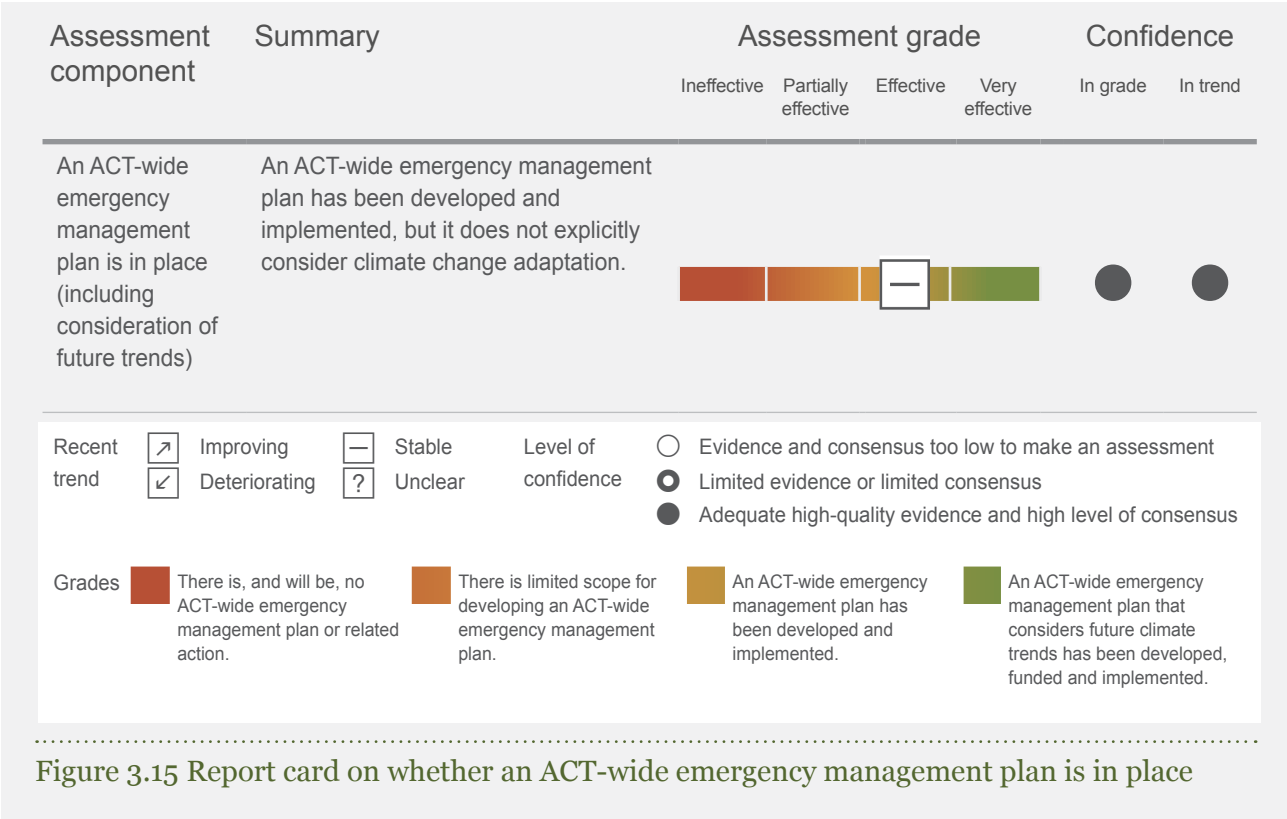
In August 2012, the Chief Minister and Cabinet Directorate commissioned the *Climate Change Vulnerability Assessment Framework for infrastructure* (CMD 2012). The paper sets out a framework for assessing the vulnerability of the ACT’s infrastructure to climate change. It should be noted, however, that the ACT standard for infrastructure is currently under review. The current standard does not consider climate change.

Limited funding has been allocated to embedding climate change considerations into planning and management of infrastructure, buildings and parks. For example, the ACT Government requires all environmental impact statements (EISs) produced in the ACT to explicitly consider climate change risk in their assessment. However, this is not a systematic method for climate-proofing buildings and infrastructure, because construction of a building does not often trigger an EIS; thus, there is no requirement to consider climate change.



An ACT-wide emergency management plan is in place (including consideration of future trends)

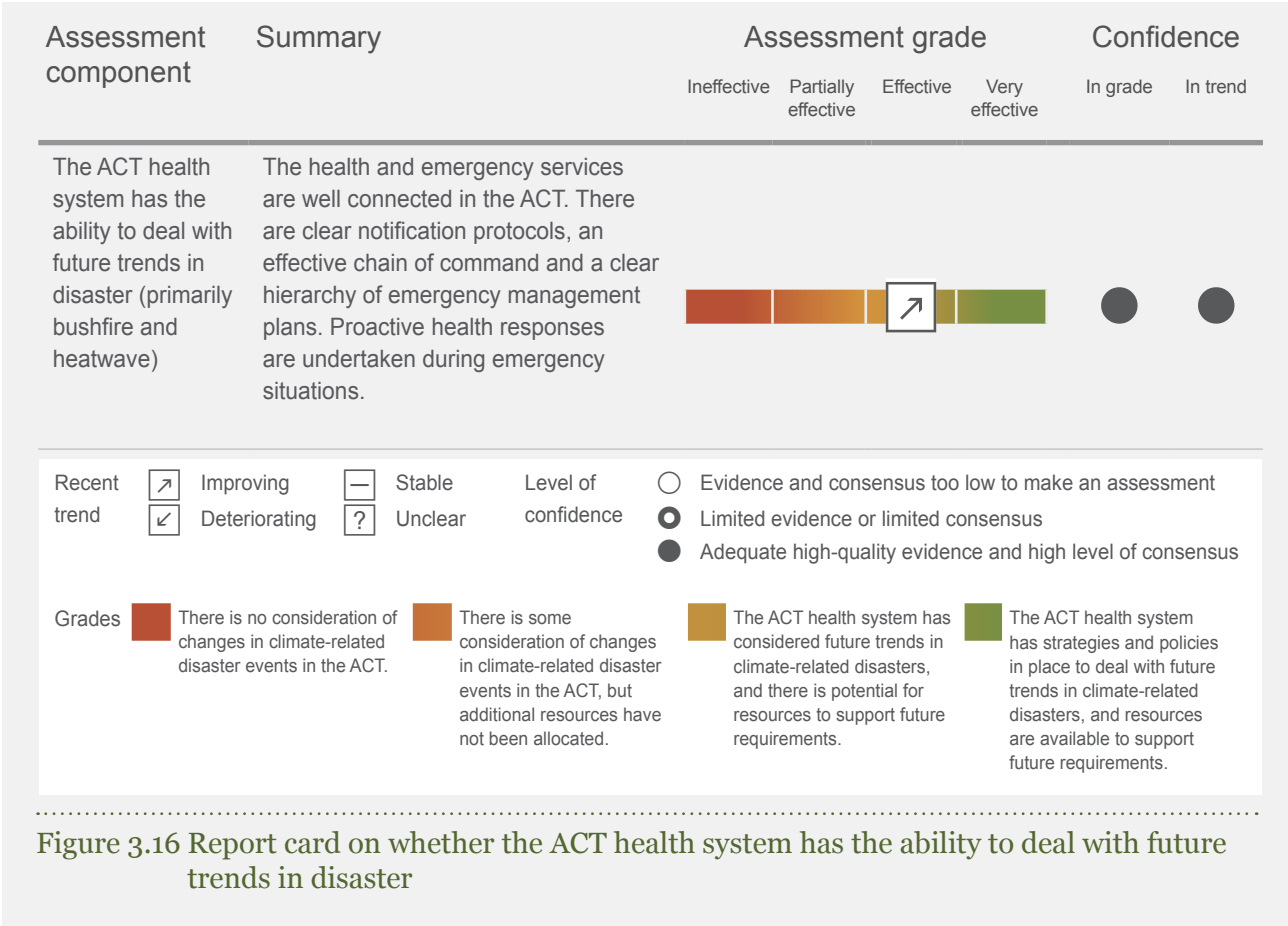
An ACT-wide emergency management plan has been developed and implemented; however, it does not explicitly consider climate change adaptation.



The ACT health system has the ability to deal with future trends in disaster (primarily bushfire and heatwave)

There are effective connections between health services and emergency services in the ACT. They include clear notification protocols, and an effective chain of command with clear roles and responsibilities

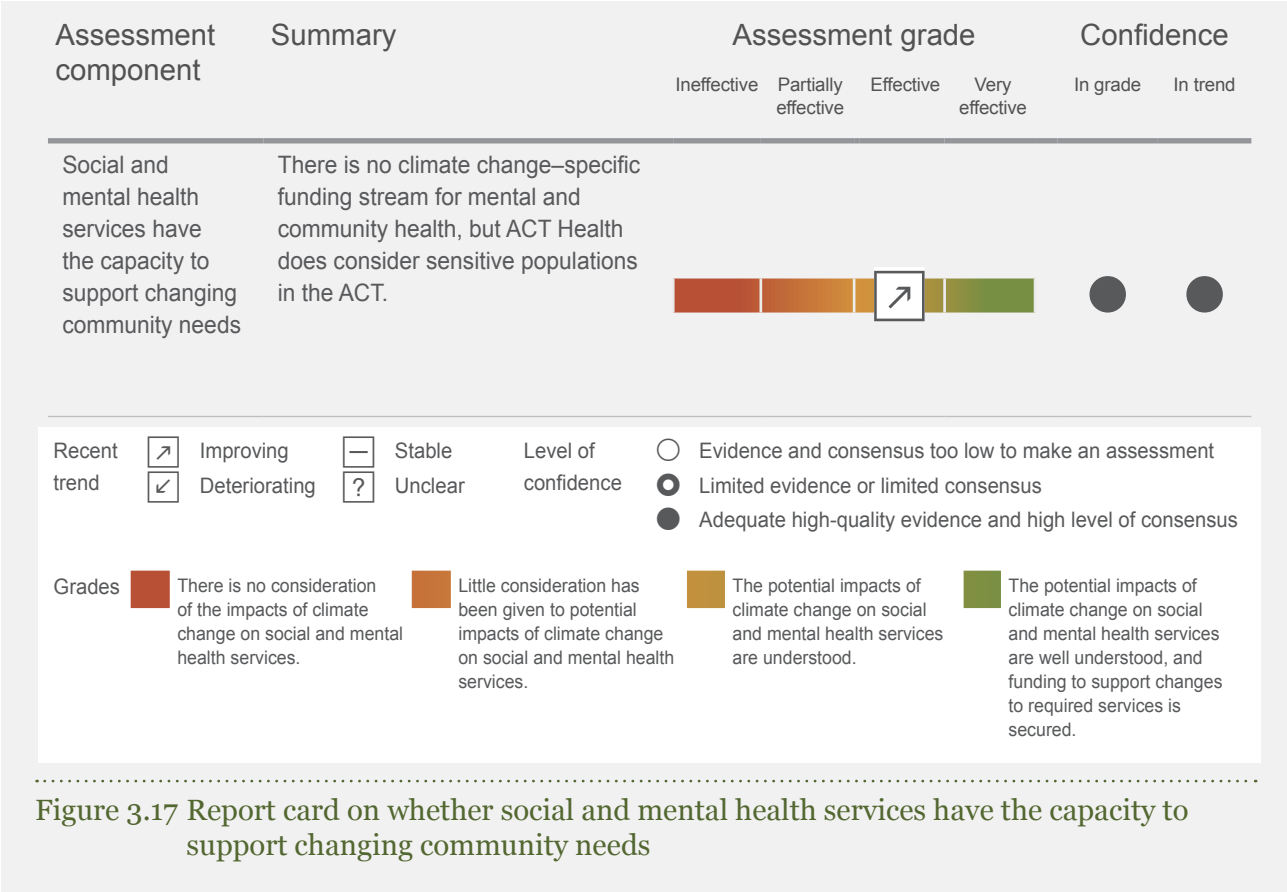
in relation to disaster response. There is a clear hierarchy of emergency management plans, which are triggered depending on the severity of the disaster emergency. In emergency situations such as a bushfire, proactive health responses, such as air quality monitoring and water testing, are undertaken.



Social and mental health services have the capacity to support changing community needs

In relation to climate change, there is no specific funding stream for mental and community health

in the ACT; rather, ACT Health considers sensitive populations in the ACT. The potential impacts of climate change on social and mental health services are not specifically considered for the ACT, but the health portfolio does use a holistic approach.



Opportunity

While the OCSE acknowledges that the ACT Government is integrating climate change adaptation across government through *Adapting to a changing climate: directions for the ACT* (ACT Government 2014), it is important that this strategy, once finalised and implemented, ensures that:

- mainstream adaptation responses are incorporated into existing policies or programs (including existing risk management strategies)
- there is integration across government (eg coordination of research priorities across government) and coordinated planning at a regional level to deal with place-based risks and ensure whole-of-government integration
- adaptation actions with co-benefits (where future climate risk is mitigated and other social, economic or environmental benefits are also delivered) are developed
- adaptation responses do not undermine emissions abatement efforts
- maladaptation is avoided, so that actions taken to avoid or reduce vulnerability to climate risks do not adversely affect, or increase the vulnerability of, other systems, sectors or social groups.







Chapter 4

How do the ACT's targets and actions stand against national and international developments?

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4 How do the ACT's targets and actions stand against national and international developments?

In 2013, the Intergovernmental Panel on Climate Change (IPCC) detailed, for the first time, the maximum amount of carbon emissions that can enter the atmosphere worldwide to limit temperature change. This global 'carbon budget' is around 1000 billion tonnes of carbon dioxide (CO₂) equivalents.

Cities are well positioned to drive local action to address climate change. However, climate change policies and actions need to be chosen to suit the state of the region and its people, depending on local climate risks, political environments, resources and capacity constraints.

In this chapter, the Australian Capital Territory's (ACT's) climate change policies and actions were compared with those of 14 Australian and 10 international cities. The analysis shows that the ACT is at least on par, and in some cases leading, other Australian and international cities in mitigating and adapting to climate change.

Against national and international targets, Canberra compares well with its proposed greenhouse gas (GHG) emissions reduction target of 40 per cent below 1990 levels by 2020. In comparison, the Australian Government has committed to an unconditional 5 per cent reduction in emissions on 1990 levels by 2020. Canberra's target aligns closely with many international cities.

Canberra is one of few cities that has a target of being carbon neutral. Of the cities used in this comparison, Canberra's target is set the furthest into the future (2060). However, the Carbon Neutral ACT Government Framework requires the ACT Government to be carbon neutral in its own operations by 2020.

Challenge

Scientific uncertainty poses significant challenges for climate change mitigation and adaptation policy makers.

The challenge for the ACT is to ensure that best practice, internationally recognised, reputable and robust science continues to underpin all climate change mitigation and adaptation actions and policies.

4.1 The role of the city

Cities consume two-thirds of the world's energy and create more than 70 per cent of global CO₂ emissions. In 2008, for the first time in history, more than half of the world's population was living in towns and cities. Cities are also at high risk from climate change and need to be prepared for the impacts of natural disasters. About half of the world's population lives within 60 kilometres of the sea, and three-quarters of cities are located on the coast. These populations are susceptible to the effects of climate change, including increased storms, fires and rising sea levels.

Individual cities are well positioned to play a leadership role in driving local action to address climate change. National governments are often focused on geopolitical issues, which can hamper cooperation. In contrast, cities – individually and collectively – are often in a better position to cooperate, and are often more effective at identifying and acting on the needs of residents. With closer proximity to the public, cities tend to be more pragmatic and concerned about the sustainability of day-to-day services than higher levels of government.

City residents can carry out globally influential actions. An example can be seen in the United States (US), where more than 1000 cities pledged for the US to

join the Kyoto Protocol and commit to lowering GHG emissions, even though the US Government of the time refused to sign the protocol (United States Conference of Mayors 2009).

Depending on the unique circumstances of each city – including local climate risks, political environments, resources and capacity constraints – different types of plans, policies and programs may be used. Some cities have stand-alone climate action plans in place, whereas others have mainstreamed climate change information into existing plans and policies; in some cases, cities have an emissions reduction target (ERT) in place. A number of cities have undertaken actions related to climate change in the absence of plans, such as the adoption of green building policies in San Jose, California (Wheeler 2008). This Implementation Status Report focuses on planning options and targets that are being implemented or are already in place in the Australian Capital Territory (ACT).

4.2 Methodology

To assess how the ACT's targets and actions stand against national and international developments, case studies and baseline data from international cities and jurisdictions similar to the ACT have been considered. The analysis compared territory targets and actions with:

- emerging trends and key concepts surrounding climate change from the current literature
- GHG emissions reduction and renewable energy targets of national and international jurisdictions
- adaptation policies, actions and legislative frameworks of national and international jurisdictions.

Comparing the ACT's targets with the targets of other jurisdictions is not a straightforward process, because some aspects of Canberra's targets are difficult to compare. Because of geographical, socioeconomic, and regional or climate challenges, it is difficult to identify a single city that is specifically comparable. In addition, differences of jurisdictional control are important when carrying out comparisons. For example, the City of Sydney only has jurisdictional power to reduce carbon emissions across councils; the City of Melbourne's target of zero net emissions by 2020 covers both council and municipality operations; and the ACT has established targets that are territory-wide, encompassing emissions reductions for both government and the public.

Selection of cities for this jurisdiction comparison was guided by the intention to provide a balance of cities considered to be 'best practice'. The selection was informed by knowledge of cities with active climate change plans, as well as targeted research. Cities appropriate for comparison were also identified through online sources such as the Global Carbon Project (2012), the C40 Cities Climate Leadership Group and the Australian Government Clean Energy Future (2013). Finally, only cities with policy documentation in English were chosen, as it was too difficult to assess other cities.

A total of 24 cities (14 Australian and 10 international) were assessed. Of these, four were used for specific jurisdictional comparisons with Canberra. The chosen cities and areas for analysis were:

- residential energy use: Canberra and Washington, DC (US)
- nonresidential energy use: Canberra and Washington, DC (US)
- transport: Washington, DC (US), Hobart and Canberra
- waste: Wellington (New Zealand), Zurich (Switzerland) and Canberra
- energy supply (specifically renewable energy targets): San Francisco (US), San Jose (US), California (US), United Kingdom (UK), London (UK), Munich (Germany) and Copenhagen (Denmark)
- adaptation: New South Wales, Victoria, South Australia, Tasmania, the UK, the US and New Zealand.

Cities were then assessed using the following criteria:

- the baseline year that is used for city ERTs
- the overall targets
- whether the city has developed sector-based ERTs
- whether the city has a carbon neutral target
- the scope or reach of the set targets – council-wide or city-wide
- how the city's ERTs are integrated into its surrounding region
- whether the city has been tracking emissions and whether it has a plan to continue doing so
- whether the city's ERT publications make reference to national or international targets or agreements
- whether the target is enshrined in legislation, and whether the legislation is local or national.

4.3 International efforts

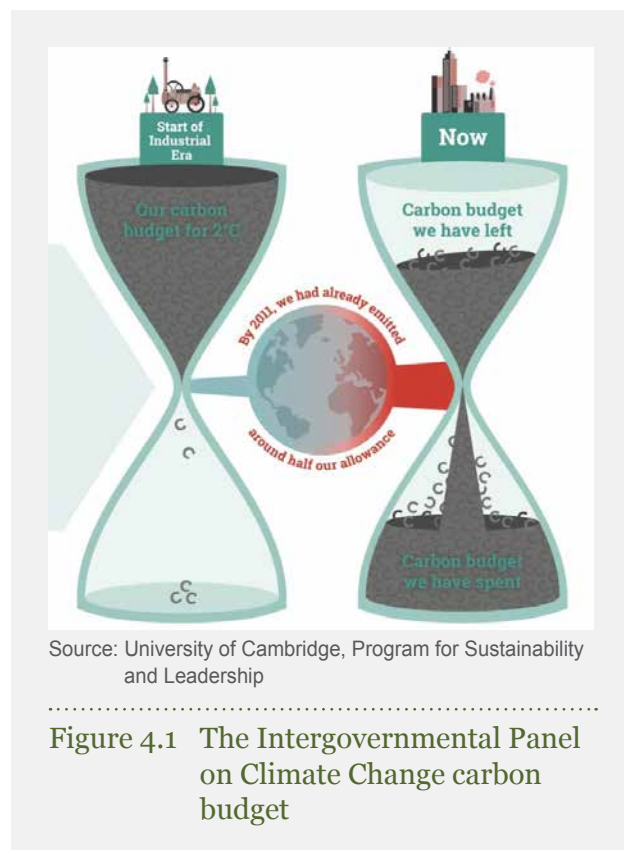
To set the scene for the city-level analysis, it is useful to look at what is happening internationally. Around the world, governments, individuals, businesses and industries are taking action against carbon pollution through a variety of measures.⁶ Governments around the world have agreed to limit carbon pollution in an effort to ensure that the average global temperature rise can be held below 2 °C above pre-industrial levels, which is broadly consistent with global concentrations of 450 parts per million of CO₂. Pre-industrial levels were 280 parts per million; recent data from the Mauna Loa observatory in Hawaii has shown that global CO₂ recently passed 400 parts per million.⁷ There is a need for urgent and critical action, and, reflecting this, some international investments in renewable energy alternatives have overtaken conventional high-pollution energy generation (UNFCCC 2013).

However, negotiating global agreements on climate change through the United Nations Framework Convention on Climate Change (UNFCCC) has proved difficult. Reports from the IPCC have been subject to dissent and controversy,⁸ and these reports have not changed current global behaviour.⁹ The 2011 Durban UNFCCC meeting presented a positive breakthrough for global climate change actions, which included the Durban Platform for Enhanced Action, with a work plan for 2012–15 and a second commitment period for the Kyoto Protocol. The work program also developed a new market mechanism in addition to the existing multilateral market mechanisms, and organised assistance for developing countries for climate change adaptation.

Discussions among multilateral, regional and local bodies outside the UNFCCC present opportunities to look for areas of agreement on practical climate change actions. The Major Economies Forum brings together most of the world's biggest economies. Members of the group account for around 80 per cent of global emissions and include the US, the UK, China, the Republic of Korea, India, Japan, Germany and Australia.

Carbon budgets

AR5 stresses the need to consider cumulative carbon emissions, rather than a yearly target, since global warming is almost directly (linearly) related to the amount of CO₂ accumulated in the atmosphere. This is the global 'carbon budget' (Figure 4.1).



The IPCC derives climate change projections by using climate models – quantitative methods that simulate how the world's atmosphere, oceans, land and ice will interact in the future. These models are constructed using a number of factors and assumptions, leading to varying degrees of uncertainty. In the previous IPCC report (AR4), six scenarios were used to model the impacts of human activity on carbon emissions and global warming. In AR5, the scientific community has defined a new set of scenarios called representative concentration pathways. These scenarios are designed to represent climate policies in the 21st century. The results of the pathways include annual GHG concentrations, from a global perspective, up to 2100.

For the carbon budgets proposed in AR5, there are varying levels of uncertainty in the amount of cumulative carbon to limit global temperature increase to 2 °C. The lower the carbon budget, the more likely it is that we can minimise the global temperature increase (according to the climate models).

⁶ For example, see www.environment.gov.au/cleanenergyfuture/.

⁷ <http://climate.nasa.gov/400ppmquotes/>

⁸ www.gulf-times.com/opinion/189/details/363739/new-drive-against-climate-change

⁹ www.technologyreview.com/news/518576/leaked-climate-report-a-reminder-of-technologys-failure

Table 4.1 describes the influence of three different global carbon budgets on limiting global temperature increase to 2 °C by 2100.

Table 4.1 Cumulative carbon emissions required to limit warming to 2 °C by 2100

Cumulative carbon emissions (from 1880) required to limit warming		Percentage carbon budget remaining (%)	Probability of limiting warming to less than 2 °C by 2100
GtC	GtCO ₂		
0–1570	0–5760	67	>35%
0–1210	0–4440	57	>50%
0–1000	0–3670	49	>66%

GtC = gigatonnes of carbon; GtCO₂ = gigatonnes of carbon dioxide

Note: The data provided above only consider carbon and carbon dioxide emissions, and do not consider other greenhouse gas emissions such as nitrogen dioxide. If other greenhouse gas emissions were considered, the carbon budget would be even lower (approximately 2900 GtCO₂ for >66% probability).

Source: IPCC (2013)

Currently, it is estimated that around 31 gigatonnes of CO₂ equivalents are emitted into the atmosphere each year. If this level of carbon emissions is sustained, the cumulative carbon budget will be spent by 2035 (under the scenario of >50 per cent probability of limiting global warming to 2 °C).

To limit global warming to 2 °C (under the >50 per cent probability scenario) would require cumulative global emissions reductions of around 4 per cent each year until 2100.¹⁰ At this rate, a carbon reduction of around 30 per cent by 2020 would be achieved (compared with current levels).

It should be noted that, although the carbon budget analogy is useful to simplify the science, it does have limitations. In particular, the concept of a budget implies that carbon emissions may be continuously produced, as long as the budget is not overspent. In some ways, this could be considered as the worst-case scenario.

The carbon budget analogy also raises questions of appropriate share in the budget for each country. Determining this proportional share raises a number of

issues, such as equity, population, economy, emissions intensity, and emissions produced and actions taken to date.

Australia has high per-capita carbon emissions compared with other nations; in 2010, Australia was twelfth highest for tonnes of carbon emissions per capita, at 16.9, compared with China at 6.2. Therefore, if the carbon budget were to be apportioned on an emissions-per-capita basis, the ACT would need to reduce emissions at an even faster rate than currently targeted.

There are difficulties in determining a fair basis for apportioning the carbon budget. Appropriate apportioning would need to consider all of the issues, and it would be politically difficult to obtain agreement across a range of countries. In the latest climate talks at the Warsaw Climate Change Conference in 2013, under the UNFCCC, there was no mention of apportioning the carbon budget to countries.

4.4 Comparison of ACT targets nationally and internationally

The ACT Government has legislated ERTs of 40 per cent from 1990 levels by 2020, and net carbon neutrality by 2060. Carbon neutrality means that the net emissions associated with an organisation's activities are equal to zero.

When compared with national-level commitments, Canberra's proposed targets are on par. Australia has only committed to an unconditional 5 per cent reduction in emissions on 1990 levels by 2020. As a member of the Copenhagen Accord, Australia has submitted a range of ERTs that are conditional on the extent of international action.

Australian context

Australia's capital cities have all committed to ERTs that exceed the national target under the UNFCCC agreement. The capital cities vary considerably in individual commitments; most have targets that are set within the next three decades, but some have far-reaching, multistaged targets.

The majority of Australian cities used in this comparison have not developed ERTs. Instead, many have sustainability strategies or more general city plans that are in various stages of development. These range from discrete projects addressing individual issues to strategies that encompass many aspects of the

¹⁰ This is a simplistic carbon calculation, and assumes that the current 31 gigatonnes of carbon dioxide being emitted each year does not increase.

city's functions. Figure 4.2 shows the breakdown of Australian city ERTs by type.

The ACT in the national context

Judging the ACT's targets against the targets of other Australian cities is not a clear-cut process. Some aspects of the ACT's targets stand above the rest. For example, the ACT's 2050 commitment represents a long-term vision that is not apparent in the targets set by many other cities. The ACT's eventual goal of being carbon neutral is similarly progressive. Only Melbourne and Brisbane are similar in this regard, having set their own city-wide carbon neutral targets. The multistaged nature of the ACT's ERTs also sets it apart; the ACT is the only city to have three interim targets, rather than one final target, set along the path to carbon neutrality in 2060. Figure 4.3 illustrates the number of Australian cities that have ERTs, and breaks these targets down to council or city level.

Although Canberra shares the common target of being carbon neutral with two other Australian cities, its carbon neutral target is scheduled to be achieved 40 years after Melbourne's. This is seen in Figure 4.4, which shows the timeframe in which carbon neutrality is expected to be achieved for Brisbane, Melbourne and Canberra.

International context

Of the 10 international ERTs examined, all but one had city-wide targets. Washington, DC, was the only city with an emissions target. The overwhelming trend was for percentage ERT, rather than carbon neutrality.

Research shows that nations tend to be less progressive in adopting international climate change conventions and protocols than do their own cities. Many cities – even if their country is not party to any international agreements or conventions – still make reference to these agreements and use them as

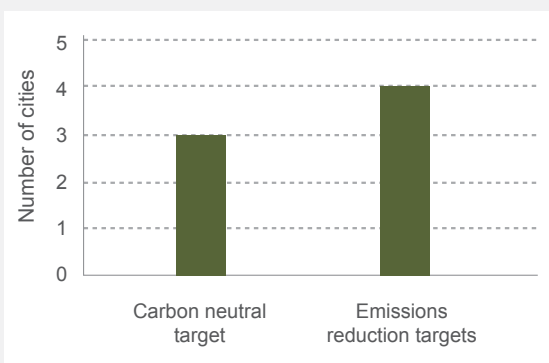


Figure 4.2 Australian city emissions reduction targets, by type

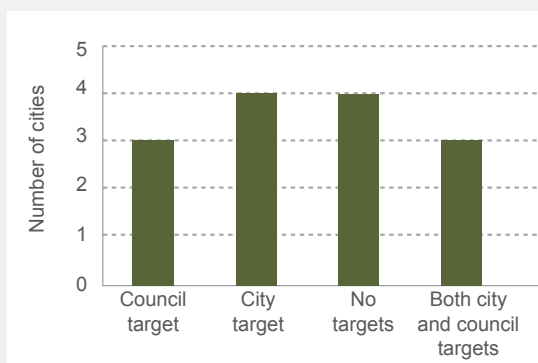


Figure 4.3 Australian city emissions reduction targets, by level

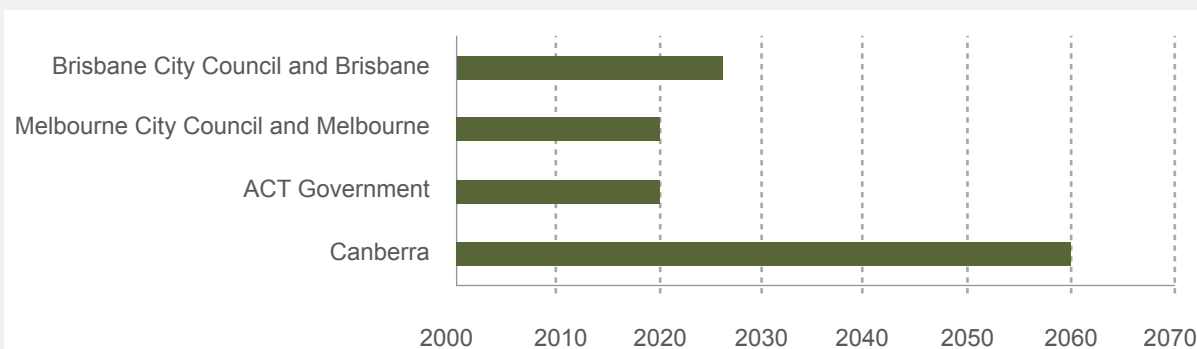


Figure 4.4 Carbon neutrality timeframes for Brisbane, Melbourne and Canberra

a basis for their own targets. For example, the US Northeast Regional Greenhouse Gas Initiative has aimed for a 45 per cent reduction in emissions by 2014,¹¹ aligned with European targets. In addition, Ottawa, Canada, has aligned its targets with the US target for 2020, against a 2005–06 baseline. Three cities in this comparison are members of the European Union, which has a minimum target of 20 per cent by 2020 against 1990 levels. Berlin and Freiburg (Germany), and Copenhagen (Denmark) are all subject to the European Union's UNFCCC agreement and have set targets that exceed the minimum requirements of this agreement.

There is also a practice of aligning with geographic or economic neighbours – for example, as Ottawa has done with the US. In the future, Ottawa's target will be aligned with the final economy-wide emissions target of the US in its enacted legislation. Similarly, Australia and New Zealand have set similar targets.

Among the 24 cities examined, the strongest trend relates to the way in which targets are constructed – formulated either as percentage-on-baseline or as carbon neutral targets. Zurich is a notable exception, being the only city to forego conventional targets. Instead, Zurich has developed its own 2000-watt society model,¹² based on an 'ideal' per-capita energy consumption derived from global averages, measured in watts. The project began as a pilot in the Basel region and was joined by Zurich in 2005¹³ (see Box 4.1).

The ACT in the international context

Canberra's targets align closely with many of the international cities' targets. Canberra's ERT of 40 per cent on 1990 levels by 2020 is similar to targets set by other cities for that year – Berlin (40 per cent ERT), Bradford (40 per cent ERT), Wellington (30 per cent ERT) and Durban, South Africa (27.6 per cent ERT). Canberra's 2050 target of 80 per cent also seems to find international resonance – Berlin has an 85 per cent ERT, and both Portland, US, and Wellington have an 80 per cent ERT.

Of all the cities in the comparison, Canberra has the target set furthest into the future, at 2060. Along with

Box 4.1 Case study: Zurich's 2000-watt society

Zurich, Switzerland, has taken a unique approach to setting targets. Rather than setting a percentage emissions reduction target, Zurich Council has set a target based on the core concept that there is such a thing as sufficient energy consumption.

In November 2008, the people of Zurich voted to place the 2000-watt society model into municipal code. The code commits the municipal council and the community to:

- reducing its energy consumption to 2000 watts (48 kilowatt-hours per day) per person
- reducing its annual CO₂ emissions to one tonne per person by 2050.

'The idea behind the 2000-watt society is that a 'lighter' life, which requires less energy instead of always consuming more, is not only an ecological necessity, but can also be a better life.' (Stadt Zurich 2011, p. 5).

Source: Stadt Zurich (2011)

Copenhagen, Melbourne and Seattle, Canberra is one of the few cities with a carbon neutral target. Under the supporting actions of AP2: *a new climate change strategy and action plan for the Australian Capital Territory's* (AP2), the Carbon Neutral ACT Government Framework details the implementation pathway to ACT Government carbon neutrality in its own operations by 2020.¹⁴

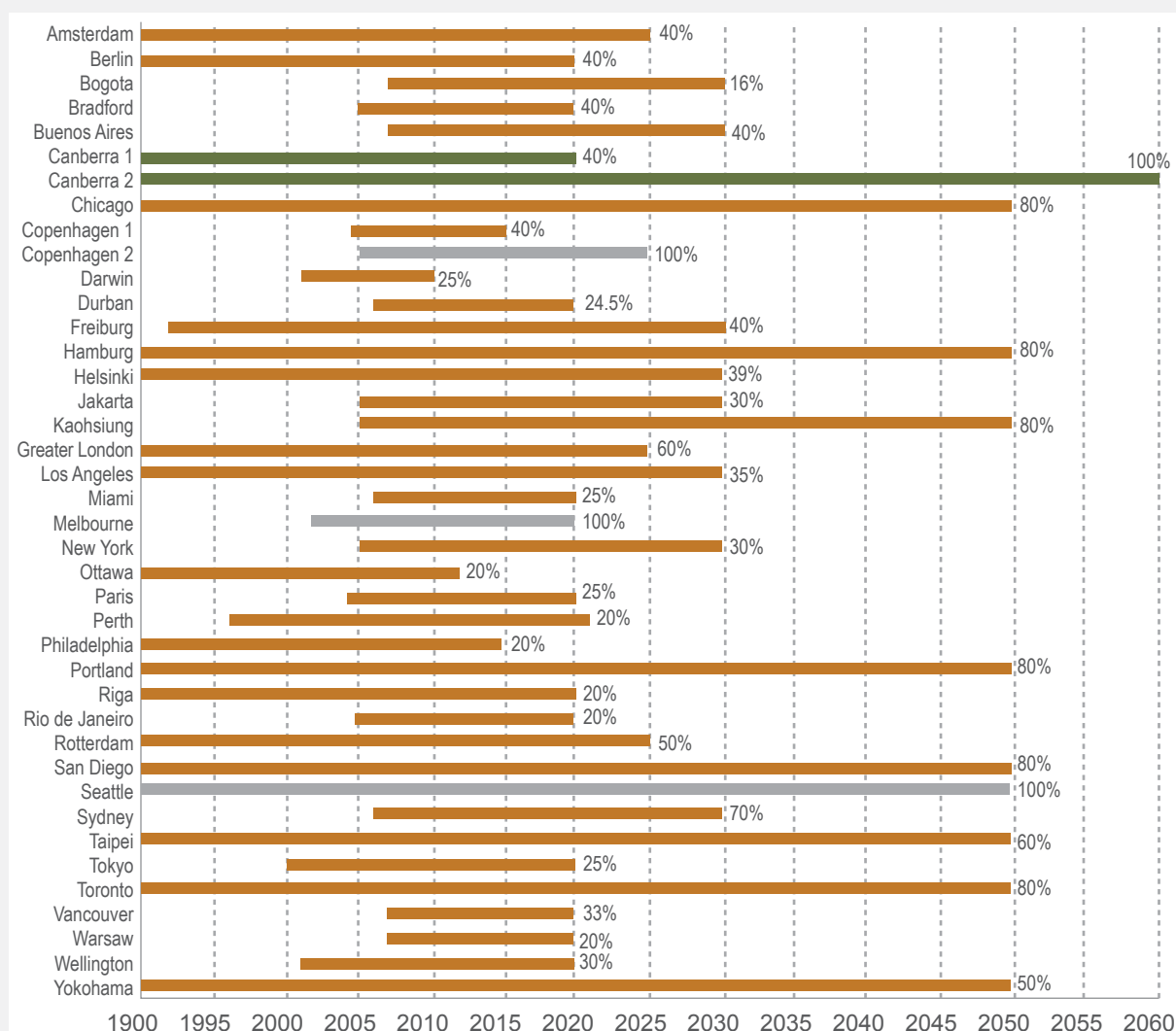
Figure 4.5 is an example of what cities are implementing around the world in relation to city-wide reduction targets. The ACT targets in AP2 and AP1 (*ACT Climate Change Strategy: weathering the change [Action Plan 1 2007–2011]*) are highlighted in green. Cities highlighted in red have targets of less than 100 per cent emissions reduction, and cities highlighted in blue have targets of 100 per cent emissions reduction.

11 <http://spectrum.ieee.org/energywise/energy/environment/us-northeast-sets-ambitious-carbon-reduction-goals>

12 www.stadt-zuerich.ch/2000-watt-society

13 [http://infoscience.epfl.ch/record/53527/files/\[LENI-ARTICLE-2004-026\].pdf?version=1](http://infoscience.epfl.ch/record/53527/files/[LENI-ARTICLE-2004-026].pdf?version=1)

14 www.environment.act.gov.au/cc/what-government-is-doing/act-government-operations



Notes:

1. Each bar shows the year the target was initiated and the year the target is set to be completed.
2. Percentages represent that city's emissions reduction target.
3. Copenhagen, like Canberra, has an interim emissions reduction target, which is 40% by 2015.

Source: Adapted from CDP (2013).

Figure 4.5 Global trends in city-wide emissions reduction targets

The Carbon Disclosure Project (CDP) has been established to help disclose environmental data in a global context. The CDP collects self-reported data from companies and cities on climate change and natural resources, such as water and forests. It provides a uniform reporting framework, allowing data to be easily reported and compared on an international scale. The data are used to improve the management of environmental risk, identify opportunities for climate change mitigation and adaptation, and make decisions that help us move towards a more sustainable world. The CDP compiles global city reports, carbon action reports and climate change reports by country.

In 2014, the ACT Government signed up to the CDP. It will begin reporting in line with CDP requirements in 2015.

A CDP report (CDP 2012) stated that 63 per cent of the 73 responding cities reported ERTs. Further, the report found that city governments with ERTs report three times as many emissions reduction activities as cities without targets. This suggests that, for cities, setting ERTs provides a strong catalyst for taking action.

All of the targets observed in the cities are dependent on emissions data. The observed variation in baseline years is partly a consequence of varying stages

of progression in the development of cities' ERTs. Before a target can be properly defined, the city must have conducted the requisite emissions monitoring to provide a baseline. Some cities that began this process later than others have had to use more recent baselines, as many only began emissions monitoring in the year or preceding year that eventually formed a baseline for their target. The baseline target year for the ACT is 1990.

Many cities have supplemented their overall target with sector-specific targets. The cities that have sector-specific targets have defined the sectors in similar ways. These sectors are usually a combination of, or a subtle variation on, the residential, nonresidential or commercial, council operations, transport and energy sectors.

Box 4.2 explains the carbon neutral certification achieved by Sydney and Melbourne.

Cities that have set council-only targets display a parallel trend. Many council ERTs focus on council and city buildings, vehicle fleets, street and traffic lights, water, waste, and recycling. In Australia and internationally, there is a moderate trend towards setting city-wide targets rather than limiting targets to council operations.

The cities that share the goal of carbon neutrality have a common approach to reaching their goals, by beginning with setting and achieving a carbon neutral target for council operations, with city-wide targets coming later.

The ACT Government is currently implementing the Carbon Neutral ACT Government Framework, with the aim of coordinating a whole-of-government approach to achieving carbon neutrality in a cost-effective manner by 2020.

Tracking and monitoring the city-wide targets in the selected cities reveals no single significant trend.

Box 4.2 Case study: carbon neutral Melbourne and Sydney

Both the City of Sydney and the City of Melbourne have achieved certification as carbon neutral under the National Carbon Offset Standard (NCOS) Carbon Neutral Program.

Melbourne

Melbourne has offset just over 44 000 tonnes of carbon, primarily through landfill gas projects:

- Included – emissions from all activities where the city has full operational control to implement policies. The emissions inventory includes direct emissions sources (scope 1), emissions from purchased energy (scope 2) and emissions from other measurable indirect sources (scope 3) material to the city's operations.
- Excluded – waste, diesel fuel (backup power generators), purchased goods and services (associated with animal management, artist/speaker travel, security services, coin collection, and aged and disability services), upstream transport and distribution, business travel, and employee commuting.

Sydney

Sydney has offset 210 000 tonnes of carbon:

- Included – emissions resulting from energy used where the city is the asset owner or service provider, or is liable to pay for the energy; emissions sources deemed to be within the city's organisation boundary, including all scope 1 and scope 2 emissions, and many scope 3 emissions sources (including from business travel, waste and paper use as required under the NCOS).
- Exclusions – similar to Melbourne; mainly scope 3 emissions. Additional exclusions are transportation of waste, waste generated in operations, domestic waste, transportation of purchased materials, outsourced activities, impact of equipment, consumables, repairs, maintenance and communications, events (except New Year's Eve), rail, public transport and freight, embodied energy of road and building materials, and personal and corporate emissions of ratepayers and businesses.

4.5 Jurisdictional comparisons across sectors

When comparing AP2 with other jurisdictions, it is useful to look at the action sectors that AP2 addresses.

Approaches to residential emissions are largely similar between city action plans. However, approaches for reducing nonresidential emissions vary significantly as a result of differences in the make-up of these emissions. Transport is a basic element in many cities' climate change action plans, as it is in Canberra. Most strategies and action plans address waste, although the extent of actions varies.

The ACT methodology around the renewable energy target appears to be unique. This is likely to be a result of the existing territory and national renewable energy schemes, and the interconnected nature of the national energy market. Certain aspects of targets and methodologies from overseas could be replicated, but specific policy and technical features must be Australian based.

An important resource in global comparisons of cities' actions against climate change is the CDP, which the ACT is reporting through. This project allows effective decisions to be made based on a large dataset.

Analysis of the approaches of different cities around the world could be used to inform a set of recommendations for leveraging climate change action plans, GHG emissions reduction targets and, more generally, energy efficiency goals within ACT climate change policy.

Residential energy use

Residential emissions are a central element in many of the action plans examined, with the majority of cities addressing the issue as a distinct category within their plans. Many acknowledge that, despite being a central element of their strategy, residential emissions comprise only a small proportion of total emissions. Actions for this sector aim to improve the efficiency of residential housing by:

- improving existing housing stock through retrofitting measures
- setting more rigorous building standards and regulations for new buildings.

The ACT Government has established a set of outcomes, set out in the Sustainable Energy Policy, that relate to energy use within the residential sector.

The four prime objectives identified are:

- Outcome one – secure and affordable energy
- Outcome two – smarter use of energy
- Outcome three – cleaner energy
- Outcome four – growth in the clean economy.

The Sustainable Energy Policy has also been tied in with actions from AP2; AP2 actions 1–6 focus on reducing residential sector emissions.

Housing density was an issue of interest in many action plans. Several plans aim to increase housing density, while simultaneously improving connectivity with transport networks, similar to the ACT City Plan¹⁵ and the Transport for Canberra policy (ESDD 2012c).

Residential strategies also often aim to increase the availability of affordable housing, and emphasise urban design accessibility to services and amenities for residents. Urban designs centred on these goals resulted in improved outcomes for city populations, particularly for disadvantaged demographics (eg older and younger people, people with disabilities and low-income people) – themes of affordability and social equality are inherently linked, and are often addressed simultaneously in action plans.

Comparison of Canberra and Washington, DC

This section compares residential energy use between Washington, DC, and Canberra. Although there are differences between the cities, they have enough similarities to enable a suitable comparison between their climate action plans:

- Both cities have high income compared with national averages, and are seats of government.¹⁶
- Both are planned cities, with average populations that are educated above national norms.
- Both are city-states.
- Washington has four distinct seasons like Canberra, meaning that there are weather impacts on residential emissions. In Washington, average winter temperatures are 1.4 °C (January), and average summer temperatures (July) are 27 °C.

¹⁵ www.cityplan.act.gov.au

¹⁶ <http://quickfacts.census.gov/qfd/states/11000.html>

- The populations are relatively comparable. Washington had a population of 602 323 in 2010,¹⁷ and the ACT as a city-state had a population of 358 600 as of 30 June 2010.
- In Washington, car use is the predominant mode of transport; the public system is underused.

In Washington, a climate action plan was drafted in 2010. This plan identified what the District of Columbia government, businesses and residents could do to establish a greener and more efficient city. It provides details of the city's GHG emissions inventory, the

emissions growth forecast, GHG emissions reduction targets, the climate action plan, government operations actions, community actions and other benefits of climate protection measures.

The Washington Government also produced a climate change adaptation plan. This plan includes a vulnerability assessment, and approach and adaptation items, which identify climatic indicators and their associated potential adaptation strategies.

Table 4.2 compares Canberra and Washington policies and actions around residential energy use.

Table 4.2 Comparison of Canberra and Washington, DC, policies and actions around residential energy use

Area	Canberra	Washington ^a
Policy	By 2015, the ACT Government will publish a Pathway to Zero Emissions Buildings policy covering residential and nonresidential building types. This policy will be informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013.	The Green Building Act, the Clean and Affordable Energy Act and the 2008 Construction Codes all have the goal of greening buildings. The private sector has taken this on board, and Washington now has more Leadership in Energy and Environmental Design and Energy Star-certified buildings than similar-sized US cities.
Public housing retrofits	Subject to a regulatory impact assessment, the ACT Government will introduce legislation to require landlords to provide information to tenants on the energy efficiency of homes and fixed appliances, and major energy uses. Regulatory impact assessment and stakeholder consultation will be completed in 2013.	The District of Columbia Housing Authority has undertaken a campaign to improve the energy efficiency of 8000 residential units. The following have been updated: <ul style="list-style-type: none"> • energy-efficient boilers and chillers • low-flow shower heads and faucets • replacing and restoring windows • energy star appliances • high-efficiency lighting.
Community engagement	The ACT Government will continue to build on the experience of its successful ACTSmart programs to develop a comprehensive strategy to engage the community on climate change matters, and provide integrated information, advice and support to Canberra households on reducing energy bills and cutting emissions. This will be guided by a community engagement strategy to be published in early 2013.	The district government will convene public forums to engage community members, businesses and institutions.

a Source: http://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/ClimateOfOpportunity_web.pdf

¹⁷ Two different figures on the population of Washington, DC, were quoted on census sites; we have used the most quoted figure.

Nonresidential energy use

Approaches to residential emissions are largely similar between city action plans; however, approaches for reducing nonresidential emissions vary significantly. This is due to the large differences in the make-up of nonresidential emissions between different cities. As a result, there is an equally diverse variation in the actions taken to address those emissions.

The Energy Information Administration (EIA) has predicted that, by 2040, world energy consumption will increase by up to 56 per cent on current usage rates (EIA 2013). At present, renewable energy and nuclear power are the world's fastest-growing energy sources, each increasing by 2.5 per cent per year. However, using the EIA's modelling, fossil fuels will continue to supply almost 80 per cent of the world's energy use until 2040.

Natural gas is the fastest-growing fossil fuel in the EIA outlook. Global natural gas consumption will increase by 1.7 per cent per year. Increasing supplies of tight gas, shale gas and coal-bed methane will support the growth in projected worldwide natural gas use. Coal use is growing faster than petroleum and other liquid fuel use, and will continue to do so until after 2030; this is mostly attributed to increases in China's coal consumption, and tepid growth in liquids demand due to slow growth in the Organisation for Economic Co-operation and Development regions and high, sustained oil prices.

The industrial sector will continue to account for the largest share of delivered energy consumption; the world industrial sector will still consume more than half of the globally delivered energy in 2040. Given current policies and regulations limiting fossil fuel use, worldwide energy-related CO₂ emissions will rise from

about 31 billion metric tons in 2010 to 36 billion metric tons in 2020, and then to 45 billion metric tons in 2040 – a 46 per cent increase from 2010 levels (EIA 2013).

Comparison of Canberra and Washington, DC

Both Canberra and Washington, DC, are service-based economies with a large proportion of the workforce employed in government roles. In both cities, publicly owned and managed buildings account for a significant proportion of overall emissions, and developing actions to reduce emissions from these sources is a priority area.

Washington's action plan specifies building-related actions as part of a 'government operations' section, while Canberra has incorporated government building actions into its 'nonresidential' section. Canberra's approach in this area is characteristically that of the regulator and facilitator, with few actions having a direct physical outcome in the form of infrastructure. Canberra's AP2 has proposed actions such as expanding the Energy Efficiency Improvement Scheme and providing consultation services through ACTSmart to businesses wishing to undertake their own energy efficiency improvements.

In contrast, Washington has initiated a number of projects that will bring significant changes to operations within government buildings and to government purchasing of services – that is, Washington's action plan dictates a consumer and provider role for the municipality. The 50 per cent Renewable Energy Contract and the Public Housing Retrofit program are examples of these governance roles.

Table 4.3 compares Canberra and Washington policies and actions around nonresidential energy use.



Table 4.3 Comparison of Canberra and Washington, DC, policies and actions around nonresidential energy use

Area	Canberra	Washington ^a
Encouraging action	<p>The ACT Government will complete a regulatory impact assessment by the end of 2012 considering the impacts and opportunities for extending the Energy Efficiency Improvement Scheme to include fuller business participation.</p> <p>The ACT Government will establish ACTSmart Energy Advice to provide up-to-date practical advice and support to small and medium-sized businesses, community groups and representative organisations.</p>	A redirection of fees is used to fund a Sustainable Energy Trust Fund. This fund will be used to promote energy efficiency projects aimed at energy efficiency, renewable energy generation and peak load management.
Business district action	The ACT Government will survey buildings in major commercial districts to develop a map of heating and cooling loads across the territory, to facilitate private investment in low-carbon energy networks. The government will look for opportunities to streamline regulatory processes through its review of the <i>Utilities Act 2000</i> .	Washington has introduced cool, reflective roofing on some buildings. This roofing reduces the need for energy to cool the building and can also reduce the urban heat island effect.
Improving energy efficiency	The ACT Energy Efficiency Improvement Scheme started on 1 January 2013; it sets a territory-wide energy savings target and includes obligations for ACT electricity retailers to meet an individual retailer energy savings obligation.	A Federal Executive Order requires all federal agency buildings to have a minimum reduction of 30% energy intensity by 2015. There is also a target of a 16% reduction in water consumption.

^a Source: http://ddoe.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/ClimateOfOpportunity_web.pdf

Transport

Transport is considered a foundational element in many cities' climate change action plans. Action plans detailing transport strategies generally acknowledge the role that transport plays in reducing emissions and realising sustainability objectives. Particular emphasis has been given to the multifaceted role of transport strategies in supporting economic, social and environmental development within cities.

Most cities have proposed transport strategies that aim to promote the use of, and to develop infrastructure for, 'green' transport options such as mass transit, and 'active' transport methods such as walking and cycling. Such strategies are also broadly considered as measures to improve social equity by increasing accessibility to transport for people with disabilities, older people and children. Promoting green transport is intended to reduce car dependency and traffic congestion, and to reduce pressure on infrastructure that will be increasingly under strain as urban populations and population density increase.

Improvements in green transport are complemented by:

- strategies to incentivise the use of mass and active transit options (discouraging car use through demand management strategies)

- policies such as congestion pricing
- introducing pedestrian-only boulevards and streets in central business areas, and priority lanes for buses.

Transport is a major source of GHG emissions in the ACT, producing approximately 22 per cent of the territory's total emissions (ESDD 2012a).

Comparison of Canberra, Hobart and Washington, DC

Global transport trends indicate that roads still account for approximately 80 per cent of global passenger transport and 50 per cent of freight transport.¹⁸ This has required policies to be produced that target reductions in transport emissions.

The cities compared here were chosen for similarities in population, geographic size and transport emissions profiles. It is beyond the scope of this analysis to compare entire transport strategies; however, the goals of the Canberra, Hobart and Washington, DC, plans have been included in Table 4.4 to provide an indication of likely actions.

¹⁸ www.comcec.org/UserFiles/File/ulastirma/COMCEC-drwalid-present-final.pdf

Table 4.4 Comparison of Canberra, Hobart and Washington, DC, policies and actions around transport

Canberra	Hobart	Washington
<p>Key strategic goals are to:</p> <ul style="list-style-type: none"> • provide an integrated transport system • promote active travel • have an efficient and cost-effective system • have a system that is accessible and socially inclusive • promote sustainability and safety. 	<p>Key strategic goals are to:</p> <ul style="list-style-type: none"> • provide high-quality sustainable transport infrastructure • educate council staff, residents and visitors about sustainable transport for Hobart • increase the take-up of sustainable transport options and arrest the growth of vehicle numbers on key arterial roads • manage parking supply to promote and support sustainable transport • promote integrated land use and transport planning • create an appropriate forum for Greater Hobart councils to pursue sustainable transport opportunities • pursue policy and institutional reforms within the council and the Tasmanian Government. 	<p>Key strategic goals are focused strongly on district council staff and operations.</p>
<p>Key actions are to:</p> <ul style="list-style-type: none"> • implement the Transport for Canberra policy • develop a Low Emissions Vehicle Strategy • develop a Green Vehicle Duty Scheme. 	<p>Key actions are to:</p> <ul style="list-style-type: none"> • implement recommendations from the council's Sustainable Transport Strategy, when finalised, to complement the strategic framework – Hobart's Climate Change Strategies × 5. 	<p>Key actions are to:</p> <ul style="list-style-type: none"> • provide district government employee commuting benefits, such as transit incentives, flexible work schedules, virtual meetings/work-from-home options, carpools/vanpools, improved bicycle access and parking, and other measures to provide attractive alternatives to single-car-occupant driving and parking. District agencies will continue to choose locations that are near mass transit • promote the employee car-sharing program; the district can further help by contributing start-up funds, assisting in promotion and providing increased free parking spaces • expand electric vehicle usage; the district government will pilot and expand use of electric vehicles and development of electric charging infrastructure • right-size the metropolitan police department cruiser fleet; the police department operates the largest fleet in the district government. Right-sizing includes replacing V8-powered cruisers with more fuel-efficient V6-powered models and with more fuel-efficient models in future years.

Waste

Most strategies and action plans address waste, although the extent of actions varies. Waste typically constitutes 1–3 per cent of a city's emissions profile. In the ACT, 'the waste sector generated just over 124 kt CO_{2-e} [kilotonnes of carbon dioxide equivalents] in 2009, or around 3 per cent of the territory's greenhouse gas emissions' (ESDD 2011a, p. 36), and this figure appears to be rising.

Waste appears to contribute a relatively small, although not insignificant, percentage of total city emissions, but waste sites are geographically concentrated and so more easily managed than other nonpoint source emissions.

Some city plans propose actions that focus on using waste as a resource, and transforming emissions

into energy through emissions capture. For example, methane can be captured from bioreactors and physical waste, and turned into energy that can be used to run plants that recycle glass, paper and rubber. Less ambitious plans aim to reduce environmental impacts associated with dump sites, and to improve collection and handling processes for waste.

Comparison of Canberra, Wellington and Zurich

Population and income are the key drivers of consumption and waste, and therefore emissions from waste in cities. Canberra, Wellington and Zurich all have high incomes relative to their country's average. Populations are also similar: Canberra, 379 554; Wellington City, 179 466 (Greater Wellington area, 364 128); and Zurich, 379 915 (as of December 2012).

Table 4.5 compares the policies and actions around waste of these three cities.

Table 4.5 Comparison of Canberra, Wellington and Zurich policies and actions around waste

Canberra	Wellington	Zurich
<p>Goals:</p> <ul style="list-style-type: none"> • ACT waste sector is carbon neutral by 2020. • Energy generated from waste is doubled by 2020. • Waste resources are recovered for carbon sequestration by 2020. 	<p>A partnership with Todd Energy has been established in relation to renewable electricity generation.</p>	<p>Waste does not feature strongly in the climate strategy.</p>
<p>Key actions from AP2:</p> <ul style="list-style-type: none"> • The ACT Government will implement the ACT Waste Management Strategy 2011–2025 (Action 11). • A focus on Outcome four; in particular: <ul style="list-style-type: none"> - capture methane from landfills - minimise organic waste to landfills - expand bioenergy generation and investigate new energy-from-waste technologies to generate energy - increase recycling to avoid greenhouse gas emissions - ensure energy-efficient waste collection and transport solutions. 	<p>Key actions are to:</p> <ul style="list-style-type: none"> • implement a garden-waste composting operation for the city's organic waste, and compost food-waste collection service to supermarkets, restaurants and cafes in the central city • build a landfill gas-to-electricity plant that collects methane to supply energy to about 1000 households • establish a household and public place recycling program • examine the potential for using new technology to convert sewage sludge into energy • advocate for product stewardship schemes • work under national legislation to develop new waste projects through a collaborative regional approach. 	<p>Key actions:</p> <ul style="list-style-type: none"> • Zurich incinerates waste in combined heat and power plants, with the waste providing heating for nearly one-fifth of the city. • A recycling tram collects bulky objects in the neighbourhoods, and the city ensures that the intensely used lakeshore parks remain clean.

AP2 = AP2: a new climate change strategy and action plan for the Australian Capital Territory

Energy supply

The *Climate Change and Greenhouse Gas Reduction Act 2010* sets a renewable energy target (RET) of 90 per cent in the ACT by 2020. To meet this target, AP2 sets out three actions that relate to RETs and climate change:

- Action 12: The ACT Government will, subject to an evaluation of the 40-megawatt solar auction and ongoing policy review, develop large-scale renewable energy generation capacity for the purposes of reducing emissions from electricity use and achieving the 2020 ERTs.
- Action 13: The ACT Government will determine a new renewable electricity consumption target of 90 per cent renewable by 2020 based on the strategic pathway set out in AP2 and, in 2013, publish a methodology for accounting for renewable energy consumption and reporting against this target.
- Action 14: The ACT Government will develop detailed mapping of the ACT electricity distribution network, providing up-to-date information on the capacity of feeders and substations to absorb additional renewable energy generation.

The Australian Government's RET is split into two parts: the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES). These schemes currently create a financial incentive for investment in renewable energy sources through the creation and sale of certificates. However, the Australian Government has now ordered a review of the current RET pledge of producing 20 per cent of power from renewable sources by 2020. In particular, the review will examine the operation, and costs and benefits of the *Renewable Energy (Electricity) Act 2000* and related legislation and regulations, and the RET scheme constituted by these instruments. Under existing law, the review is due in 2014, and is planned to be provided to government by the middle of the year to enable input into an energy white paper.

Renewable energy target comparisons

The analysis compared Canberra's RETs with those of other jurisdictions.

In New South Wales, the City of Sydney has the most closely related RET targets to the ACT's. Sydney's RET of 30 per cent by 2030 will be met through 60 per cent internal (within a 250-km radius of the city) and 40 per cent external renewable energy. Although the City of

Sydney's methodology is still in the formative stages, it is likely that the accounting methodology will include many of the features that are used by the ACT. This may include at least large-scale RETs and embedded generation.

Internationally, San Francisco and San Jose – both in California, US – have established ambitious targets to achieve 100 per cent renewable energy within the current decade.

In the UK, the Greater London Authority has set a RET of 25 per cent inside the existing municipal boundaries. This method avoids the need to determine grid renewable energy.

Munich and Copenhagen have established targets of 100 per cent renewable energy by 2025. However, these cities own a municipal utility that will offset local consumption through renewable energy, which may be produced either inside or outside municipal boundaries. Essentially, the renewable energy approach taken by both cities is similar to the operation of the LRET or GreenPower.

The international measurement methodologies fall into three categories:

- use of generation portfolios from vertically integrated retailers (California)
- restriction of target to embedded renewable energy (London)
- mandate for renewable energy offsets through a municipally owned utility (Munich and Copenhagen).

The latter two methodologies are significantly less complex than the methodology required for the ACT. In fact, they are each equivalent to one component of the ACT's methodology:

- 'Restriction of target to embedded renewable energy' is equivalent to the large-scale and small-scale embedded renewable electricity in the ACT.
- 'Mandate for renewable energy offsets through a municipally owned utility' is similar to the LRET and GreenPower schemes, for which ActewAGL Retail is liable.

The two approaches disregard electricity from the grid, and focus on sources of renewable energy that are easily controlled and measured.

The first methodology is of most relevance to the ACT. The Californian electricity market operates in a manner similar to the Australian national electricity market. However, the Californian market also benefits from a



retail market characteristic that is not present in the ACT: it is composed of a few large, vertically integrated retailers, which are mandated to report their generation sources to the Californian Public Utilities Commission. This allows the municipalities to produce an estimate of grid renewable energy.

The ACT's main retail electricity supplier is not vertically integrated, nor does it own significant renewable energy generation. Consequently, the vertical integration is not likely to be capable of providing the equivalent information, nor would this necessarily be representative of the electricity the ACT receives from the Australian national electricity market.

In these comparisons, the ACT methodology appears to be unique. This is likely to be a result of the existing territory and national renewable energy schemes, and the interconnected nature of the national energy market. Certain aspects of existing targets and methodologies can be replicated from overseas, but specific policy and technical features must be Australian based.

4.6 Adaptation

Adaptation to the consequences of climate change has been addressed by AP2 in three actions:

- Action 15: The ACT Government will assess the potential risks of climate change to community health, and territory life and property, including through acute weather and fire impacts in the ACT and the surrounding region, through a new ACT-wide risk assessment. This knowledge will be integrated into future health system planning, and natural disaster and emergency risk management and planning.
- Action 16: By the end of 2013, the ACT Government will publish a ministerial statement on how, from a whole-of-government perspective, the built environment and urban open spaces will be developed to respond to climate change and the ACT's long-term mitigation objectives. This will incorporate a review of the Territory Plan's development codes and design standards.
- Action 17: The ACT Government will continue to assess the potential impacts of climate change on ecological systems in the ACT and the surrounding region, and integrate this knowledge into environmental management and development planning decisions to ensure that our natural environment is conserved and enhanced.

In addition, the ACT is currently developing the ACT Climate Change Adaptation Strategy. The aim of the strategy is to make the city's infrastructure and community more resilient to a changing climate.

Climate change adaptation actions by other state or local governments

To assist the ACT in its development of new adaptation actions, Table 4.6 provides a short list of adaptation projects and actions undertaken by some governments in Australia.

Table 4.6 Examples of climate change adaptation actions

Type of climate change adaptation action	Climate change adaptation action
Climate change impact profiles	<p>A starting point for many state governments in adaptation planning is the development of regional climate change impact profiles. These profiles detail the extent of projected climate change impacts on the region, and some focus on sector-specific impacts.</p> <p>New South Wales (NSW). The NSW Government has undertaken an Impacts of Climate Change on Natural Hazards Profiles project, which provides an assessment of the exposure of a region to natural hazards (eg fire, wind, lightning, hail, flash flooding, riverine flooding, heatwaves, coastal erosion), with regard to future projections of climate change. (www.environment.nsw.gov.au/climateChange/naturalhazardprofiles.htm)</p> <p>Additionally, in 2013, the state government launched a \$2.75 million investment fund for research into actions for NSW to be better equipped to respond and adapt to a changing climate. The NSW Adaptation Research Hub is a collaboration with Climate Futures (Macquarie University), Sydney Institute of Marine Science and the Institute for Sustainable Futures (University of Technology, Sydney).</p> <p>Victoria. In 2008, Victoria launched a report that detailed climate change projections for Victoria as a state summary. These were generated from national climate change projections. (www.climatechange.vic.gov.au/__data/assets/pdf_file/0020/73172/DSEstatesummaryWEB.pdf)</p> <p>South Australia (SA). The SA Government has produced reports on the projected impacts of climate change for SA. These regional impact statements were launched in 2010 by the South Australian Research and Development Institute. (www.pir.sa.gov.au/regions/regional_impact_assessment)</p> <p>Tasmania. The Tasmanian Government undertook a Climate Futures of Tasmania project, which determines climate change projections at a local scale by downscaling global climate models. This work includes climate profiles for each of Tasmania's 29 local government areas. (www.dpac.tas.gov.au/divisions/climatechange/adapting/climate_futures)</p>
State government climate change adaptation plan	<p>A number of states have developed approaches or plans to climate change adaptation.</p> <p>Victoria. In 2013, Victoria launched its first Victorian Climate Change Adaptation Plan. The plan sets out a framework to manage climate risks for critical assets and services of the state government. (www.climatechange.vic.gov.au/adapting-to-climate-change/Victorian-Climate-Change-Adaptation-Plan)</p> <p>NSW. The NSW Government takes a sectoral approach, having a number of plans and strategies that specifically focus on climate change adaptation for a particular issue. These include plans for regional councils, heatwave planning, natural hazards profiling, biodiversity adaptation planning and planning through research.</p> <p>SA. The SA Government's Climate Change Adaptation Framework for South Australia outlines the roles that the government will play in implementing the framework. (www.sa.gov.au/topics/water-energy-and-environment/climate-change/adapting-to-climate-change/adapting-to-climate-change-in-south-australia)</p> <p>Tasmania. Tasmania is currently undertaking community consultation on adapting Tasmania to climate change. The government has released an issues paper and consultation report, and invited community feedback. (www.dpac.tas.gov.au/divisions/climatechange/adapting)</p>

continued

Table 4.6 *continued*

Type of climate change adaptation action	Climate change adaptation action
Local government climate change adaptation guides	<p>Two state governments (NSW and SA) have developed climate change adaptation guides for local government and industries, to assist the development of plans to assess vulnerability to climate change impacts. These are:</p> <ul style="list-style-type: none"> • NSW Office of Environment and Heritage (2013). <i>Guide to integrated regional vulnerability assessment (IRVA) for climate change</i>, OEH, Sydney. (www.environment.nsw.gov.au/resources/climatechange/130016IRVAguide.pdf) • Local Government Association of South Australia (2012). <i>Draft guideline for undertaking an integrated climate change vulnerability assessment</i>, LGA, Adelaide. (www.lga.sa.gov.au/page.aspx?c=25892)
Local government adaptation funding and plans	<p>Victoria. As part of the Victorian Climate Change Adaptation Plan, the government has created a Victorian Adaptation and Sustainability Partnership (made up of 79 councils) and established \$4.79 million in grants to support local government work in climate adaptation. (www.depi.vic.gov.au/__data/assets/pdf_file/0019/220681/Victorian-Adaptation-and-Sustainability-Partnership-Grants-2013-Recipients.pdf)</p> <p>NSW. The NSW Government has developed a guide to assist local government in adaptation planning. The government has also launched two specific programs:</p> <ul style="list-style-type: none"> • Integrated Regional Vulnerability Assessments for Regional Communities – involves a cross-government approach within regional areas, to assess potential climate change impacts on issues such as human health, major infrastructure, tourism and emergency services (www.environment.nsw.gov.au/climatechange/irvadescription.htm) • Towards a Resilient Sydney – assesses cross-sector vulnerability to climate change impacts for the metropolitan Sydney areas. The program has developed a number of NSW 2021 Regional Action Plans (www.2021.nsw.gov.au/regions). <p>SA. The state government guide has assisted the Yorke and Mid North Regional Alliance to undertake an integrated regional vulnerability assessment for its region. (www.sa.gov.au/topics/water-energy-and-environment/climate-change/adapting-to-climate-change/adapting-to-climate-change-in-south-australia)</p>
Heatwave planning	<p>A number of state governments, in response to record heatwaves, have developed heatwave planning guides and documents.</p> <p>NSW. The NSW Government has developed a campaign to provide information to the public on preparedness for extreme heat and heatwaves. (www.health.nsw.gov.au/environment/beattheheat/pages/default.aspx)</p> <p>National. The NCCARF and Monash University have undertaken research into the vulnerability of Australian state capital cities to heatwaves. The work has resulted in an interactive website – ‘Mapping heatwave vulnerability’ – which includes a mapping of vulnerability and emergency health outcomes for Canberra. (www.mappingvulnerabilityindex.com)</p>
Biodiversity adaptation planning	<p>NSW. The government has set priorities and a strategy to address climate change impacts on biodiversity. The strategy focuses on the protection of bioregions and species from projected impacts. (www.environment.nsw.gov.au/biodiversity/climatechange.htm)</p>
Assessment of vulnerability of government building assets	<p>Victoria. In 2012, Whitehorse City Council developed a framework for understanding the vulnerability of individual buildings to projected climatic changes to 2030 and 2070. The framework assesses buildings’ exposure and sensitivity to a particular change in climate, as well as the ability of council services to cope with the resulting impact. The work included:</p> <ul style="list-style-type: none"> • an adaptation action plan of priority capital works projects for the council to deliver • a toolbox of design measures to assist the council to climate-proof future buildings • a suite of adaptive management measures that can be incorporated into the council’s asset management processes.

NCCARF = National Climate Change Adaptation Research Facility



Comparison of New Zealand, the United Kingdom and the United States

Many countries have produced policy frameworks to address adaptation.

New Zealand

The New Zealand Government provides information to facilitate adaptation, including some guidance for local governments. At the national level, there is no formal legislative or policy framework for climate change adaptation, although environmental legislation does require local governments to have particular regard to the effects of climate change.

United Kingdom

The UK Government has adopted an explicit legislative framework to support adaptation. Under the *Climate Change Act 2008* (UK), the government must assess climate change risks and implement strategies to manage them. Each central government department has published an adaptation plan that explains its proposed actions to deal with a changing climate. The UK Climate Impacts Programme disseminates a range of information and guidance, and large utilities and their regulators are required to report on how they are addressing climate change risks. An Adaptation Sub-Committee has also been established to advise the UK Government on adaptation policy.

United States

At the federal level, the US Government provides climate-related research and information, and requires federal government agencies to implement strategies to manage climate change risks. In addition, some state and local governments have adopted adaptation policy frameworks and strategies, which often set out how climate change will be considered in infrastructure, planning and environmental decisions.

Opportunity

The ACT compares well with other Australian and international cities in mitigating and adapting to climate change. Against international targets, it also compares well in terms of GHG emissions reduction targets.

Continued application of a precautionary approach through the application of the most robust and current science is vital to ensuring the effectiveness of the ACT's climate change mitigation and adaptation actions and policies.

Use of best practice international tools and mechanisms, such as the Greenhouse Gas Protocol, as well as analysing the approaches of different cities, could be used to inform climate change action plans, GHG emissions reductions targets and, more generally, energy efficiency goals within ACT climate change policy.







Chapter 5

How does ACT planning take account of climate change?

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5 How does ACT planning take account of climate change?

The effects of urbanisation, development and climate change are converging in ways that seriously threaten the world's environment, and economic and social stability. Perhaps the most critical and holistic lens for viewing this complex convergence is planning.

For planners, responding to climate change presents a complex suite of challenges and opportunities, spanning social, environmental, political, economic, cultural and technical dimensions. Moreover, planners have to identify and examine potential conflicts and synergies between climate mitigation strategies and climate adaptation strategies. For example, in terms of mitigation, increasing urban density may help to reduce emissions from transport, but may have negative implications for adaptation, such as intensifying urban heat island effects and posing problems for urban drainage.

This chapter examines the Australian Capital Territory (ACT) planning system and processes to determine how they are contributing to climate change mitigation and adaptation.

Challenge

Planning provides an effective means for the design and management of climate change mitigation and adaptation measures.

To use planning for this purpose, climate change mitigation and adaptation needs to be systemically addressed and embedded in all urban planning decisions.

5.1 Methodology

The Office of the Commissioner for Sustainability and the Environment (OCSE) determined that the most constructive approach for the 2014 Implementation Status Report (ISR) would be to consider the ACT's planning system by assessing the statutory approvals process, and the extent to which this process addresses the ACT's climate and adaptation needs.

Therefore, a gap analysis framework was used to:

- assess the climate change vulnerabilities and risks associated with
 - conventional detached dwellings
 - a residential development to which an estate development plan (EDP) applies, noting that the EDP underpins individual dwelling assessments; the EDP received approval after the release of *AP2: a new climate change strategy and action plan for the Australian Capital Territory* (AP2)
 - a piece of infrastructure to which an environmental impact statement (EIS), under the *Planning and Development Act 2007*, applies; the infrastructure received approval after the release of AP2
- examine the statutory requirements that need to be addressed for each of the above development approvals and/or building approvals
- examine and assess the disparities between the climate change mitigation and adaptation risks and vulnerabilities and the statutory requirements
- identify how any gaps found could be addressed; the findings took into account governance, resource and financial constraints.

5.2 AP2 climate change mitigation and adaptation measures relevant to ACT planning

AP2 included six actions for the reduction of 218 000 tonnes of carbon dioxide equivalents in residential sector emissions. Only two of these actions are likely to be directly linked to the assessment of emissions savings achieved from reforms to building of new detached housing, and preparation of new EDPs and EISs associated with infrastructure provision:

- Action 2: Subject to a regulatory impact assessment, the ACT Government will introduce legislation to restrict the replacement and installation of high-emissions water heaters in houses and townhouses in gas-reticulated areas, and will investigate the expansion of emissions standards for hot water heaters to all new residential buildings by June 2014, with a view to introducing new standards in the 2015 revisions of the ACT building code if found to be cost-effective.
- Action 4: By 2015, the ACT Government will publish a 'pathway to zero emissions buildings' policy, informed by a regulatory impact assessment and stakeholder consultation to be undertaken from 2013, covering residential and nonresidential building types.

However, in relation to the development of new residential estates, AP2 also refers to the following:

- *Draft variation 306 to the Territory Plan* (DV306; ESDD 2011b) incorporates a number of important provisions for solar access. They include a requirement that residential blocks should be oriented and proportioned so that a house can be designed with daytime living areas facing north, to provide sunlit private open space. DV306 also provides that new developments should not unreasonably impact on a neighbour's access to sunlight.
- DV306 contains a new Estate Development Code with block compliance tables that indicate which blocks are considered to be 'complying', acknowledging that certain combinations of block size, slope and orientation are more likely to achieve solar-efficient house design.
- The provisions in DV306 (with some relatively minor changes) were incorporated in variation 306. Further amendments were later incorporated in the *Technical amendment to the Territory Plan variation 2013 – 12* (ESDD 2013b).

- Provisions incorporated in DV306 and the *Technical amendment to the Territory Plan variation 2013 – 12* were not specifically included in the list of actions identified as contributing to the AP2 sectoral targets for emissions reduction by 2020 (including the target for reducing residential sector emissions by 218 000 tonnes).

AP2 also includes a commitment by the ACT Government to work towards a high level of transparency and accountability through a new public reporting framework, including:

- more comprehensive online data reporting, with at least 90 per cent of emissions reported within six months of the end of each reporting year
- real-time or near real-time reporting of ACT electricity and gas consumption, and renewable energy generation at the territory- or network-area level.

ISRs, delivered by the OCSE, are included in the new reporting framework.

5.3 ACT planning system, statutory approval processes and building codes

ACT planning framework and legislation

The ACT's planning framework and planning processes are largely governed by the provisions of the *Planning and Development Act 2007*. Information relevant to climate change adaptation is summarised below.

The Territory Plan

The Territory Plan (ACT Government 2008) is the key statutory planning document in the ACT, providing the policy framework for the administration of planning. The purpose of the Territory Plan is to manage land-use change and development in a manner consistent with strategic directions set by the ACT Government and the Legislative Assembly.

The planning framework for the ACT includes a hierarchy of centres, with each town having a centre as a focal point for higher-order retail functions, commercial services, offices and community facilities. The nested hierarchy includes the Canberra central business district, town centres, group centres and local centres.

ACT Planning Strategy

The ACT Planning Strategy (ESDD 2012d), which was adopted by the ACT Government in June 2012, replaced the Canberra Spatial Plan (ACTPLA 2004). The strategy provides long-term planning policy and goals to promote orderly and sustainable development, consistent with the social, environmental and economic aspirations of the people.

The strategy reinforces the focus of the Canberra Spatial Plan to establish a more compact, sustainable city that uses its resources and infrastructure more efficiently. The strategy differs from the plan in that it identifies key areas for development and urban intensification that can deliver the social, economic and ecological benefits of a more compact city, while retaining much of the suburban fabric.

Transport for Canberra

The ACT Government released a new transport policy, Transport for Canberra (ESDD 2012c), in March 2012, which updated and replaced the 2004 Sustainable Transport Plan (ACT Government 2004) and complements the ACT Planning Strategy.

The focus is on creating a transport system that:

- is integrated with land-use planning
- makes active travel, such as walking and cycling, the easy way to get around
- provides sustainable travel options and reduces transport emissions
- is safe for moving people, for whichever mode of transport they choose
- is accessible for everybody, whatever their level of mobility at any time or place
- is efficient and cost-effective, providing value for money for government, businesses and the community by managing travel demand across the whole transport system.

Transport for Canberra also identifies journey-to-work targets, which include a target of 23 per cent of all trips to be via walking, cycling or public transport by 2016. To achieve this target, increased development within town centres and along major transport routes is seen as essential.

Planning provisions for the development of new urban land and housing

Planning for future urban areas in the ACT – for example, a new suburb – requires a range of spatial planning and structure planning tasks, which are then formally recognised through changes to the Territory Plan.

A structure plan sets out broad principles and policies for the development of a future urban area. The plan is typically at the district level, incorporating a number of suburbs. It may include information on environmental and heritage matters, future major infrastructure requirements, key features, zoning and residential densities. A structure plan may be accompanied by a strategic environmental assessment.

A concept plan then applies the principles and policies of a structure plan to identify the specific requirements that will apply to the future detailed planning and development of the suburb. The concept plan, through a variation to the Territory Plan, will become a Precinct Code in the Territory Plan. The Precinct Code guides the preparation, assessment and determination of the future development application for the land, which is presented as an EDP.

An EDP sets out the proposed subdivision pattern and associated infrastructure works for development of an estate in an urban area of the ACT. The EDP is assessed against the relevant parts of the Estate Development Code, and any applicable structure plan or Precinct Code. The policy initiatives contained in DV306 were based on commitments made by the ACT Government to improve solar performance of new housing (see Section 3.7).

Box 5.1 shows a case study of an EDP designed to provide for energy-efficient dwellings that take advantage of solar access, including through block orientation and the planting of deciduous trees in appropriate locations.

Box 5.1 Case study: estate development plan

This estate development plan (EDP) is part of a new development in the Molonglo Valley and was presented as a development application in early 2014. The development aimed to provide site subdivision and housing design that maximised adoption of passive sustainable design strategies and supported adoption of active sustainable technologies.

The EDP is for a 1.6-hectare multi-use site. Blocks will accommodate a mix of dwellings with 1–4 bedrooms. The compact blocks for detached dwellings range from 95 to 236 square metres. The multi-unit sites range from 283 to 342 square metres, and accommodate a mix of 1-, 2- and 3-bedroom apartments. The total yield for the site is 47.5 dwellings per hectare. The site is close to areas identified for shops and services, including schools, recreation facilities and a major transport corridor (which has been identified as a future high-frequency bus route).

Consumption of energy will be reduced by using passive and active solar energy.

Water-sensitive urban design measures are to be incorporated, including underground stormwater tanks within each shared driveway court to retain water from storm events and reduce potable water use, and a number of rain-garden tree pits and bioretention systems.

A stormwater master plan has been prepared for the estate, which includes provision for piping of stormwater flows up to and including ‘1-in-5-year’ events (which have a 20 per cent chance of happening in any year). Major roads will be used

to convey stormwater generated by larger storms up to ‘1-in-100-year’ events (which have a 1 per cent chance of happening in any year).

The development will use sustainable materials and seek EnviroDevelopment certification (an environmental rating scheme coordinated by the Urban Development Institute of Australia).

The project will use a community title arrangement. This will allow for communal driveway courts that will also provide outdoor space for very compact residential blocks. Courtyard driveway areas will include irrigated grass for children’s play, shrubs, groundcovers and rain gardens. Three-metre-wide bands of paving will also be included for ball games and other activities.

Suitable deciduous trees will be planted on the shared driveway court areas and central access road area to provide shade during summer and sun penetration during winter. Adjacent to the southern boundary of the estate will be a pedestrian and cycle path, supplementary eucalypt planting, and associated seating and walling.

No specific bushfire protection measures were included as part of this EDP, but a Bushfire Risk Assessment Report had previously been prepared and approved for the suburb as a whole.

This case study example has yet to be tested ‘on the ground’ and ‘in the market’, as it has not been built yet. Whether the energy and water savings envisaged at the planning stage can be fully realised is not yet clear.



Development applications and exemptions

Before undertaking various building and renovation activities in the ACT, approval must be sought through a development application process. Some developments (eg a small shed) may be exempt, although the proposal may still need a building approval under the *Building Act 2004*.

Different assessment tracks are followed for different kinds of development proposals, depending on the development's location, size and possible impact on the surrounding area. The tracks are:

- a code track, which applies to simpler developments that meet all the relevant rules in the Territory Plan
- a merit track, which applies to most development applications; developments are assessed against the rules or criteria in the applicable assessment code of the Territory Plan, and are publicly notified
- an impact track, which applies for development applications that may have a major impact on the environment of the ACT; developments are subject to the highest level of scrutiny and are publicly notified.

Building approvals

The Building Code of Australia (BCA), produced by the Australian Building Codes Board, contains technical provisions for the design and construction of buildings and other structures, covering such matters as structure, fire resistance, access and egress, services and equipment, and energy efficiency, as well as certain aspects of health and amenity. Since 2006, the BCA has contained energy efficiency measures for all building classifications.

On 3 July 2008, the Council of Australian Governments agreed to the development of a National Construction Code (NCC) to cover building, plumbing, electrical and telecommunications standards. NCC 2011 was released for adoption by state and territory governments on 1 May 2011.

The BCA energy efficiency provisions for housing are contained in NCC volume 2. These provisions aim to reduce greenhouse gas (GHG) emissions. The provisions for new housing take into account the:

- performance of the house, including
 - building fabric (eg walls, floors and roofs)
 - external glazing and shading
 - sealing of the building
 - effects of air movement

- performance of the house's domestic services, including
 - hot water supply
 - insulation and sealing of ductwork and central heating water piping
 - space heating
 - artificial lighting
 - heating and pumping of swimming pools and spas.

NCC volume 2 contains two main ways to comply with the BCA's energy efficiency provisions:

- Option 1 Energy Rating can be used to achieve the required energy rating for reducing heating and cooling loads, as verified by accredited software from the Nationwide House Energy Rating Scheme (NatHERS; see the following section). The required minimum energy rating for reducing heating and cooling loads is 6 stars.
- Option 2 Elemental Provisions can be used to comply with all BCA Deemed-to-Satisfy Provisions for the building fabric, including floors, walls, roof, glazing and air movement.

Both options also require compliance with specific energy-saving features, such as testing and installing insulation, thermal breaks, compensating for downlights, floor-edge insulation and building sealing.¹⁹

The BCA has been adopted by each state and territory as a technical standard for the design and construction of dwellings. However, there is no compulsion for any state or territory to adopt the BCA in full or as the exclusive instrument of building policy. In practice, state and territory governments adopt additional or alternative legislation and regulations relating to building matters. The BCA includes appendices for each state and territory that detail any provisions that apply in individual jurisdictions. These may be in addition to the standards in the main text of the BCA or may override them (Productivity Commission 2005).

In the ACT, building codes and standards are specified in the *Building Act 2004* and associated regulations.

Energy efficiency star ratings for buildings

An energy efficiency star rating applied to a new home refers to NatHERS. A NatHERS star rating is a ranking of a building's ability to maintain thermally comfortable

¹⁹ www.abcb.gov.au

conditions in terms of the annual amount of energy needed for artificial heating and cooling. NatHERS uses a 10-star band, where:

- zero stars means that the building shell does practically nothing to reduce the discomfort of hot or cold weather
- a 5-star rating indicates good, but not outstanding, thermal performance
- a 10-star rating means that occupants are unlikely to need any artificial cooling or heating.

However, the stars do not imply the same amount of energy use in each location, as climate conditions vary around Australia. The modelling data used to calculate NatHERS ratings contain data for 69 climate zones (proposed to be increased to 80), with a different annual energy assigned to each climate.²⁰

The NatHERS star rating system measures the energy required for heating and cooling a building on a per-square-metre basis. Thus, the amount of energy required to heat a large detached house will be significantly greater than that required for a smaller detached house that has been awarded the same star energy rating in the same location.

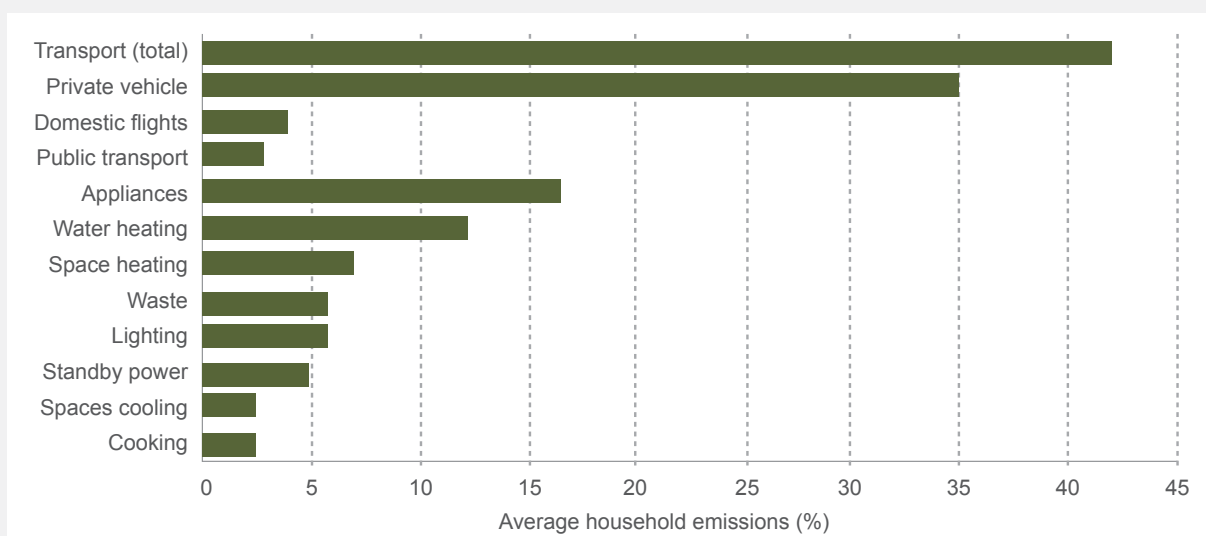
5.4 Potential for climate change mitigation and adaptation in ACT planning processes

Potential for mitigation

Mitigation is mainly achieved by reducing energy consumption and shifting to less GHG-intense energy sources. Secondary methods to reduce GHG emissions include reducing waste production, water use and on-site GHG emissions (eg methane, chlorofluorocarbons).

Identifying the potential for the planning and statutory approvals process to contribute to mitigation includes identifying the areas in which approvals can influence change, and the potential scale of that change.

The Australian residential sector has accounted for 11–12 per cent of Australia's total energy consumption since 2002–03. However, absolute consumption increased from 412.5 petajoules (PJ) in 2002–03 to 452.1 PJ in 2010–11, or by just over 10 per cent (DIRD 2013). Figure 5.1 shows that transport contributes the largest proportion of Australia's average household carbon dioxide emissions, at almost 42 per cent. Private vehicle use accounts for 35 per cent of average household emissions. Significant proportions of household energy use are also attributable to the use of appliances, water and space heating, waste, lighting and space cooling.



Source: DIRD (2013)

Figure 5.1 Proportion of average household emissions, including transport, 2012

Potential for adaptation

Adaptation of assets means two things: firstly, that they are designed to be able to cope with the hazards associated with climate change that may affect them during their service life; and secondly, that they can reduce the vulnerability of occupants, users and service recipients to other hazards.

Hazards to dwellings include extreme winds, floods, fire, landslip, hail and, to a limited extent, extreme temperature. Hazards to occupants that may be mitigated by dwelling design include extreme temperatures, interruptions to power or water supply, and emergency access.

Hazards to residential communities include floods, loss of access or services due to extreme events (eg flooding, wind damage to services from fallen trees or poles, bushfire), and exposure to disease vectors.

Hazards to infrastructure depend significantly on the specific nature of the infrastructure, and its sensitivity and role in service provision. Hazards would typically include extremes of temperature, flooding, storms and bushfires, but may also include specific vulnerabilities (eg a drainage system depending on pumping losing power for the pumps). Vulnerability of users would depend on the service provided (eg roads, water supply, power).

Identifying the appropriate way to incorporate climate change adaptation measures in planning and statutory approvals processes requires an assessment of relative risks and alternatives.

For both mitigation and adaptation, some responses may be better addressed by interventions other than planning and statutory approvals processes.

Effect of estate development plans

In terms of mitigation, transport contributes the largest proportion of Australia's average household carbon dioxide emissions (Figure 5.1). Planning provisions that support greater densities, more efficient public transport and less frequent use of private vehicles can contribute significantly to reducing GHG emissions, although this is not guaranteed. Box 5.2 further exemplifies this.

Also contributing to mitigation are the recent changes to EDP requirements included in DV306 and in *Technical amendment to the Territory Plan variation 2013 – 12*, which have sought to achieve greater solar

Box 5.2 Case study: public versus private transport

A study undertaken in North America during the past 60 years has shown that compact planned suburbs with a range of housing types and reliable public transport are 20–40 per cent less reliant on privately owned vehicles than regular suburbs of the same North American cities that are not compact planned and do not have access to reliable public transport.

Source: Hamin & Gurran (2008)

efficiency in estate planning. However, the changes have also shown that there can be trade-offs between solar efficiency and the number of detached housing blocks that can be accommodated within a particular area. This has been particularly apparent in some areas in Molonglo where the land is undulating, and good solar access cannot easily be obtained on many smaller south-facing blocks (see Box 5.1). As at April 2014, the Environment and Sustainable Development Directorate was seeking to refine the rules and criteria for northern block boundaries, with assistance from a working group.

If the overall use of energy by Canberra households is to be reduced, there is clearly a need to provide a range of different housing types, including a better choice of affordable and energy-efficient housing options to suit the needs of one- and two-person households.

There is a need for 'on the ground' (ie existing) examples of innovation in estate developments that can contribute to GHG mitigation, as well as meeting other goals for housing choice and affordability. Many housing industry practitioners are conservative when it comes to the development and delivery of innovative products, and may wish to see positive market responses to new housing developments and options before committing to the delivery of new styles of development. Examples from other cities may be useful (Box 5.3).

The contributions to the ACT's overall GHG emissions targets from the introduction of new estate development planning requirements will initially be limited. The overall housing stock, urban form and

Box 5.3 Case study: strategic planning in Byron Bay, New South Wales

Byron Bay's strategic planning approach includes a 100-year planning period for proposals or issues that may be affected by climate change, and incorporates climate change into all relevant plans.

The incorporation of these climate change measures has resulted in trade-offs with Byron Bay's other sustainability objectives, such as reducing local vehicle miles travelled. As a result, Byron Shire Council has dramatically reduced the available area of land for new development and redevelopment within the existing Byron village.

Source: Hamin & Gurran (2008)

urban density will only be marginally affected in the short term by new estate development provisions.

In terms of **adaptation**, the extent to which current EDPs accommodate climate change adaptation is not always clear.

The water-saving and recycling measures to reduce use of potable water will have climate change adaptation benefits during periods of low rainfall. If planning for stormwater infrastructure to accommodate 1-in-5-year and 1-in-100-year events, such as storms and flooding, is based on past events, there is a need to revise risk assessments to plan for potential climate change impacts. This may require a review of the design standards used by the ACT's Territory and Municipal Services Directorate. Planning for bushfire risk will also need to take into account the higher likelihood of bushfires as a result of climate change.

Effect of environmental impact statements

The *Planning and Development Act 2007* specifies circumstances in which an EIS is required in relation to a development proposal.

As outlined in Section 5.3, impact track assessments are required for development applications that include circumstances in which:

- there is a risk of significant adverse environmental impact from the development proposal
- the Minister responsible for administering the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) has advised that the development proposal is a controlled action under that Act
- the Minister responsible for the *ACT Public Health Act 1997* makes a declaration that the proposed development requires an impact track assessment.

Box 5.4 presents a recent example of an EIS and its consideration of climate change.

Effect of housing regulations

Effect of minimum energy ratings on mitigation

State and territory governments across Australia have worked together for a number of decades to improve the consistency of building regulations and requirements, and thus improve industry efficiency across the country. Recently, there has been agreement to increase the minimum energy rating requirements for all new dwellings to a minimum of 6 stars or a general equivalent.

In the ACT, a house energy rating scheme has been in place since 1 July 1995. At the time this scheme was introduced, all new houses had to meet a minimum 4-star standard.

Under the 2010 BCA, which took effect from 1 May 2010, all new houses in the ACT are required to be built to a 6-star energy efficiency rating or equivalent standard. The 2010 BCA also included new domestic lighting efficiency requirements.²¹

In addition to a mandatory energy efficiency standard for new houses, under the *Energy Efficiency Ratings (Sale of Premises) Act 1997*, from 31 March 1999, anyone wishing to sell an existing property has to obtain an energy efficiency rating assessment. There is no minimum energy efficiency standard for existing dwellings, but sellers have to disclose the energy efficiency of the home.

21 www.actpla.act.gov.au

Box 5.4 Case study: relocating a 132-kilovolt powerline

In the ACT Government's Lawson South development, a powerline relocation was a preliminary component of the associated environmental impact statement (EIS). The selected powerline alignment was to proceed underground from a new overhead/underground transition structure east of an existing transmission tower adjacent to William Slim Drive. The line was to pass underground north-eastwards beneath Lake Ginninderra, south-eastwards to the Belconnen Zone Substation, then eastwards to a new transition structure just west of Baldwin Drive. Here, the powerline would resurface and join the existing overhead powerline, which continues eastwards above the intersection of Ginninderra and Haydon drives. This would involve removing five transmission towers and associated conductors.

A draft EIS for the powerline relocation was released in February 2013, and comments on the draft closed in April 2013. The EIS covered a range of areas, a number of which addressed climate change:

- The powerline relocation project is in accordance with the intent of the ACT Climate Change Strategy in that construction practices would, wherever possible, minimise greenhouse gas emissions. In addition, revegetation of disturbance areas, and the resultant net increase in carbon assimilation as the plants establish and grow, would offset carbon dioxide emitted during construction activities.

- The EIS identified potential bushfire risks associated with the proposal. Many of the identified risks were associated only with the construction phase. There was reference to the bushfire risks associated with the development of the suburb of Lawson in general, but only limited comment on the potential risk of bushfires associated with the new powerlines. There was no specific comment on potential implications of increased risks of bushfires associated with climate change, or the potential reduction in fire risks and associated impacts as a result of the relocation of the powerlines underground.
- The EIS included some comments on flooding risk but, again, did not specifically address increased future flooding risks associated with climate change. The EIS noted that all relevant above-ground structures and most of the underground powerlines would be constructed above the 1-in-100-year flood level. Cables below the 1-in-100-year flood level and below Lake Ginninderra are to be encapsulated in water-protective conduits. The EIS concluded that flooding was unlikely to have any adverse effect on the relocated powerline.

Source: ACT Government (2013)

Given the hot summers and cold winters in the ACT, the impact of these measures is more significant than in some of Australia's other climate zones.

In Canberra's climate, a 3-star home is predicted to require 387 megajoules (MJ) per square metre for heating and cooling, which is 2.3 times more energy per square metre than a 6-star house (165 MJ per square metre). The differences in modelled thermal performance among houses are mainly due to windows

(orientation, window dressings and size relative to room floor area), insulation levels and airtightness (ESDD 2013c).

The new energy requirements will mainly affect new houses. New detached houses currently add around 1.2–1.3 per cent to the total housing stock each year. Thus, even substantial improvements to the energy efficiency of new detached dwellings will have a relatively small impact in the short term on energy

savings across the whole housing stock. However, this impact will be cumulative.

In addition, over time, the energy efficiency rating of older houses is likely to be increased through installation of insulation and window coverings, and measures to reduce draughts. In a recent case study, analysis of the correlation between reduction of air leakage and reduction in energy use suggested that, for some houses, savings from draught sealing alone could be as high as 20 per cent (ESDD 2013c).

The type of dwelling also affects the impact of energy measures. Multi-unit dwellings, such as townhouses and apartments, often have lower energy demand per square metre because they have less external wall area per unit of floor area. They also tend to have smaller average floor areas per dwelling. Table 5.1 shows that detached dwellings are gradually declining as a proportion of the total stock of dwellings. This shift in housing mix will contribute to some reduction in energy demand per dwelling as the proportion of 'other dwellings' increases.

Although an increase in mandatory energy efficiency star ratings improves performance, there are some constraints. At lower star ratings, each additional star leads to a reduction in energy use of around 22–28 per cent. However, once a relatively high star rating is achieved, the impact of each additional star achieved is smaller. Higher marginal effort and cost are required to achieve each additional successively smaller step (CIE 2010).

Effect of other housing measures on mitigation

State of Australian cities 2013 concluded that GHG emissions generated by the Australian residential sector are likely to continue to rise as a result of the increasing number of houses, increasing average floor space and declining number of people per household (DIRD 2013).

To date, most emissions reduction programs in Australia aimed at the residential sector have focused on increasing energy efficiency within households, and increasing the availability and use of energy from renewable sources. However, the savings achieved from these initiatives are being offset by higher overall rates of energy consumption. Air-conditioner ownership, for example, has increased significantly, rising from an average of 0.395 units to 0.762 units per household between 1994 and 2004 (DIRD 2013).

Size of new detached dwellings is also important, as current star rating schemes and requirements are based on energy use per square metre. Figure 5.2 shows how the average floor area of new homes in Australia has increased over time.

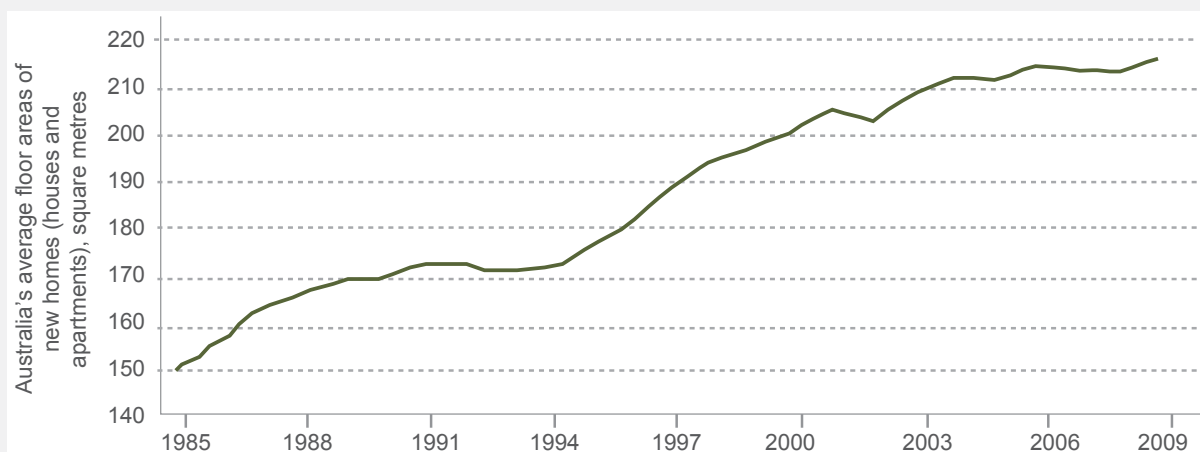
The average floor area of new houses in Australia was 245.3 square metres in 2008–09, and the average for the ACT was 239.4 square metres (CommSec 2009). Despite the increase in dwelling size, the average number of occupants in detached houses in the ACT fell from 2.61 in 2001 to 2.56 in 2011 (ABS 2011). For any given star rating, an increase in the size of a dwelling by, say, 20 per cent is likely to increase the amount of energy used by a similar amount.

Actual energy use in a particular dwelling also varies according to the dwelling use and personal habits of the occupants of the dwelling. For example, energy use can depend on the appliances used by household members for heating and cooling, their tolerance to heat or cold, and how much time they spend at home (CIE 2010). The energy benefits measured by the star rating system generally assume that the house is occupied all day every day. However, in terms of the occupancy patterns for an average Australian house, and typical use of heating and cooling in different parts of the house, it has been suggested that expected savings arising from energy efficiency measures may actually be 50 per cent or less than anticipated (CIE 2010).

Table 5.1 Other dwellings as a proportion of total ACT stock, 2001, 2006 and 2011

Year	Detached homes	Other dwellings	Total	Proportion of other dwellings (%)
2001	87 729	26 341	114 070	23
2006	92 151	30 706	122 857	25
2011	96 770	38 208	134 978	28

Source: ABS (2011)



Source: CommSec (2009)

Figure 5.2 Average floor areas of new homes

The energy efficiency rating of dwellings also assumes that all household energy demands are met by electricity, whereas in Canberra there is a relatively high use of gas (CIE 2010).

There are also GHG emissions implications from dwelling construction that are not taken into account in energy rating systems. For example, concrete production is relatively GHG intensive. The Productivity Commission has estimated that it would take 62 years for the GHG savings from lower use of energy associated with concrete rather than timber floors to outweigh the higher emissions embodied in the concrete floor (Productivity Commission 2005). Although the energy efficiency savings associated with the materials used in construction are taken into account for energy efficiency star rating purposes, the embodied GHG costs for materials such as concrete are not included (CIE 2010).

Effect of housing measures on adaptation

Adaptation measures, in addition to the measures already identified for mitigation, include measures to reduce the impact of bushfires, floods, water shortages, high temperatures and high winds. For some of these measures, district and estate planning will be more important than decisions made when planning individual detached houses.

The ability to reduce the adverse impacts of high temperatures can, to some extent, be achieved by the design of individual dwellings – for example, the inclusion of eaves and awnings to reduce heat impact (particularly on west-facing walls), effective placement of windows to reduce heat absorption, and provision

for cross-ventilation and other measures to remove heat from houses on summer nights. Many of these measures are taken into account in the star rating system for measuring the energy efficiency of buildings.

Including mandatory rainwater tanks and provisions for recycling domestic wastewater in planning requirements could also improve the adaptation capacity of new detached dwellings (to respond to water shortages).

The most recent version of the Strategic Bushfire Management Plan for the ACT (ESA 2009) includes measures to reduce bushfire risk in areas subject to ember attack, radiant heat and flame contact, through effective urban planning, design and construction. The plan includes references to the bushfire provisions in the BCA (AS:3959/1999 – *Construction of buildings in bushfire prone areas*). It also includes a footnote indicating that the ACT Planning and Land Authority will review its *Planning for bushfire risk mitigation general code* (2008), with an updated version to be implemented through a new Residential Development Code for the Territory Plan. Consultations are a part of the regular updating of the Strategic Bushfire Management Plan for the ACT, for which version 2 will be released later in 2014.



5.5 Assessment of the effect of planning processes on mitigation and adaptation

Contribution of the ACT's statutory processes to climate change mitigation goals

The ACT Government has progressively introduced measures to reduce the generation of GHGs as part of its strategic and statutory planning processes. Although many of these measures have been successful to some extent, GHG generation has continued to grow. This growth has been partly attributed to the overall increase in the population, the number of new dwellings and the average size of new dwellings, and the way in which households use energy for heating, cooling and entertainment. Statutory planning is not generally able to directly control these factors and influences.

However, the energy efficiency measures introduced through the planning system have been successful in reducing the growth in GHG use relative to what would have occurred in the absence of these measures. In addition, the relatively short period of time since some of the new requirements have been enacted means

that only a small number of new dwellings have since been built, and the overall impact to date has been limited.

The ACT Planning Strategy (2012) has identified key areas for development and urban intensification, with the aim of establishing a more compact, sustainable city that uses its resources and infrastructure more efficiently. This is likely to have energy efficiency benefits, assuming that the increase in residential density is proportionate to increases in the use of mass transit systems. However, the relationship between increased residential density and energy savings resulting from use of mass transit systems is not always clear-cut (DIRD 2013).

DV306, which has been in force since 5 July 2013, includes revised residential development, estate development and leasing codes. The provisions in DV306 were designed to improve solar access for new dwellings. Changes were made in January 2014, and further consultation with relevant stakeholders is now being conducted.

In relation to detached dwellings, there is clearly scope for planning provisions to be further amended to

require new dwellings to meet higher energy efficiency star rating requirements than the current minimum of 6 stars. However, the short-term impact of this change on the overall GHGs generated will be marginal. During 2014–20, the direct impact of such a change would apply to a maximum of around 7–8 per cent of the total dwelling stock.

Any decision to increase the minimum energy efficiency star rating required for new detached dwellings would also need to take into account the loss of benefits provided by the consistency associated with the current national standard of 6 stars. For example, if the impact of a higher mandatory energy rating requirement on the initial cost of a new detached dwelling was significant, it might result in more ACT employees moving to Queanbeyan or Yass to avoid this up-front cost. The likely result would be an increase in private vehicle use for commuting and an increase in GHG generation.

Contribution of the ACT's statutory processes to climate change adaptation goals

Many of the statutory processes designed to reduce the generation of GHGs, such as installing insulation in dwellings, will also contribute to better climate change adaptation.

Other initiatives already incorporated in the ACT's statutory planning system, such as water-sensitive urban design measures, will assist ACT residents to adapt to lower rainfall.

However, greater reliance on renewable energy sources will need to be accompanied by measures to ensure the reliability of supply, especially of energy required to mitigate the impact of prolonged heatwaves.

The planning provisions and infrastructure design standards used by ACT Government agencies to accommodate stormwater flows associated with 1-in-5-year events and 1-in-100-year events may have to be reviewed, so that they do not rely only on historical data but also take into account the likely increase associated with climate change impacts.

Planning provisions for bushfire risk will also need to consider the higher likelihood of bushfires as a result of climate change.

Effectiveness of measures to reduce residential sector emissions

AP2 included six actions to reduce GHG emissions from the residential sector by 218 000 tonnes of carbon dioxide equivalents by 2020.

Action 2 proposes to introduce legislation to restrict the replacement and installation of high-emissions water heaters in houses and townhouses in gas-reticulated areas, and to investigate the expansion of emissions standards for hot water heaters to all new residential buildings by June 2014. Action 2 will be subject to a regulatory impact assessment. Subject to a positive outcome from the regulatory impact assessment, it should proceed.

Actions 1, 3 and 5 in AP2 largely relate to measures to assist ACT residents to make good energy efficiency choices, and to reduce energy use associated with existing dwellings and use of appliances.

A relatively high proportion of the GHGs generated by Australian households comes from the increasing use of appliances. Water and space heating, waste, lighting and space cooling are also significant contributors to households' GHG generation. Although planning and building regulations may have some impact on the generation of GHGs for heating, cooling and lighting in new houses, Actions 1, 3 and 5 will target a much broader audience and are likely to have a bigger impact.

Measures to improve the energy efficiency of existing dwellings, such as installing insulation, blocking draughts and covering windows at night, will often be very cost-effective.

Actions 4 and 6 envisage the implementation of further measures identified as a result of research and consultation. Action 4 is likely to require changes to planning legislation and will be subject to a regulatory impact assessment. Given some of the challenges associated with implementation of DV306 to the Territory Plan, significant GHG emissions savings associated with the implementation of a 'pathway to zero emissions buildings' policy are unlikely before 2020. However, these measures are still likely to have longer-term benefits.

In the short to medium term, the most significant GHG generation savings associated with the residential sector are likely to arise from implementation of Action 13 – the renewable electricity consumption target of 90 per cent renewables by 2020. Although this action is not specifically targeted to the residential and building sectors, solar panels on residential buildings are contributing to the achievement of this target, with 1 in 10 Canberra households already having a rooftop solar installation. More efficient larger-scale projects are also being pursued.

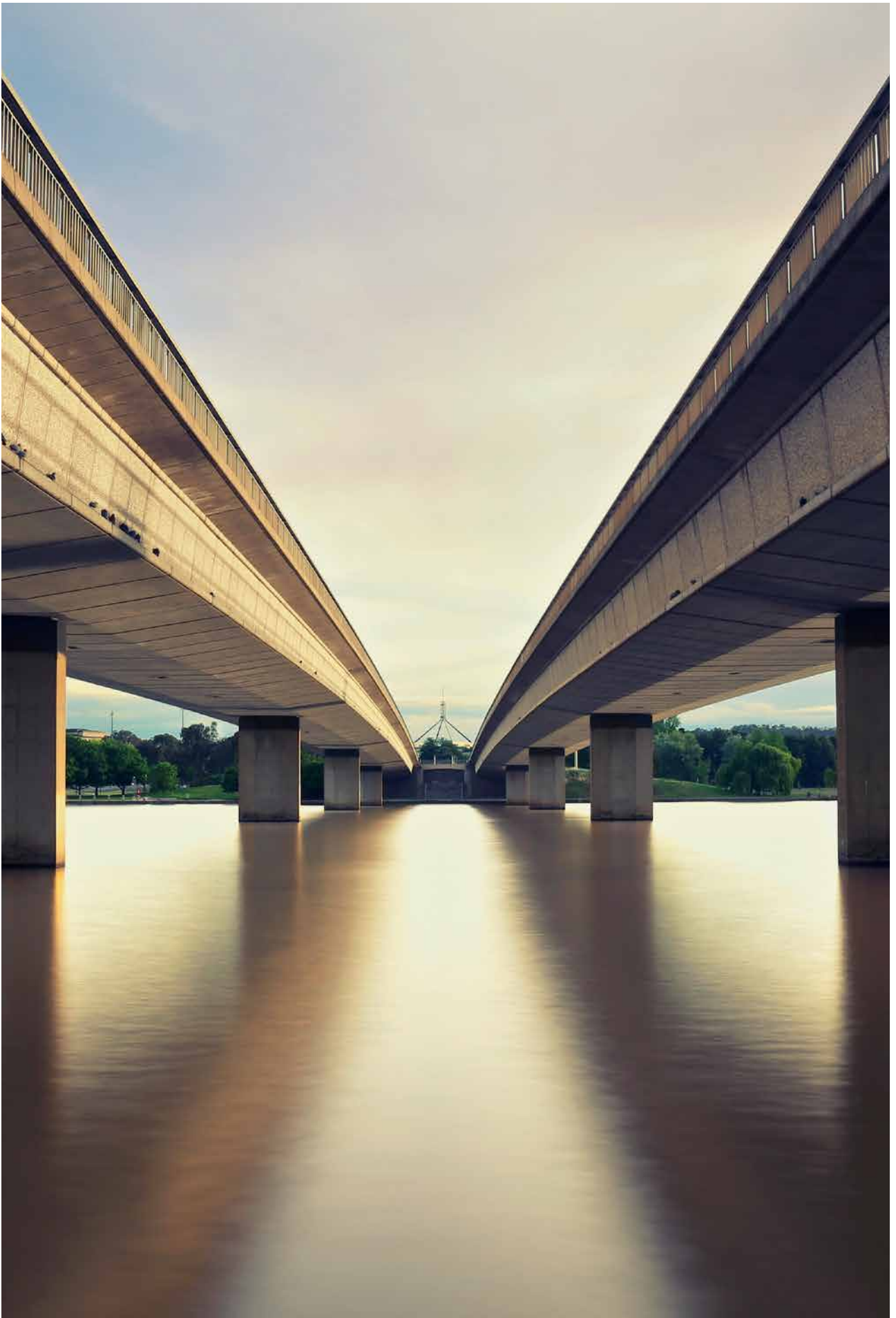
The use of statutory planning, regulatory and education measures to reduce GHG emissions can often be complemented or replaced by financial incentives and disincentives. In the ACT, these could include:

- energy-saving subsidy measures, such as those already funded by the ACT Government (eg audits of household energy use, waste incentives, solar panel subsidies)
- adjusted stamp duties and conveyancing costs, which increase the costs of moving to a more appropriately sized dwelling as a household's circumstances change (the ACT Government has made some moves to reduce stamp duties on dwelling purchases over time)
- a reduction in the incentive to live in a house larger than needed (these incentives largely relate to capital gains tax treatment and pension eligibility concessions associated with owner-occupied housing, and are largely a matter for the Australian Government).

Opportunity

The opportunities presented below are designed to be practical and temporally achievable in the ACT. They address the major obstacles that need to be overcome or addressed to achieve the systemic integration of climate change mitigation and adaptation into planning. The ACT Government can:

- implement metropolitan strategic planning directions at a local level (eg Structure Plan or Centre Master Plan) or in statutory planning (eg Territory Plan variation and Precinct Codes)
- monitor and evaluate planning implementation (including reporting on performance indicators, post-occupancy research)
- adopt a whole-of-government approach and coordination, which will be needed to successfully implement strategies (eg climate-adaptive public realm and street design, infrastructure provision) across multiple government directorate portfolios
- support the development industry to implement relevant planning strategies, particularly related to climate-responsive building design.





Chapter 6

What new opportunities
or challenges have emerged?

6 What new opportunities or challenges have emerged?

In totality, *AP2: a new climate change strategy and action plan for the Australian Capital Territory (AP2)* is an ambitious and constructive policy, which is designed to meet greenhouse gas (GHG) emissions targets that are the most progressive in Australia. The challenges that arose in the assessment of AP2 provide opportunities for the Australian Capital Territory (ACT) to progress its climate change mitigation and adaptation activities to meet these targets as effectively as possible.

The Office of the Commissioner for Sustainability and the Environment (OCSE) found that the major challenges were in relation to **GHG accounting**. To a large extent, this was unavoidable, given that AP2 was developed before the release of the Greenhouse Gas Protocol (GGP) and that there is a two-year time lag in the release of some GHG emissions data, which makes reporting in real time problematic. However, this is the case for all jurisdictions, both national and international.

In relation to GHG accounting, the OCSE found the major challenges to be:

- the existence of some discrepancies between emissions sources in the Greenhouse Gas Inventory and the sectors in AP2
- the unavailability of GHG emissions data necessary to track AP2 sector emissions targets
- complications in relation to measuring the causal or relational links between AP2 actions and the legislated GHG emissions reduction targets, and a corresponding lack of clarity around the purpose of each action.

In addition, the OCSE found that the **setting of emissions reductions targets** and the methodologies used to set these targets are complex. A variety of methods can be used, each of which have benefits and disadvantages.



As climate science and GHG accounting methods progress, these challenges become eminently resolvable. The OCSE found that the following individual GGP standards provide the ACT Government with tangible options for redressing the majority of challenges identified in the Implementation Status Report (ISR):

- GGP Policy and Actions Accounting and Reporting Standard, which provides a methodology for estimating and reporting the change in GHG emissions and removals resulting from the implementation of policies and actions
- Global Protocol for Community-Scale Emissions Standard, which provides a methodology for cities to prepare and publicly report a GHG inventory; this standard is currently in draft and is due to be finalised in December 2014
- Mitigation and Goals Accounting and Reporting Standard, which provides a methodology for assessing and reporting progress towards national and regional mitigation goals.

The assessment of the AP2 **adaptation actions** found that the current actions are ‘fit for purpose’. However, there are some gaps in relation to adaptation being addressed explicitly and holistically. The new policy, *Adapting to a changing climate: directions for the ACT*, released in 2014, provides new opportunities to incorporate adaptation responses into all relevant policies or programs, and to coordinate approaches across government. Similarly, climate change mitigation and adaptation needs to be systemically addressed and embedded in all urban **planning** decisions.

Finally, all governments need to base their decisions on the most up-to-date and accurate **information**. Building links with the scientific and expert community will ensure that the ACT Government can draw on the considerable resources and research that are continually being developed to support the development of future adaptation policy and actions.

In addition, it is important that the ACT keeps abreast of **international best practice** in mitigating and adapting to climate change. Use of best practice international tools and mechanisms, such as the GGP, as well as analysing the approaches of different cities, could be used to inform future climate change action plans and targets.

Appendix Projected climate change impacts

Table A Comparison of referenced background documents in AP2 with updated background documents (up to 2013)

- ✓ indicates that the referenced projected climate change impact in AP2 remains relevant in 2013. The text is greyed out to further indicate this.
- × indicates that a change or update to a climate change projection has occurred since AP2. A description of this change is provided.
- + indicates that there is additional detail to projections, and this detail is provided.

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
Refers to the IPCC's Fourth assessment report (2007) (AR4). The strategy also references a number of reports for the ACT (or applicable region) and climate change impacts (as below).		✓ Projected impact is still current. IPCC's Fifth assessment report (AR5) builds on the findings of AR4.	Intergovernmental Panel on Climate Change (2009). <i>Fifth assessment report: climate change 2013, summary for policymakers</i> , IPCC, Geneva. Intergovernmental Panel on Climate Change (2009). <i>Fifth assessment report: Climate change 2013, IPCC Working Group I contribution to AR5, the physical science basis</i> , IPCC, Geneva.
	Rainfall: • The ACT region will experience 4–12% wetter conditions in summer and autumn. • The ACT region will experience 2–12% drier conditions in winter and spring.	✓ Rainfall: • The ACT region will experience 4–12% wetter conditions in summer and autumn. • The ACT region will experience 2–12% drier conditions in winter and spring.	AP2 referenced document is current.
	A greater fire risk is predicted. By 2020, the predicted number of days with very high or extreme fire danger could average 26–29 in Canberra (now 23).	✓ A greater fire risk is predicted. By 2020, the predicted number of days with very high or extreme fire danger could average 26–29 in Canberra (now 23).	AP2 referenced document is current.
		+ Annual average number of days when the Forest Fire Danger Index rating is very high or extreme: • 2006 = 23.1 days • 2020 = 25.6–26.0 (low), 27.5–28.6 (high) • 2050 = 27.9–28.9 (low), 36.0–38.3 (high).	CSIRO & Bureau of Meteorology (2007). Regional climate. In: <i>Climate change in Australia</i> , Bureau of Meteorology, Melbourne.

Table A continued

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
Hennessy K, McInnes K, Abbs D, Jones R, Bathols J, Suppiah R, Ricketts J, Rafter T, Collins D & Jones D (2004). <i>Climate change in New South Wales. Part 2: Projected changes in climate extremes</i> , CSIRO, Canberra.	ACT temperature conditions – current, 2030, 2070:	✓ ACT temperature conditions – current, 2030, 2070:	AP2 referenced document is current.
	• days below 0 °C: 62, 39–60, 9–52	✓ • days below 0 °C: 62, 39–60, 9–52	AP2 referenced document is current.
	• cold spells below 0 °C: 12, 7–12, 1–10	✓ • cold spells below 0 °C: 12, 7–12, 1–10	AP2 referenced document is current.
	• days exceeding 35 °C: 5, 6–13, 8–42	× • days exceeding 35 °C: 5, 8 (A1B median), 12–26 (A1FI low and high)	CSIRO & Bureau of Meteorology (2007). Regional climate. In: <i>Climate change in Australia</i> , Bureau of Meteorology, Canberra.
	• hot spells exceeding 35 °C: 1, 1–2, 1–9	✓ • hot spells exceeding 35 °C: 1, 1–2, 1–9	AP2 referenced document is current.
	• days exceeding 40 °C: 0, 0–1, 0–10	✓ • days exceeding 40 °C: 0, 0–1, 0–10	AP2 referenced document is current.
	• very hot spells exceeding 40 °C: 0, 0–0, 0–1.	✓ • very hot spells exceeding 40 °C: 0, 0–0, 0–1.	AP2 referenced document is current.
	A 10–40% reduction in snow cover is likely by 2020.	✓ A 10–40% reduction in snow cover is likely by 2020.	AP2 referenced document is current.
		+ Projected percentage changes in frost days by 2050 in Canberra: • 2007 = 63.8 days • 2030 = –14% (A1B median) • 2070 = –8% (A1FI low) • 2070 = –27% (A1FI high).	CSIRO & Bureau of Meteorology (2007). Regional climate. In: <i>Climate change in Australia</i> , Bureau of Meteorology, Melbourne.
McMichael AJ, Woodruff RE, Whetton P, Hennessy K, Nicholls N, Hales S, Woodward A & Kjellstrom T (2003). <i>Human health and climate change in Oceania: a risk assessment</i> , Australian Government Department of Health and Ageing, Canberra.	Climate warming and population ageing may increase annual heat-related deaths in those aged over 65, as follows in Canberra: • current: 14 deaths a year • by 2020: 37–41 deaths a year • by 2050: 62–92 deaths a year.	✓ Climate warming and population ageing may increase annual heat-related deaths in those aged over 65, as follows in Canberra: • current: 14 deaths a year • by 2020: 37–41 deaths a year • by 2050: 62–92 deaths a year.	Australian Government Department of the Environment (2014). <i>Climate change impacts in the ACT</i> , Canberra. www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/australian-capital-territory
		+ 10–40% increase in the number of extreme fire danger days in Canberra by 2020.	CSIRO (2011). <i>Climate change: science and solutions for Australia</i> , CSIRO, Canberra.

Table A *continued*

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
Suppiah R, Hennessy KJ, Whetton PH, McInnes K, Macadam I, Bathols J, Ricketts J & Page CM (2007). Australian climate change projections derived from simulations performed for the IPCC 4th Assessment Report, <i>Australian Meteorological Magazine</i> 56(3):131–152.	The number of days in Canberra exceeding 35 °C could average 6–14 (now 5).	× The number of days in Canberra exceeding 35 °C could average 8–26 (now 5) (depending on emissions scenario): • 2030 = 8 (A1B median) • 2070 = 12 (A1F1 low) • 2070 = 26 (A1F1 high).	CSIRO & Bureau of Meteorology (2007). Regional climate. In: <i>Climate change in Australia</i> , Bureau of Meteorology, Melbourne.
		× A record heatwave was recorded in January 2014: • number of extreme hot days: 9 days exceeding 37 °C (BoM) and 13 days exceeding 35 °C (AccuWeather.com) • number of hot spells (exceeding 37 °C for 5 consecutive days): 1 hot spell (BoM), 2 hot spells (AccuWeather.com) • number of days exceeding 40 °C: 3 (BoM), 1 (AccuWeather.com). Compared with projections from CSIRO and BoM, the above indicates more extreme heat than projected for 2070.	Bureau of Meteorology (2014). <i>Canberra in January 2014: dry weather and heatwaves</i> , Bureau of Meteorology. www.bom.gov.au/climate/current/month/act/summary.shtml . AccuWeather.com (2014). Recorded temperatures for January 2014 at Canberra, Australia. www.accuweather.com/en/au/canberra/21921/month/21921?monyr=1/01/2014
		+ In south-eastern NSW, average daily maximum temperatures are very likely to increase by 2.0–3.0 °C in autumn, winter and spring, and by 1.5–2.0 °C in summer.	NSW Department of Environment, Climate Change and Water (2010). <i>NSW climate impact profile: the impacts of climate change on the biophysical environment of NSW</i> , DECCW, Sydney.
	The number of days in Canberra below 0 °C could average 35–57 (now 62).	✓ The number of days in Canberra below 0 °C could average 35–57 (now 62).	AP2 referenced document is current.
		✓ In south-eastern NSW, average daily minimum temperatures are very likely to increase by 1.0–3.0 °C.	NSW Department of Environment, Climate Change and Water (2010). <i>NSW climate impact profile: the impacts of climate change on the biophysical environment of NSW</i> , DECCW, Sydney.

Table A continued

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
CSIRO & Bureau of Meteorology (2012). <i>State of the climate 2012: Australia continues to warm</i> , Bureau of Meteorology, Melbourne.	By 2070, Australian average temperatures are projected to rise by 1.0–5.0 °C by 2070 (when compared with recent decades).	✓ By 2070, Australian average temperatures are projected to rise by 1.0–5.0 °C by 2070 (when compared with recent decades).	AP2 referenced document is current.
	By 2030, Australian average temperatures are projected to rise by 0.6–1.5 °C (when compared with recent decades).	✓ By 2030, Australian average temperatures are projected to rise by 0.6–1.5 °C (when compared with recent decades).	
Climate Commission (2011). <i>The critical decade: climate change and health</i> , Australian Government Department of Climate Change and Energy Efficiency, Canberra.	Climate change projections indicate that there are likely to be significant impacts on public health in the ACT:	✓ Climate change projections indicate that there are likely to be significant impacts on public health in the ACT:	
	• direct impacts, such as sunburn and heat stress during heatwaves	✓ • direct impacts, such as sunburn and heat stress during heatwaves	AP2 referenced document is current.
		+ • projected annual heat-related deaths for older people (over 65 years) - current = 14 (1997–99 average) - 2020 = 37–41 - 2050 = 62–92 • projected annual cold-related deaths - current = 3 - 2050 = 4–9	Australian Government Department of the Environment (2014). <i>Climate change impacts in the ACT</i> , Department of the Environment, Canberra. www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/australian-capital-territory
	• indirect impacts – increased allergic symptoms	✓ • indirect impacts – increased allergic symptoms	AP2 referenced document is current.
	• impacts of natural disasters and extreme weather events, including foodborne and waterborne diseases, deaths, injuries, mental trauma and population displacement.	✓ • impacts of natural disasters and extreme weather events, including foodborne and waterborne diseases, deaths, injuries, mental trauma and population displacement.	AP2 referenced document is current.

Table A continued

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
Australian Government Department of Climate Change and Energy Efficiency (2011). <i>Climate change – potential impacts and costs: Australian Capital Territory</i> , DCCEE, Canberra.	The ACT is expected to experience the following climatic changes:	✓ The ACT is expected to experience the following climatic changes:	
	• reduced rainfall and run-off	✓ • reduced rainfall and run-off	AP2 referenced document is current.
		+ • by 2030, in south-eastern Australia, for 1 °C of global warming - mean annual rainfall is projected to decrease by 0–9% (median of 4%) - mean annual run-off is projected to decrease by 2–22% (median of 12%) Impacts will double for 2 °C of global warming	South Eastern Australian Climate Initiative (2012). <i>Climate and water availability in south-eastern Australia: a synthesis of findings from Phase 2 of SEACI</i> , SEACI, Canberra.
	• increase in temperatures	✓ • increase in temperatures and a greater number of extreme hot days (days exceeding 35 °C)	AP2 referenced document is current.
	• a greater number of extreme hot days (days exceeding 35 °C)	+ • number of extreme hot days: - 2007 = 5 - 2030 = 8 (A1B median) - 2070 = 12 (A1F1 low) - 2070 = 26 (A1F1 high)	CSIRO & Bureau of Meteorology (2007). Regional climate. In: <i>Climate change in Australia</i> , Bureau of Meteorology, Melbourne.
	• increase in risk of bushfires due to increased temperature and evaporation	✓ • increase in risk of bushfires due to increased temperature and evaporation	AP2 referenced document is current.
	• increase in number of illnesses and heat-related deaths, with older people particularly vulnerable	✓ • increase in number of illnesses and heat-related deaths, with older people particularly vulnerable + • projected annual heat-related deaths for older people (over 65 years) - current = 14 (1997–99 average) - 2020 = 37–41 - 2050 = 62–92	Australian Government Department of the Environment (2014). <i>Climate change impacts in the ACT</i> , Department of the Environment, Canberra. www.climatechange.gov.au/climate-change/climate-science/climate-change-impacts/australian-capital-territory
	• increase in foodborne infectious diseases, air pollution and mental health consequences	✓ • increase in foodborne infectious diseases, air pollution and mental health consequences	AP2 referenced document is current.
	• changes in water availability, temperatures, bushfires and the distribution of pest species will affect natural environments	✓ • changes in water availability, temperatures, bushfires and the distribution of pest species will affect natural environments	AP2 referenced document is current.
	• direct effects of projected changes on the productivity of the region's agricultural industries.	✓ • direct effects of projected changes on the productivity of the region's agricultural industries.	AP2 referenced document is current.

Table A continued

Referenced document in AP2 (2010)	Projected climate change impact (related to ACT) in AP2	Updated projected climate change impact	Updated document (2011–13)
<i>Intergovernmental Panel on Climate Change (2007). IPCC fourth assessment report: climate change 2007, IPCC, Geneva.</i>	By the end of the century, the average global surface temperature is expected to increase by 1.8–4 °C.	× By 2011, global average air temperature has already risen by around 0.85 °C. By the end of the century, the average global temperature could rise by 3.2–5.4 °C (high IPCC emissions scenarios). By the end of the century, the average global temperature could rise by 0.9–2.3 °C (low IPCC emissions scenarios).	Intergovernmental Panel on Climate Change (2009). <i>Fifth assessment report: climate change 2013, summary for policymakers</i> , IPCC, Geneva. Intergovernmental Panel on Climate Change (2009). <i>Fifth assessment report: climate change 2013, IPCC Working Group I contribution to AR5, the physical science basis</i> , IPCC, Geneva.
	For Australia: <ul style="list-style-type: none">• by 2020, significant loss of biodiversity in some ecologically rich sites is likely• by 2030, water security problems are projected to intensify in eastern Australia• by 2030, production from agriculture and forestry is projected to decline across eastern Australia.	✓ AR4 projections still apply. AR5 provides further levels of confidence and other projections from a global perspective.	
	Targets to avoid catastrophic impacts of climate change: <ul style="list-style-type: none">• average global temperature must not rise by more than 2 °C• 80% of GHG levels in 1990 by 2050• 40% of GHG levels in 1990 by 2020.	✓ The report provided estimates of the total allowable global emissions to limit temperature rise to 2 °C above pre-industrial levels. The cumulative carbon emissions to limit global temperature rise to 2 °C are about 1000 billion tonnes of carbon. In 2011, approximately 515 billion tonnes of carbon had been cumulatively emitted globally.	

ACT = Australian Capital Territory; AP1 = *ACT Climate Change Strategy: weathering the change (Action Plan 1 2007–2011)*; AP2 = *AP2: a new climate change strategy and action plan for the Australian Capital Territory*; BoM = Australian Government Bureau of Meteorology; GHG = greenhouse gas; IPCC = Intergovernmental Panel on Climate Change; NSW = New South Wales

Notes:

1. A1B: One of six scenarios used for climate models. The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and a balanced spread of technology using a wide range of energy sources.
2. A1F1: One of six scenarios used for climate models. The scenario assumes an integrated world characterised by rapid economic growth and a global population of 9 billion people in 2050, a quick spread of new and efficient technologies, and an emphasis on fossil-fuel technologies (ie a fossil fuel–intensive technological world).

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