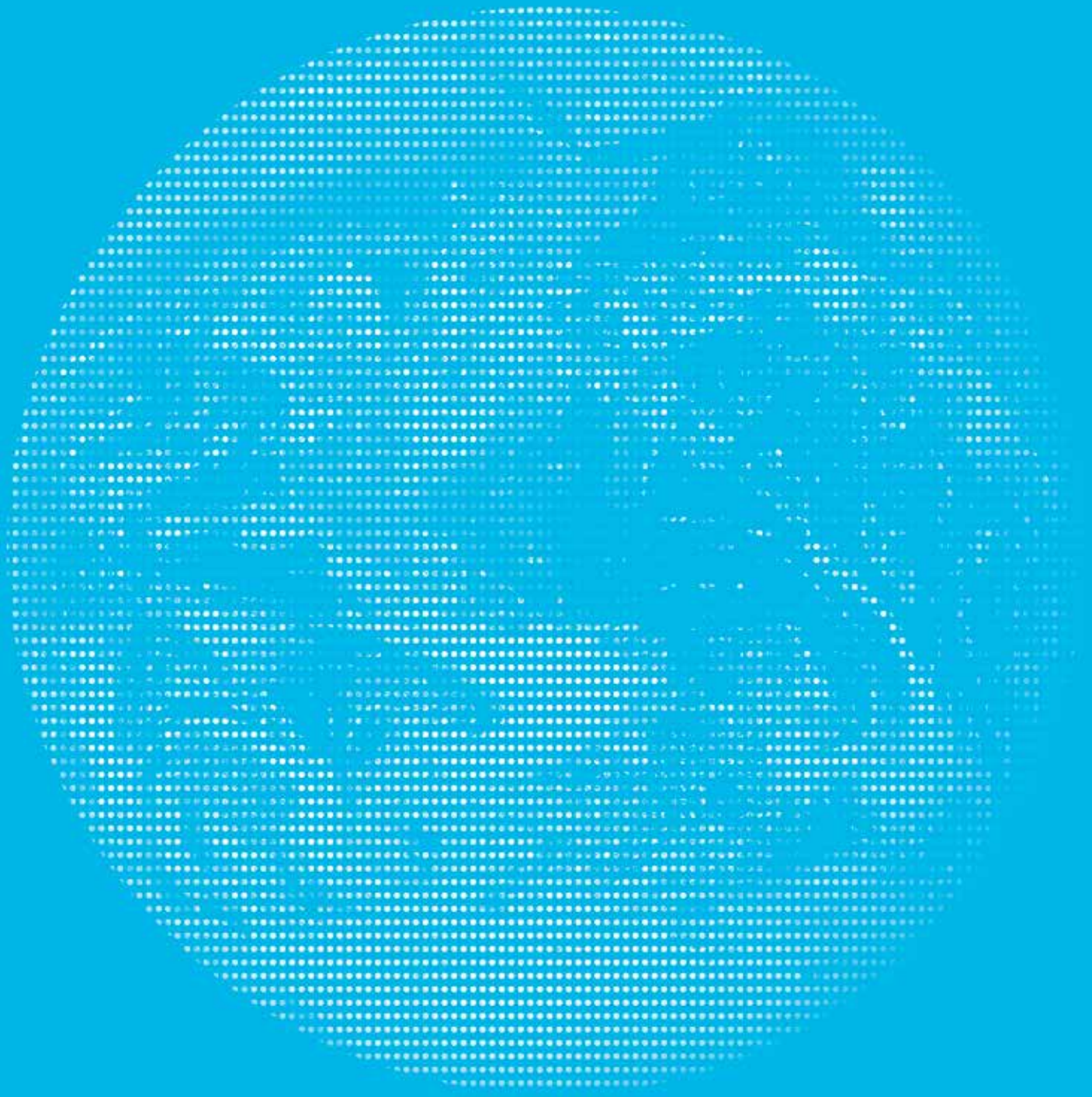
Australian Government
Climate Change Authority

REDUCING AUSTRALIA'S GREENHOUSE GAS EMISSIONS – TARGETS AND PROGRESS REVIEW

DRAFT REPORT

OCTOBER 2013



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DRAFT REPORT

The Climate Change Authority has released this Draft Report to assist individuals and organisations to prepare submissions to the Targets and Progress Review. It outlines:

- the scope of the Review;
- the matters the Authority has considered, and its draft recommendations; and
- how to make a submission.

KEY DATES FOR THE TARGETS AND PROGRESS REVIEW

Issues Paper	Draft Report	Submissions close	Final Report
April 2013	October 2013	29 November 2013	February 2014

HOW TO MAKE A SUBMISSION

The Authority seeks submissions from interested parties on the options and draft recommendations presented in this Draft Report. Submissions must be lodged by 29 November 2013.

Submissions can be lodged online at www.climatechangeauthority.gov.au/submissions.

CONTACTS

For further information about the Targets and Progress Review or making a submission, contact the Climate Change Authority on freecall 1800 475 869 or by emailing enquiries@climatechangeauthority.gov.au.

WEBSITE

www.climatechangeauthority.gov.au

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SUMMARY

This is the Climate Change Authority's Draft Report on its Targets and Progress Review ...

The Climate Change Authority is required under existing legislation to conduct a review of Australia's greenhouse gas emissions reduction goals – the 'Targets and Progress Review'. The purpose of this Review is to recommend emissions reduction goals for the short, medium and long term that are in Australia's national interest. It is primarily about ends, not means. This Draft Report sets out draft recommendations on targets and emissions budgets for Australia, based on the Authority's deliberations over several months and stakeholder submissions and consultations. The Draft Report also details the progress Australia has made in reducing emissions, and identifies opportunities and challenges ahead.

... which is to be completed by 28 February 2014.

The Climate Change Authority is an independent statutory agency that reports to the Australian Parliament through the Minister responsible for climate change. The Final Report for this Review is required to be lodged by 28 February 2014. In preparing its Final Report, the Authority will have regard to stakeholder feedback on this Draft Report.

WHY IS THIS REVIEW IMPORTANT?

This Review comes at an important time for Australia for several reasons.

This Review can inform upcoming decisions on international commitments ...

Australia has an international undertaking to reduce emissions by at least 5 per cent by 2020 compared with 2000 levels. Australia has indicated it may do more – up to 15 per cent or 25 per cent – under certain circumstances. As part of the international negotiations schedule, Australia will be asked to review its minimum 5 per cent offer and to firm up its 2020 intentions in 2014.

A new international agreement, involving all major emitting economies, is scheduled to be negotiated by 2015. This agreement will cover emissions reduction goals beyond 2020; Australia will be expected to participate in this process.

... guide long-term investment decision-making ...

On the domestic front, longer term guidance on emissions reduction goals is a critical factor for many investment decisions, particularly in long-lived capital items.

... and inform the design of the Government's Direct Action Plan.

And, not least, the recent change of government is leading to changes in climate policy, with the carbon pricing mechanism to be replaced by a Direct Action Plan. The centrepiece of the Direct Action Plan is an Emissions Reduction Fund, which will purchase emissions reductions through a reverse auction process. Material contained in this Review sheds light on where emissions reduction opportunities and challenges might lie, and how targets beyond the minimum 5 per cent might be achieved.

WHAT HAS THE AUTHORITY CONSIDERED IN FORMING ITS DRAFT RECOMMENDATIONS?

The Authority's views are grounded in the science ...

The Authority's considerations start with the science (Chapter 2). The most recent report from the Intergovernmental Panel on Climate Change (IPCC) confirms that warming in the climate system is unequivocal, and that human influence on the climate system is clear.

Continued growth in global emissions creates real risks for all countries, including Australia. It is in Australia's interests to contribute to global action to limit the increase in global average temperature compared with pre-industrial levels to below 2 degrees. This is the goal agreed by the international community, along with the objective of avoiding 'dangerous' climate change.

... which says the world needs a long term limit on emissions to stay below 2 degrees of warming and reduce the risks of dangerous climate change.

Climate science also suggests that to have a reasonable chance of achieving this goal, the amount of greenhouse gas emissions needs to be limited (Chapter 3). Keeping within a global emissions budget of 1 700 000 million tonnes of carbon dioxide equivalent (Mt CO_2-e) between 2000 and 2050 is estimated to give a 67 per cent chance of staying below 2 degrees – emitting less would improve these odds; emitting more would reduce them.

Australia also needs to take a long term view of emission limits and set a 2050 emissions budget.

If Australia is to take this science – and the below 2 degrees goal – seriously, it needs to act now and continue this effort over the long term. In this Draft Report, the Authority has expressed its view on what might constitute Australia's fair share of the estimated global emissions budget. The Authority's view is that an Australian emissions budget of 10 100 Mt CO_2-e for the period 2013 to 2050 (or around 1 per cent of the estimated global budget) would represent an equitable share (Chapter 9). The long term emissions budget should obviously be kept under review.

The Authority has also considered international action on climate change ...

A global problem requires global action, and what might be considered a fair effort by Australia depends in part on what other countries are doing. The Authority has therefore reviewed the scale and pace of international action on climate change (Chapter 4), considering both the targets other countries have pledged to achieve, and the policies chosen to pursue those targets.

The evidence suggests international action on climate change is strengthening, particularly in some of the world's largest economies.

... which shows a clear trend towards more ambitious action ...

Ninety-nine countries, including Australia's major trading partners and neighbours, and covering over 80 per cent of global emissions and over 90 per cent of the world's economic output, have 2020 emissions reduction pledges. All of these countries are implementing policies to reduce emissions, including renewable energy targets, emissions trading schemes and vehicle emissions standards.

In particular, the world's two largest emitters – China and the United States (jointly producing over a third of global emissions) – are stepping up their efforts to reduce emissions. Both countries have emissions reduction targets. China is investing heavily in renewable energy projects, closing inefficient coal power plants and trialling market mechanisms to reduce emissions. President Obama announced an ambitious plan for US action in June 2013, including new restrictions on emissions from coal-fired power plants, strengthened vehicle emission standards and renewable energy activities. These complement state-based market initiatives to reduce emissions.

... although all countries need to do more.

Despite these efforts, the cumulative effect of current 2020 emissions reduction pledges falls short of what is required to hold temperature increases below 2 degrees. This suggests all countries, including Australia, will need to do more to help achieve this goal.

The Authority has considered the economic implications of stronger targets ...

As required, the Authority has considered the economic implications of adopting more ambitious targets than the existing 5 per cent minimum commitment.

As part of this consideration, it reviewed Australia's progress to date on emissions reduction (Chapter 7). This suggests that it is possible to sustain economic growth while reducing emissions. Since 1990, the size of the Australian economy has doubled, but the level of emissions has stayed much the same. Emissions reduction policies and other changes in the composition of the economy have been important in keeping emissions flat. Major policy initiatives have included regulations to restrict land clearing, incentives to promote lower emissions sources of electricity generation and energy efficiency policies. A change in the composition of the economy toward a greater reliance on lower emissions sectors (for example, services) and less reliance on high emitting sectors (for example, manufacturing) has also played a role.

... and has concluded that it is possible to move to stronger targets at relatively small cost to the economy.

The Authority has also drawn on modelling work to estimate the costs to the economy of moving to a stronger target (Chapter 10), and to identify where opportunities and challenges might arise in seeking further emissions reductions (Chapter 12). This work suggests that the impact on economic activity and national income would be relatively small even if more ambitious emissions reduction targets were to be adopted.

WHAT IS THE AUTHORITY RECOMMENDING?

The Authority's draft recommendations seek to balance short term clarity and stability with longer term flexibility ...

In this Draft Report, the Authority is recommending emissions reduction goals for the short, medium and long term (Chapter 8). These recommendations seek to balance the need to:

- set clear goals for the near term that are consistent with current long term objectives; but
- maintain flexibility to respond to changing circumstances as they emerge.

... by recommending a single 2020 target and a trajectory range to 2030.

In its Final Report, the Authority proposes to recommend a single target for 2020, a trajectory range to 2030, and a long term emissions budget to 2050.

The trajectory range and the long term emissions budget would be subject to periodic review, having regard to developments in:

- climate change science;
- what other countries are doing; and
- the likely costs of achieving different targets.

IS A 5 PER CENT REDUCTION ENOUGH BY 2020?

The Authority considers a 5 per cent target for 2020 to be inadequate because ...

In short, the Authority views Australia's current minimum 5 per cent target more as a benchmark than an appropriate target, and believes Australia should do better (Chapter 11).

Three main reasons are advanced.

... the Government's conditions and the pace of international action justifies us going further ...

First, the scale and pace of international action suggests that Australia should be pursuing a stronger target. Taken as a whole, the Government's own conditions for moving beyond 5 per cent appear to have been met. More broadly, a 5 per cent target would put Australia at the lower end of effort compared with other developed countries. This position would sit uncomfortably with Australia's relative prosperity and high per person emissions.

... it is inconsistent with action toward the 2 degree goal ...

Second, 5 per cent is considered an inadequate first step if Australia is to play its part in limiting warming to below 2 degrees. Australia would spend a large part of the proposed long term emissions budget earlier, leaving little for the rest of the period out to 2050. A 5 per cent target would require an implausibly rapid acceleration of effort beyond 2020. Failing to do more in the short term is likely to increase future costs and cause unnecessary disruption to the economy and community more broadly. To keep open the option of acting in accordance with the below 2 degrees goal, Australia needs to do more in the short term than is implied in the 5 per cent target.

... and more ambitious targets might now be easier to achieve than earlier thought.

Third, the Authority considers that moving to a stronger target now could be accommodated at a relatively low cost to the economy, based on modelling of Australia's economy and emissions outlook.

Since Australia first announced its target range, the estimated effort required to achieve the 5 per cent (or any stronger) target has fallen. Emissions are not growing as quickly as previously forecast. Australia can now count a broader range of emissions reduction activities toward its target. The costs of several low emissions technologies, particularly renewable energy, have fallen significantly. And Australia's emissions in 2008 to 2012 were lower than its commitment under the Kyoto Protocol, which means that Australia has 91 Mt CO_2-e of emissions rights which it can 'carry over' to the next period – this represents a potential 3 percentage point contribution that might form part of a more ambitious 2020 target.

Official projections made in 2012 indicated that 754 Mt CO_2-e of emissions reductions were required in the period to 2020 to deliver the 5 per cent reduction target. On current estimates, the same level of emissions reductions would be equivalent to an 11 per cent reduction. Taking into account the Kyoto 'carry over' equivalent to 91 Mt CO_2-e, this would imply a 14 per cent reduction by 2020.

Further, a wide range of emissions reduction opportunities are available across all sectors of the economy at relatively modest cost (Chapter 12). Electricity is the most important sector for potential emissions reductions. It has the largest share of Australia's emissions, and the modelling undertaken for the Authority suggests it could contribute the largest share of emissions reductions if policy drivers are effective.

OPTIONS FOR 2020 AND 2030

The Authority's present thinking is that a target of 15 per cent by 2020 is the minimum option consistent with what, in the Authority's view, represents an equitable share for Australia of the estimated global emissions budget to 2050.

The Authority presents two options for 2020 – 15 per cent and 25 per cent, with different trajectory ranges to 2030.

This Draft Report presents two sets of options for Australia's 2020 target and 2030 trajectory range (Chapter 11):

- 15 per cent reduction compared with 2000 level emissions by 2020, and a trajectory range of 35 to 50 per cent by 2030; and
- 25 per cent reduction by 2020 and a trajectory range of 40 to 50 per cent by 2030.

The pros and cons of these options are canvassed in this Report.

Compared with 25 per cent, 15 per cent would require faster reductions later, and would use up more of the budget sooner ...

In relation to their consistency with the long term emissions budget, a 25 per cent target would clearly make a greater short term contribution to emissions reductions, allowing a more consistent pace of emissions reductions in the period to 2050. A 15 per cent target would defer more reductions to later in the period, requiring an acceleration of effort after 2020.

... would place us in the middle of the pack on climate change action ...

Compared with what other countries are doing, the 15 and 25 per cent targets are both broadly in line with the efforts of other key countries.

In terms of the Government's 'conditional' targets, a 15 per cent target would be more consistent with its stated conditions than a 25 per cent target.

... and would cost slightly less in the short term.

In terms of economic costs, a 15 per cent target would impose lower costs on the Australian economy in the short term, but would imply higher costs later (given the implied steeper emissions cuts in future). Based on the modelling, the Authority estimates that the incremental reduction in Gross National Income (GNI) in 2020 would be $2.7 billion, or 0.16 per cent, for a 25 per cent target compared with a 15 per cent target.

As noted above, Australia has the opportunity to carry over unused emissions rights from the first commitment period of the Kyoto Protocol. The Authority's current view is that this carryover of 3 percentage points would be best used to strengthen Australia's 2020 target (Chapter 8).

The Authority is continuing its deliberations on these options, and seeks stakeholder views.

THE ROLE OF INTERNATIONAL EMISSIONS REDUCTIONS

Australia can use international emissions reductions to help meet its target.

Australia's international commitments to reduce greenhouse gas emissions are all expressed in net terms. That is, if actual emissions in Australia are higher than the target, they can be offset by purchases of international emissions reductions. This is the case under the Kyoto Protocol (covering Australia's commitments from 2008 to 2012, and now from 2013 to 2020), and will almost certainly be the case under any new post-2020 agreement.

Climate change is a global phenomenon and requires reductions in emissions around the globe. From a global environmental perspective, there is no special merit in confining emissions reductions to domestic actions, so long as the international emissions reductions purchased are credible.

The Government has stated it will achieve the minimum 5 per cent target domestically, but is still to decide whether international emissions reductions would be drawn upon to meet any stronger target.

While we have many domestic opportunities to reduce emissions ...

Extensive emissions reduction opportunities are available domestically, and progress has been made towards meeting the 5 per cent unconditional target. Based on the modelling, the Authority identifies substantial low to medium cost emissions reduction opportunities across all sectors of the economy – for example, using energy more efficiently in homes and businesses, continuing to reduce land clearing, and adopting cleaner, low emission technologies and production processes.

... allowing international emissions reductions to be part of the mix can help lower costs.

While there are extensive emissions reductions opportunities available in the domestic economy, the modelling also shows that international emissions reductions can help Australia meet its targets in a cost-effective way. There are many options for securing emissions reductions from other countries.

The Government should consider allowing the use of international emissions reductions to go beyond 5 per cent.

In the Authority's view, the Government should consider allowing the use of international emissions reductions to go beyond its minimum 5 per cent commitment, paying careful attention to the environmental integrity of the emissions reductions allowed. Moreover, the Government could consider using genuine international emissions reductions to complement domestic efforts to achieve Australia's minimum 5 per cent commitment.

NEXT STEPS

The Authority seeks feedback on this Draft Report to inform its deliberations on final recommendations.

The Authority welcomes public comment on this Draft Report and the draft recommendations presented. The Authority will consider all submissions received as it finalises this Review and its recommendations on Australia's emissions reduction goals.

The Final Report will be presented to the Minister and published on the Authority's website by 28 February 2014. The report must be tabled in the Australian Parliament within 15 sitting days of the Minister receiving it.

SUMMARY OF DRAFT RECOMMENDATIONS

The Authority's key draft recommendations are summarised below:

National emissions reduction goals to 2020 and 2030

Two sets of options are canvassed for the national emissions reduction target in 2020, carbon budget to 2020, indicative trajectory to 2020 and trajectory range from 2020 to 2030:

	Option 1	**Option 2**
2020 emissions reduction target	15 per cent below 2000 levels	25 per cent below 2000 levels
Indicative national emissions trajectory for the period 2013–2020	A straight line to the 2020 target. This line starts at Australia's first commitment period target under the Kyoto Protocol (108 per cent of 1990 levels) in 2010, and ends at 15 per cent below 2000 levels in 2020.	A straight line to the 2020 target. This line starts at Australia's first commitment period target under the Kyoto Protocol (108 per cent of 1990 levels) in 2010, and ends at 25 per cent below 2000 levels in 2020.
National carbon budget for the period 2013–2020	4 314 Mt CO_2-e	4 010 Mt CO_2-e
Trajectory range to 2030	Beyond 2020, reduce emissions within a trajectory range bounded by the paths to a 35 and 50 per cent reduction below 2000 levels in 2030.	Beyond 2020, reduce emissions within a trajectory range bounded by the paths to a 40 and 50 per cent reduction below 2000 levels in 2030.

National budget to 2050

A national carbon budget for the period 2013–2050 of 10 100 Mt CO_2-e, to be reviewed regularly, having regard to developments in climate science, international action and economic factors.

Using international emissions reductions

Australia to keep under consideration the use of genuine international emissions reductions where this is a cost-effective way of helping to meet its emissions reduction goals.

Level of carbon pollution caps

As called for in the current legislation, five annual carbon pollution caps for the existing carbon pricing mechanism:

	If Australia adopts a 2020 target of 15 per cent (Mt CO_2-e)	If Australia adopts a 2020 target of 25 per cent (Mt CO_2-e)
2015–16	234	193
2016–17	229	178
2017–18	224	182
2018–19	219	171
2019–20	214	165

PART A

INTRODUCTION AND CONTEXT

Part A introduces the Targets and Progress Review. In this Review, the Authority will make recommendations to the Australian Parliament, through the Minister responsible for climate change, about emissions reduction goals for Australia, including a 2020 target and a long term emissions budget. The Authority will also review Australia's progress toward meeting these goals and identify future emissions reduction opportunities – both within Australia and internationally. In developing its recommendations, and in drawing the conclusions set out in this Draft Report, the Authority considered evidence and expert and stakeholder views about a wide range of matters.

Part A explores the context in which Australian decisions about emissions reductions are made. It presents evidence about the climate science, the impacts of climate change and what is required to meet the collective global goal to limit global warming to below 2 degrees Celsius above pre-industrial levels. It then considers global action to reduce greenhouse gas emissions, how global action measures against the below 2 degrees global goal and what this means for Australian action.

Part A explores:

- **the scope of the Review and the Authority's approach to it (Chapter 1);**
- **evidence arising from climate science and the likely impacts of climate change on Australia and other countries (Chapter 2);**
- **the amount of greenhouse gas emissions the world can emit while preserving a likely chance of limiting global warming to below 2 degrees (Chapter 3);**
- **global action to date to reduce greenhouse gas emissions and build supporting international frameworks and agreements (Chapter 4); and**
- **how the global context should be factored into the Authority's recommendations about Australia's emissions reduction goals (Chapter 5).**

CHAPTER 1
ABOUT THIS REVIEW

The Climate Change Authority provides independent, expert advice on Australian climate change policy.

The Targets and Progress Review is intended to help the Commonwealth Government make decisions about Australia's future emissions reduction goals. The Final Report will recommend a 2020 target and national emissions budget, a 2030 trajectory range and a 2050 emissions budget.

This Review is primarily about ends rather than means. It focuses on Australia's goals for reducing emissions and progress toward those goals, rather than the policy mechanisms for achieving them.

The Authority has taken as a starting point Australia's existing international obligations and undertakings, including its commitment to the global goal to limit average temperature increases to below 2 degrees above pre-industrial levels, and its 2020 emissions reduction targets under the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol.

In making recommendations, the Authority has taken into account the latest climate science and assessment of possible impacts, international action, Australia's progress in reducing emissions, issues of international and inter-generational equity, the economic costs of different targets and opportunities for future emissions reductions.

The Authority is seeking stakeholder feedback on its draft recommendations ahead of its Final Report, to be submitted to the Minister responsible for climate change by 28 February 2014 for tabling in Parliament.

This chapter introduces the Targets and Progress Review and provides information about:

- the Climate Change Authority, its role and guiding principles;
- the scope of the Review;
- the approach the Authority has taken in its analysis and recommendations; and
- the structure and content of this Draft Report.

1.1 THE CLIMATE CHANGE AUTHORITY

The Climate Change Authority is an independent statutory agency, established to provide expert advice on Australian climate change policy, including through a scheduled series of reviews of climate programs and legislation. The Targets and Progress Review is the Authority's second review; the Authority completed its first review of the Renewable Energy Target in December 2012.

The Authority is chaired by Mr Bernie Fraser and consists of eight other members with expertise in climate science, economics, business and public policy.

The Authority's work is guided by a set of principles listed in the *Climate Change Authority Act 2011* (Cth). The Act states that, in conducting a review, the Authority must have regard to the principle that any measure to respond to climate change should:

- be economically efficient;
- be environmentally effective;
- be equitable;
- be in the public interest;
- take account of the impact on households, business, workers and communities;
- support the development of an effective global response to climate change;

- be consistent with Australia's foreign policy and trade objectives; and
- take into account any additional principles the Authority considers relevant.

The Targets and Progress Review has been guided by these principles.

The Authority is required to conduct public consultation for all its reviews. The Authority has engaged with a wide range of interested parties during the Targets and Progress Review, including through presentations to stakeholder groups (details of stakeholder engagement are listed at Appendix A). The Authority sought broad comment on an Issues Paper, which it released in April 2013. The Authority received 73 submissions in response to the Issues Paper and considered those views in preparing this Draft Report. The Issues Paper and submissions are available on the Authority's website at www.climatechangeauthority.gov.au.

The Authority proposes to continue to engage actively with stakeholders as it finalises this Review.

1.2 REVIEW OF TARGETS AND PROGRESS

The Commonwealth Government will need to make decisions in the near future (outlined in Box 1.1) about Australia's 2020 target and post-2020 emissions reduction goals. Under the UNFCCC and the Kyoto Protocol, countries are considering ways to increase global action to reduce emissions and will have an opportunity to put forward stronger 2020 targets in 2014. At the same time, UNFCCC Parties are considering a post-2020 international climate framework. Australia is likely to be requested to put forward some indication of its post-2020 action in 2014 or 2015.

This Review of Australia's emissions reduction targets and progress toward them is intended to help inform the Government in reaching decisions on these matters.

In the Review, the Authority seeks to:

- present evidence about climate science and international action to reduce greenhouse gas emissions;
- assess Australia's progress in reducing greenhouse gas emissions across the whole economy and within specific sectors;
- recommend a long term emissions budget to 2050 that connects Australia's emissions reduction goals to its national interest in limiting average global warming to below 2 degrees Celsius above pre-industrial levels, to be subject to regular review;

BOX 1.1: CLIMATE CHANGE MILESTONES, 2013–2015

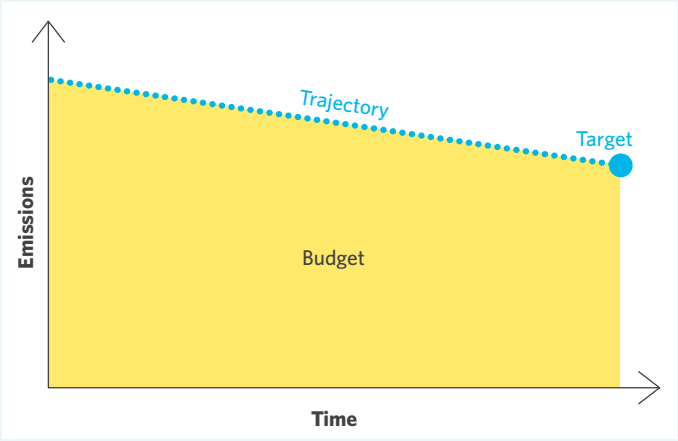
2013	
November	UNFCCC meeting in Warsaw, Poland
2014	
April	Australia due to submit a report to the UNFCCC on whether it will revisit its 2020 target under the Kyoto Protocol
September	World leaders' summit to discuss global action on climate change
October	IPCC Synthesis Report of the Fifth Assessment Report (synthesising the previously released reports from the IPCC working groups)
November	Australia hosts G20 Leaders' summit as 2014 chair of G20
November/December	UNFCCC meeting in Peru, including a review of global ambition for climate action (providing an opportunity for Australia to increase its 2020 targets)
2015	
December	UNFCCC meeting in Paris, France; new agreement on post-2020 framework for global climate action due to be negotiated

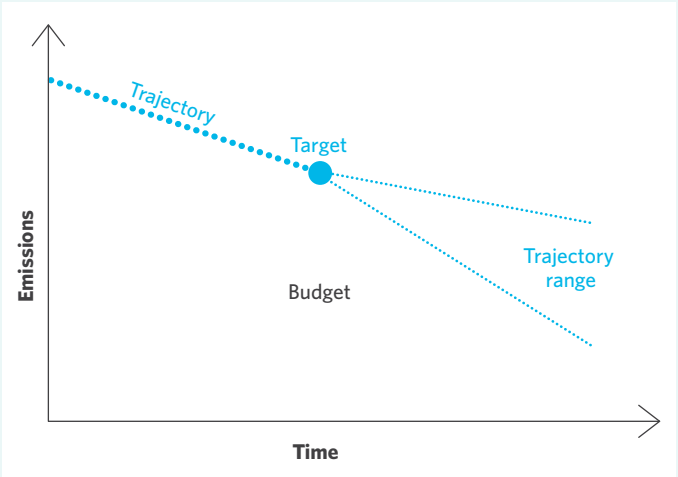
- recommend a single 2020 emissions reduction target to replace Australia's current 2020 target range of 5 to 25 per cent;
- recommend trajectory ranges to 2030 bounding Australia's medium term emissions reductions, and criteria for extending and adjusting the medium term trajectory range over time; and
- identify and assess opportunities for emissions reductions in different sectors of the economy.

Consistent with Australia's international commitments, the recommended emissions reductions goals are net of trade. This means that international emissions reductions purchased by Australia can count towards Australia's target, but any emissions reductions that Australia sells overseas cannot be counted toward the target.

Legislation requires the Authority's Final Report of the Targets and Progress Review to be completed by 28 February 2014.

BOX 1.2: KEY DEFINITIONS – AUSTRALIA'S EMISSIONS REDUCTION GOALS





Target: A goal for national emissions for a specified year. The Authority will recommend a 2020 target expressed as a percentage reduction in emissions from 2000.

Budget: Australia's cumulative emissions allowance over a period of time (see diagram). The Authority will recommend a short term budget for total emissions between 2013 and 2020 (the 2020 budget), and a long term budget between 2013 and 2050 (the 2050 budget).

Trajectory: Australia's indicative year-by-year national emissions pathway to its target. The Authority will recommend a trajectory from 2013 to 2020. It will also recommend a trajectory range from 2020 to 2030 to guide future trajectories (see 'trajectory range' below). The year-by-year points on the trajectory are indicative (non-binding) targets in each year. The area under the trajectory constitutes an emissions budget.

Trajectory range: Range within which future trajectories may be set (see diagram). A trajectory range provides an indication of future trajectories and flexibility to take into account new information. The Authority is recommending a trajectory range from 2020 to 2030.

'Net' emissions: Australia's target, and all of the other goals discussed above, relate to 'net emissions' – that is, they are goals for emissions from the domestic economy after accounting for any emissions units imported from other countries or exported by Australia. Actual emissions in Australia could be higher if offset by purchases of international emissions reductions.

This Review covers two legislated reviews under the *Clean Energy Act 2011* (Cth), which require the Authority to:

- make recommendations about Australia's emissions reduction goals, including specifically an indicative national emissions trajectory and a national carbon budget (referred to in this report as an emissions budget) and carbon pollution caps (section 289); and
- report on Australia's progress in achieving its medium term and long term emission reductions targets, as well as progress to meeting a national emissions budget (section 291).

The matters to which the Authority must have regard in conducting these reviews are set out in the *Clean Energy Act* and listed at Box 1.3.

BOX 1.3: LEGISLATED REVIEW REQUIREMENTS

The *Clean Energy Act* sets out specific matters to which the Authority must have regard in the Targets and Progress Review:

Review of caps, trajectories and budgets
(section 289)

(a) Australia's international obligations under international climate change agreements;

(b) undertakings relating to the reduction of greenhouse gas emissions that Australia has given under international climate change agreements;

(c) Australia's medium term and long term targets for reducing net greenhouse gas emissions;

(d) progress toward the reduction of greenhouse gas emissions;

(e) global action to reduce greenhouse gas emissions;

(f) estimates of the global greenhouse gas emissions budget;

(g) the economic and social implications associated with various levels of carbon pollution caps;

(h) voluntary action to reduce Australia's greenhouse gas emissions;

(i) estimates of greenhouse gas emissions that are not covered by this Act;

(j) estimates of the number of Australian carbon credit units that are likely to be issued;

(k) the extent (if any) of non-compliance with this Act and the associated provisions;

(l) the extent (if any) to which liable entities have failed to surrender sufficient units to avoid liability for unit shortfall charge;

(m) any acquisitions, or proposed acquisitions, by the Commonwealth of eligible international emissions units;

(n) such other matters (if any) as the Climate Change Authority considers relevant.

Review of progress
(section 291)

(a) the level of greenhouse gas emissions in Australia;

(b) the level of purchases of eligible international emissions units (whether by the Commonwealth or other persons);

(c) the level of greenhouse gas emissions that:

(i) are attributable to activities in the Australian economy; and

(ii) are not reflected in the provisional emissions numbers of liable entities;

(d) voluntary action to reduce greenhouse gas emissions;

(e) such other matters (if any) as the Climate Change Authority considers relevant.

1.3 A NEW CLIMATE CHANGE POLICY FOR AUSTRALIA

The Authority recognises that the recently elected Commonwealth Government intends to implement different policy settings from those in the *Clean Energy Act*. This Review, however, is more about ends than means. It focuses on Australia's goals for reducing emissions and past progress towards those goals, rather than the policy mechanisms for achieving them. It should therefore be relevant to Government consideration of Australia's future climate goals, whatever the preferred policy instruments for pursuing such goals.

It is understood that the centrepiece of the Government's new Direct Action Plan will be an Emissions Reduction Fund. The Government has issued Terms of Reference for the development of a White Paper on the Emissions Reduction Fund. It will release a Green Paper setting out the Government's preferred options for the design of the Fund in December 2013, and a White Paper in early 2014 outlining the final design of the Fund. The Authority has not speculated about the precise parameters of the Plan ahead of the Government's decision. The Authority believes the analysis of Australia's emissions reduction activities in this report, including opportunities for emissions reductions in the Australian economy, is likely to be relevant to the implementation of such a policy.

At the same time, some aspects covered in this Review are specific to the carbon pricing mechanism, including the Authority's recommendations on the level of carbon pollution caps. The Authority is required to make these recommendations by the current legislation; they are detailed in Part E of the Draft Report.

1.4 THE AUTHORITY'S APPROACH TO RECOMMENDING EMISSIONS REDUCTION GOALS AND ASSESSING AUSTRALIA'S PROGRESS

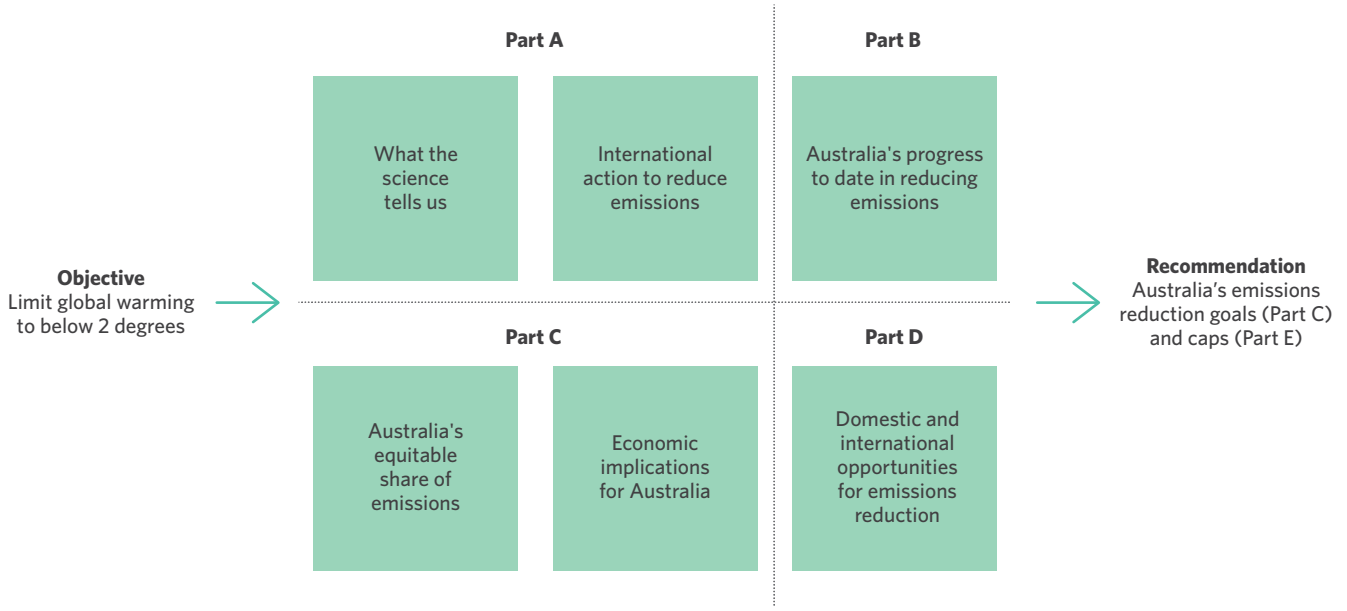
The Authority has weighed a broad range of considerations in reaching the draft recommendations in this Review. Prominent among these was Australia's participation in efforts to limit global warming. The Authority has weighed this interest against the costs of reducing emissions, and sought to reach a view about Australia's appropriate share of the global emissions reduction task.

Figure 1.1 illustrates the key considerations of the Targets and Progress Review, as explored in this Draft Report.

The Authority has taken Australia's existing international obligations and undertakings as a starting point for its deliberations, including Australia's commitment to the collective goal to limit average global warming to below 2 degrees. It has also taken into account Australia's other emissions reduction commitments, including:

- Australia's international undertaking under the UNFCCC to reduce emissions by 5 per cent (unconditional undertaking) or up to 15 per cent or 25 per cent below 2000 levels by 2020; and

FIGURE 1.1: TARGETS AND PROGRESS REVIEW – KEY CONSIDERATIONS AND STRUCTURE OF THE REPORT



- Australia's international undertaking under the Kyoto Protocol to limit average annual emissions in the period 2013 to 2020 to 99.5 per cent of 1990 levels, a calculation based on the unconditional 5 per cent target.

None of the Authority's recommendations would lead to Australia breaching its existing international obligations and undertakings; in other words, Australia's existing UNFCCC and Kyoto Protocol commitments have been taken as minimums.

This report is divided into five parts.

PART A: INTRODUCTION AND CONTEXT

The Authority has considered Australia's emissions reduction goals in a global context. Part A outlines the Authority's consideration of:

- what climate science tells us about the threats climate change poses to Australians (Chapter 2);
- how climate science can inform the calculation of global emissions budgets, and possible limits on greenhouse gas emissions to achieve a given limit on global warming (Chapter 3);
- observed trends in action taken by other countries to address climate change (Chapter 4); and
- Australia's role in global climate change action, including how different Australian emissions reduction targets compare with the targets of other key countries (Chapter 5).

PART B: AUSTRALIA'S POLICY AND PROGRESS TO DATE

Australia's progress to date in reducing emissions is relevant to considering future action to reduce emissions. Part B considers:

- Australian policy to address climate change (Chapter 6); and
- Australia's progress in reducing greenhouse gas emissions (Chapter 7).

PART C: AUSTRALIA'S EMISSIONS REDUCTION GOALS

Part C sets out the Authority's draft recommendations for Australia's emissions reduction goals (Chapter 11). Part C considers:

- the timeframe, form and scope of Australia's emissions reduction goals (Chapter 8);
- an equitable 2050 budget for Australia, including equity between countries and generations (Chapter 9); and
- economic implications of Australia's emissions reduction goals (Chapter 10).

PART D: REDUCING AUSTRALIA'S EMISSIONS – OPPORTUNITIES AND CHALLENGES

Part D examines emissions reduction opportunities across different sectors of the Australian economy and challenges to realising those opportunities (Chapter 12). It also examines international emissions reduction activities and considers the risks and benefits of supporting mitigation overseas as a way of meeting Australia's emissions reduction goals (Chapter 13).

PART E: IMPLEMENTATION ISSUES UNDER THE CARBON PRICING MECHANISM

Part E sets out the Authority's recommendations associated with achieving Australia's emissions reduction goals under the carbon pricing mechanism, including recommendations for carbon pollution caps (Chapter 14).

CHAPTER 2
SCIENCE AND IMPACTS OF CLIMATE CHANGE

2

There is no doubt that the climate has been warming since the 19th century. It is extremely likely[1] that humans have been the dominant cause of the observed warming since the 1950s due to greenhouse gas emissions from activities such as the burning of fossil fuels.

Increases in greenhouse gas concentrations and global surface temperature are occurring much more rapidly than at previous times in the Earth's history. This is affecting weather, human settlements, agriculture, water resources and ecosystems.

The international community has committed to limiting global warming to below 2 degrees. This will not avoid impacts – humans and the natural environment will still experience more frequent extreme weather events, changes to the distribution of rainfall and changes in the habitat range for particular species. However, if the world limits warming to no more than 2 degrees, Australia is likely to be capable of adapting to many of the projected impacts. Above 2 degrees, many regions, environmental and economic sectors will face increasingly significant challenges and adaptation may not be possible.

If emissions continue to grow at current rates, warming is projected to increase rapidly over the 21st century, exceeding 2 degrees within the next few decades, and foreseeably reaching 4 degrees or more by the end of the century. Higher temperatures are projected to bring more severe impacts, including inundation of low-lying coastal areas, climate-induced migration of millions of people, growing risks to human health from many sources, and the collapse of many vulnerable ecosystems including the Great Barrier Reef and the Kakadu wetlands. Temperature increases above 2 degrees also heighten the risks of triggering several highly disruptive climate feedbacks, which could amplify the initial warming caused by greenhouse gases and increase the severity of climate change impacts. These impacts would be highly disruptive, impose a heavy financial burden and, in many cases, would prove to be beyond Australia's capacity to adapt.

Australia has a clear national interest in limiting global warming to no more than 2 degrees.

This chapter provides the essential context for this Review, and why Australia and the world must take action to limit global warming. The scientific reality is that climate change is taking place, and that humans are having a clear influence on the climate system – greenhouse gas concentrations have grown at rapid rates since the 1950s, more energy has been trapped within the Earth's system, temperatures have increased and scientific understanding of the climate system has advanced (IPCC 2013a, p. 10). These developments are comprehensively discussed in the latest Intergovernmental Panel on Climate Change (IPCC) 2013 report on the physical science basis of climate change, which is the pre-eminent source of peer-reviewed science assessing climate change.

Despite the compelling scientific evidence, coverage of the science can at times be misrepresentative and confusing, focusing on moment-in-time detail, rather than long-term trends. Long-term trends will ultimately determine the magnitude of impacts from a warming climate and their effects on future generations, and are the most appropriate guide for policy-makers. This Review uses the scientific consensus on climate change as its foundation, and takes the warnings it has been sounding over many years very seriously.

1 'Extremely likely' is defined by the IPCC as 95–100% probability.

Climate change is already affecting human settlements and ecosystems in a range of damaging and disruptive ways, which will extend and worsen with increasing temperatures. To reduce the risk of encountering increasingly severe impacts, the world needs to make substantial and continued efforts to reduce greenhouse gas emissions, consistent with limiting warming to no more than 2 degrees. The scale of this global challenge is described in Chapter 3, which outlines what is required at a global level to give a reasonable chance of limiting warming to below 2 degrees. Chapter 9 discusses the national challenge and what Australia's fair share of the global emissions reduction task may be.

Specifically, this chapter discusses:

- the relationship between greenhouse gases and global warming;
- climate science modelling and risks;
- the impacts from climate change observed to date; and
- the projected impacts of climate change, both globally and in Australia.

2.1 CLIMATE CHANGE SCIENCE

2.1.1 THE RELATIONSHIP BETWEEN GREENHOUSE GASES AND TEMPERATURE

There is no doubt that the climate has been warming since the 19th century. The main cause is the increase in concentrations of greenhouse gases (and especially carbon dioxide), which have been growing since industrialisation, primarily as a result of human activities.

The connection between greenhouse gas concentrations in the atmosphere and the warming of the climate was made more than a century ago (IPCC 2007a, p. 103). Greenhouse gases trap and re-emit radiant heat in the atmosphere, which warms the Earth's surface and climate through what is commonly called the greenhouse effect. The primary greenhouse gases are carbon dioxide, methane, nitrous oxide, water vapour and ozone; additional greenhouse gases are covered under the Kyoto Protocol[2]. Carbon dioxide is the most important – it is produced in large quantities by human activities, is in the highest concentration of all the greenhouse gases and is very long-lived: about one-third of the carbon dioxide increase due to emissions this year will remain in the atmosphere in 100 years, and about 20 per cent will still be present in 1 000 years. This means that carbon dioxide emissions continue to affect the climate long after they are released.

The record of the distant past confirms current observations that increasing greenhouse gas concentrations have a warming effect on the climate. The historical record has been established by samples of ice cores, which provide 800 000 years of information regarding the composition of the gases in the atmosphere (trapped in bubbles within the ice) and temperatures over time (IPCC 2013a, p. 7). Additional information on the climate of the past has been obtained from deep sea sediments and geological formations and fossils, which extend our understanding of the Earth's climate to millions of years ago.

BOX 2.1: BACKGROUND TO THE IPCC FIFTH ASSESSMENT REPORT

The IPCC is a scientific body under the auspices of the United Nations and the leading international body for the assessment of climate change. It reviews, assesses and synthesises the most recent peer-reviewed scientific, technical and socio-economic literature on the status of climate change produced worldwide. The IPCC has a comprehensive review process to ensure assessments are objective and thousands of scientists contribute to it globally.

The first working group report of the IPCC's 2013 Fifth Assessment Report reinforces a message which has been consistent since the IPCC's First Assessment Report in 1990, almost 25 years ago – human activities are heating up the planet. The 2013 report again confirms the projected long-term trends attributable to increased greenhouse gas concentrations, with strengthened confidence and scientific understanding based on a vast body of evidence accumulated over many years.

2 The Kyoto Protocol gases are carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexafluoride and nitrogen trifluoride. Nitrogen trifluoride is included for the second commitment period.

Since 1750 and the beginning of the Industrial Revolution, human activities, primarily the burning of fossil fuels and deforestation, have dramatically increased the amount of carbon dioxide in the atmosphere (by 40 per cent), as well as methane (by 150 per cent) and nitrous oxide (by 20 per cent) (IPCC 2013a, p. 7). Based on ice core records, current concentrations of these three greenhouse gases substantially exceed the concentrations which existed over the last 800 000 years (IPCC 2013a, p. 7).

It is extremely likely that most of the warming observed since the 1950s has been caused by increases in greenhouse gas concentrations that have been produced from human activities (IPCC 2013a, p. 12). This assessment is supported by very strong scientific consensus that climate change has been caused by human activities – from a study of almost 12 000 peer-reviewed journal article abstracts published between 1991 and 2011 which mention anthropogenic global warming, more than 97 per cent endorsed this conclusion (Cook et al. 2013).

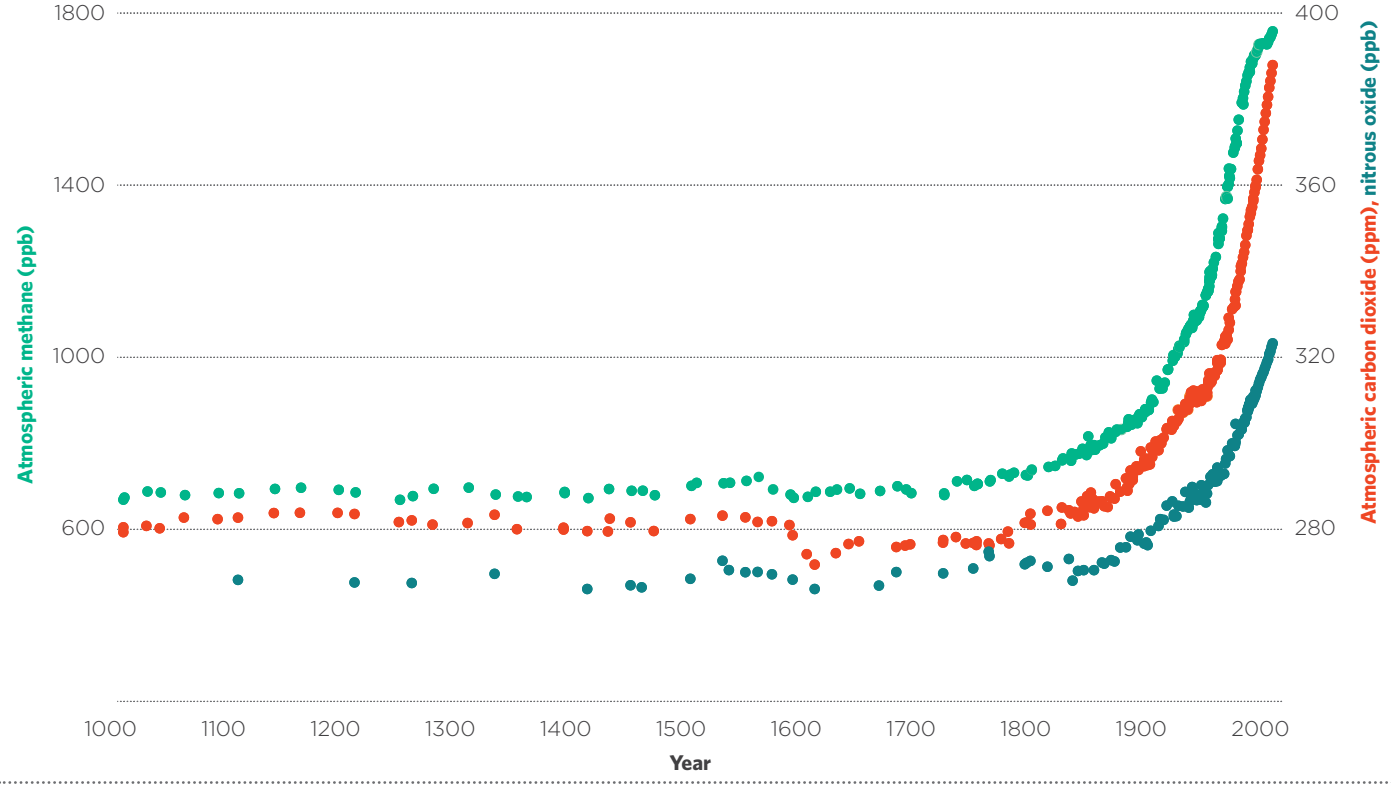
Figure 2.1 charts the level of carbon dioxide, methane and nitrous oxide over the past 1 000 years, showing rapid increases in concentrations in all three major greenhouse gases, particularly since the 1950s.

While all greenhouse gases have a warming effect, other agents in the atmosphere can have either a cooling or warming influence. The most widely discussed are aerosols, tiny airborne particles such as soot produced from burning fossil fuels, that remain in the atmosphere for a few hours to a few weeks. Aerosols produced by human activities have a net cooling influence on the global climate, and currently mask the warming influence of all non-carbon dioxide greenhouse gases. The cooling effect of aerosols is expected to decline over coming decades as countries implement pollution reduction policies.

2.1.2 IS THE CURRENT WARMING UNUSUAL?

Measurements from the recent past (going back more than a hundred years) confirm that both temperatures on Earth and greenhouse gas concentrations have been increasing. Despite the Earth's history of climate variability, the level of current carbon dioxide concentrations is unprecedented for at least 800 000 years (IPCC 2013a, p. 7). Warming is also occurring much more rapidly, at rates which are very unusual compared with climate in the past (IPCC 2007a, p. 465). It is highly likely that temperature changes will intensify over coming decades, increasing at a rate at least 10 times faster than any climatic shift over the past 65 million years (Diffenbaugh et al. 2013). A recent reconstruction of global temperatures spanning the last 11 300 years – roughly the time span of developed human civilizations – found that the decade from 2000–2009 was warmer than 75 per cent of all temperatures during the same period, and that the projections for global temperatures to 2100 under various emissions scenarios exceed the range of temperatures ever experienced by modern humans (Marcott et al. 2013).

FIGURE 2.1: CARBON DIOXIDE, METHANE AND NITROUS OXIDE CONCENTRATIONS OVER THE PAST 1 000 YEARS



Source: Adapted from CSIRO 2012, p. 8

2.1.3 CLIMATE MODELS

Climate models also support the evidence of a warming climate. Climate models are based on physical laws and representations of the climate system, including the atmosphere, land, oceans, carbon cycles and climate. There is a high degree of confidence in the ability of climate models to simulate changes such as large-scale temperature changes, the more rapid warming which has occurred since the 1950s, seasonal Arctic sea ice extent and the global distribution of temperature extremes (IPCC 2013b, ch. 9, pp. 3–4). This confidence is a result of comparing actual observations of past climate with model simulations on a regular basis. The future extent of climate change cannot be predicted with certainty because there are several unknowns, such as the level of emissions from human activities and the precise temperature response to concentrations of greenhouse gases. Despite this, extensive testing provides confidence that climate models represent the best tools for estimating future climate change (CSIRO 2013a).

2.1.4 UNCERTAINTIES AND RISKS OF A WARMING CLIMATE

One of the factors that will determine future temperature is the way in which carbon dioxide emissions are taken up within the Earth's system. Carbon dioxide emissions can dissolve in the ocean, be taken up by plants and other vegetation through photosynthesis or remain in the atmosphere. So far, about 55 per cent of carbon dioxide emissions from fossil fuel combustion have been absorbed by the land and oceans combined, with the rest remaining in the atmosphere, which is where the greenhouse effect takes place. But there is evidence that the ocean has become less effective at absorbing carbon dioxide emissions over the past 50 years (Canadell et al. 2007). Although trees and vegetation have been increasing the amount of carbon dioxide removed through photosynthesis, this trend is expected to peak and decline by the middle of the 21st century under current rates of emissions (IPCC 2007b, p. 213).

This is due to plants reaching their maximum rates of photosynthesis and higher rates of decay of dead organic matter (which releases greenhouse gases). There is also projected dieback of some forests due to changes in precipitation and temperature, notably in the Amazon rainforest (IPCC 2007b, pp. 221–222). The weakening capacity of the land and oceans to absorb carbon dioxide means that more emissions are expected to remain in the atmosphere in the future, which would increase the warming trend.

A substantial risk in the future level of climate change relates to uncertainty in the timing and temperature at which some very disruptive climate feedbacks will be triggered. Climate feedbacks are climate-related processes that can have positive or negative impacts on temperature change, depending on whether they amplify or negate the current increase in temperature. Positive climate feedbacks are particularly concerning because they may drive additional warming. There are many significant positive feedbacks which could occur. One example is the potential large-scale melting of permafrost, which is perennially frozen ground that stores carbon in the form of organic matter (Tarnocai et al. 2009). If permafrost melts on a large scale, the organic material will decay, releasing unknown quantities of carbon dioxide and methane over centuries that could amplify the greenhouse effect.

BOX 2.2: HAS GLOBAL WARMING 'PAUSED'?

While the long-term trend of a warming climate remains, the warming trend between 1998 and 2012 in global average surface temperature was lower than the average trend over the period 1950–2012 (IPCC 2013a, pp. 3, 10). The lower rate of warming observed over the past 15 years is explained by natural variability, including volcanic eruptions which increased the volume of cooling aerosols in the stratosphere, as well as redistribution of heat within the ocean (IPCC 2013a, pp. 9–10).

This relatively short-term variability does not change the long-term trends of a warming climate – average surface temperatures over land and oceans have been successively warmer in each of the last three decades compared with any preceding decade since 1850, and the first decade of the 2000s was the warmest on record. Many other climate indicators confirm the ongoing warming influence of higher concentrations of greenhouse gases – from the 1990s to the present, sea levels have continued to rise, warming is occurring at greater depths of the ocean and ice sheets have been melting at greater rates, compared to earlier periods.

Higher levels of warming also increase the likelihood that the climate system will reach a tipping point that results in an abrupt and irreversible change to the climate system. Examples of tipping points include permanent melting of the Greenland and West Antarctic ice sheets. This could be triggered before the end of the 21st century under higher levels of warming and create continuously rising seas for centuries or millennia – there is enough ice contained in the West Antarctic ice sheet to increase global average sea levels by about six metres under complete melting, while Greenland's ice sheet could increase sea levels by an additional seven metres (Richardson et al. 2011, ch. 3.5.2). Another tipping point would be a permanent shift in the strength and location of the Indian summer monsoon, which could endanger the production of food for more than a billion people (Lenton et al. 2008, Table 1).

Current scientific understanding indicates that thresholds for setting off most of these high-risk climate system processes are unlikely to lie below 2 degrees of warming (Lenton et al. 2008, Table 1). An important exception is the irreversible melting of Arctic summer sea ice and the Greenland ice sheet, which could be triggered under average global warming of between 1 and 2.5 degrees, as temperature increases in the Northern Hemisphere are higher than the global average (Lenton et al. 2008, Table 1[3]).

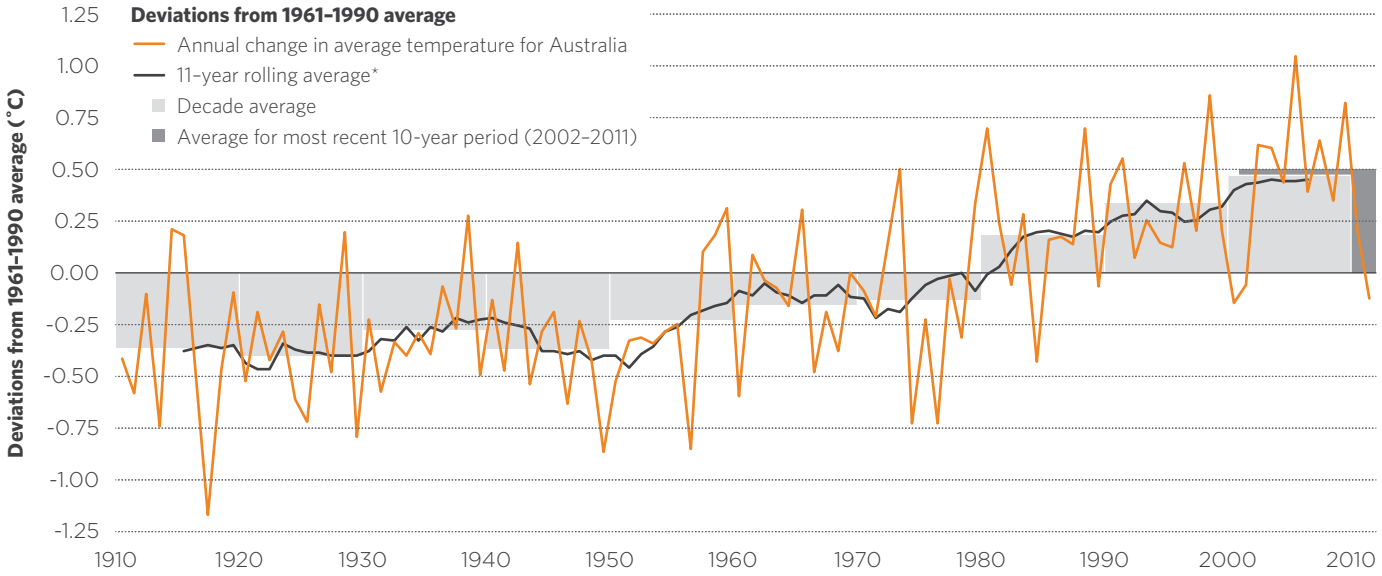
The precise temperature thresholds of some disruptive feedbacks and tipping points are not known with certainty, but they could result in very severe outcomes. It is clear that action should be taken to avoid the risk of triggering them wherever possible.

2.2 CLIMATE CHANGE IMPACTS

In 2009, the international community agreed to a global goal to limit average temperature increases to below 2 degrees (Copenhagen Accord 2009). This does not mean that significant impacts from climate change do not occur below 2 degrees. Emerging evidence indicates that climate change impacts at lower temperatures are larger and more damaging than previously estimated, and that changes in the climate system are occurring more rapidly than expected (IPCC 2007b, 19.3.7; Smith et al. 2009). Small island states are particularly vulnerable to sea level rise, storm surges and ocean acidification, and are among those that do not accept 2 degrees as a sufficient upper limit to prevent dangerous climate change impacts. The international community has agreed to conclude a review in 2015 of whether the 2 degree goal should be strengthened to a 1.5 degree limit.

Current and projected impacts of climate change are discussed below. These clearly demonstrate Australia's interest in limiting global warming to 2 degrees or below.

FIGURE 2.2: AVERAGE TEMPERATURES IN AUSTRALIA OVER THE PAST CENTURY



Source: CSIRO 2012, p. 3
Note: *11-year average is the standard used by the IPCC.

3 Lenton describes warming above the 1980–1999 average. 0.5 degrees has been added to Lenton et al's estimates for warming from the Industrial Revolution to 1980–1999.

2.2.1 TEMPERATURE RISE AND OBSERVED IMPACTS TO DATE

Between 1880 and 2012, average global surface temperatures over land and the ocean have warmed by 0.85 degrees (IPCC 2013a, p. 3). Each of the last three decades has been successively warmer than any preceding decade since 1850 (IPCC 2013a, p. 3). This average conceals substantial regional variations, with higher levels of warming at northern latitudes in particular – average Arctic temperatures have increased at twice the global average over the past century, and the three decades to 2012 were likely the warmest 30-year period in the Northern Hemisphere for the last 1 400 years (IPCC 2007b, p. 30; IPCC 2013a, p. 3).

In Australia, average daily temperatures have warmed by 0.9 degrees and average nightly temperatures have warmed 1.1 degrees since 1910 (CSIRO 2012, pp. 3–4). Figure 2.2 charts the difference in Australian average annual temperatures (orange line) and smoothed trend (black line) against the 1961–1990 average temperature. Decade average deviations from the 1961–1990 average are shown in the grey boxes. Despite annual variability, every decade has been warmer than the previous one since the 1980's.

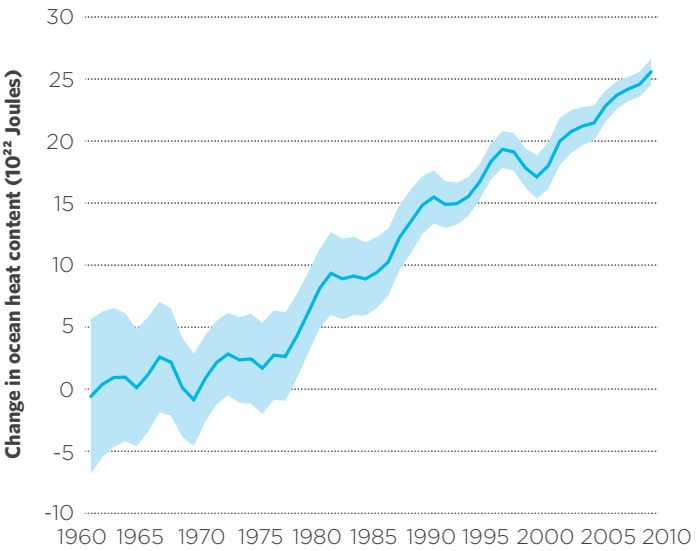
The world's oceans have also been warming, absorbing about 90 per cent of the additional heat within the Earth's system (IPCC 2013a, p. 4). The increase in ocean heat content since the 1960s is shown in Figure 2.3. Temperatures have increased most at the sea's surface and upper ocean (to 700 metres below), where 60 per cent of the net increase in energy within the climate system has been stored (IPCC 2013a, p. 5). In Australia, sea surface temperatures have warmed by about 0.8 degrees since 1910, which is faster than the global average. In 2010, sea surface temperatures in Australia were the highest on record (CSIRO 2012, p. 7).

Oceans take a long time to warm in response to additional heat in the atmosphere. This thermal inertia means the world will continue to warm even if fossil fuel burning stops today. If greenhouse gas concentrations and other atmospheric constituents such as aerosols had been held at 2000 levels, an additional 0.6 degrees of warming would still occur by the end of the 21st century (IPCC 2007a, 10.7.1). Together with 0.8 degrees of warming observed to 2000, the total warming that would be expected to occur from emissions to 2000 would be 1.4 degrees (IPCC 2007a, SPM). Additional emissions from human activities will mean that humans will commit the climate to further warming.

Sea water expands as it warms, which contributes to a rise in global sea levels – thermal expansion of the oceans has contributed 40 per cent of observed sea level rises since 1971, and is projected to make the largest contribution to sea level rise in centuries to come (IPCC 2013b, Table 13.1). Between 1901 and 2010, global average sea levels rose by 0.19 metres (IPCC 2013a, p. 6). As with temperature, the average hides variation across different locations. Since 1993, the rate of sea level rise to the north and northwest of Australia has been 7–11 millimetres per year, more than double the 1993–2011 global average (CSIRO 2012, p. 6). Central east and southern coasts of Australia have been closer to the global average (CSIRO 2012, p. 6; IPCC 2013a, p. 6).

The loss of mass from glaciers and ice caps, and the melting of large polar ice sheets on Greenland and Antarctica, have been making a greater contribution to sea level rise in recent decades. Since the 1990s, these major ice sheets have shifted to a state of losing ice (about 4 000 billion tonnes combined between 1992 and 2011), and at an accelerating pace (Shepherd et al. 2012; IPCC 2013b, Table 13.1). Other dramatic changes have been observed in the Earth's ice and snow coverage, which play a very important part in moderating the climate system. There has been a sharp decline in Arctic summer sea ice extent since the 1950s, which reached a record low in the Northern Hemisphere summer of 2012 (IPCC 2007b, p. 83; NSIDC 2012). The melting of ice also exposes darker water and landscapes, which absorb more solar radiation and amplify warming (Lenton 2008, p. 3). In recent years, glaciers have retreated world-wide, Northern Hemisphere snow cover in spring has declined and substantial thawing of permafrost has occurred, particularly in Russia (IPCC 2013b, ch. 4, pp. 4–5).

FIGURE 2.3 CHANGES IN OCEAN HEAT CONTENT SINCE 1960



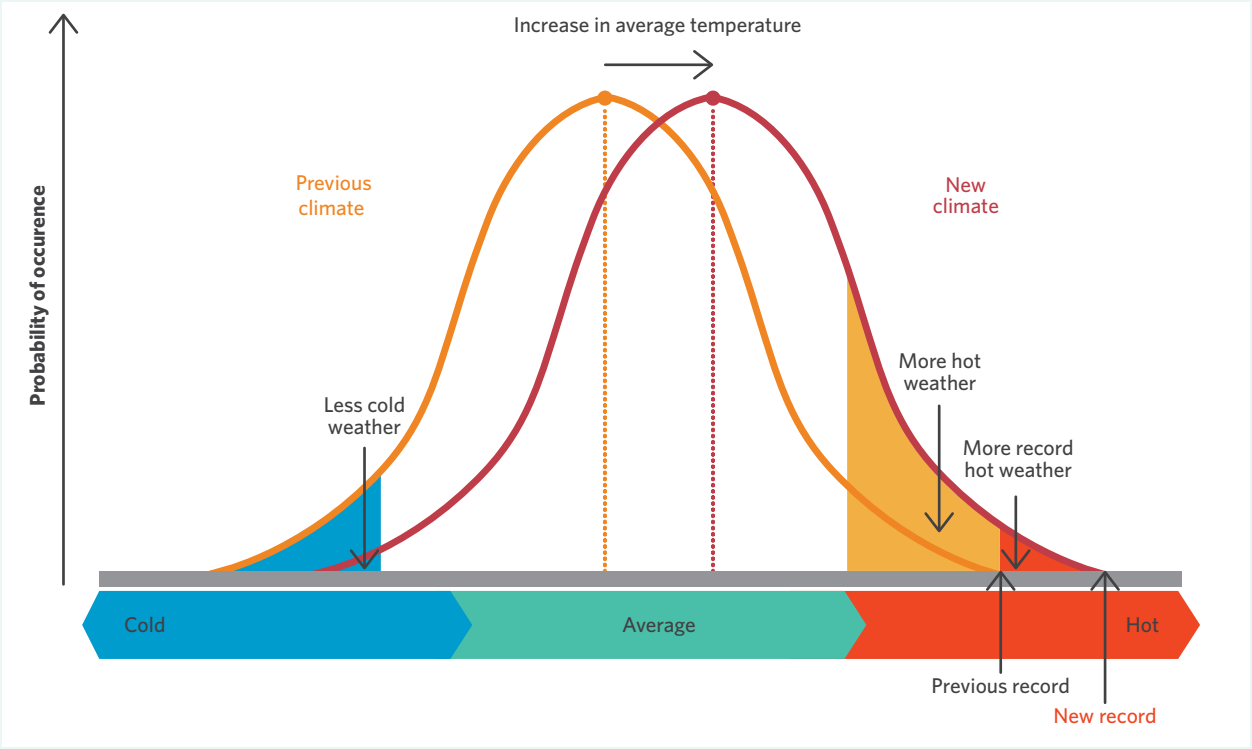
Source: CSIRO 2012, p. 7
Note: Ocean heat content is relative to 1970 levels. Shading provides an indication of the accuracy of the estimate.

Many other observations of climate system changes have been recorded, including changes in rainfall and increased frequency of extreme weather events (see Box 2.3). In south-west Western Australia, average winter rainfall has declined by 20 per cent since the 1960s, and scientists have attributed half of this impact to climate change (Cai and Cowan 2006). Warmer temperatures have also been shown to affect the timing of plant and animal life cycles and the range in which plants and animals live, while heat stress from more frequent and longer duration heatwaves has resulted in mortality of humans, plants, animals and coral reefs (IPCC 2007b; Smith et al. 2009; Climate Commission 2013).

BOX 2.3: EXTREME HEAT EVENTS

The atmosphere and oceans have changed as a result of more heat being trapped within the atmosphere. These changes affect storms and extreme climate events – but it can be difficult to discern those effects from natural climate variability. One approach to detecting the influence of climate change is to look for long-term changes in mean climate conditions – a small shift in the average can result in very large percentage changes in the extremes (Trenberth 2012).

FIGURE 2.4: THE RELATIONSHIP BETWEEN CLIMATE AVERAGES AND EXTREMES



Source: Modified from Climate Commission 2013b

As shown in Figure 2.4, an increase in average temperatures can have a large effect on the frequency and extent of extreme hot weather (Climate Commission 2013b). In Australia, this pattern is becoming more apparent. Average temperature in Australia has increased by 0.9 degrees since 1910 and, as predicted, there has been a significant increase in the number of hot days (over 35 degrees) and hot nights, and a general decrease in the number of cold days and nights. The 2012–13 Australian summer was Australia's hottest since records began, with more than 80 heat-related records set in January 2013 alone, including the hottest day on record (BoM 2013).

Over the past decade, many other countries and regions have experienced periods of extreme heat, including severe heatwaves in India (2002 and 2003), Europe (2003) and various parts of China (2010) (WMO 2011, p. 5). The 2010 Russian heatwave was of particular note, not only for its intensity and resulting death toll of over 55 000 people (CRED 2011), but also for demonstrating another linkage between climate change and extreme weather. The loss of Arctic sea ice resulting from increased air and ocean temperatures has been linked to changes in the polar jet stream – the river of high-altitude air that works to separate Arctic weather from that of northern Europe, Russia and Canada. There is now growing evidence that aberrations in jet streams contributed to various recent extreme weather events, including the record-breaking Russian heatwave (2011), the wet summer and autumn in the United Kingdom and Ireland (2012), the blocking of Hurricane Sandy's trajectory (which subsequently hit New York in 2012) and the recent historic floods in Central Europe (2013).

Many climate change impacts could impose high financial costs in the form of damage to infrastructure and buildings affected by extreme weather events and rising sea levels, reduced tourism revenue from damaged or less appealing attractions (such as bleached coral reefs) and reduced agricultural production and stock loss in the event of drought and floods. There are also likely to be substantial impacts that are hard to value in dollar terms, such as the damage or collapse of vulnerable ecosystems, reduction in biodiversity and mental health consequences of more frequent drought and flood (Bambrick et al. 2008).

Box 2.4 describes some of the attempts to estimate the cost of climate change impacts and provides some examples of the costs of extreme weather events that have occurred in the recent past – and are projected to occur more frequently under a warming climate.

2.2.2 PROJECTED GLOBAL IMPACTS

Climate change is projected to affect different regions in different ways, depending on the level of temperature rise, shifts in weather systems, and the vulnerability of different ecosystems and human populations to changing climate conditions.

BOX 2.4: ESTIMATING THE COST OF CLIMATE CHANGE IMPACTS

Attempts to quantify the cost of climate change impacts were made in both the Stern (2006) and Garnaut (2008) reviews. Stern addressed the question of whether global mitigation benefits outweighed the costs of climate change impacts for the world as a whole, while Garnaut focused on the benefits and costs of Australia contributing to the global mitigation effort.

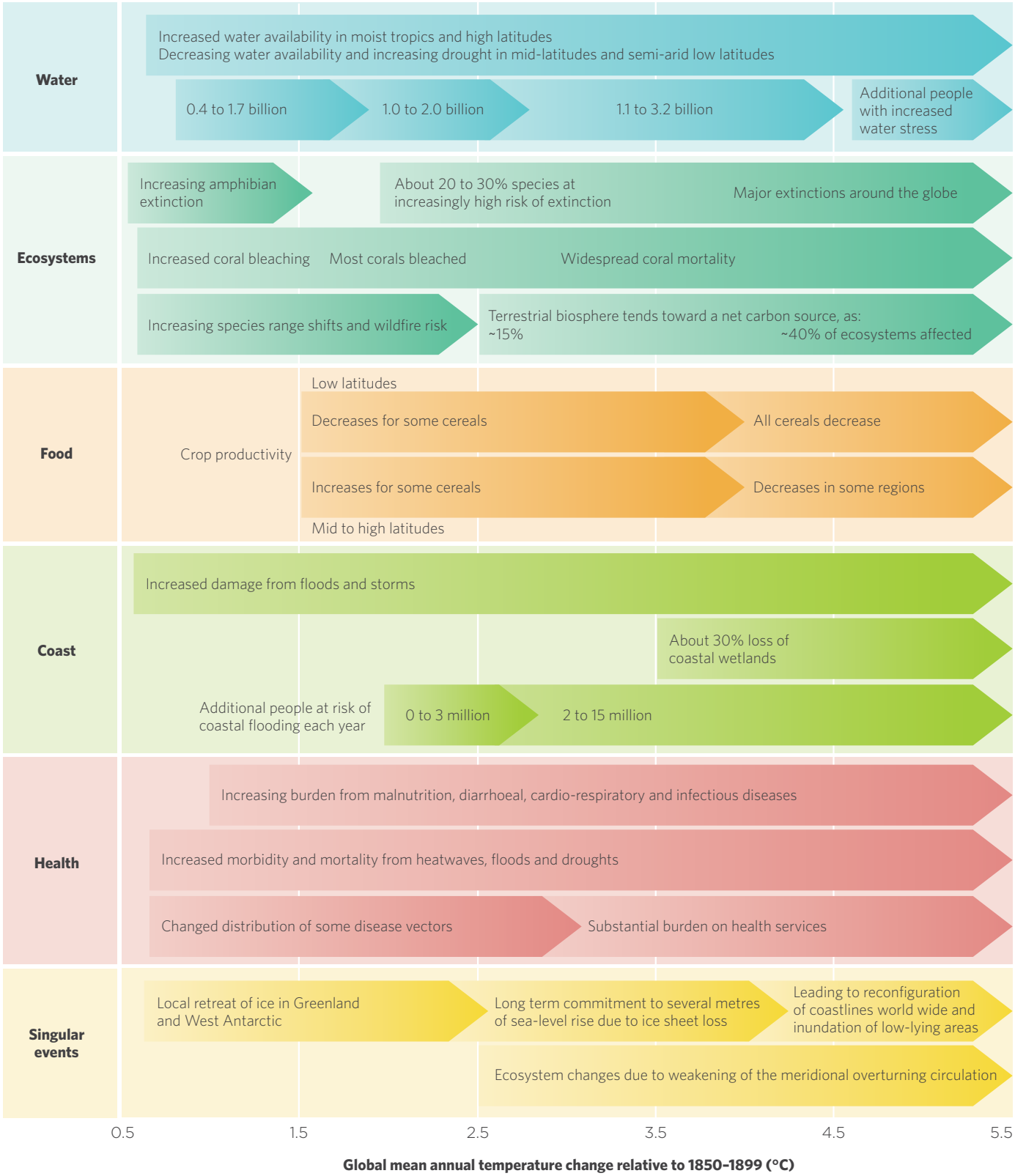
Garnaut noted that it is only possible to quantify some of the costs of projected climate change impacts, namely where there is a market effect and available data, such as the loss of gross domestic product (GDP) due to declining agricultural productivity or reduced tourism. Other costs associated with climate change impacts are harder to quantify, as they require valuation of non-market goods, such as society's willingness to pay to avoid a small probability of catastrophic damage, or the value that Australians place on maintaining the integrity of its environmental assets, such as the Great Barrier Reef. Garnaut also highlighted the challenge of directly assessing the effect of Australian mitigation on the impacts of climate change because the task of reducing emissions is a global one.

Despite the challenges of estimating costs of climate change impacts, and the omission of quantitative estimates for a significant proportion of non-market impacts, both Stern and Garnaut came to broadly similar conclusions – that the cost of unmitigated climate change will exceed the costs of mitigating it.

While estimating the global or national costs of climate change impacts remains an extremely difficult task, it is possible to look at the historical cost of events likely to occur more frequently in the future due to climate change. For example, there is a clear link between the intensity and frequency of extreme weather events and climate change (discussed in Box 2.3). Australians have witnessed several extreme weather events in the last decade that have incurred substantial economic costs. The 'millennium drought' of 1997–2009 was the most severe Australian drought on record, and resulted in substantial declines in agricultural production in south-east Australia, affecting both crops and stock (CSIRO 2010). In 2006–07, the net value of farm production fell 74 per cent ($5.4 billion) on the previous year alone (DAFF 2010). In addition to the loss of 173 human lives, the economic costs of the 2009 Victorian Black Saturday bushfires were estimated to be in excess of $4 billion (Royal Commission 2010). The 2011 Queensland floods caused the loss of 35 lives and were estimated by the Office of the Queensland Chief Scientist to have cost the state between $5 and $6 billion. The 2011 Review of the 2010–11 Victorian floods estimated costs up to $1.3 billion. The economic, environmental and human cost of more frequent and intense extreme weather events is likely to be significant in the future.

Sea level rise could also result in substantial economic costs. Some of Australia's most economically, socially and culturally valuable property is in the coastal zone (CSIRO 2013b). Sea levels are projected to rise 0.43–0.73 metres by 2100 (best estimate), compared with the average sea level for 1986 – 2005 (IPCC 2013b, Table 13.5). This could lead to coastal inundation of tens or even hundreds of metres inland, depending on local topography. It is virtually certain that global average sea levels will continue to rise after 2100, which would further increase the risks to human settlements (IPCC 2013b, ch. 13, p. 4). For Australia, if sea levels rose by 1.1 metres, approximately $226 billion in capital assets would be exposed (DCCEE 2011). Across the country, some local and state governments are acting to address the expected impacts from sea level rise, but progress is highly varied.

FIGURE 2.5: GLOBAL IMPACTS PROJECTED TO RESULT FROM RISING TEMPERATURES



Source: Adapted from IPCC 2007b, Table TS.3

Figure 2.5 depicts the types of global impacts which are projected at different levels of warming above pre-industrial levels, showing considerable impacts even for temperature changes below 2 degrees. Higher temperatures are projected to have more severe impacts, including extensive melting of ice, higher sea levels leading to coastal inundation, far greater water scarcity in many regions and irreversible loss of biodiversity, including coral reef systems (World Bank 2012, p. ix). As discussed in Section 2.1, there is also the potential to pass thresholds for disruptive feedbacks and tipping points.

Some of the key projected global impacts include:

- Across the world, dry regions are generally projected to become drier (through increased evaporation) and wet regions are projected to become wetter (through increased rain) (IPCC 2007a). Extreme weather events such as heatwaves, droughts, storms, floods and wildfires are projected to become more frequent and more intense for some locations – with 4 degrees of warming, the most extraordinary heatwaves experienced today will become the new norm and a new class of heatwaves, of magnitudes never experienced before, will occur regularly (Schaeffer et al. 2013, p. 15).
- Glaciers, ice sheets and polar ice are projected to melt and sea levels to continue to rise, with increasing risks of flooding, coastal erosion and salt contamination of fresh water. The most recent IPCC (2013a) science report projects higher sea level rises than previous reports, and with greater confidence. Under the lowest emissions scenario (which require large and rapid cuts to global emissions), sea levels in 2100 are estimated to be 0.43 metres higher (with a likely range of 0.28–0.6 metres) compared with the average sea level between 1986 and 2005. For the IPCC's high emissions scenario, sea level rise is projected to be around 0.73 metres (with a likely range of 0. 53–0.97 metres) (IPCC 2013b, Table 13.5). Sea level rise will exacerbate the effects of coastal flooding because higher sea levels mean that large waves produced by storm surges will be taller and could reach further inland (Climate Commission 2013, p. 58). Projected sea level rise could flood low-lying islands and densely populated delta areas in countries such as Bangladesh, India, Vietnam and China, with potentially severe consequences for infrastructure, human settlements, transportation, tourism, livelihoods and insurance costs (IPCC 2007b, ch. 10.4.3). For example, the projected minimum sea level rise in Asia of 40 centimetres over the course of this century is projected to increase the number of people in coastal populations flooded each year from 13 million to 94 million (IPCC 2007b, ch. 10.4.3). As temperatures and sea levels continue to rise, these risks will increase.
- Ecosystems are projected to experience major changes in structure and function under climate change, with 20 to 30 per cent of assessed plant and animal species at increased risk of extinction for an average temperature increase of 2 to 3 degrees, and 40 to 70 per cent of assessed species committed to extinction above 4 degrees (IPCC 2007b, pp. 38, 242). Particularly vulnerable ecosystems include coral reefs (due to ocean acidification and coral bleaching), Arctic and alpine ecosystems and tropical forests (including the Amazon rainforest). Projected losses of individual species are also likely to have serious ramifications across entire interlinked ecosystems which are more difficult to predict. The resilience of many ecosystems is likely[4] to be exceeded this century due to climate change and associated impacts such as flood, drought, ocean acidification and invasive species, combined with other stressors such as deforestation and pollution (IPCC 2007b, p. 11).
- Continued increases in atmospheric concentrations of carbon dioxide will lead to further global increases in ocean acidification (IPCC 2013a, p. 19). Increasing acidification is likely to have adverse impacts on some marine ecosystems, such as coral reefs.
- Impacts on human populations include, at the extreme, far greater loss of life from a variety of causes linked to rising temperatures. Damage to infrastructure and private property due to extreme events, reduction in agricultural productivity and displacement by rising sea levels are also projected to have global ramifications. Climate-induced migration could create humanitarian crises and cause or exacerbate ethnic, political and international conflict and even terrorism (Australian Government 2013, p. 18). One study has estimated that, under a high emissions scenario with one metre of sea level rise in the 21st century, up to 187 million people could experience forced displacement (Schaeffer et al. 2013, p. 17)
- Human health effects from climate change will have many sources. The risk of exposure to higher temperatures, particularly among vulnerable populations, is well understood – for example, the European heatwave of 2003 is estimated to have resulted in an additional 1 000 deaths over several days in Paris alone (McMichael 2014, pp. 156–7). Climate change is also projected to create more areas with a suitable climate for the transmission of pathogen and vector-borne diseases, including those carried by mosquitos (McMichael and Lindgren 2011). In the developing world, climate change is projected to cause protracted impacts on human health as a result of increased malnutrition due to declines in local agricultural production. Malnutrition is projected to increase the incidence of stunted growth in children and result in higher numbers of famine-related deaths (Lloyd et al. 2011; Black et al. 2008).

4 66–90 per cent probability.

- Adaptation to impacts of climate change may be possible for several sectors and many countries under lower levels of temperature rise (up to 2 degrees). For example, agricultural crops could be switched to more drought-tolerant and disease-resistant varieties, or coastal communities threatened by sea level rise could be resettled further inland – but many of the adaptation opportunities will be costly to implement (CSIRO 2011, ch. 4).
- Wealthier countries generally have a much greater capacity to adapt to climate change compared with developing countries, because more resources are available to put towards research and development, deploying new technologies and techniques, repairing physical damage to infrastructure and delivering health care. By comparison, developing countries such as those in Africa are considered to have weak adaptive capacity (Collier et al. 2009; IPCC 2007b, ch. 9). At 4 degrees of warming, the adaptive capacity of even wealthy countries is projected to become constrained – in Australia, almost all key sectors (including ecosystems, human health, tourism, agriculture and forestry) are projected to be vulnerable at 4 degrees (IPCC 2007b, fig. 11.4).

2.2.3 PROJECTED AUSTRALIAN IMPACTS

Australia is the driest inhabited continent in the world, and has an inherently variable climate, including extremes of floods and droughts. Climate change is projected to exacerbate these extremes, with heatwaves, fire, floods and drought expected to become more frequent and more intense over coming decades in much of Australia, particularly in the south. Frost and snow are expected to become rarer or less intense events (CSIRO 2011, p. 46). There is evidence these changes are already occurring, with more heatwaves, fewer frosts, more rain in north-west Australia, and less rain in southern and eastern Australia in recent decades.

The future impacts of climate change in Australia will vary by location, due to differences in local climate and the vulnerability of different regions to change. The risks to Australia at 2 degrees of warming have been well established through successive IPCC Assessment Reports and other work by organisations such as the CSIRO. Australia is a wealthy country with considerable experience in adapting to challenges in our natural environment (such as floods, fire and drought), and is likely to be able to adapt to many of the impacts of a 2 degree temperature increase, with the important exception of vulnerable ecosystems (CSIRO 2011, ch. 5). But the expected changes even under low levels of warming will be unwelcome, disruptive and likely to pose heavy financial, physical and emotional burdens on governments, communities and individuals. Governments, including Australia, will also be tasked with responding to an increased demand for humanitarian assistance, disaster relief and stabilisation operations resulting from climate impacts in the region (Defence White Paper 2013).

More recently, attention has focused on the risks to Australia if current emissions trends continue and temperature increases by 4 degrees by the end of the century. As a recent work notes, 'what emerges [under 4 degrees projections] is a disturbing and bleak vision of a continent under assault … our everyday lives will change profoundly even if adaptation succeeds' (Christoff 2014, p. 236). Some of the projected impacts under warming of around 4 degrees are identified for various locations around Australia in Figure 2.6. From these examples it is clear that 4 degrees of warming would have far-reaching effects, with consequences for all types of people, communities and ecosystems.

The emissions produced today and into the future will determine the speed and extent of climate change over coming decades and centuries. Avoiding the most severe impacts requires substantial and sustained global action. The size of the task is described in Chapter 3, which discusses the limit on the emissions the world can release over coming decades to give a reasonable chance of limiting warming to no more than 2 degrees.

FIGURE 2.6: PROJECTED IMPACTS FOR AUSTRALIAN LOCATIONS UNDER 4 DEGREES OF WARMING

Australian alps

Snow cover is projected to fall to zero for most regions that currently experience a significant snow season.

A snow season is projected to only persist at very high locations, but the snow season would be greatly reduced (e.g. at 2 000 metres, the snow season is reduced to one-third of its current length) (Whetton et al. 2014, p. 28).

Adelaide

The number of days in Adelaide above 35 degrees is projected to increase from 17 (1971–2000 average) to 47 by 2070 (under high scenario) (Braganza et al. 2014,Table 3.1, p. 48).

Mildura

The average number of extreme fire danger days in Mildura is projected to increase from 79.5 days per year to 107.3 days in 2050 under a high emissions scenario (Commonwealth of Australia 2007, Table 5.7).
Note: 'present' is the 1974–2003 average.

Queensland

More than $50 billion in commercial, industrial, road and rail and residential assets in Queensland are potentially exposed to flooding and erosion caused if sea levels rise by 1.1 metres, making it the most at-risk state for these types of assets (DCCEE 2011, Figure 1).

South-west WA

Average annual rainfall in south-west Western Australia is projected to continue to decline (following the drying trend observed since the 1970s). Rainfall is projected to decrease by 20 per cent in 2070 compared with 1990 – from 747 mm (1971–2000 average) to 605 mm. Rainfall decline is expected to have a significant impact on wheat yield. Under the worst projections of extremely hot and dry climate conditions, wheat production may be abandoned in most Australian regions by 2100 (Garnaut 2008, p. 133; CSIRO and BoM, 2008).

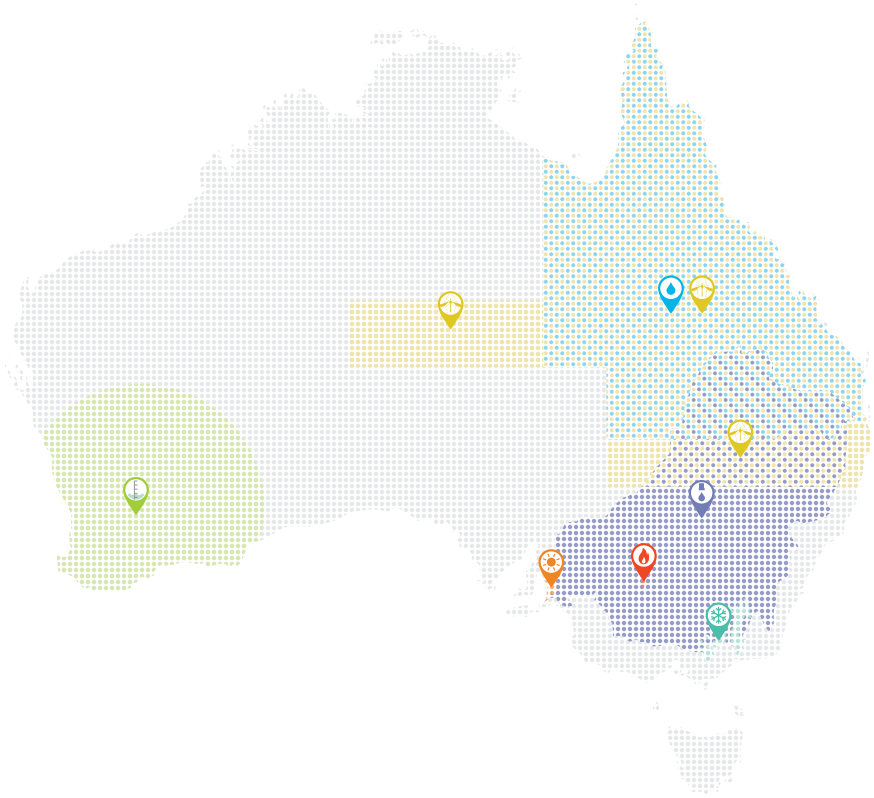
Southern NT, Queensland and northern NSW

The area of Australia with a suitable climate for dengue fever transmission is projected to expand southwards, increasing from northern and central areas of Queensland and the Northern Territory to northern New South Wales by 2100. This is projected to increase the population exposed from almost 0.5 million in 2020 to around 5–8 million in 2100 (Bambrick et al. 2008, pp. 37–38).

Notes: Some of the impacts occur on the trajectory to 4 or more degrees by the end of the 21st century (high emissions scenario), but temperatures may be below 4 degrees when the reported impact is projected. The impact examples above (which assume 4 degrees of warming is reached or exceeded sometime within the next century) are based on climate models in which emissions continue to grow at rapid rates. A commonly used high emissions scenario (published by the IPCC in 2000) is the A1FI scenario, which assumes a future world of very rapid economic growth, global population that peaks in the middle of the 21st century and continued technological emphasis on fossil fuels (IPCC 2000).

Murray-Darling Basin

In the absence of mitigation, the value of agricultural product from the Murray-Darling Basin may decrease by 12–44 per cent in 2030 (compared to a scenario with no human-induced climate change) and 49–72 per cent in 2050, as a result of projected declines in stream flow, increases in water salinity and reduced water allocation to irrigation (Garnaut 2008, p. 130; Quiggin et al. 2008).



Key

- Australian alps
- Adelaide
- Mildura
- Queensland
- South-west WA
- Southern NT, Queensland and northern NSW
- Murray-Darling basin

CHAPTER 3
A GLOBAL EMISSIONS BUDGET FOR 2 DEGREES OR LESS

3

Chapter 2 set out the severe potential impacts, for the world and for Australia, of a global temperature rise of greater than 2 degrees. This chapter looks at what it will take to have a reasonable chance of limiting warming to no more than 2 degrees.

Limiting global emissions to keep warming to no more than 2 degrees above pre-industrial levels is challenging, but remains technologically and economically feasible. Immediate and strong action is required by all countries, especially the major emitting economies.

Global emissions budgets help quantify the challenge of limiting global warming. They specify the total amount of emissions projected to result in a given rise in global temperature. They are expressed in terms of probabilities to reflect uncertainties about the exact temperature effect of a given amount of emissions; a tighter global budget provides a higher probability of keeping global warming to 2 degrees or less but reduces the amount of emissions allowed.

The Authority recommends (Chapter 8) that Australia's emissions goals include a long term national budget. The global emissions budget provides important guidance for recommending this national budget, and the appropriate set of targets and trajectories over time for national emissions reductions consistent with the national budget.

The Authority considers that the global emissions budget adopted as a reference point for consideration of Australia's national emissions budget in this Review should provide a likely chance (defined here as a 67 per cent probability) of limiting warming to 2 degrees or less. This requires that global emissions of greenhouse gases covered by the Kyoto Protocol not exceed a budget of approximately 1700 gigatonnes of carbon dioxide equivalent (Gt CO2-e) between 2000 and 2050. About 35 per cent of this budget has already been used between 2000 and 2012.

As outlined in Chapter 2, keeping global temperature rises to no more than 2 degrees is strongly in Australia's interests. Australia's emissions targets cannot be seen in isolation from the global task of limiting emissions. A global emissions budget sets out the total amount of global emissions consistent with the aim of limiting warming to 2 degrees or less, but does not dictate a particular emissions pathway, so long as the budget is not breached. This chapter examines global emissions budgets, including:

- whether limiting global warming to no more than 2 degrees above pre-industrial levels remains feasible, and the scope and timing of action required to maintain a global emissions pathway consistent with that limit;
- the global emissions budgets that set out a maximum level of global emissions to provide a given probability of limiting temperature increases to no more than 2 degrees; and
- the characteristics of global emissions budgets to be used as a reference for the Targets and Progress Review, including the level of probability and the greenhouse gases included.

3.1 FEASIBILITY OF LIMITING GLOBAL WARMING TO 2 DEGREES OR LESS

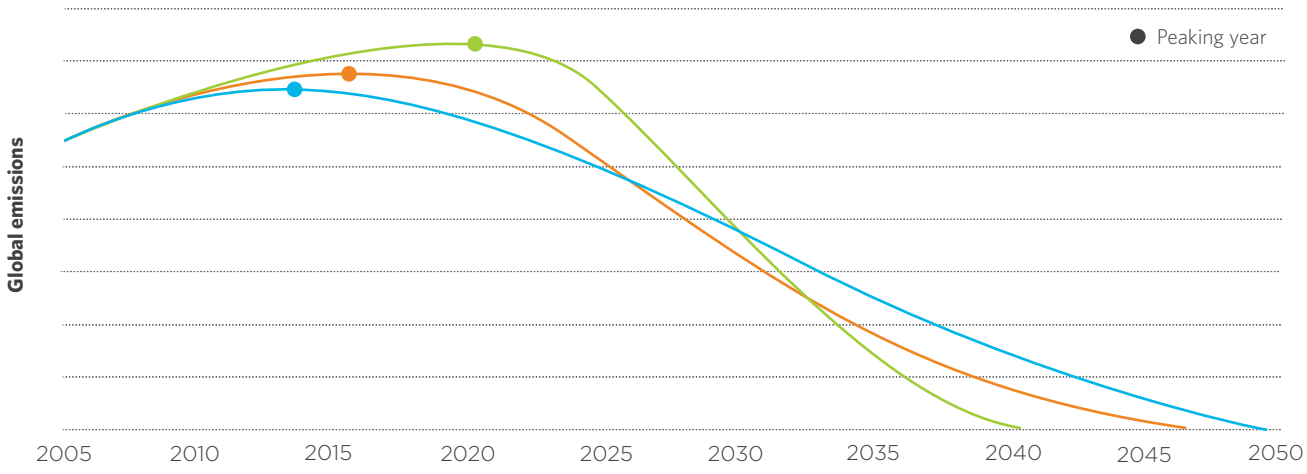
Lessening the impacts of climate change will require strong international action to reduce emissions. The Authority has accepted Australia's interest in limiting global warming to 2 degrees or less as a given for the Targets and Progress Review. This is consistent with the below 2 degrees global goal agreed by the international community. It has also been adopted by other organisations as a starting point in their consideration of national emissions reduction goals, including the United Kingdom Committee on Climate Change and the German Advisory Council on Global Change.

Two critical questions for policy-makers are whether a 2 degree temperature limit remains feasible, and the scope and timing of action required to maintain an emissions pathway consistent with that limit. Global emissions are currently tracking towards the upper bound of projections, on a pathway consistent with a 4 degree increase in global average temperature by 2100 (World Bank 2012, p. xiii). The longer emissions diverge from a 2 degree pathway, the faster the available global emissions budget will be used up, requiring greater efforts to reduce emissions in future and eventually ruling out the possibility of limiting warming to 2 degrees or less.

The feasibility of the 2 degree temperature limit has been considered extensively in the research literature, providing consensus that a range of 2 degree emissions scenarios remain technically and economically feasible (see, for example, Rogelj et al. 2011; UNEP 2012). Feasible 2 degree pathways generally share several important characteristics:

- **Early emissions reductions.** A near-universal finding is that early action is critical to limit future costs and maintain feasibility of limiting temperature increases, with many studies pointing to the importance of global emissions peaking by 2020 (see, for example, Rogelj et al. 2012). Delaying emissions reductions increases the rate of decarbonisation required in the future, increases costs of meeting emissions targets, reduces flexibility in choosing how to reduce emissions, and increases reliance on the development and commercialisation of currently speculative technologies to achieve net negative emissions (see, for example, Rogelj et al. 2013). Figure 3.1 illustrates alternative emissions trajectories that result in the same amount of cumulative emissions, but with different peaking years and maximum rates of emissions reductions. Analysis by the United Nations Environment Programme (UNEP) finds that there is an 'emissions gap' of approximately 813 Gt CO_2-e between projected emissions levels in 2020 and the global emissions in 2020 consistent with a 'likely' (greater than 66 per cent) chance of 2 degrees, but that it is still possible to close this gap (UNEP 2012, pp. 1–7). The UNEP emissions gap analysis is discussed further in Chapter 4.
- **Steep decarbonisation rates.** Even with early peaking of global emissions, scenarios to remain within 2 degrees generally require high, sustained rates of emission reductions for much of the rest of this century. The maximum rate of global emission reductions that can be maintained is a key constraint for feasible pathways, with one recent study (den Elzen et al. 2010) estimating a maximum rate of about 3–4 per cent per year without the use of bioenergy with carbon capture and storage, or 4–5 per cent if this technology becomes viable.

FIGURE 3.1: ILLUSTRATIVE ALTERNATIVE GLOBAL EMISSIONS TRAJECTORIES FOR A GIVEN GLOBAL EMISSIONS BUDGET



Source: Climate Change Authority

- **Demand-side reductions in energy use.** Under the IEA '450 Scenario', over half of the required emissions savings from energy are achieved by energy efficiency improvements (IEA 2012b, p. 241). Another study found that strong action on energy efficiency can allow some flexibility in the choice and timing of other emissions reduction measures (Rogelj et al. 2013).
- **Negative emissions.** Many 2 degree scenarios assume the use of negative emissions technology (for example, bioenergy with carbon capture and storage), in the second half of this century. Of a large number of emissions scenarios analysed by UNEP, 40 per cent of those considered to provide a likely chance of a not more than 2 degree temperature increase require net negative emissions before 2100 (UNEP 2012, p. 26). If net negative emissions prove to be infeasible, a radical shift in mitigation options may come too late to limit warming to 2 degrees or less.
- **Technology investment and diversification.** A number of studies raise the importance of investment in technology. The more ambitious the scenario, the earlier large investments in technology development are required. This highlights the importance of pursuing multiple technology options simultaneously to reduce the risk of particular technologies proving unviable.

Several stakeholder submissions to the Issues Paper for this Review requested that the Authority use a 1.5 degree rather than a 2 degree temperature limit.

Pathways that provide a 50 per cent or greater chance of limiting warming to 1.5 degrees have received limited consideration in the scenario literature, although there is some evidence that a 1.5 degree limit remains viable. The limited analyses available suggest that for the first half of this century 1.5 degree pathways share many of the same characteristics as 2 degree pathways (Rogelj 2013). This opens up the possibility that a 2 degree pathway could provide scope, with increased effort in future, to shift to a more ambitious 1.5 degree pathway.

Scenarios for 1.5 degrees are, however, likely to rely even more strongly on large-scale implementation of negative emissions technology in the second half of this century. The increased reliance on negative emissions and carbon capture and storage creates larger risks for 1.5 degree scenarios should such technologies prove to be infeasible.

The Authority's assessment is that the global 2 degree limit remains feasible, but that immediate and strong international action is required, especially by all major emitting economies, as discussed further in Chapter 4. Failure to take global action at the scale required will progressively close off emissions scenarios, increase costs and eventually foreclose a reasonable possibility of limiting warming to 2 degrees or less. The Authority considers that global emissions and the ongoing requirements to remain within the 2 degree limit should be monitored in future.

DRAFT CONCLUSION

C.1 Limiting global emissions to keep warming to no more than 2 degrees is still feasible, but only with immediate and strong international action, and especially by the major emitting economies.

3.2 GLOBAL EMISSIONS BUDGETS

The magnitude of global temperature increases is not determined by emissions in any one year, but by the concentration of greenhouse gases in the atmosphere. This is the net outcome of total emissions and removals of greenhouse gases from the atmosphere over an extended time period.

Global emissions budgets estimate the total amount of greenhouse gas emissions that will result in a given temperature increase, within a probability range. The emissions budget approach links cumulative emissions of greenhouse gases directly to temperature, without focusing on the intermediate steps shown in Figure 3.2 and discussed in Box 3.1. The relationship is expressed as a probability, to reflect the variability of the climate response to a given amount of greenhouse gas emissions.

While global emissions budgets identify the overall limit on global emissions, they do not identify a particular timing of peak emissions or the rate at which emissions are reduced, so long as the overall budget is not breached. There will be a large number of trajectories that could lead to the budgeted level of cumulative emissions (and the related expected temperature increase) over time, as illustrated by Figure 3.1. Because the emissions budget is ultimately fixed, however, delays in reducing emissions must be compensated with more rapid emissions reductions in future years.

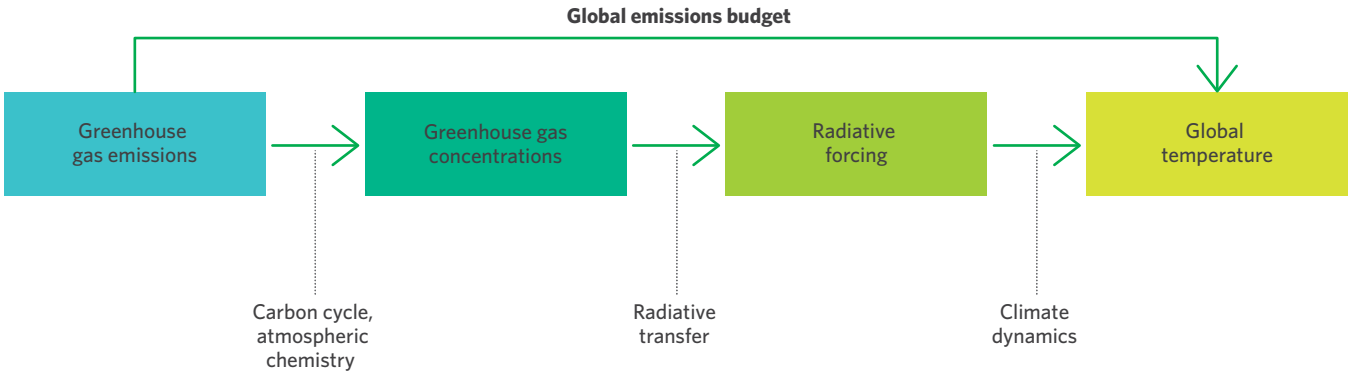
The Authority is required, under the *Clean Energy Act 2011* (Cth) (s 289), to have regard to estimates of the global greenhouse gas emissions budget.

The concept of a global emissions budget provides important guidance for setting Australia's national targets. The global budget links to Australia's ultimate aim of limiting warming to no more than 2 degrees and provides clear guidance on the scale of the global challenge. Australia's national emissions budget, discussed in Chapter 9, can be thought of as Australia's fair share of this future global budget.

Two issues relevant to selecting a global emissions budget as a reference point for this Review are:

- the associated probability of limiting warming to 2 degrees or less; and
- whether to specify the budget in terms of CO_2 only or of multiple greenhouse gases.

FIGURE 3.2: RELATIONSHIP BETWEEN GREENHOUSE GAS EMISSIONS AND GLOBAL TEMPERATURE



Source: Adapted from Raupach, Harman & Canadell 2011

BOX 3.1: GLOBAL EMISSIONS BUDGETS, ATMOSPHERIC CONCENTRATION AND RADIATIVE FORCING

Global emissions budgets, also referred to as carbon budgets, have gained prominence as a method of analysing and communicating the scale of emissions reductions required to remain within a global temperature limit. Emissions budgets provide a useful way of linking emissions targets and trajectories to the underlying science of climate change.

Emissions limits that keep global temperature increases to 2 degrees or less can be expressed in a number of ways. Two other measures are the concentration of greenhouse gases in the atmosphere, and the radiative forcing of greenhouse gases and other substances. As set out in Figure 3.2, these measures reflect different intermediate steps in the chain between emissions and global temperature rises. Atmospheric concentration has been a commonly used measure to communicate the limit consistent with a certain level of temperature rise (for example, an atmospheric concentration of 450 parts per million (ppm) is consistent with about a 50 per cent chance of limiting warming to 2 degrees or less.

For example, an approximately 67 per cent probability of limiting warming to 2 degrees or lower could be expressed using the following measures:

- an equilibrium concentration of 415 ppm of CO_2-e in the atmosphere;
- an equilibrium radiative forcing of about 2.1 watts per square metre; or
- a global emissions budget of 1 700 Gt CO_2-e from 2000 to 2050.

3.3 PROBABILITY LEVEL FOR BUDGETS

As discussed, budgets are expressed in terms of their probability of remaining within a given temperature limit. A higher or lower likelihood of a temperature increase of 2 degrees or less corresponds to different budgets. For example, a 50 per cent probability of limiting warming to 2 degrees or less gives an allowable budget of Kyoto gases of approximately 2 020 Gt CO_2-e over the period 2000–2050. A 67 per cent probability reduces the allowable budget to approximately 1 700 Gt CO_2-e (adapted from Meinshausen et al. 2009, p. 1161).

Choosing a budget with a higher probability better manages risks from:

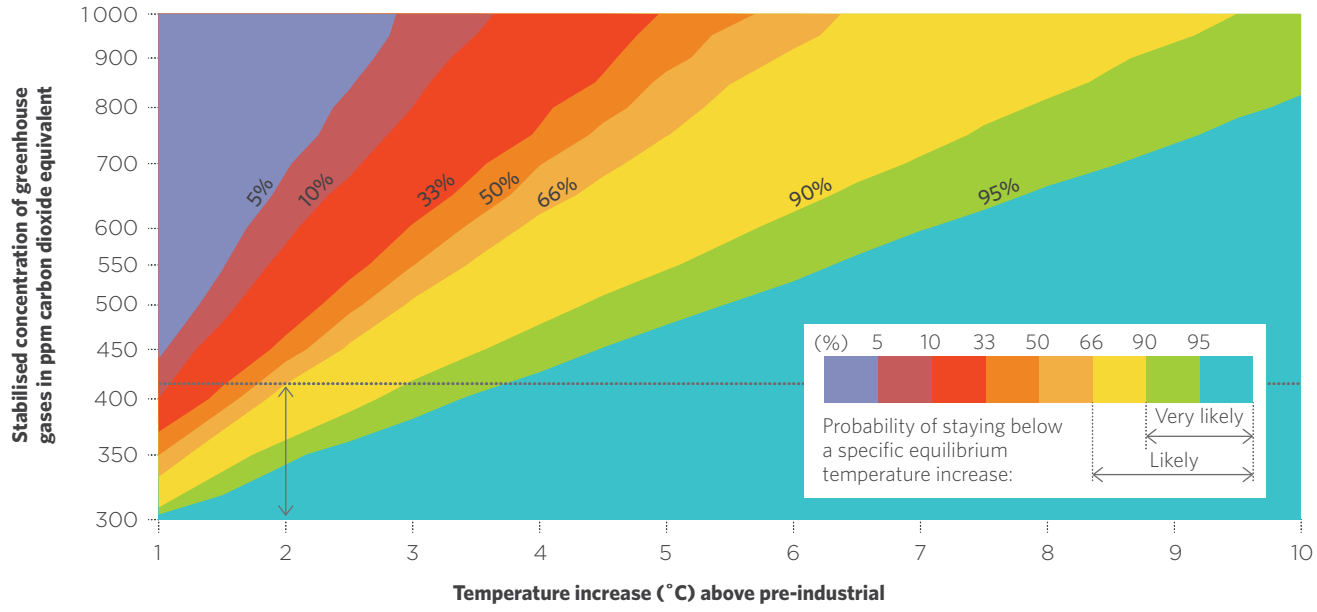
- uncertainties over the precise temperature increase from a given budget, and the possibility of greater warming; and
- the severity of impacts of a temperature increase above 2 degrees.

Tighter budgets will, however, require more action to reduce emissions.

A number of submissions to the Issues Paper for this Review indicated that budgets with higher, rather than lower, levels of probability should be the chosen reference for the Authority. Other submissions indicated a preference for budgets with a relatively high probability such as 80 per cent, but opted for a lower probability budget (such as 67 per cent) on the basis that higher probability budgets are no longer practicably attainable.

The Authority considers that the global budget used as a reference point for Australia's national carbon budget and targets should have at least a likely probability (greater than 66 per cent, but defined here as a 67 per cent probability for the purposes of selecting a reference point) of limiting warming to 2 degrees or less. Some widely used limits (such as a maximum allowable atmospheric greenhouse gas concentration of 450 ppm) characterised as consistent with the 2 degree limit carry only an approximately 50 per cent probability of limiting warming to 2 degrees or less. In light of the severe global and national risks of the impacts projected at temperatures of up to and beyond 2 degrees, the Authority considers that a global budget with a higher probability is the more responsible reference for Australia's national emissions budget, and represents a more appropriate risk management approach. A 67 per cent probability level is also consistent with the greater than 66 per cent probability global emissions budget referred to by the Intergovernmental Panel on Climate Change (IPCC), discussed in Box 3.2. Section 9.4 discusses setting a national emissions budget that corresponds to a global budget with a 67 per cent probability level. The implications of the choice of different global reference budgets for Australia's national emissions budget are discussed further in Chapter 11.

FIGURE 3.3: PROBABILITY OF STAYING BELOW SPECIFIC TEMPERATURE INCREASES ABOVE PRE-INDUSTRIAL LEVELS GIVEN CARBON DIOXIDE EQUIVALENT STABILISATION LEVELS



Note: The left scale indicates a CO_2-e concentration level at equilibrium from all greenhouse forcing agents. The arrow illustrates that to limit global temperature increase to below 2 degrees with a likely (greater than 66 per cent) probability, CO_2-e concentrations should be should be lower than 415 ppm.
Source: Adapted from Rogelj, Meinshausen & Knutti 2012

A budget that provides a higher probability of limiting temperature increases to 2 degrees or less also provides a lower probability of higher temperature rises, as shown in Figure 3.3. Figure 3.3 sets out probabilities (the coloured bands) of remaining below a specified temperature increase for different concentrations of greenhouse gases in the atmosphere. An atmospheric CO_2-e concentration that provides an approximately 67 per cent probability of limiting warming below 2 degrees, shown by the horizontal dotted line, is also projected to provide an approximately 90 per cent probability of staying below 3 degrees and a greater than 95 per cent probability of staying below 4 degrees. It also provides a less than 10 per cent probability of staying below a 1 degree temperature increase.

3.3.1 REVIEWING THE GLOBAL EMISSIONS BUDGET OVER TIME

The Authority proposes that the appropriateness of the chosen global reference budget can be reviewed and adjusted, if necessary, over the longer term. This can occur as part of periodic reviews of Australia's national emissions budget, which the Authority recommends be conducted at least every five years (see Chapter 8). This flexibility would better position Australia to respond should the international community choose a more stringent temperature goal in future or if increased scientific understanding of climate uncertainties reduces estimates of the allowable global emissions budget. Conversely, if the scale and pace of international action in future is such that a greater than 66 per cent probability of limiting warming to 2 degrees becomes infeasible, the Authority could review whether to move to a reference budget with a lower probability of achieving 2 degrees.

3.4 CARBON DIOXIDE-ONLY OR MULTI-GAS BUDGETS

The Authority considered whether to adopt a CO_2-only or a multi-gas budget that includes all the Kyoto gases. CO_2 is long-lived in the atmosphere and is the dominant contributor to human-induced climate change. CO_2-only budgets can give a good indication of the extent of likely long-term temperature rise, are simple and target the most significant greenhouse gas. A multi-gas budget is most closely aligned with Australia's international obligations under the Kyoto Protocol, but has some scientific limitations. In part, this is because different gases behave differently in the atmosphere and remain there for different lengths of time.

The Authority received a small number of submissions on the use of multi-gas budgets, with one submitter highlighting the potential limitations of a budget approach that includes both short- and long-lived gases. Another supported a focus on CO_2 as the longest lived greenhouse gas, suggesting that additional separate budgets should be provided for the other gases.

While acknowledging the limitations, the Authority considers that a multi-gas approach is preferable for the purposes of setting Australia's national emissions budget. Multi-gas approaches are consistent with Australia's international commitments and with the approach adopted by other nations. Non-CO_2 greenhouse gases are also a significant component of Australia's emissions – about 28 per cent in 2011 (adapted from DIICCSRTE 2013, Vol. 1 p. 29). A multi-gas approach acknowledges the importance of reducing these emissions.

TABLE 3.1: ESTIMATES OF GLOBAL EMISSIONS BUDGETS 2000–2050

CARBON DIOXIDE ($Gt\ CO_2$)	KYOTO GASES ($Gt\ CO_2$-e)	PROBABILITY OF REMAINING WITHIN 2 DEGREE LIMIT
900	1370	80 per cent
1010	1520	75 per cent (74 for Kyoto gases)
1170	1700	67 per cent
1450	2020	50 per cent

Note: The budget figures in Meinshausen et al. are specified for 2000–2049; an extra year of estimated emissions has been added to give a budget to 2050.
Figures rounded to the nearest 10 Gt.
In 2009 the greenhouse gases covered by the Kyoto Protocol were CO_2, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulphur hexafluouride. A seventh gas, nitrogen trifluoride, has been added for the second commitment period of the Protocol; overall emissions of this gas are expected to be relatively small.
Source: Adapted from Meinshausen et al. 2009, p. 1161.

3.5 GLOBAL BUDGET ESTIMATES

The Authority is using the global emissions budget estimates developed in a 2009 study by Meinshausen et al., *Greenhouse-gas emission targets for limiting global warming to 2°C* (Table 3.1). These estimates have been widely cited by other scientific studies and used by national and international bodies as a reference for global emissions budgets.

The Authority has extended the 2000–2049 budget to 2050, and rounded to the nearest 10 Gt CO_2-e. The Meinshausen et al. emissions budget estimates account for the temperature effects of aerosol pollution such as sulphates created by the burning of coal and oil (discussed in Chapter 2).

Approximately 35 per cent of the budget of 1 700 Gt CO_2-e that would provide a 67 per cent probability of limiting temperature increases to 2 degrees or less has already been used between 2000 and 2012 (based on IEA 2012a; see Appendix C.6).

A budget to 2050 provides a robust indication of the probability that warming this century will not exceed 2 degrees (Meinshausen et al. 2009, p. 1158) and is consistent with the timeframes for long term domestic emissions reduction targets set by Australia and a number of other countries, shown in Table 4.4. It is important to note, however, that continued global effort to reduce emissions will be required after 2050.

This chapter set out a global emissions budget that is consistent with a likely chance of limiting global warming to 2 degrees or less. Climate change is a global problem and immediate and strong international action will be required for the world to remain within this budget. Chapter 4 sets out the global context and assesses international trends in emissions reduction activities.

DRAFT CONCLUSION

C.2 A global emissions budget that provides at least a likely (defined here as a 67 per cent probability) chance of limiting warming to no more than 2 degrees above pre-industrial levels should be used as a reference for the Review. This equates to a global budget of no more than 1700 Gt CO_2-e emissions of Kyoto gases from 2000 to 2050.

BOX 3.2: THE IPCC GLOBAL EMISSIONS BUDGET

For the first time, the IPCC quantifies a cumulative emissions budget in its Fifth Assessment Report on the physical science basis of climate change, released in September 2013 (IPCC 2013). The IPCC refers to a global emissions budget of 1 000 Gt of carbon to provide a likely (greater than 66 per cent) chance to limit global warming to 2 degrees or less, and notes that about half that budget has already been emitted.

The IPCC's estimated emissions budget is consistent with the budgets described in the Meinshausen et al study discussed above and used in this Review. The two studies, however, use some different assumptions and report in different units, resulting in different budget figures. These differences include:

- The IPCC budget is specified in carbon (C) whereas the Meinshausen budget used as a reference for the Review is specified in carbon dioxide equivalent (CO_2-e). A tonne of carbon is equivalent to approximately 3.7 tonnes of carbon dioxide, with a 1 000 Gt C budget equating to a 3 700 Gt CO_2 budget.
- The IPCC budget considers the period of 1861–1880 to 2100 while the Meinshausen budget only covers the period from 2000 to 2050. Both budgets, however, provide a robust indication of global warming likely remaining below a 2 degree temperature increase.
- The IPCC budget covers the effect of CO_2 only and does not include the warming or cooling effects of other substances such as non-CO_2 greenhouse gases and aerosol pollution. The IPCC notes that the budget would be lower if these other effects were included.

As discussed above, the Authority has chosen to use a multi-gas budget for a specified time period to 2050 as the most appropriate reference budget for this Review.

CHAPTER 4
GLOBAL ACTION TO REDUCE GREENHOUSE GAS EMISSIONS

4

As the evidence and risks posed by global warming have become clearer (Chapter 2), global action to reduce greenhouse gas emissions has steadily increased.

Ninety-nine countries, covering over 80 per cent of global emissions, have 2020 emissions reduction goals. Countries are implementing a range of policies to meet these goals, including renewable energy targets, emissions trading schemes, tax incentives for improved energy efficiency and fuel economy and electricity generation emissions standards.

The current level of action, measured by the 2020 goals, is not sufficient to put the world on track to limit warming below 2 degrees relative to pre-industrial levels. But the level of action has steadily increased over the last 20 years and accelerated recently; more countries are taking on targets and more emissions reduction policies are in place than ever before. The two largest emitters of greenhouse gases – China and the United States – are both stepping up their actions to reduce emissions, separately and together. These measures could have a significant impact on global emissions reductions.

The next few years will be a critical time as countries decide whether to strengthen their 2020 emissions reduction goals under the United Nations Framework Convention on Climate Change (due 2014) and negotiate a new post-2020 climate agreement (due 2015).

Chapter 3 set out a global budget that is consistent with limiting global warming to 2 degrees. Climate change is a global problem and developing a solution will require action by all countries; in particular; major emitting economies like Australia.

Chapter 4 sets out the global context and assesses international trends in emissions reduction activities. Chapter 5 builds on this assessment to consider Australia's role in international action and how the international context should be factored into the Authority's recommendations for Australia's emissions reduction goals.

Chapter 4 discusses:

- the Authority's approach to assessing global action to reduce emissions;
- progress under the United Nations Framework Convention on Climate Change (UNFCCC) and other international forums;
- countries' 2020 emissions reduction goals, including their aggregate effect on global emissions;
- climate policies and measures in other countries with a special focus on actions of the world's two largest emitters, China and the United States; and
- post-2020 global climate action.

4.1 THE AUTHORITY'S APPROACH TO ASSESSING GLOBAL ACTION

The Authority considers that global trends in emissions reductions targets and policies provide the best picture of global action.

Global action is complex – some countries are taking ambitious action now, some are doing less, and the pattern is likely to vary over time. In such circumstances, broad trends are a better indicator than the isolated actions of any individual country at a particular point in time. The exceptions are China and the United States, which together constitute over one-third of global emissions. The Authority has considered the actions of these two countries in some detail given their significant effect on climate change.

In assessing global trends, the Authority has considered both:

- targets and commitments to future action; and
- domestic policies and measures to reduce emissions.

Both targets and policies are important. Targets provide a useful indication of countries' intentions; however, targets are, by their nature, aspirational. They can only be met if they are backed by policies and measures that make emissions reductions happen. Targets and policies are mutually supportive – targets can help drive the implementation of climate change policies, while successful policies can make stronger targets more achievable.

The Authority has focused its analysis on emissions reductions outcomes – it has not discriminated on the basis of the form of a commitment (legally binding or not) or where it is inscribed (internationally or domestically). The Authority has therefore taken into account progress under the UNFCCC, but it has also looked beyond – to domestic action and other international forums. While legal form can be an important indicator of how likely action is to occur, ultimately it is emissions reductions that are important for limiting global warming to below 2 degrees.

The Authority's focus on emissions reduction outcomes was supported by a number of stakeholders, including the Business Council of Australia (*Issues Paper submission*, p. 8).

Primary sources of information about global action include the United Nations, the World Resources Institute and the Australian Government. In some cases, different data sets have been used for the international analysis than in other chapters of this report to allow for consistent data sets over a wide range of countries. Appendix B provides further details on the data sources used in the Authority's analysis.

4.1.1 KEY COUNTRIES CONSIDERED IN THE AUTHORITY'S ANALYSIS

The Authority has chosen a set of key countries to illustrate trends in global action throughout the draft report. The set is listed at Table 4.1 and includes countries with similar levels of development to Australia, major emitting economies and Australia's trading partners and neighbours. The selection takes into account stakeholder feedback by including developed and developing countries, OECD countries, and countries with similarly sized economies and economic structure to Australia (see Origin Energy submission, p. 3; Business Council of Australia submission, pp. 10–11). It also includes four of Australia's top five trading partners in 2012.

A number of stakeholders emphasised the relevance of considering trade competitors' actions when setting Australia's target (including the Australian Industry Greenhouse Network submission, p. 4 and the Business Council of Australia submission p. 14). Identifying trade competitors for the whole economy is difficult as competitors vary widely across sectors, across activities and over time. To the extent that Australia's competitors are also its main trading partners, they are included in Australia's key country mix. Legislation currently requires the Productivity Commission to consider which countries constitute Australia's trade competitors as part of its first review of the Jobs and Competitiveness Program, scheduled in the *Clean Energy Act 2011* (Cth) to be conducted in the 2014–15 financial year.

Table 4.1 also describes emissions and development data for each country. Emissions data are presented both as a per cent of global emissions and in per person terms (in tonnes of carbon dioxide equivalent, tCO_2-e). The Human Development Index (HDI) is used to provide an indication of countries' development levels. The HDI is a measure of development compiled by the United Nations Development Programme which combines indicators of life expectancy, educational attainment and income.

4.2 PROGRESS UNDER THE UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The UNFCCC is the centrepiece of the international climate change framework. The UNFCCC has facilitated significant progress to address climate change – from an acknowledgement by all countries that climate change is a problem (1992) to emissions reduction goals by developed countries (1997) to emissions reduction goals by all major emitting economies in 2009 (major emitting economies are defined as countries that participate in the Major Economies Forum).

TABLE 4.1: KEY COUNTRIES – EMISSIONS, DEVELOPMENT AND TRADE ANALYSIS

COUNTRY	INDICATORS			WHY IS THIS A KEY COUNTRY?
	Per cent of global emissions *Units: per cent*	Emissions per person *Units: tCO_2-e*	Human Development Index* *Index rank: 1=highest*	Emissions analysis and trade relationships with Australia
Australia	1.3	25.1	2nd	-
China	22.1	7.1	101st	China is the world's largest emitter and the world's second largest economy. Its per person emissions are around the global average. With $118 billion in two-way merchandise trade in 2012, China is Australia's largest trading partner.
United States	15.3	21.2	3rd	The United States is the world's second largest emitter and the world's largest economy. It has per person emissions broadly comparable with Australia's. With $40 billion in two-way merchandise trade in 2012, the United States is Australia's third largest trading partner.
European Union (28 member states)	10.9	9.2	From 4th (the Netherlands to 57th) Bulgaria	As a bloc of 28 member states, the European Union is the world's third largest emitter, and it has among the world's most extensive climate policies, including an emissions trading scheme in place since 2005. With $60 billion in two-way merchandise trade in 2012, the European Union accounts for 12 per cent of Australia's trade.
India	5.5	1.9	136th	India is a large emitting economy with a large population and very low average development. With $15 billion in two-way merchandise trade in 2012, India is Australia's seventh largest trading partner.
Japan	2.8	9.5	10th	Japan is an advanced OECD economy in Australia's region and a major emitting economy. With $67 billion in two way merchandise trade in 2012, Japan is Australia's second largest trading partner.
Germany	2.1	10.9	5th	Germany is a major emitting and large OECD economy. It has strongly promoted renewable technology and is an important developer and manufacturer of some renewable technologies. With $13 billion in two-way merchandise trade in 2012, Germany is Australia's 11th largest trading partner.
Indonesia	1.9	3.3	121st	Indonesia is an emerging economy in Australia's Asia-Pacific region. Its development and emissions per person are relatively low by global standards, but growing. With $11 billion in two-way merchandise trade in 2012, Indonesia is Australia's 13th largest trading partner.
Canada	1.6	19.9	11th	Canada is a resource-intensive OECD country like Australia, with similar extractive industries and economic structure. It has per person emissions similar to Australia's. With $4 billion in two-way merchandise trade in 2012, Canada is Australia's 20th largest trading partner.
Republic of Korea	1.4	12.5	12th	The Republic of Korea is an OECD economy in Australia's region, with a strong focus on 'green growth' and sharing the benefits of green growth with developing countries. With $30 billion in two-way merchandise trade in 2012, the Republic of Korea is Australia's fourth largest trading partner.
United Kingdom	1.4	9.3	26th	The United Kingdom is an OECD developed economy with a similar share of emissions to Australia. With $13 billion in two-way merchandise trade in 2012, the United Kingdom is Australia's 10th largest trading partner.
South Africa	1.3	11.2	121st	South Africa is an emerging economy with a large resources sector and similar economic structure to Australia. With $2 billion in two-way merchandise trade in 2012, South Africa is Australia's 28th largest trading partner.
New Zealand	0.2	16.6	6th	New Zealand is an advanced OECD economy in Australia's region and works closely with Australia on climate change policy. With $15 billion in two-way merchandise trade in 2012, New Zealand is Australia's ninth largest trading partner.
Norway	0.1	11.2	1st	Norway is a resource-intensive OECD economy, with a large economic dependence on fossil fuel extraction. It is the only country in 2012 with a higher rank in the Human Development Index than Australia. With $0.5 billion in two-way merchandise trade in 2012, Norway is Australia's 55th largest trading partner.

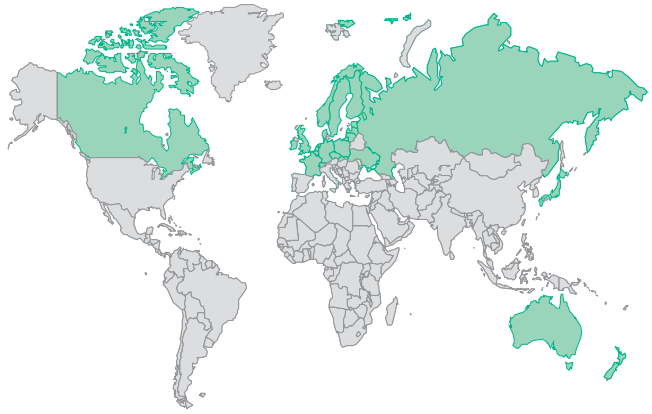
* HDI is the United Nations Human Development Index, a composite measurement of development.

Sources: Emissions data from World Resources Institute 2013 Climate Analysis Indicators Tool, year 2009, excluding land use. GDP data from International Monetary Fund 2013. Human Development Index rankings from United Nations Development Programme 2012. Trade data from Department of Foreign Affairs and Trade 2013, merchandise trade only, excluding services.

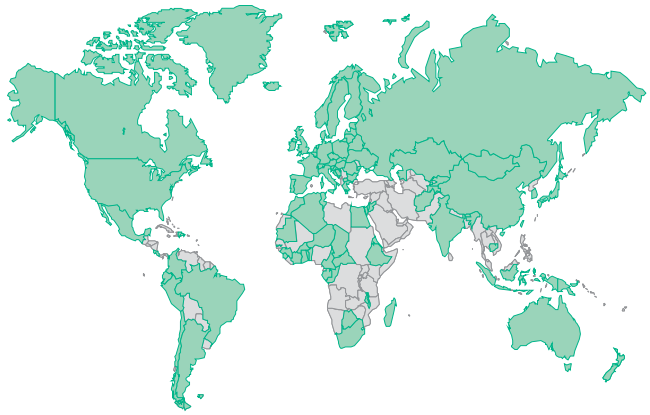
FIGURE 4.1: COUNTRIES WITH INTERNATIONAL EMISSIONS GOALS UNDER THE UNFCCC

1990 – NO COUNTRIES

1997 – 37 COUNTRIES



2013 – 99 COUNTRIES



Source: UNFCCC (Kyoto Protocol in 1997, Nationally Appropriate Mitigation Actions and Economy-wide Reduction Targets in 2013)

The UNFCCC entered into force in 1994 and, with 195 Parties, it has one of the most universal memberships of any international treaty.

The UNFCCC reflects near-global agreement on a number of key matters:

- an objective to 'prevent dangerous anthropogenic interference with the climate system';
- that all Parties should formulate and implement national programs to mitigate climate change;
- that all Parties should report on their emissions and national action through inventories and national communications; and
- that developed country Parties should provide support to assist developing countries take action to address climate change and adapt to it.

The Kyoto Protocol to the UNFCCC was adopted in 1997, following the Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report, which found that greenhouse gas emissions could cause changes to the climate unprecedented in human history and that climate change would be virtually irreversible.

The Protocol built on the general commitments of the UNFCCC by establishing specific targets for developed (Annex I) countries to reduce their greenhouse gas emissions. For most Annex I Parties, these targets are expressed as a percentage reduction from a 1990 baseline over the period 2008–2012 (the 'first commitment period').

The 2007 IPCC Fourth Assessment Report concluded that the climate was changing faster than predicted in previous reports. This report was closely followed by the 2007 Bali Action Plan under the UNFCCC, which began a new negotiating process to discuss mitigation action by all countries, including the United States (which did not ratify the Kyoto Protocol) and developing countries (which do not have emissions reduction commitments under the Kyoto Protocol).

The Bali Action Plan negotiations were expected to conclude at the 2009 Copenhagen Conference with a mandate to negotiate a new legal agreement. In 2009, however, Parties were unable to come to final agreement, instead 'noting' the Copenhagen Accord. While falling short of expectations, the Accord set out significant new steps, which were formally agreed by Parties in 2010 at the Cancun Conference:

- an objective to reduce global emissions so as to 'hold the increase in global temperatures below 2 degrees Celsius' together with a 2013–15 review to assess the adequacy of this goal in the light of current science;
- specific 2020 pledges to reduce or limit emissions by most developed and developing countries. Currently 99 countries have made pledges;

- more robust measurement, reporting and verification arrangements for emissions and emissions reductions; and
- short- and long-term financial commitments by developed countries to assist developing countries.

The 2011 Durban Conference continued work to clarify countries' 2020 pledges, as well as setting out a pathway for a post-2020 agreement. This post-2020 agreement will be applicable to all countries, and is due to be concluded by 2015 to come into effect by 2020.

The 2012 Doha Conference saw the formal adoption of amendments to the Kyoto Protocol to create a second commitment period from 2013–2020. Thirty-seven Annex I Parties agreed to take on a target – Australia, Belarus, all 28 European Union members, Iceland, Liechtenstein, Monaco, Kazakhstan, Norway, Switzerland and Ukraine. Russia, Japan and New Zealand did not take second commitment period targets. Canada has formally withdrawn from the Protocol. Importantly, all the Annex I Parties that do not have targets under the second commitment period of the Kyoto Protocol, including the United States, have 2020 targets under the UNFCCC.

Countries are currently reviewing the level of global ambition – both in the context of increasing the strength of Kyoto Protocol emissions reduction commitments, and more broadly under the UNFCCC. Both these reviews will take place in 2014, informed by the IPCC Fifth Assessment Report, which will be completed in 2014.

Negotiations have also begun on the form and content of a post-2020 agreement, which is due to be negotiated by 2015. To work towards this new agreement and aim to increase global effort on climate change, the United Nations Secretary General will convene a leaders' summit on climate change in September 2014.

The UNFCCC is an important source of information about global action, including national inventories of emissions and national communications by countries explaining what they are doing to address climate change. The 2020 emission reduction goals put forward by countries under the UNFCCC (discussed in Section 4.3) also provide a useful indication of countries' future intentions.

Recently, there has been much attention on the fact the UNFCCC has not yet agreed on a new treaty with legally binding emissions reduction commitments by all countries. 'Legally binding' agreements may provide greater assurance that countries fulfil their committed action. However, they are not the only indicator of action. Significant progress has been made under the UNFCCC beyond a new treaty, including emissions reduction goals and systems to measure, report and verify emissions and emissions reductions.

4.2.1 OTHER INTERNATIONAL INITIATIVES

There are a range of international initiatives underway aimed at facilitating climate change action outside of the UNFCCC. These allow countries to exchange practical ideas about reducing emissions and include:

- research and development into low-emissions technologies, such as carbon capture and storage, renewable energy and approaches to reduce emission from agriculture;
- commitments to reduce or phase out fossil fuel subsidies including under the G20;
- linking of emissions trading schemes, such as those of the EU and Norway, and proposed links between California and Quebec, and Switzerland and the EU;
- bilateral and regional agreements targeting particular areas of climate change policy; for example, short-lived gases such as methane and hydrofluorocarbons through the Climate and Clean Air Coalition, and carbon markets through the World Bank Partnership for Market Readiness.

Other international initiatives that reduce global warming include the Montreal Protocol on Substances that Deplete the Ozone Layer (The Montreal Protocol), which was designed to 'phase out' a range of gases to protect the ozone layer by destroying them safely and replacing them with substitutes. Many of the gases covered by the Montreal Protocol drive global warming as well as damaging the ozone layer, so the phase-out has had a significant positive impact on climate change.

Emissions from international aviation and maritime activities are currently not counted towards individual country emissions or targets under the UNFCCC. Both have nearly doubled in the last 10 years. Discussions to reduce emissions from these sectors occur in the International Maritime Organization and the International Civil Aviation Organization.

Appendix B provides further information on international initiatives outside the UNFCCC.

4.3 2020 EMISSIONS REDUCTION TARGETS

Ninety-nine countries, including Australia, have committed to 2020 emissions reduction targets and actions under the UNFCCC. These countries account for over 80 per cent of global emissions and 90 per cent of the global economy. The UNFCCC documents listing countries' pledges are available on the UNFCCC website (www.unfccc.int).

In many of these countries, these pledges are also included in domestic legislation and national planning documents. Table 4.2 shows the 2020 emissions reduction targets of key countries, both international pledges and, where relevant, additional domestic targets or commitments.

TABLE 4.2: 2020 EMISSIONS REDUCTION TARGETS OF KEY COUNTRIES

COUNTRY	INTERNATIONAL AND DOMESTIC 2020 EMISSIONS REDUCTION TARGETS*
Australia	International: 5 per cent, up to 15 per cent or 25 per cent relative to 2000 (5 per cent unconditional).
China	International: Lower carbon dioxide emissions per unit of GDP by 40–45 per cent relative to 2005. Domestic: China's 2020 target has been incorporated in its medium and long-term economic and social development plans as a binding target. China has an interim carbon intensity target under its 12th Five-Year Plan (2011–2015).
United States	International: In the range of 17 per cent relative to 2005. Domestic: This goal is included in President Obama's 2013 Climate Action Plan.
European Union (28 member states)	International: 20 per cent relative to 1990. Conditional target of 30 per cent relative to 1990. Domestic: Many European Union countries have climate targets included in legislation or national plans. The European Union also has agreed to a formal 'burden sharing arrangement' for some of its collective climate targets.
India	International: reduction in emissions intensity (emissions per unit of GDP) by 20–25 per cent relative to 2005 (excluding agriculture).
Japan	International: 25 per cent relative to 1990.**
Germany	International: 20 per cent relative to 1990, as part of EU target. Domestic: The German Government has included in legislation a national target of reducing greenhouse gas emissions by 40 per cent by 2020 relative to 1990.
Indonesia	International: 26 per cent relative to 'business as usual'. Domestic: Indonesia's National Action Plan for Greenhouse Gas Emission Reduction states Indonesia could reduce emissions up to 41 per cent by 2020 relative to business as usual with international support.
Canada	International: 17 per cent relative to 2005. Canada has withdrawn from the Kyoto Protocol, but maintains this target under the UNFCCC.
Republic of Korea	International: 30 per cent relative to 'business as usual'. Domestic: The 2020 goal is included in Korea's 2010 Framework Act on Low Carbon, Green Growth.
United Kingdom	International: 20 per cent relative to 1990, as part of EU targets. Domestic: The UK has a domestic 2020 target of 34 per cent below 1990 levels. It also has a series of binding carbon budgets under its Climate Change Act for the period 2008–2027. The 2027 carbon budget represents emissions of 50 per cent relative to 1990.
South Africa	International: 34 per cent relative to 'business as usual', and 42 per cent relative to 'business as usual' by 2025. Domestic: The 2020 goal is referred to in South Africa's 2011 National Climate Change Response.
New Zealand	International: Unconditional target of 5 per cent relative to 1990. Conditional target of 10–20 per cent relative to 1990.
Norway	International: 30 per cent relative to 1990. Conditional target of 40 per cent relative to 1990.

* Many countries' targets are conditional on the extent of climate action in other countries. The conditions can be found in UNFCCC submissions compiled here for developed countries: http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf and here for developing countries: http://unfccc.int/resource/docs/2013/sbi/eng/inf12r02.pdf. Domestic action included in this table covers targets included in domestic legislation, national planning documents and other official government plans.

** Japan is currently reviewing its energy and climate policies after the Fukushima disaster in 2010.

Sources: International emissions reduction targets from UNFCCC 2011 and UNFCCC 2013; domestic targets from country websites

It is too early to definitively say whether countries will meet their 2020 targets. Many countries are in the process of implementing policies for which the actual mitigation effect is not yet known (for example, Korea's legislated carbon price and South Africa's carbon tax). Other countries, including Norway, are intending to meet their targets through using fast-acting policies closer to 2020, such as the planned purchase of overseas emissions units. Countries' energy mixes can also change rapidly for non-climate-centred reasons and make it either easier or harder to achieve a target, as demonstrated by the United States gas boom and Japan's nuclear disaster. Finally, ambition of targets is linked to achievability. Countries with strong targets may be less likely to achieve them, although they may still reduce their emissions significantly.

With those important caveats, it is clear that countries are generally taking their targets seriously and bringing in policies to meet them. There is also heartening precedent – most countries that have first commitment period targets listed in Annex B of the Kyoto Protocol appear to be on track to comply with them (two exceptions are the United States, which did not ratify the Kyoto Protocol, and Canada, which withdrew from the Protocol in 2012).

Importantly, the United States and China (the world's top two emitters, responsible for about 37 per cent of global emissions) are both capable of meeting or exceeding their 2020 targets. The World Resources Institute assessed US policy in 2013, and concluded it could meet its target by using executive powers of the sort recently announced by President Obama (WRI 2013a). Similarly, the Climate Action Tracker Project, run by a coalition of European climate research groups, concluded that China was on track for its 2020 target: 'Recent energy and emissions data combined with China's 12th Five-year plan announced in March 2011 indicate that China is set to not only meet its [2020] emissions intensity pledge, but is likely to go beyond it.' (Climate Action Tracker, 2011).

4.3.1 AGGREGATION OF 2020 TARGETS

A range of studies has attempted to quantify the aggregate emissions reductions associated with the current 2020 UNFCCC emissions reduction pledges. There are high degrees of uncertainty associated with these studies; however, most find that while current 2020 commitments will reduce emissions below business-as-usual projections, they are not sufficient to put the world on track to meet the below 2 degrees global goal.

The United Nations Environment Programme (UNEP) Emissions Gap report series (published annually) is one of the most comprehensive studies aggregating commitments. The report series estimates the difference, or 'gap', between the level of projected global greenhouse gas emissions with current 2020 pledges, and the level climate science recommends to limit future temperature increases to below 2 degrees.

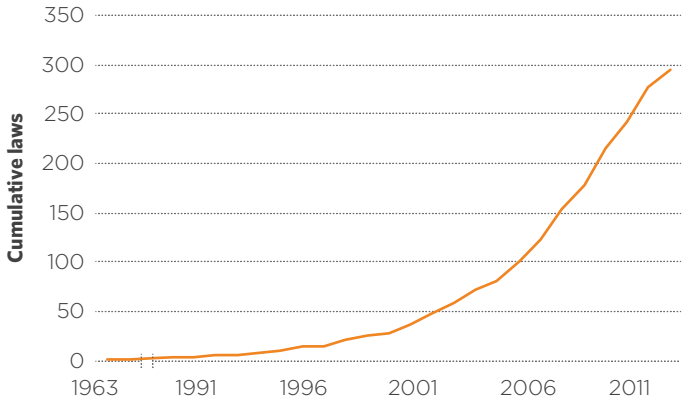
The most recent UNEP report finds that the emissions gap for a likely chance of tracking below 2 degrees is 8 to 13 Gt CO_2-e (a likely chance is defined by UNEP as 67 per cent). This is equivalent to around 14 to 24 times Australia's entire annual emissions.

Importantly, the report finds that it is technically feasible to limit temperature increases to below 2 degrees with either greater pre-2020 action or post-2020 action; however, it notes that increasing action post-2020 will be more costly than acting earlier due to lock-in of emissions-intensive infrastructure (UNEP 2012).

4.4 COUNTRIES' DOMESTIC POLICIES AND MEASURES

Domestic action to address climate change has increased over time. GLOBE notes that in 2012 there were a total of 286 climate change-related laws in the 33 study countries (GLOBE International 2013) – see Figure 4.2.

FIGURE 4.2: TOTAL CLIMATE CHANGE LAWS IN GLOBE COUNTRY STUDIES, 1963–2012



Source: Globe 2013

All the major emitting economies now have domestic policies and measures to support their 2020 emission reduction targets. Policies include incentives for renewable energy, energy efficiency standards, emissions trading schemes and emissions performance standards in electricity generation and transport. Particular approaches vary from country to country depending on its development level, economic structure and the targeted sector or desired response.

Table 4.3 describes the climate actions of key countries in different sectors. Most countries, including China and the United States, have policies in all these sectors. An expanded version of this table is in Appendix B.

TABLE 4.3: POLICIES AND MEASURES OF KEY COUNTRIES

TYPE OF POLICY	EXAMPLE OF POLICIES	COVERAGE
Energy supply	Renewable energy targets, feed-in tariffs	**All key countries** have some or multiple energy supply policies in place
Energy demand	Appliance and building energy efficiency standards	**All key countries** have some or multiple energy demand policies in place
Transport	Mandatory vehicle emissions, pollution or fuel efficiency standards; incentives for renewable fuel production	**Nearly all key countries** other than Australia and New Zealand have some form of mandatory vehicle standards; more than half have greenhouse gas emissions standards
Carbon pricing	Taxes or emissions trading schemes	**Most key countries** have policies in place at national or subnational level; others including the Republic of Korea and South Africa are planning to introduce policies in 2015

4.4.1 CLIMATE CHANGE ACTION IN CHINA AND THE UNITED STATES

The two countries with the largest impact on global climate change action are China and the United States. Together, they were responsible for over a third of the world's emissions in 2009 (refer to Box 4.1).

Both countries are acting on climate change. They have put in place policies and measures to address climate change, and are stepping up these efforts[1].

ACTION IN CHINA

China is acting on climate change, including by investing in renewable energy, imposing stringent energy performance standards and establishing emissions trading schemes. Box 4.2 provides a snapshot of China's climate change action.

China has integrated climate change as a core part of its economic planning. China's climate targets are included in its central economic policy document for 2011–15, the 12th Five-Year Plan. The Five-Year Plan contains targets for energy intensity (energy consumption per unit of GDP: 16 per cent reduction by 2015 relative to 2010 levels) and CO_2 emissions per unit of GDP (17 per cent reduction by 2015 relative to 2010 levels). Achieving these targets would put China on track to meet its international commitments.

China has shown its ability to set and achieve environmental targets. Between 2006 and 2010, China reduced its energy intensity by 19.1 per cent from 2005 levels (The Network for Climate and Energy Information, 2012), and the national government reported that it had closed nearly 500 smaller and less efficient power plants.

BOX 4.1: CHINA AND THE UNITED STATES EMISSIONS AND TARGETS*

Emissions (2009)

Total: 9 434 Mt CO_2-e	Total: 6 513 Mt CO_2-e
22.1 per cent of world total	15.3 per cent of world total
Per person: 7.1 t CO_2-e	Per person: 21.2 t CO_2-e

Each country has committed to an international target to reduce its emissions, and is capable of achieving this target with continued domestic action.

2020 targets

40–45 per cent reduction in CO_2 emissions per unit of GDP relative to 2005	17 per cent reduction in emissions relative to 2005

* Emissions data source: 2009, Climate Analysis Indicators Tool, not including land use

1 Unless otherwise attributed in text, all information about domestic climate policies in the United States and China has been sourced from publicly available reporting, and verified through the Australian Embassy in Beijing and Washington.

China is a world leader in renewable and low-carbon energy. In 2012, $US67 billion in renewable energy (more than a quarter of the world total) and wind power generation capacity grew faster than coal-fired generation capacity (REN21, 2013). It also has the world's largest installed renewable generation capacity at 90 gigawatts (excluding hydropower, Australia's comparable renewables capacity was about 5 gigawatts in 2012). The power China produces from wind is now larger than the power it obtains from nuclear (REN21, 2013).

In response to air pollution, China has announced a target of capping coal consumption of 4 billion tonnes of coal equivalent per year, with a parallel cap on coal output of 3.9 billion tonnes in 2015. Although these caps are non-binding, they clearly signal China's intention to address its energy use and environmental problems. China also tightened its fuel economy standards for passenger vehicles in 2013.

China is implementing market mechanisms to reduce its emissions. Emissions trading commenced in Shenzhen in June 2013, covering more than 600 companies and approximately 31 Mt of CO_2 emissions (about the size of South Australia's annual greenhouse gas emissions). Pilot emissions trading schemes are proposed to start over the next few years in six other cities and provinces Beijing – Chongqing, Shanghai, Tianjin, Guangdong and Hubei. These seven areas make up a third of China's economy and about a fifth of its energy use (DIICCSRTE, 2013). China plans to start a national emissions trading scheme after 2015.

ACTION IN THE UNITED STATES

US emissions have dipped downwards in recent years, partly due to slower economic growth and a boom in gas production that has reduced coal-fired electricity production. Momentum for stronger climate policy is also building in the United States.

In June 2013 President Obama announced a new Climate Action Plan, in a speech that mentioned Hurricane Sandy and the necessity for immediate federal climate leadership. The Plan aims to reduce US emissions, prepare for the domestic impacts of climate change and increase international climate cooperation. It uses the President's executive powers to increase regulations on new and existing power plants, accelerate renewable energy development on public land, and direct federal agencies to use more renewable energy and increase their energy efficiency. The combined effect of these measures could be significant – the power plant regulations could prevent the construction of new coal-fired power plants without carbon capture and storage technology.

Strict vehicle fuel economy and emissions standards introduced in 2011 will drive large reductions in emissions (transportation makes up nearly one-third of total US emissions). The US Government estimated that the new standards would save 6 000 Mt of CO_2-e between 2011 and 2025, more than 10 times Australia's 2012 total emissions. The US Energy Information Administration (2013) estimates that there are already two million hybrid vehicles in the United States, and an additional nine million 'alternative fuel' vehicles capable of using electricity, ethanol, liquid petroleum gas or natural gas.

The United States has been at the forefront of investment in renewable energy for the past decade. Renewable energy investment in the United States totalled US$36 billion in 2012 and invested $US36 billion in 2012. It is a close second to China in renewable capacity, with 86 gigawatts installed (REN21, 2013.)

BOX 4.2: SNAPSHOT OF CHINA'S ACTIONS

- World's largest investor in renewable energy (US$67 billion in China in 2012).
- Proposed scaling down coal use, including non-binding caps on consumption and production.
- Closed nearly 500 smaller and less efficient coal power plants by 2010.
- Emissions trading scheme operating in Shenzhen and planned for six other provinces and municipalities, to be followed by a national scheme.

Photo Credit: Getty Images

Much action on climate change in the United States is happening at state and local level. Twenty-nine states have adopted greenhouse gas reductions targets or limits, with varying stringency. Nine north-eastern states have in place an emissions trading scheme for their power sector that began in 2009 – the Regional Greenhouse Gas Initiative. California has a separate emissions trading scheme which began in 2013. The scheme will eventually cover most of California's emissions, which comprise around 7 per cent of total US emissions – equivalent to about 80 per cent of Australia's annual emissions.

CHINA–US COOPERATION

The United States and China have committed to work together on climate change.

In June 2013, President Obama and President Xi reached a bilateral deal to work to phase down the consumption and production of hydrofluorocarbons – potent greenhouse gases used in refrigeration and air conditioning – under the Montreal Protocol.

At the two countries' annual Strategic and Economic Dialogue in July 2013, China and the United States announced renewed cooperation in five areas:

- reducing emissions from heavy-duty and other vehicles
- carbon capture and storage demonstration
- increasing energy efficiency in buildings, industry and transport
- improving greenhouse gas data collection and management; and
- promoting smart grids.

The United States and China are cooperating on climate change at subnational levels. The US state of California and the Chinese municipality of Shenzhen are working together on air quality. Both regions have emissions trading schemes in place, and have also agreed to share policy design and early experiences from these schemes.

4.5 POST-2020 FRAMEWORK AND GOALS

To achieve the below 2 degrees goal, global action needs to further accelerate before and after 2020. International negotiations to establish a post-2020 framework for action on climate change have begun.

In the UNFCCC, the new agreement is due to be negotiated by 2015 and to come into effect in 2020. Countries including Australia are expected to begin putting forward post-2020 goals in the UNFCCC, possibly as early as 2014.

Australia can influence the development of this framework in the UNFCCC, especially in the context of the new agreement negotiations. The Authority considers it important that the new agreement encourages countries to reduce their emissions and ensures their actions are transparent and verifiable. Facilitating trade of credible emissions reductions could also add to the speed and effectiveness of a global response to climate change.

Alongside the UNFCCC negotiations towards a new agreement, many countries have begun internal policy processes to consider medium-term targets such as 2025 or 2030. Several countries have also set domestic 2050 goals to guide their progress, including the European Union, the United Kingdom, New Zealand, Mexico, Japan and Norway. Table 4.4 sets out current post-2020 goals in key countries. More countries are expected to announce post-2020 goals as international and domestic processes advance.

BOX 4.3: SNAPSHOT OF US ACTIONS

- World's second largest investor in renewable energy after China – nearly half the electric capacity added in 2012 was renewable.
- Proposed stringent regulations of new and existing coal power plants.
- Emissions trading schemes operating in 10 states.
- Ambitious vehicle emissions standards.

Photo Credit: Wikipedia

TABLE 4.4: POST-2020 EMISSIONS REDUCTION TARGETS OF SELECTED KEY COUNTRIES

COUNTRY	POST-2020 DOMESTIC TARGET IN PLACE	CONSIDERING ADDITIONAL TARGETS
Australia	**2050** 80 per cent below 2000 levels.	
United States	**2050** In 2009, President Obama committed to a goal of 83 per cent below 2005 levels.	
European Union (28 member states)	**2050** 80–95 per cent below 1990 levels.	Considering 2030 targets, decision expected late 2013. Roadmap to 2050 planning document contains reduction targets of 40 per cent by 2030 and 60 per cent by 2040, both relative to 1990 levels.
Japan	**2050** 80 per cent below 1990 levels included in its Fourth Basic Environment Plan.	
Germany	**2050** Germany contributes to the EU 2050 targets. It has adopted the EU goal of 80–95 per cent in its energy blueprint.	Considering 2030 targets with EU, decision expected late 2013. Legislation passed in 2010 sets out a road map to 2050, with indicative targets below 1990 levels: 40 per cent by 2020, 55 per cent by 2040, 70 per cent by 2040 and 80–95 per cent in 2050.
United Kingdom	**2050** The UK contributes to the EU 2050 targets. 80 per cent below 1990 levels The UK's goal is supported by legislated carbon budgets from 2008 to 2027. The 2027 carbon budget represents emissions of 50 per cent below 1990 levels.	Considering 2030 targets with EU, decision expected late 2013.
South Africa	**2025** 42 per cent below business as usual levels set in South Africa's National Climate Change Response.	South Africa has a 'peak, plateau and decline' strategy where its emissions peak between 2020 and 2025, plateau for around 10 years and then fall.
New Zealand	**2050** 50 per cent below 1990 levels.	
Norway	**2050** Carbon neutrality (reduce global greenhouse gas emissions by the equivalent of 100 per cent of its own emissions).	If an ambitious global climate agreement is achieved, in which other developed countries also take on extensive obligations, Norway has stated it will undertake to achieve carbon neutrality by 2030.

* Many countries' targets are conditional on the extent of climate action in other countries. The conditions can be found in UNFCCC submissions compiled here for developed countries: http://unfccc.int/resource/docs/2011/sb/eng/inf01r01.pdf and here for developing ones: http://unfccc.int/resource/docs/2013/sbi/eng/inf12r02.pdf.
Sources are either the UNFCCC submissions or country websites. Key countries not in this table have not yet announced post-2020 goals.

DRAFT CONCLUSION

C.3 Although the current level of global action is not yet on track to meet the below 2 degree global goal, there is a significant and accelerating trend to global action to reduce greenhouse gas emissions. All the major emitting economies, including China and the United States, have 2020 emissions reduction goals backed by domestic policies and measures.

CHAPTER 5 AUSTRALIAN ACTION IN A GLOBAL CONTEXT

5

Australian action on climate change is part of an international response. The sum of countries' actions on climate change determines whether or not it will be possible to limit global warming, relative to pre-industrial levels, to below 2 degrees.

While current global action – as measured by countries' 2020 pledges – is not on track to meet this objective, there is a clear trend to increased action, with more countries taking on targets and implementing policies than ever before.

Australian 2020 targets of 15 or 25 per cent would be broadly comparable with the current actions of other key countries, including major emitters, Australia's trading partners and neighbours.

A stronger Australian target could also have a positive influence on the actions of other countries by demonstrating that emissions-intensive economies, such as Australia, can pursue and achieve ambitious targets.

The Authority's analysis of the Government's target conditions show that the conditions for moving beyond 5 per cent have been met. Whether the conditions for 15 per cent have been met is unclear – some elements have been met, others are marginal. The conditions for a 25 per cent target have not been met. While the Authority has taken these conditions into account, it is also required to examine a broader range of considerations.

Chapter 4 considered the overall trends in global action to reduce greenhouse gas emissions. This chapter builds on that assessment to consider the implications of global action for Australia's emissions reduction goals.

Australian action is part of a broader international response. In considering recommendations for Australia's emissions reduction goals, it is relevant to consider how different goals compare with the action other countries are taking – this places Australian action in context. It is also important to consider whether, and how, Australia's targets influence other countries' efforts.

This chapter sets out:

- Australia's place in the world, including its international obligations and undertakings;
- Australia's target conditions and the extent to which they have been met;
- how Australian targets of 5, 15 and 25 per cent below 2000 levels compare with the targets of other key countries; and
- Australian influence on other countries' climate action.

5.1 AUSTRALIA'S PLACE IN THE WORLD

Australia is prosperous compared with most countries. It has the 12th highest gross domestic product (GDP) per person in the world and a high standard of living.

Australia is also a high-emitting country in absolute and per person terms. Australia has the highest emissions per person of all developed countries and is responsible for about 1.3 per cent of the world's emissions of greenhouse gases. While this may sound like a small proportion of the global total, Australia is the 15th highest emitter of greenhouse gases in the world. Some of this reflects Australia's relatively high share of fossil fuels in its energy supply. In 2011–12, coal represented nearly 60 per cent of Australia's total primary energy supply (Bureau of Resource and Energy Economics 2013) compared with an OECD average of 20 per cent (IEA 2012). Australia is one of 19 countries that emits more than one per cent of the world's emissions. The combined emissions from these countries is more than two-thirds of the world's total emissions.

Box 5.1 provides a snapshot of Australia's place in the world, both in economic (capacity) and emissions terms.

5.1.1 AUSTRALIA'S INTERNATIONAL UNDERTAKINGS AND 2020 TARGET CONDITIONS

Australia has made an international undertaking to the United Nations Framework Convention on Climate Change (UNFCCC) to reduce its emissions by 5 to 15 or 25 per cent by 2020 relative to 2000 levels. The 5 per cent target is unconditional and a policy has been set for when Australia might move beyond 5 per cent or to 15 or 25 per cent. This policy is set out at Box 5.2.

Different readers legitimately might come to different conclusions about whether the conditions are met. This was demonstrated in submissions to the Issues Paper, where stakeholders expressed differing views. For example, the Australian Aluminium Council (submission, p. 1) did not consider the conditions to move beyond 5 per cent were met; nor did the Australian Industry Greenhouse Network (submission, p. 3). On the other hand, The Climate Institute considered that, based on the Government's conditions, Australia's minimum 2020 target should be 12 to 15 per cent (submission, p. 21). Other groups, including the Australian Conservation Foundation (submission, p. 8) and Oxfam Australia (submission, p. 15) did not consider the existing conditions to be an appropriate basis for setting Australia's 2020 target.

BOX 5.1: KEY CLIMATE AND ECONOMIC FACTS ABOUT AUSTRALIA

EMISSIONS	
Per cent of global emissions: 1.3 (15th in the world in 2009)	
Emissions per person: 25 tonnes of carbon dioxide equivalent (t CO_2-e) (11th in the world in 2009, highest of any developed country)	
DEVELOPMENT AND ECONOMY	
Human Development Index ranking: 2	
GDP (Int$, PPP): $971 billion (18th in the world)	
GDP (Int$, PPP) per person: $42 640 (12thin the world)	
Australia's top five export markets:	Australia's top five import markets:
1. China (27 per cent)	1. China (15 per cent)
2. Japan (17 per cent)	2. United States (13 per cent)
3. Republic of Korea (7 per cent)	3. Japan (7 per cent)
4. United States (5 per cent)	4. Singapore (6 per cent)
5. India (5 per cent)	5. Germany (4 per cent)

Sources: Emissions data from World Resources Institute 2013, 2009, excluding land use; International Monetary Fund Australian Bureau of Statistics; United Nations Development Programme.

BOX 5.2: AUSTRALIA'S 2020 TARGET POLICY

Reduce emissions by 5 per cent relative to 2000 levels
Conditions: None

Reduce emissions beyond 5 per cent
Conditions: The Government will not increase Australia's emissions reduction target above 5 per cent until:

- the level of global ambition becomes sufficiently clear, including both the specific targets of advanced economies and the verifiable emissions reduction actions of China and India;
- the credibility of those commitments and actions is established for example, by way of a robust global agreement or commitments to verifiable domestic action on the part of the major emitters including the United States, India and China; and
- there is clarity on the assumptions for emissions accounting and access to markets.

Reduce emissions by 15 per cent compared to 2000 levels
Conditions: International agreement where major developing economies commit to restrain emissions substantially and advanced economies take on commitments comparable to Australia's. In practice, this implies:

- global action on track to stabilisation between 510 and 540 ppm CO_2-e;
- advanced economy reductions in aggregate in the range of 15–25 per cent below 1990 levels.
- substantive measurable, reportable and verifiable commitments and actions by major developing economies in the context of a strong international financing and technology cooperation framework, but which may not deliver significant emissions reduction until after 2020;
- progress towards inclusion of forests (reduced emissions from deforestation and forest degradation) and the land sector, deeper and broader carbon markets and low-carbon development pathways.

Reduce emissions by 25 per cent relative to 2000 levels (up to 5 percentage points through Government purchase)
Conditions: Comprehensive global action capable of stabilising CO_2-e concentrations at 450 ppm CO_2-e or lower. This requires a clear pathway to achieving an early global peak in total emissions, with major developing economies slowing the growth and then reducing their emissions, advanced economies taking on reductions and commitments comparable to Australia's, and access to the full range of international abatement opportunities through a broad and functioning international market in carbon credits. This would involve:

- comprehensive coverage of gases, sources and sectors with inclusion of forests (reduced emissions from deforestation and forest degradation) and the land sector (including soil carbon initiatives (for example, biochar) if scientifically demonstrated) in the agreement;
- clear global trajectory, where the sum of all economies' commitments is consistent with 450 ppm CO_2-e or lower, and with a nominated early deadline year for peak global emissions not later than 2020;
- advanced economy reductions, in aggregate, of at least 25 per cent below 1990 levels by 2020;
- major developing economy commitments to slow growth and to then reduce their absolute level of emissions over time, with a collective reduction of at least 20 per cent below business as usual by 2020 and a nomination of peaking year for individual major developing economies;
- global action which mobilises greater financial resources, including from major developing economies, and results in fully functional global carbon markets.

Note: 'Advanced economies' refers to Annex I Parties to the UNFCCC and at least some other high-middle income economies; 'major developing economies' refers to non-Annex I members of the Major Economies Forum.
Source: Commonwealth of Australia 2013

In the Authority's view, a strong case can be made that the conditions for moving beyond the 5 per cent target have been met:

- as set out in Chapter 4, since the target conditions were set, there has been significant process 'clarifying the level of global ambition', with all major emitting economies putting forward 2020 emissions reduction goals under the UNFCCC;
- a robust international framework for measurement, reporting and verification of targets and actions was established in 2011 at the Durban Climate Conference; and
- a clear framework for markets and accounting has been established for second commitment period targets under the Kyoto Protocol. For targets outside the Protocol, countries will set out their rules for accounting and markets in biennial reports and biennial update reports, due to begin 1 January 2014.

Whether the conditions for moving to a 15 per cent target are fulfilled is less clear. In the Authority's view, some elements are met; for example, there has been strong progress developing a global framework including targets by all major emitting economies; measurement, reporting and verification of emissions; and action on finance and technology for developing countries.

Some elements of the 15 per cent target conditions are marginal, including global action on track to stabilisation between 510 and 540 ppm. Studies generally estimate that the level of global effort is on track to stabilisation at around 550 ppm (Project Catalyst 2010); however, there is significant uncertainty surrounding these estimates. First, there is uncertainty about the exact level of emissions reductions implied by the UNFCCC 2020 pledges (UNEP 2012). Second, the stabilisation outcome depends on the shape of the world's long term emissions trajectory; this means it is difficult to relate 2020 emissions levels to particular stabilisation outcomes without making significant assumptions about action after 2020 (Rogelj and Meinshausen 2010). Given these uncertainties, stabilisation between 510 and 540 ppm cannot be ruled out.

The condition regarding aggregate Annex I Party action is also marginal. Recent analytical work estimates aggregate Annex I Party action to currently be 12–18 per cent below 1990 levels by 2020 (compared with the 15 to 25 per cent reductions listed in the conditions) (den Elzen et al. 2012, p. 9). This work concedes that there is uncertainty regarding these estimates, which could pull the aggregate up or down.

In the Authority's view, the conditions for 25 per cent have not been met at this time. In particular, while stabilisation of greenhouse gas concentrations at around 450 ppm remain technically feasible, most assessments consider this is only possible with wide spread use of negative emissions technology after 2020 (UNEP 2012). For this reason, most studies do not consider that the current 2020 pledges are on track to stabilisation at 450 ppm. The aggregation of Annex I targets, even under the most ambitious assumptions, is also unlikely to be 'at least 25 per cent' reductions on 1990 levels.

Table 5.1 sets out the Authority's assessment of the target conditions in detail.

These conditions have been long-standing Australian policy and have provided guidance to stakeholders about the likely Australian target. However, as noted in Chapter 1, the Authority is legislatively required to take into account a broader range of factors in making recommendations about Australia's 2020 target, including estimates of the global greenhouse gas emissions budget; economic efficiency; equity and the impact on households, business, workers and the community (*Climate Change Authority Act 2011*, s 12). The Authority is also required to take account of 'the level of global action to reduce greenhouse gas emissions' more broadly.

Therefore, while the above assessment is an important factor in the Authority's deliberations, it is only one input to its recommendations about Australia's appropriate 2020 emissions reduction target.

TABLE 5.1: ASSESSMENT OF GOVERNMENT TARGET CONDITIONS

REDUCE EMISSIONS BEYOND 5 PER CENT RELATIVE TO 2000 LEVELS

The Government will not increase Australia's emissions reduction target above 5 per cent until:

Condition	Circumstances	Authority's assessment
The level of global ambition becomes sufficiently clear, including both the specific targets of advanced economies, and the verifiable emissions reduction actions of China and India	Since the conditions were set, the level of global ambition has become significantly clearer – 99 countries, covering 80 per cent of global emissions have pledged to reduce or limit their emissions before 2020. Countries have also provided further information clarifying their pledges and the potential emissions reductions outcome. All Annex I Parties have committed to specific targets under the UNFCCC or Kyoto Protocol. Many developing countries, including China and India, have pledged 2020 emissions reductions targets or actions under the UNFCCC. They have also agreed to increased measurement, reporting and verification of their emissions and their pledged action through biennial update reports, including national inventories. Details of pledges can be found at www.unfccc.int	Condition met
The credibility of those commitments and actions is established, for example, by way of a robust global agreement or commitments to verifiable domestic action on the part of the major emitters including the United States, India and China	In a series of UNFCCC decisions, countries have agreed to a robust international method for measuring, reporting and verifying emissions and progress towards pledged targets and actions through biennial reports. This supports the credibility of all countries' commitments and domestic actions. The United States, India and China have all agreed to these rules – the United States released the draft of its first biennial report detailing its emissions and actions to reduce them on 27 September 2013; China and India's first biennial update report is due December 2014. There is clear evidence, as outlined in this report, of domestic action on climate change in support of targets, including in major emitting economies (see Chapter 4).	Condition met
There is clarity on the assumptions for emissions accounting and access to markets	The Authority's understanding is that this condition was aimed at ensuring Australia had clarity regarding the underlying rules before it committed to a target. Under the second commitment period of the Kyoto Protocol, there is a clear framework for accounting for Australia's target and clear access to Kyoto market units. Australia recently set out the underlying accounting assumptions for its UNFCCC 2020 emissions reduction commitment in its 2013 National Communication and Biennial Report.	Condition met

REDUCE EMISSIONS BY 15 PER CENT RELATIVE TO 2000 LEVELS

International agreement where major developing countries commit to restrain emissions substantially and advanced economies take on commitments comparable to Australia's. In practice, this implies:

Condition	Circumstances	Authority's assessment
Global action on track to stabilisation between 510 and 540 ppm CO_2-e	Many studies (Project Catalyst 2010 and a range of studies pending publication) estimate the current 2020 pledges are on track to stabilisation at around 550 ppm CO_2-e; however, given the uncertainties surrounding these estimates, stabilisation at 510 to 540 ppm cannot be ruled out, depending on the level of post-2020 action.	Condition partially met
Advanced economy reductions in aggregate in the range of 15–25 per cent below 1990 levels by 2020	Most aggregates of Annex I Party pledges suggest they fall partially within this range. For example, den Elzen et al. 2012 estimates aggregate Annex I Party pledges to be in the range of 12–18 per cent below 1990 levels by 2020. Uncertainties surrounding these estimates could pull them up or down.	Condition partially met
Substantive measurable, reportable and verifiable commitments and actions by major developing economies in the context of a strong international financing and technology cooperation framework, but which may not deliver significant emission reductions until after 2020	All major developing economies have pledged targets and actions under the UNFCCC. As discussed above, these pledges are backed by the new measurement, reporting and verification framework, which requires countries to submit biennial reports detailing their emissions and progress towards their pledge. Since 2009, significant progress has been made on financing and technology cooperation, including a collective commitment by developed countries to provide new and additional resources approaching USD 30 billion over 2010–2012 and a long-term commitment by developed countries to mobilise jointly USD 100 billion per year by 2020 to address the needs of developing countries.	Condition met

Progress towards inclusion of forests (reduced emissions from deforestation and forest degradation) and the land sector, deeper and broader carbon markets, and low carbon development pathways	There has been significant progress towards developing a framework for reducing deforestation and forest degradation in developing countries, both in the UNFCCC and through bilateral pilot programs. In addition, the Kyoto Protocol second commitment period also sets rules that cover emissions from land-based activities more comprehensively than the first commitment period. Since 2009, many countries have implemented carbon markets and many more have plans to do so (GLOBE 2013). All countries agreed in the Cancun Agreements to establish low-carbon development strategies.	Condition met

REDUCE EMISSIONS BY 25 PER CENT RELATIVE TO 2000 LEVELS (UP TO 5 PERCENTAGE POINTS THROUGH GOVERNMENT PURCHASE)

Comprehensive global action capable of stabilising CO_2-e concentration at 450 ppm CO_2-e or lower. This requires a clear pathway to achieving an early global peak in total emissions, with major developing economies slowing the growth and then reducing their emissions, advanced economies taking on reductions and commitments comparable to Australia's, and access to the full range of international abatement opportunities through a broad and functioning international market in carbon credits. This would involve:

Condition	Circumstances	Authority's assessment
Comprehensive coverage of gases, sources and sectors with inclusion of forests (reduced emissions from deforestation and forest degradation) and the land sector (including soil carbon initiatives (for example, biochar) if scientifically demonstrated) in the agreement	All Annex I Parties targets comprehensively cover gases, sources and sectors. Non-Annex I Party pledges vary in their coverage of gases, sources and sectors. The Kyoto Protocol second commitment period comprehensively covers greenhouse gases (not covered by the Montreal Protocol), sources and sectors. The second commitment period of the Kyoto Protocol allows countries to elect grazing land, which would include removals from soil carbon initiatives (Australia has chosen to elect grazing land for its second commitment period target). As discussed above, significant progress toward developing a framework for reducing deforestation and forest degradation in developing countries.	Condition partially met
Clear global trajectory, where the sum of all economies' commitments is consistent with 450 ppm CO_2-e or lower and with a nominated early deadline year for peak global emissions not later than 2020	As discussed above, most studies estimate the pledges aggregate to a stabilisation of around 550 ppm CO_2-e. These studies generally show that, while a 450 ppm stabilisation is still technically feasible, it would require extensive use of negative emissions technology post-2020. There is no agreed global peaking date.	Condition not yet met
Advanced economy reductions, in aggregate, of at least 25 per cent below 1990 levels by 2020	As discussed above, den Elzen et al. (2012) considered Annex I Party reductions to aggregate around 12–18 per cent levels. Even accounting for uncertainties that could pull this estimate up, it is unlikely to aggregate to 'at least 25 per cent'.	Condition not met
Major developing economy commitments to slow growth and to then reduce their absolute level of emissions over time, with collective reduction of at least 20 per cent below business as usual by 2020 and a nomination of peaking year for individual major developing economies.	Recent analysis suggests that aggregate major developing economy commitments are currently around 13–16 per cent below business as usual by 2020 (den Elzen et al. 2013). Most individual major developing economies have not yet nominated peaking years (South Africa has and many others are actively considering one).	Condition not met
Global action which mobilises greater financial resources, including from major developing economies, and results in fully functioning global carbon markets	As discussed above, significant work has been done to mobilise greater financial resources; however, the role of major developing economies is unclear. While a wide range of markets has been established in the last few years (GLOBE 2013), they are still developing and domestic and regional markets are not yet fully linked.	Condition not yet met

Note: The Government has defined 'advanced economies' as 'Annex I Parties to the UNFCCC and at least some other high-middle income economies'. The Authority has used Annex I Parties as a proxy for 'advanced economies' in its analysis.
Annex I Parties are: Australia, Austria, Belarus, Bulgaria, Canada, Croatia, Czech Republic, Denmark, European Economic Community, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Latvia, Liechtenstein, Lithuania, Luxembourg, Monaco, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom of Great Britain and Northern Ireland and United States of America
The Government has defined 'major developing economies' as 'non-Annex I members of the Major Economies Forum'. These countries are Brazil, China, India, Indonesia, Republic of Korea, Mexico and South Africa.
Source: Climate Change Authority

5.2 AUSTRALIA'S 2020 TARGET RANGE IN A GLOBAL CONTEXT

In considering an appropriate 2020 target for Australia, it is relevant to consider how different Australian targets compare with the 2020 targets put forward by other countries. This provides context to Australia's target range and an idea of where different Australian targets sit on the international spectrum of effort – whether Australia is behind, ahead or in the middle of the pack.

The Authority has considered Australian targets of 5, 15 and 25 per cent in the context of the targets of the key country set identified in Chapter 4. The countries are those with similar levels of development to Australia, major emitting economies and Australia's major trading partners and neighbours.

Countries have put forward targets in different forms with different reference years, which makes them difficult to compare directly. The Authority has therefore translated the 2020 targets of key countries to the same four key measures:

- absolute emissions reductions or limitations;
- emissions intensity;
- deviations from business as usual; and
- changes in per person emissions.

Each of these measures provides different information about countries' targets. **Changes in absolute emissions** provide a straight assessment of the overall emissions reduction levels, which is directly relevant to the international goal. Most developed countries have absolute emissions reduction targets under the UNFCCC.

Emissions intensity reflects the ratio of economy-wide greenhouse gas emissions per unit of GDP. Reductions in emissions intensity demonstrate a country's intended rate of economic decarbonisation. China and India have framed their UNFCCC targets as reductions in emissions intensity.

Changes relative to business as usual emissions levels give a comparative measure of the effect of targets on emissions and the effectiveness of climate change policies. Many developing countries (including South Africa and Indonesia) have UNFCCC targets as reductions from business as usual projections.

Per person reductions removes population growth as a variable and provides links to the contraction and convergence and equity discussions in Chapter 9.

While comparing Australia's target helps put it in the international context, there are two important caveats to this analysis – first, no one measure – or even set of measures – can capture the full meaning of a country's action. For example, none of the above measures takes into account a country's development level or its previous action or emissions levels. Second, different countries' actions will vary over time due to a range of circumstances (including economic and political conditions); therefore, any one 'point in time' comparison cannot capture the full international context across time.

5.2.1 HOW AUSTRALIA'S 2020 TARGET RANGE COMPARES ACROSS FOUR MEASURES

This section summarises the findings of the Authority's comparison work – further information can be found at Appendix B.

The Authority has chosen 2005 as the base year for comparison. This is the base year for the targets of China and the United States. Base years can change how a target is perceived – earlier base years put more emphasis on previous emissions reductions, whereas later base years emphasise the future effort. For example, if Australia was to match the US 2020 target of 17 per cent reduction on 2005 levels, the equivalent level is either around 10 or 20 per cent depending on whether a 2000 or 2005 base year is used. Further information on the choice of base year is in Appendix B.

ABSOLUTE EMISSIONS REDUCTIONS

Figure 5.1 shows most countries' targets result in emissions reductions, as measured as a percentage change by 2020 compared with 2005 levels, except for India and China.

An Australian 5 per cent target is not as strong as the targets of New Zealand (including its newly announced 5 per cent unconditional target and 10 – 20 per cent conditional target range), Norway, Japan, the United States and Canada. A 15 per cent target for Australia implies stronger reductions than the United States and Canada. While a 25 per cent target is at the stronger end of the countries compared, it is not as strong as the targets of New Zealand and Norway.

Developing countries' targets generally result in less strong absolute emissions reductions (and growth in the case of China and India), in line with their lower development status.

EMISSIONS INTENSITY

Australia has a relatively high emissions intensity compared with other countries (Figure 5.2). This is particularly acute when compared with other developed countries with high levels of fossil fuel production and use – Australia's 2005 emissions intensity is higher than that of the United States and Canada.

An Australian 5 per cent target reduces its emissions intensity to similar levels as South Africa's in 2020. An Australian 15 per cent target is generally in line with Canada's target, while the Australian 25 per cent target is stronger than Canada's target. All of Australia's targets result in 2020 emissions intensity levels that are more intensive than the EU, US and Japanese targets. The implied rate of reduction from Australia's targets is, however, stronger than those three countries' and is similar to the reduction rates of China and South Africa.

REDUCTIONS FROM BUSINESS AS USUAL PROJECTIONS

Considering targets in terms of changes to projected emissions is complicated. Different assumptions can lead to substantially different estimates of projected emissions (see Appendix B for further discussion). The uncertainty is much higher for developing countries, which are often in the process of building large-scale infrastructure to lift their populations out of poverty. The way such infrastructure is built can have a significant impact on a country's future emissions levels.

All key countries' targets, excluding India, are estimated to result in emissions reductions from their business as usual (BAU) level (see Figure 5.3).

An Australian 25 per cent target is estimated to be the strongest reduction from business as usual of all the countries compared. An Australian 15 per cent target remains one of the strongest targets of the countries compared. While the Australian 5 per cent target is not estimated to be as strong as South Africa, the US and Indonesia's targets, it is on par with Japan, and stronger than Canada and the EU's minimum targets.

PER PERSON EMISSIONS

Australia has the highest per person emissions in 2005 of the key countries compared.

Figure 5.4 shows that Australian 5 and 15 per cent targets would see Australia continue to have the highest per person emissions of the group in 2020. An Australian 25 per cent target means Australia would have the second highest emissions per person in 2020 after Canada.

5.2.2 CONCLUSIONS ON TARGET COMPARISONS

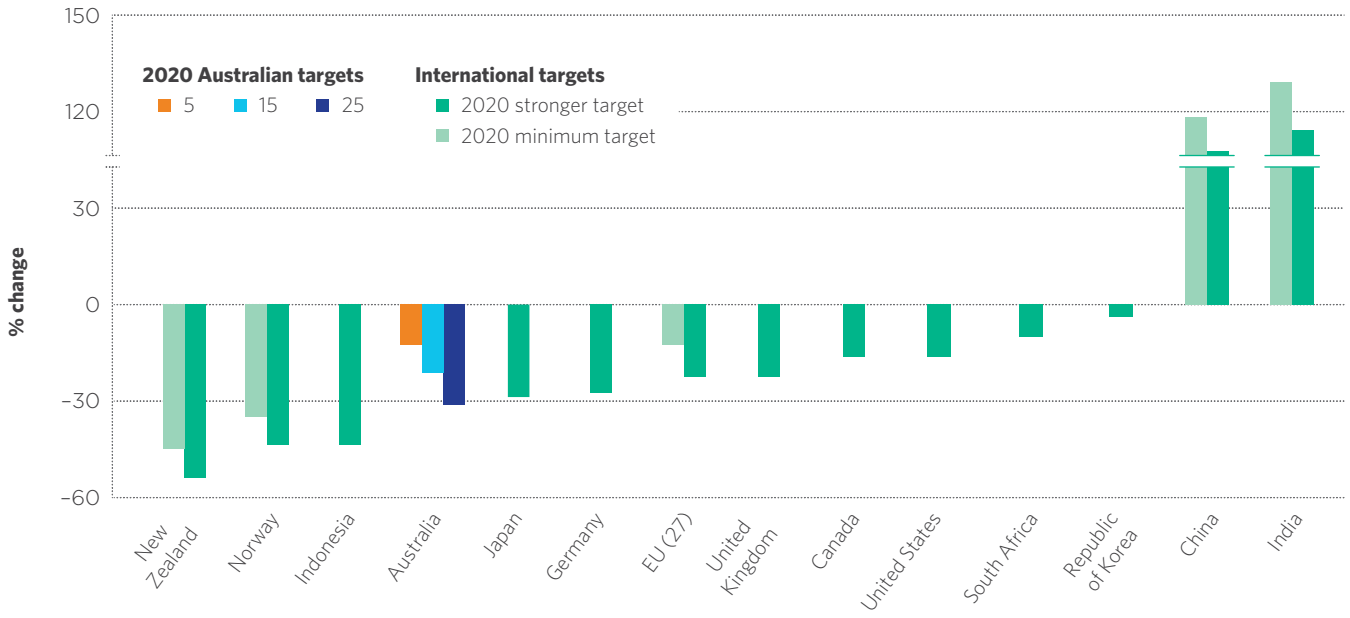
The effort of Australia's target range relative to other key countries looks very different on each measure. Figure 5.5 provides a summary of the earlier analysis of how Australian 2020 targets of 5, 15 and 25 per cent rank relative to other countries' targets and how this varies across each measure.

Australia's 2020 target range, particularly the 5 per cent target, does not look comparable when measured by emissions per person and emissions intensity. The same target range looks more ambitious when assessed against deviations from business as usual. The variability of the conclusions indicates the difficulty of 'calibrating' Australian effort directly to a country or group of countries.

At a very general level, this analysis shows that Australia's 5 per cent target tends to be at the weaker end of the group against most metrics. A 15 per cent target is broadly comparable, as is Australia's 25 per cent target, which is at the more ambitious end of the group, but not consistently stronger than other countries across all metrics. As noted above, this analysis does not take into account countries' development levels.

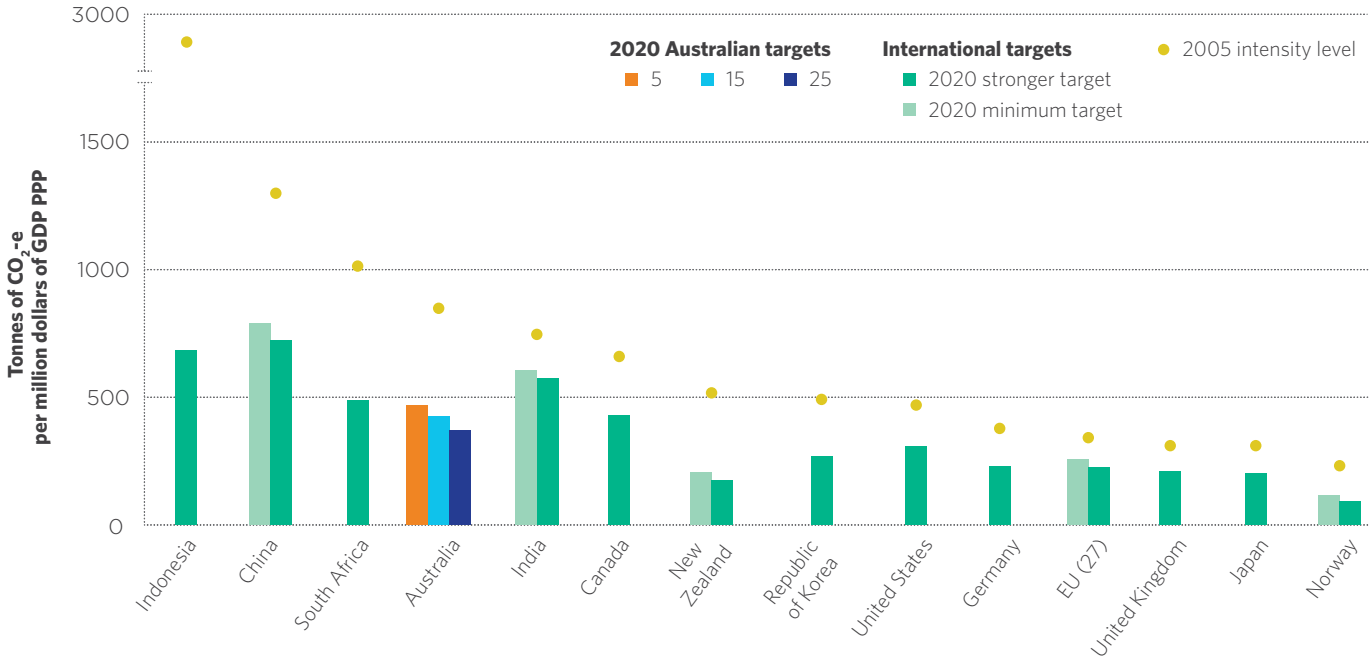
Appendix B sets out the Authority's comparison analysis in greater detail.

FIGURE 5.1: COUNTRIES' 2020 TARGETS RELATIVE TO 2005 LEVELS



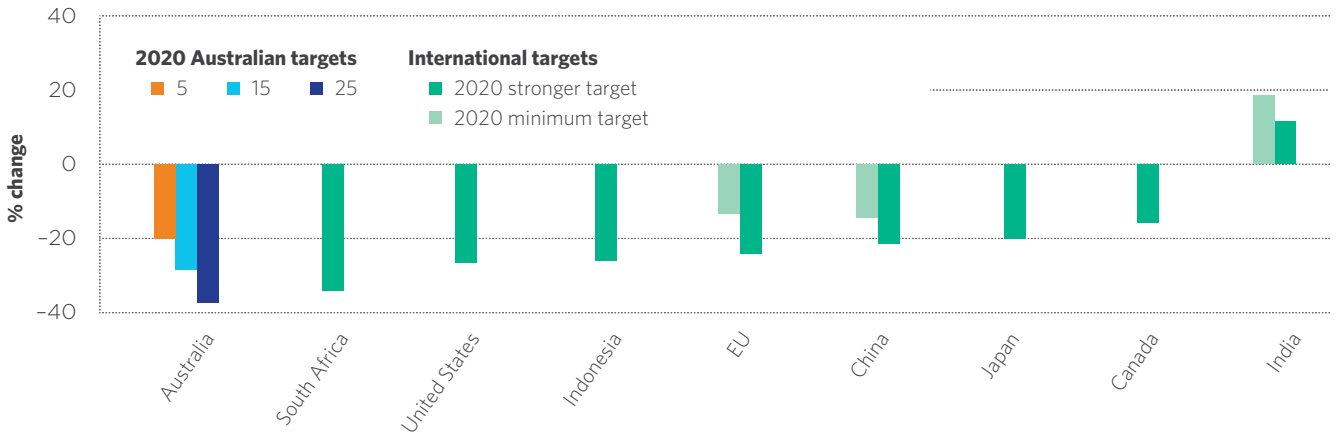
Sources for figures 5.1–5.4: Historical greenhouse gas emissions: Australia – The Treasury and DIICCSRTE 2013; Annex I Parties – United Nations Framework Convention on Climate Change (2013); remaining countries – World Resource Institute (WRI). This analysis uses WRI Climate Analysis Indicators Tool (CAIT) version 7. This differs from elsewhere in the report because of uncertainties over the accuracy of land use change data and because CAIT 2.0 does not include the full set of anthropogenic activities related to land use change emissions. The version 7 has been previously used in similar analysis and so allows for greater confidence in the land use change data. GDP: International Monetary Fund 2013; EU (27) GDP for 2020 estimated by CCA from OECD 2013. Population: United Nations 2013; Australia – The Treasury and DIICCSRTE 2013. Projected BAU 2020 emissions: The Treasury and DIICCSRTE 2013 where available (EU projection is for EU (25)), otherwise national projections. To allow comparison across all countries, all emission estimates are using assessment report (AR2) methodology. The EU results do not include Croatia; however, this is not expected to change the results for figures 5.1–5.4 given the relative small size of its economy and emissions.

FIGURE 5.2: EMISSIONS INTENSITY OF COUNTRIES, 2005 LEVELS AND 2020 TARGETS



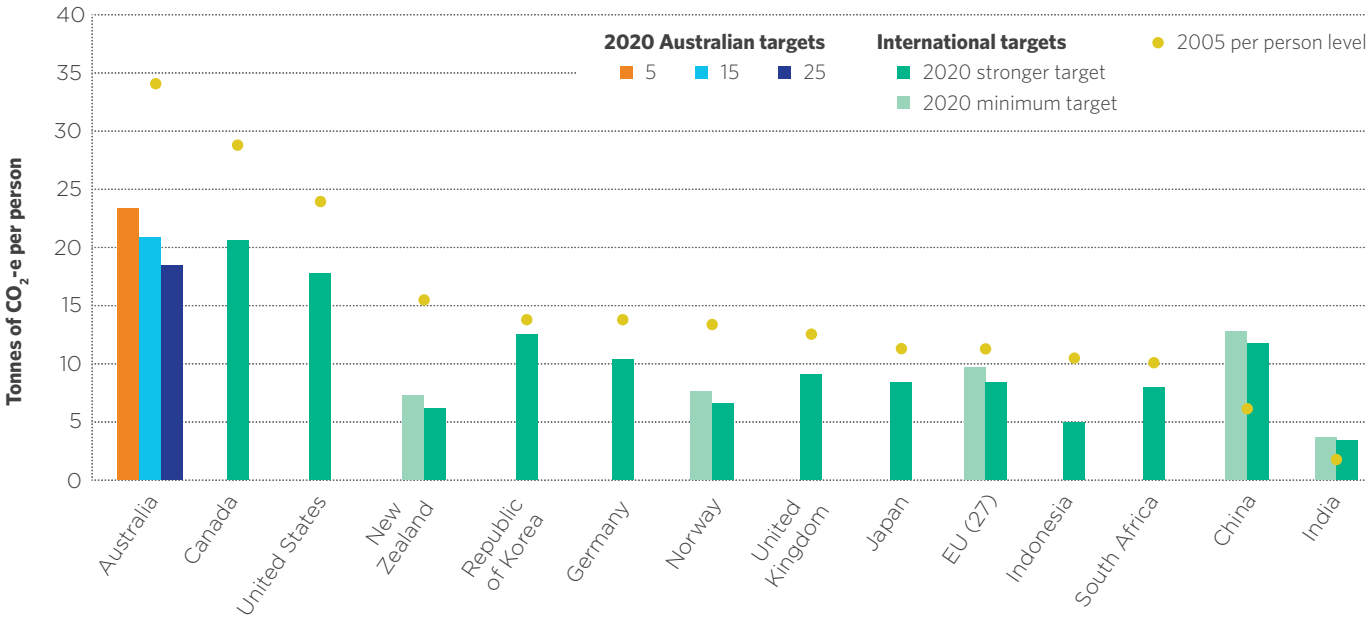
Source: See Figure 5.1

FIGURE 5.3: PERCENTAGE CHANGE IN EMISSIONS UNDER COUNTRIES' TARGETS RELATIVE TO BAU LEVELS AT 2020



Notes: The Republic of Korea is not included in Figure 5.3 as it is not part of The Treasury and DIICCSRTE 2013 modelling. It has a target of 30 per cent below its business as usual, which is close to Australia's 15 per cent target.
Source: See Figure 5.1

FIGURE 5.4: PER PERSON EMISSIONS OF COUNTRIES, 2005 LEVELS AND 2020 TARGETS



Source: See Figure 5.1

5.3 AUSTRALIA'S COMPARATIVE ECONOMIC COST OF EMISSIONS REDUCTIONS

The Business Council of Australia emphasised the importance of taking the cost of emissions reductions into account when considering Australia's target (Business Council of Australia submission, pp. 2–3).

As discussed in other parts of the Review (chapters 9 and 13), most studies – both Australian and international – show that Australia has relatively high costs of emissions reductions (see Chapter 9 for further discussion). McKibbin, Morris and Wilcoxen (2010, p. 30) compared the cost of countries meeting their minimal pledged 2020 targets and found Australia has the highest cost, in terms of impact on GDP in 2020 under its 5 per cent target. These results, however, did not include international trade in emissions reduction units.

These findings are important, but need to be balanced against three factors – first, that the magnitude of the costs may be ameliorated to a very significant effect by access to international emissions reduction units. Second, that emissions reduction costs – and their distribution across households and industry – depend heavily on policy design. Policies can be designed to assist households and moderate the costs on businesses. Third, that while Australia's costs may be relatively high, it also has relatively high development levels and therefore greater capacity to meet them. Chapter 9 discusses these issues in greater detail.

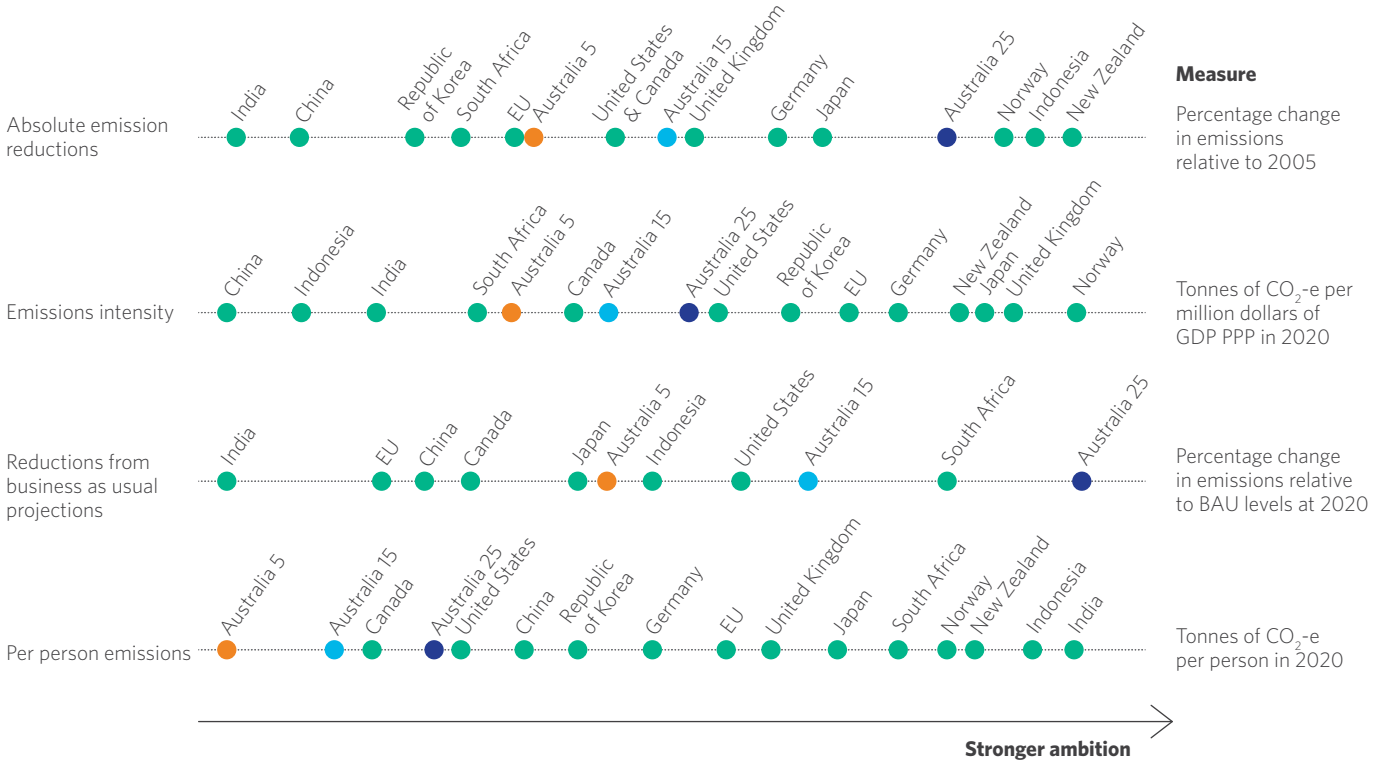
5.4 AUSTRALIA'S INFLUENCE

Countries do not make decisions about climate targets and policies in a vacuum; they are influenced by the level of global action and the policies and targets of their neighbours, trading partners and countries with similar economies.

Influence can be positive – encouraging greater action – or negative; countries could use the absence of action in another country as a reason to delay further action or defer existing commitments.

Australia is a small, but important, part of the global picture on climate change. While Australian influence on global efforts should not be overstated, there are certain ways Australia can influence other countries. First, it has strategic roles in international groups. In the UNFCCC, Australia chairs the Umbrella Group – one of the major negotiating blocs including the United States, Russia, Canada, Japan and Norway. Australia is also a founding member of the Cartagena Dialogue for Progressive Action; an influential group of developed and developing countries committed to working together to resolve negotiating deadlocks and drive progress in the UNFCCC. Australia's role in these groups means its actions are more likely to be noticed by other countries. Outside the UNFCCC, Australia is active in complementary initiatives that ensure its views are heard in a range of forums (see Appendix B for a list of these initiatives).

FIGURE 5.5: SUMMARY OF AUSTRALIA'S POSITION ON FOUR DIFFERENT MEASURES



Source: The results are adapted from figures 5.1–5.4

Second, Australia also has some influence because of its particular circumstances – it is an emissions-intensive economy with a relatively high cost of emissions reduction. If a country in these circumstances chooses a stronger target – and achieves it – it is likely to have a disproportionate effect spurring action from others. Conversely, Australia is a highly developed country with a high capacity to act. If Australia fails to take strong action, other, poorer countries are more likely to characterise climate change action as unaffordable and unachievable. Demonstrating that a high-emitting and fossil fuel-dependent economy can successfully cut emissions and achieve a strong target may be one of the most effective ways Australia can influence other countries.

Third, Australia can have influence by demonstrating that climate policies can be effective. Countries observe and copy the successful policies of other countries. Successful Australian demonstration can be seen across a range of policies including plain packaging for cigarettes (now being considered or introduced in Ireland, Canada, India, New Zealand, Turkey and the European Union) and Australia's Renewable Energy Target, with similar models adopted in the United Kingdom and some US states. The demonstration effect of robust climate policies is likely to increase other countries' confidence that they can adopt effective policies, and take on stronger targets in the future.

Timing should also not be overlooked. Australia is uniquely placed to influence global climate action over the next few years. The international climate change framework is in a developmental phase, and many countries are putting in place new climate policies and looking for examples to model. These factors are likely to mean that action now will be especially influential. Australia's current international roles – chairing the G20 in 2014 and its position on the United Nations Security Council mean Australian action in the next few years is likely to be noticed by more countries.

Australian influence on collective action can be positive or negative at this critical time. On the positive side, a stronger Australian target underpinned by robust policy is likely to support a sense that countries are serious and committed to achieving their targets. This may help encourage countries to stand by their commitments or do more. Drawing back from our international commitments would have a negative influence; an effect that is likely to be heightened due to Australia's high level of development. And, in some ways, negative action can be more influential in collective forums than positive action – the US failure to ratify the Kyoto Protocol and Canada's subsequent withdrawal has received far more attention than the approximately 36 countries that look likely to comply with or exceed their first commitment period targets.

DRAFT CONCLUSION

C.4 The Authority's analysis of the Government's target conditions show that the conditions for moving beyond 5 per cent have been met. Whether the conditions for 15 per cent have been met is unclear – some elements have been met, others are marginal. The conditions for a 25 per cent target have not been met. While the Authority has taken these conditions into account, it is also required to examine a broader range of considerations.

C.5 Considering a range of measures, an Australian 5 per cent target is low compared with the targets of other key countries. A stronger 2020 target of 15 or 25 per cent is broadly comparable with other countries' targets, including that of the United States. This is especially the case given Australia's high level of development, relative wealth and governance capacity.

Chapter 5 concludes Part A of the draft report. Part B considers Australia's policy and progress to date.

PART B

AUSTRALIA'S POLICIES AND PROGRESS TO DATE

Part A of this Draft Report described Australian action in comparison to that of other countries, concluding that Australian action to address climate change is happening in the context of significant global efforts to reduce greenhouse gas emissions. The role of domestic policy initiatives is to translate these high-level commitments into practical measures for a domestic transition towards a low-carbon economy.

Part B charts the policies that have been in place over the last two decades and assesses the extent to which they have been effective relative to other drivers of emissions changes.

Chapter 6 describes the major policy initiatives taken by Australia on climate change, including the proposed future policy framework by the current government. Policy initiatives include voluntary measures, regulatory measures, government funding and trading schemes.

Chapter 7 describes the trends in emissions since 1990, overall and by sector, and the drivers that underpin these. By assessing the changes at a detailed sector-by-sector level, the role of policy initiatives is explored. While policy has been an important driver of emissions reductions to date, this needs to be sustained and accelerated in order to contribute to Australia's long term emissions reduction objectives.

This supports the following sections of the Draft Report in two ways:

- **the rates of emissions reductions to date provide points of comparison with the future rates of reduction recommended in Part C; and**
- **Part D sets out the extent to which the required reductions are feasible, and the extent to which they may be achieved through domestic action and international emissions reductions.**

CHAPTER 6 AUSTRALIA'S ACTION ON CLIMATE CHANGE

Australia's existing policy mix – and planned changes to that mix – provide important context for considering its future emissions reduction goals.

Over more than two decades, Australian governments at all levels have implemented policies to reduce emissions. Regulatory measures include labelling and minimum performance standards for appliances, building codes and restrictions on land clearing. A range of trading schemes has been implemented to promote renewable energy, emissions reductions in the land sector, energy efficiency, and emissions reductions more generally.

In 2011, legislation was passed to create the carbon pricing mechanism (a cap-and-trade emissions trading scheme). The Government intends to repeal this legislation, and implement the Direct Action Plan. The centrepiece of this Plan is the Emissions Reduction Fund, which is to purchase emissions reductions through a reverse auction.

Chapter 6 introduces Australia's policy initiatives to reduce emissions. It:

- outlines the range of policy measures for addressing climate change;
- describes Australia's existing climate change policies to reduce emissions; and
- outlines the Government's proposed new policy.

In the next chapter we assess the extent to which Australia has progressed towards a low-emissions economy.

6.1 AUSTRALIA'S CLIMATE CHANGE POLICY OPTIONS

Like other countries, Australia has drawn on a wide range of measures to reduce its greenhouse gas emissions. The policy 'toolbox' includes:

- voluntary measures, such as the GreenPower renewable energy purchasing scheme;
- regulatory measures, such as labelling laws, minimum performance standards, building codes and restrictions on land clearing;
- trading schemes, such as the carbon pricing mechanism, Renewable Energy Target (RET), state-based energy efficiency trading schemes, the former NSW Greenhouse Gas Reduction Scheme (GGAS) and the Carbon Farming Initiative (CFI); and
- a wide range of government funding schemes, such as grants provided by the Australian Renewable Energy Agency (ARENA) and the Government's planned Emissions Reduction Fund.

In Australia, climate change policies have been introduced by both major parties and at all levels of government since the late 1980s. Climate change policies began with voluntary schemes such as energy labelling (initially in New South Wales and Victoria from 1986) and the national Greenhouse Challenge Program for industry from 1995. Energy labelling became mandatory from 1992, and progressed to minimum standards on a range of devices from 1999 (for example, refrigerators, freezers and air conditioners). In 2003, New South Wales introduced GGAS, one of the first mandatory emissions trading schemes in the world. The Commonwealth Parliament introduced a mandatory renewable energy target in the electricity sector in 2001 (see Section 6.2.1 for detail).

6.2 MAJOR EXISTING POLICY AND LEGISLATION

In 2011, the Clean Energy Future Package was legislated. The *Clean Energy Act 2011* (Cth) established long term goals to reduce emissions by 80 per cent from 2000 levels by 2050 and to contribute to a global response to limit global warming to no more than 2 degrees above pre-industrial levels. Other major elements include a carbon price that covers over half of Australia's emissions and the CFI which provides incentives to reduce emissions in the land sector.

A broader suite of sector-specific initiatives are also in place, and state and local government levels play an important role through, for example, land use controls, energy efficiency and renewable energy programs.

At the Commonwealth Government level, the main legislated policy tools are currently the RET, the CFI and the carbon pricing mechanism. These policies, plus a range of other significant policies applying to particular activities, are summarised below.

6.2.1 RENEWABLE ENERGY TARGET

The RET drives investment in renewable energy. It creates a guaranteed market for renewables using a tradable certificate scheme that encourages projects at large scale (for example, wind farms) and small scale (for example, solar PV on household rooftops). Electricity retailers and other entities that purchase wholesale electricity are required to surrender a certain number of renewable energy certificates each year or pay a shortfall charge.

The RET has been in place and driving renewable energy generation since 2001. The target, initially legislated by the Howard Government, was expanded in 2009 to 45 000 GWh by the Rudd Government. At the time, this was expected to deliver around 20 per cent of electricity generation in 2020. Recent softening of electricity demand means that 45 000 GWh could constitute a higher share in 2020 (CCA 2012).

This target was split into two schemes in 2011:

- the Large-scale Renewable Energy Target (LRET) supports large-scale renewable energy projects. The LRET has annual fixed targets and a 2020 target of 41 000 GWh; and
- the Small-scale Renewable Energy Scheme (SRES) supports the installation of small-scale renewable technology systems. The SRES has an implicit target of 4 000 GWh, but is uncapped. The Authority estimates it may result in about 11 000 GWh of generation in 2020 (CCA 2012).

Since the introduction of a RET in 2001, Australia's renewable electricity capacity has doubled (CCA 2012). In terms of electricity generation, there was 24 GWh of renewable electricity in 2012, about 9 per cent of total electricity.

Around one million households have already installed rooftop solar PV (DIICCSRTE 2013), which the Australian Energy Market Operator (AEMO) estimates will generate around 2 700 GWh in 2013 (AEMO 2013).

6.2.2 CARBON PRICING MECHANISM

The carbon pricing mechanism began operation in 2012 and requires Australia's largest greenhouse gas emitters to report and be liable for their greenhouse gas emissions, creating an incentive to reduce those emissions. As noted above, the Government intends to repeal the carbon pricing mechanism; this section describes the scheme as currently legislated. The carbon pricing mechanism covers about 370 of Australia's biggest emitters, accounting for more than half of Australia's emissions, including in electricity generation, other direct combustion, landfills, wastewater, industrial processes and fugitive emissions[1]. Some other sectors are covered by an equivalent carbon price (see Part E for further details).

For every tonne of greenhouse gases emitted, firms need to surrender one unit to the regulator. The price of these units is referred to as the carbon price. The carbon pricing mechanism has a three-year fixed-price period from 1 July 2012 to 30 June 2015. During the fixed price period, liable entities pay a price for each unit that starts at $23 a tonne in 2012–13 and rises at 2.5 per cent a year in real terms. When the fixed-price period ends, a cap will limit the emissions units that can be issued. Under the legislation, the Minister responsible for climate change must set caps, taking into consideration the Authority's advice as part of this Review. The legislation requires caps to be announced five years in advance. In the event that Parliament does not set caps through regulation, default caps apply.

Approved international units can be surrendered to meet up to 50 per cent of an entity's carbon liability. At present, approved international units include European Union Allowances (EUAs) and units generated under the Kyoto Protocol. More detail on international carbon markets is provided in Appendix B.

6.2.3 CARBON FARMING INITIATIVE

The CFI commenced in 2011. It allows approved carbon reduction projects to generate carbon units. Sectors eligible for the CFI are not covered by the carbon pricing mechanism and include agriculture, forestry and landfills (for waste deposited before July 2012). Units created under the CFI are called Australian Carbon Credit Units. These can be sold to liable parties under the carbon pricing mechanism, or to individuals and organisations wishing to voluntarily offset their emissions (for example, in the Carbon Neutral Program).

1 Fugitive emissions are greenhouse gases emitted during the extraction, production, processing, storage, transmission and distribution of fossil fuels such as coal, oil and gas.

Activities that have earned units under the scheme include:

- Reduction of emissions from waste. The waste sector accounts for the largest share of registered CFI projects. As at 12 September 2013, the CFI has 60 registered waste projects involving gas capture, combustion and diversion. The Clean Energy Regulator (2013) reports that about 1.9 million Australian carbon credit units have been issued, representing a reduction in emissions of 1.9 million tonnes of carbon dioxide equivalents (CO_2-e).
- Management of savanna burning in the Northern Territory. The Indigenous Land Corporation has generated credits by implementing a method of controlled burning early in the dry season.
- Capture of methane generated from manure at a piggery in New South Wales. The electricity generated from the captured methane at Blantyre Farm has been sufficient to power the entire property.

6.2.4 OTHER SECTOR-SPECIFIC INITIATIVES

A range of initiatives exist to reduce emissions in the land use, industry and buildings sectors:

- **Land clearing.** Annual rates of land clearing have decreased substantially since 1990, due to state-based regulations in New South Wales and Queensland on new land clearing and weaker economic conditions for farming (leading to reduced incentives for farmers to clear land and expand production).
- **Minimum energy performance standards.** From 1999, some products and appliances such as refrigerators and air conditioners have been subject to minimum energy performance standards through state government legislation. Building upon this, the *Greenhouse and Energy Minimum Standards (GEMS) Act 2012* (Cth) implements nationally consistent standards for appliances in the residential and commercial sectors.
- **The Energy Efficiency Opportunities program.** Introduced in 2006, this program promotes energy efficiency in Australia's largest energy-using firms (firms that consume more than 0.5 PJ of energy per year – equivalent to 10 000 households). The program requires firms to assess their energy use and identify cost-effective energy efficiency opportunities (with up to a four-year payback period).
- **New building standards.** Under the *Building Energy Efficiency Disclosure Act 2010* (Cth), commercial offices must disclose energy performance and receive a building efficiency rating through the National Australian Built Environment Rating System. Since 2003, residential energy efficiency standards have existed for new buildings in the National Construction Code, and these were strengthened in 2010. Most states and territories now require energy performance equivalent to 6-stars on a 10-star scale for new residential construction.
- **Efficient lighting.** The Commonwealth is also phasing out inefficient lighting and moving to more efficient alternatives such as compact fluorescent and LED lamps. Sales restrictions on inefficient lighting began in 2009 and standards will be rolled out to include a broader range of energy efficient lighting over time.

The Government intends to replace the carbon pricing mechanism with the Direct Action Plan. Details of the plan are being developed and are discussed in Section 6.3.

6.3 THE DIRECT ACTION PLAN

The Government has committed to introduce the Direct Action Plan to replace the carbon pricing mechanism and other elements of the 2011 Clean Energy Future Package.

Work is underway on the implementation of the Direct Action Plan. In this Review, the Authority has not made any assumptions regarding the detailed policy design or implementation beyond what has been announced.

A central feature of the Direct Action Plan is to be the Emissions Reduction Fund. It is proposed the Fund will purchase least-cost emissions reductions in Australia through reverse auctions. It is expected that the scope of methodologies under the Carbon Farming Initiative will be expanded and that the Clean Energy Regulator will continue to play a central role on the approval of projects (Hunt 2013).

The Government has indicated it will call for submissions on issues such as the auction process and the setting of baselines within 30 days of forming government, and that the Emissions Reduction Fund would commence on 1 July 2014.

In addition to the Emissions Reduction Fund, the Direct Action Plan proposes to include:

- rebates for solar panels, solar hot water systems and heat pumps;
- grants for renewable energy in schools and towns; and
- planting an additional 20 million trees.

Australia's policy mix, combined with underlying trends in the economy, has influenced its emissions performance. Chapter 7 sets out how Australia's emissions have been tracking to date.

CHAPTER 7
AUSTRALIA'S PROGRESS TO DATE IN REDUCING EMISSIONS

Australia's emissions were broadly the same in 2012 as in 1990, despite a doubling in the size of the economy over this period. This means that the emissions intensity of the economy (emissions per unit of GDP) has halved.

Falling emissions intensity is in part due to the changing composition of the economy. For example, the share of economic value generated by emissions-intensive manufacturing has decreased.

Policy initiatives have also played an important role. Regulation in the land sector has reduced emissions from land clearing. In the electricity sector, the Renewable Energy Target and state-based schemes (the New South Wales Greenhouse Gas Reduction Scheme and the Queensland Gas Scheme) have helped shift the fuel mix towards lower emissions alternatives, particularly since 2008.

Firms and households have installed energy-efficient appliances, lighting, motors and other technologies. But trends such as rising ownership of appliances and IT equipment have offset many of the gains.

These emissions reduction trends need to be sustained and accelerated if Australia is to meet its long term emissions reduction objectives.

Chapter 6 introduced Australia's policy initiatives to reduce emissions. Chapter 7 assesses emission trends and what has been shaping them. It:

- describes Australia's emissions trends between 1990 and 2012; and
- assesses the drivers of these trends, including the role of policy.

The level of emissions reductions required to meet future goals is discussed in Part C of this report.

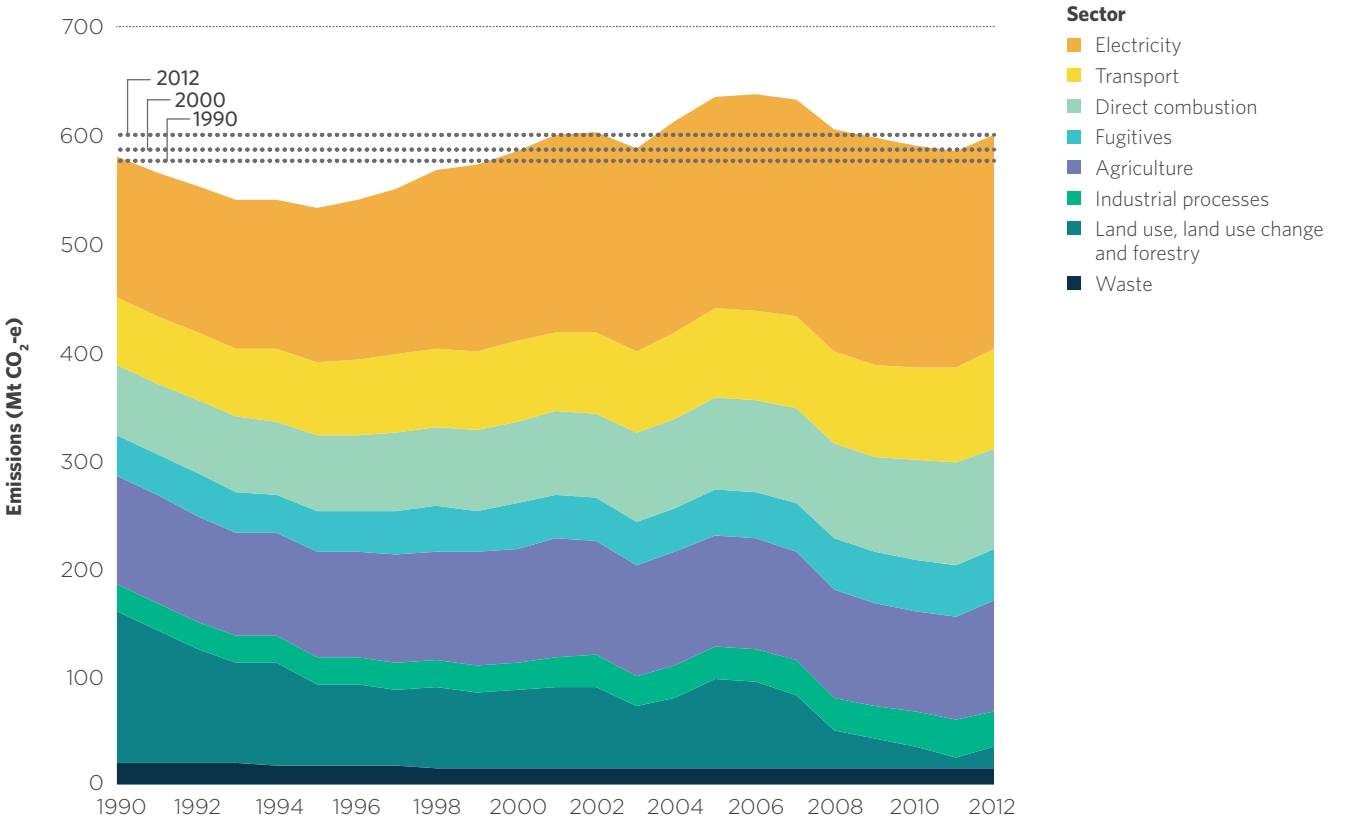
7.1 EMISSIONS TRENDS BETWEEN 1990 AND 2012

In 2012, Australia's emissions were 600 million tonnes of carbon dioxide equivalent (Mt CO_2-e). The majority (72 per cent) of Australia's CO_2 emissions are energy-related (The Treasury and DIICCSRTE 2013). That is, they are produced in the combustion and production of fossil fuels for transport or stationary energy. The remainder of Australia's emissions are produced in agriculture, waste, land use, land use change and forestry (LULUCF), and chemical reactions in the manufacturing sector.

Australia's total greenhouse gas emissions in 2012 were 3.5 per cent higher than in 1990, and 2.5 per cent higher than in 2000 (Figure 7.1). There have been steady increases in emissions in most sectors, resulting in a 32 per cent increase in emissions excluding LULUCF in the period 1990 to 2012 (Figure 7.2). In contrast, LULUCF emission fell by 85 per cent in the period 1990 to 2012. The steep reductions in the LULUCF emissions offset the increase in emissions from the rest of the economy.

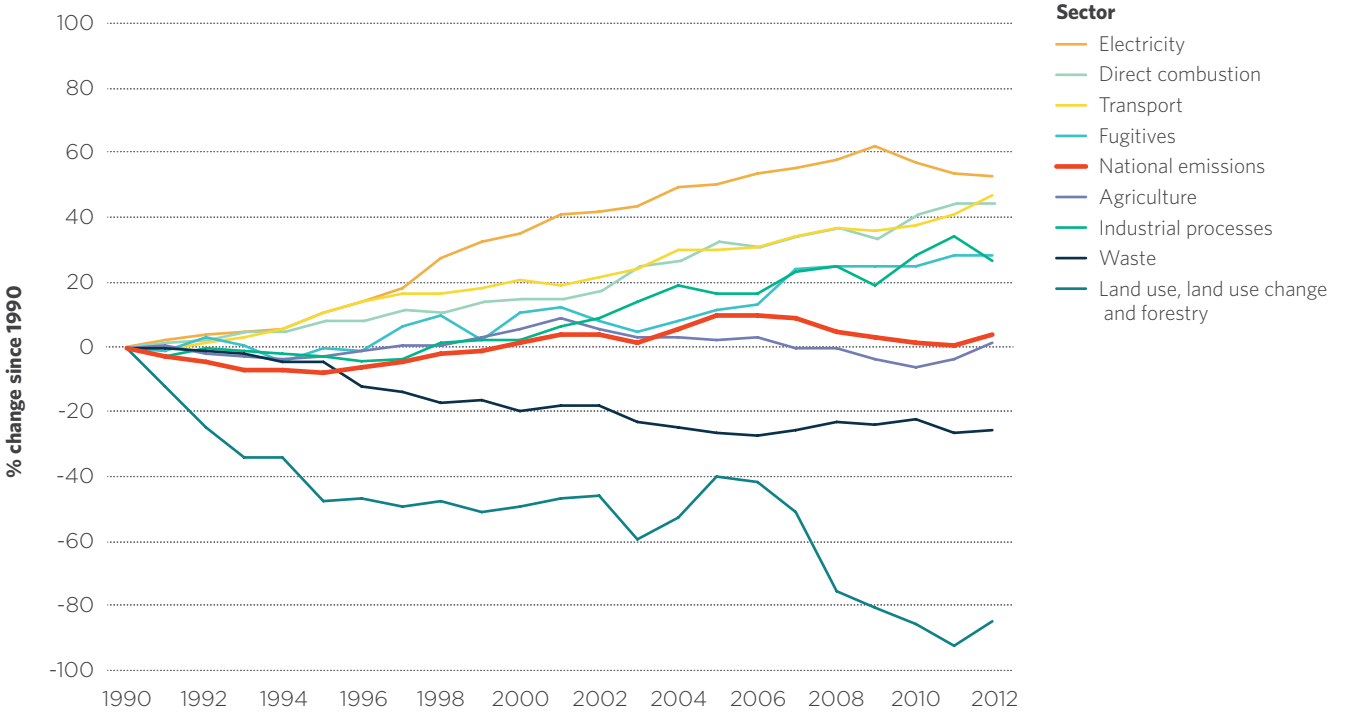
Australia's commitment under the Kyoto Protocol required it to limit emissions in the period 2008 to 2012 to an average of 108 per cent of 1990 level emissions. Australia's emissions were below this level, averaging 105 per cent of 1990 emissions over the period. This creates a 'carryover', currently estimated at 91 Mt CO_2-e. The treatment of this carryover is discussed in Chapter 8.

FIGURE 7.1: AUSTRALIA'S EMISSIONS BY SECTOR, 1990–2012



Source: The Treasury and DIICCSRTE 2013. For more detail see Box 7.1.

FIGURE 7.2: GROWTH IN AUSTRALIA'S EMISSIONS BY SECTOR, 1990–2012



Source: The Treasury and DIICCSRTE 2013

The main trends by sector between 1990 and 2012 are (Commonwealth of Australia 2013):

- Electricity and direct combustion of fuels (for example, in buildings and industry) increased by 50 per cent (97 Mt CO_2-e) driven in part by population growth, rising household incomes and increasing exports from the resources sector.
- Transport emissions increased by 46 per cent (29 Mt CO_2-e), due to continuing growth in household incomes and numbers of vehicles.
- Fugitive emissions (greenhouse gases emitted during the extraction, production, processing, storage, transmission and distribution of fossil fuels) increased by 28 per cent (10 Mt CO_2-e). Increased production from coal mines contributed to rising emissions.
- Industrial process emissions increased by 27 per cent (7 Mt CO_2-e). This was largely due to emissions associated with hydrofluorocarbons (mainly used in refrigeration and air conditioning equipment and in a range of industrial processes) and chemical industries.
- Agricultural emissions rose by one per cent (1 Mt CO_2-e). Reductions due to prolonged and widespread drought conditions from 2002 to 2010 were offset by more fertiliser use and savanna burning. Emissions have begun to increase since the drought broke.
- Waste emissions decreased by 26 per cent (5 Mt CO_2-e). Regulations and incentives to better manage methane emissions from landfills contributed to falling emissions.
- LULUCF emissions decreased by 85 per cent (119 Mt CO_2-e). Regulations and weaker economic conditions for farmers (reducing the incentive to clear land) played a significant role in reducing emissions.

There has been a departure from longer term trends in emissions since 2008. Between 1990 and 2008, total national emissions rose by about 4 per cent, but have fallen by about 1 per cent since 2008. This is due to changes in economic conditions (for example, the global financial crisis leading to slower economic growth; rising energy prices are also reducing growth in demand for energy) and emissions reduction activities in particular sectors. The departure from long-term growth trends after 2008 is most pronounced in the electricity sector.

Although Australia's total emissions in 2012 are at broadly the same levels as in 1990, this has been achieved in a period of strong growth in Gross Domestic Product (GDP). The economy has doubled in size since 1990, from $0.7 to $1.5 trillion in real $2011 terms. This means the emissions intensity (emissions per dollar of GDP) of the economy has approximately halved between 1990 and 2012.

The next Section discusses the drivers behind these emissions trends, and whether these are likely to represent significant progress toward a low-emissions economy.

BOX 7.1: DATA CONVENTIONS IN THIS REPORT

Emissions data varies across sources. In this report, historical and projected emissions for the period 1990 to 2030 are taken from The Treasury and DIICCSRTE modelling (2013).

- Historical emissions data for the period 1990 to 2011 are based on the 2013 National Greenhouse Gas Inventory report 2010–11, converted to CO_2-e using global warming potentials from the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.
- 2012 emissions are based on preliminary inventory data and modelled estimates.
- Historical emissions for LULUCF for the period 1990 to 2012 have been adjusted to be consistent with the new accounting rules agreed for the second commitment period of the Kyoto Protocol.
- Emissions for the period 2013 to 2030 are modelled estimates.
- All annual data in this report is for the financial year ending June 30 unless otherwise indicated. For example, data reported for 2013 is for the financial year 2012–13.
- Australian dollars ($AUD) are reported in 2012 real terms (that is, adjusted for inflation) unless otherwise specified.

These specifications apply to all data in the report unless otherwise noted.

7.2 MAJOR DRIVERS OF EMISSIONS TRENDS

Australia's falling emissions intensity indicates that underlying progress is already being made towards a lower emissions economy.

The Authority commissioned Vivid Economics[1] (2013) to assess the main drivers behind Australia's historical emissions trends (Figure 7.3). Vivid's analysis suggests that changes in economic activity have been the strongest driver. Emissions growth due to economic growth has been largely offset by a shift in the structure of the economy towards lower emissions sectors (for example, from manufacturing to services), and emissions reductions activities (in particular, in the electricity and land sectors). These changes are detailed below.

7.2.1 ECONOMY WIDE DRIVERS – ECONOMIC ACTIVITY AND STRUCTURAL SHIFTS IN THE ECONOMY

Australia has experienced strong and sustained economic growth at an average annual rate of 3 per cent in real terms between 1990 and 2012 (ABS 2013). Increases in economic activity led to higher emissions (Figure 7.3).

Emissions growth due to economic growth weakened in some sectors after 2008, in part reflecting the global financial crisis. These changes were significant – manufacturing activity fell at an annualised rate of 1.4 per cent between 2008 and 2012, compared with 1.7 per cent growth in the period from 2000 to 2008 (ABS 2013). This is reflected in moderated emissions growth from economic activity after 2008 (Figure 7.4).

The sectoral pattern of growth is also changing over time. The share of emissions-intensive manufacturing fell by about 4 per cent between 1990 and 2011. High commodity prices and high exchange rates in recent years have accelerated the relative decline in the size of the manufacturing sector as a share of the economy (The Treasury and DIICCSRTE 2013). The share of less emissions-intensive sectors rose; for example, the services sector increased its share of the economy by 6 per cent (Table 7.1).

While Figure 7.4 shows little emission change due to structural changes after 2008, this masks two offsetting effects – structural change within manufacturing led to falling emissions, whereas structural change towards agriculture following the end of the drought increased emissions.

Figures 7.3 and 7.4 also highlight the role of emissions reduction activities, and show that these activities accelerated after 2008. This is discussed in detail in the next section.

TABLE 7.1: CHANGE IN SHARE OF ECONOMIC VALUE BY SECTOR, 1990–2011

SECTOR	CHANGE IN CONTRIBUTION TO OVERALL ECONOMIC VALUE (GVA) FROM 1990 TO 2011	EMISSIONS INTENSITY OF SECTOR IN 2011 ($kgCO_2$-e/$AUD)
Manufacturing (C)	-4.3%	0.66
Commercial and Services (F–H, J–Q)	6.0%	0.04
Electricity, Gas and Water Supply (D)	-0.9%	6.06
Construction (E)	1.1%	0.08
Mining (B)	0.4%	0.52
Transport, Postal and Warehousing (I)	0.4%	0.39
Agriculture, Forestry and Fishing (A)	-0.2%	3.22

Source: The Treasury and DIICCSRTE 2013; ABS 2013
Note: GVA (Gross value added) in real $2011 terms. Bracketed letters are relevant ANZSIC codes. Emissions by ANZSIC code for 2012 were not available at the time of drafting.

7.2.2 EMISSIONS REDUCTION ACTIVITIES AND THE ROLE OF POLICY

Emissions reduction activities are broadly defined to include the implementation of new energy-efficient technologies, fuel switching to lower emissions fuels, and changing operating practices in a way that makes sectors more efficient. These activities may be driven by policy, such as increases in renewable energy due to the Renewable Energy Target (RET), or market factors such as rising fuel prices and falling technology costs.

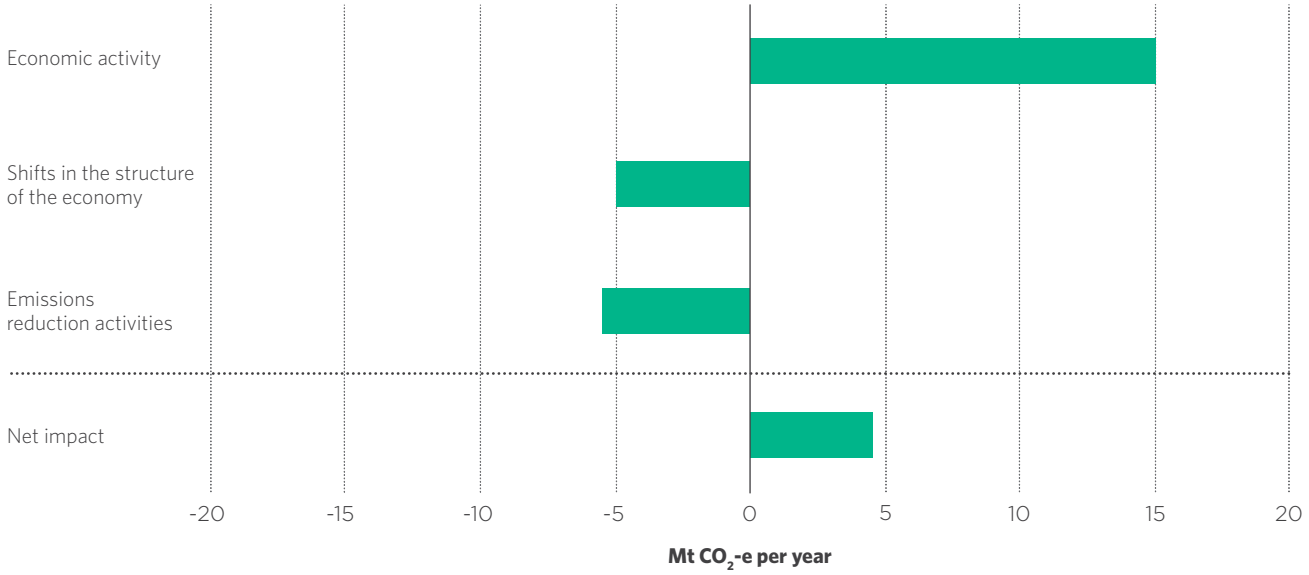
The analysis by Vivid Economics suggests that emissions reduction activities have played a key role in reducing Australia's emissions, similar to the level of reductions due to structural change since 2000. Detailed sector-by-sector analysis, including by ClimateWorks (2013), shows that the emissions reduction activities are concentrated where there have been significant policy initiatives, particularly the land and electricity sectors.

THE LAND SECTOR

The vast majority of land clearing takes place in New South Wales and Queensland (Figure 7.5). Regulations to restrict land clearing have been implemented at a state level, in part in response to community concerns about biodiversity and climate change. The annual area deforested has halved since 2003, primarily due to these regulations (see Appendix D for more detail).

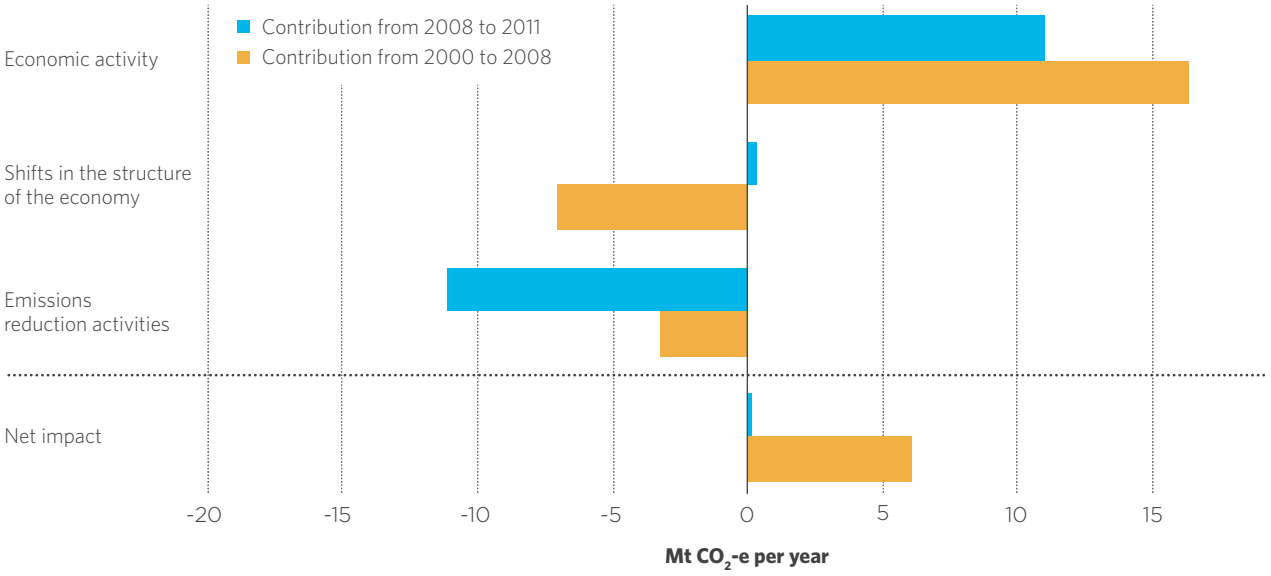
1 Vivid Economics's analysis does not include LULUCF emissions. However, the broader assessment of emissions reduction activities includes this sector.

FIGURE 7.3: DRIVERS OF EMISSIONS TRENDS, 2000–2011



Source: Vivid Economics 2013; Climate Change Authority
Note: Emissions reduction activities include the implementation of new energy-efficient technologies, fuel switching and changes in operating practices in a way that makes sectors more efficient.

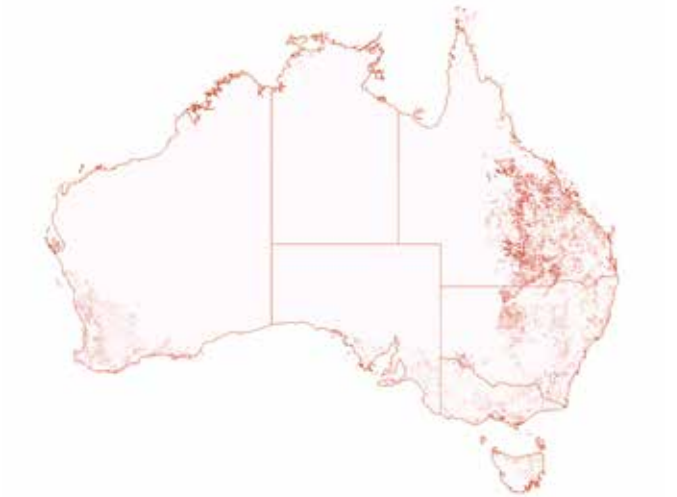
FIGURE 7.4: DRIVERS OF EMISSIONS TRENDS, SHOWING CHANGE BEFORE AND AFTER 2008



Source: Vivid Economics 2013; Climate Change Authority

Between 1990 and 2012, emissions fell by around 119 Mt CO_2-e in the land sector. Weakening economic conditions for farmers were an important driver of reductions between 1990 and 2000. About half of the reductions occurred between 2006 and 2012 due to the implementation of land clearing restrictions.

FIGURE 7.5: LOCATION (IN RED) OF LAND CLEARING EVENTS DETECTED BETWEEN 1990 AND 2011



Source: DIICCSRTE 2013

In addition, plantation rates of new timber forests reached a peak in 2000. This was largely in response to Managed Investment Schemes, which provided tax incentives for new plantations. New plantations fell sharply after 2000 as investment regulations were tightened, and again in 2007 in response to economic factors and the collapse of investment companies during the global financial crisis. Since 2012, company reports suggest that there has some increase in planting due to companies seeking compliance offsets under the Carbon Farming Initiative.

THE ELECTRICITY SECTOR

Between 2000 and 2012, there was a shift in the fuel mix toward lower emissions fuels and renewables, largely driven by policies such as the state-based schemes in New South Wales and Queensland and the RET.

The New South Wales Greenhouse Gas Reduction Scheme was introduced in 2003, and the Queensland Gas Scheme in 2005. These schemes contributed to the share of gas in electricity generation across Australia rising from 8 per cent to 19 per cent between 2000 and 2012.

The RET was introduced in 2001 and expanded in 2009. While installed capacity of renewables has approximately doubled, the share of renewables in electricity generation has been stable, at about 8 per cent over this period. The share of non-hydro renewable generation rose from 0.4 per cent in 2000 to 3.9 per cent in 2012 (BREE 2013a).

Emissions reductions in the electricity sector accelerated after 2008 due to a combination of falling emissions intensity of generation and flattening demand for electricity.

- The emissions intensity of Australia's electricity supply fell at an annualised rate of about 1.9 per cent over the period 2008 to 2012 due to increases in renewables and gas generation (BREE 2013a; The Treasury and DIICCSRTE 2013):
  - The annualised increase in renewable generation was 1.3 per cent per year from 2000 to 2008, and accelerated to 4.9 per cent between 2008 and 2012 (BREE 2013a).
  - Installation of solar photovoltaics has increased rapidly since 2008, from around 100 MW installed in that year to over 2 400 MW in 2012 (a 10-fold increase between 2010 and 2012 alone), linked to the RET and state-based incentive schemes (Australian PV association 2012; CEC 2012; ACIL Allen Consulting 2013).
  - Emissions intensity of electricity sourced from the National Electricity Market (NEM[2]) decreased at an annualised rate of about 1.5 per cent from 2008 to 2012, and fell a further 4.6 per cent in 2013 (AEMO 2013). Since 2012 the carbon pricing mechanism has been in place, increasing the relative costs of high-emissions generators compared to low-emissions sources such as wind and hydro. The reduction in output from the Yallourn brown coal generator after flooding in 2012 also played a significant role in reducing emissions intensity.
- In the period from 1990 to 2008, Australia-wide demand for electricity grew by an annualised rate of 2.5 per cent. Between 2008 and 2012, demand growth softened to 1.1 per cent on an annualised basis[3]. Rising electricity prices, lower economic activity and an improvement in energy efficiency have contributed to this:
  - Retail electricity prices rose by about 60 per cent between 2008 and 2012. The analysis by Vivid Economics suggests that the manufacturing sector was the most responsive to these price increases, followed by the commercial and residential sector.
  - Economic activity slowed for some key sectors (as described in section 7.2.1). In manufacturing, Gross Value Added (GVA) fell by 1.4 per cent in annualised terms between 2008 and 2012, compared with annualised growth of 1.7 per cent between 2000 and 2008.
  - Uptake of efficient lights and appliances (described below) may have moderated consumption to some extent.

2 The NEM electricity grid covers New South Wales, Queensland, Victoria, South Australia, Tasmania and the Australian Capital Territory, and in 2012 accounted for 86 per cent of total electricity consumed in Australia.

3 Vivid Economics (2013) suggests that BREE data for the commercial and services sector appears inconsistent with data from the NEM. If a correction is applied to the BREE data, the annualised rate of growth falls from 1.1 to 0.2 per cent.

There were regional differences in the trends for electricity demand, in particular for Western Australia and the NEM jurisdictions:

- Consumption in Western Australia grew at an annualised rate of 6 per cent between 2008 and 2012, faster than the average increase across Australia of 1.1 per cent, linked to economic growth.
- Demand for remote and off-grid power sources is thought to be growing, particularly in Western Australia, although relatively little data is available (BREE 2013b). As noted above, deployment of solar PV is also growing Australia-wide.
- Electricity supplied by the NEM (that is, not including demand met by off-grid or solar PV generation) remained flat over the period 2008 to 2012. However, between 2010 and 2013 demand fell at an annualised rate of 1.3 per cent (AEMO 2013).

ENERGY EFFICIENCY AND FUEL-SWITCHING

There is some evidence of energy efficiency and fuel-switching contributing to emission reductions in the building and industry sectors.

The most significant contributor to emissions reductions in the residential sector between 1990 and 2012 was gas heating replacing emissions-intensive electric heating, following expansion of the gas network (BREE 2012). The energy intensity of Australia's buildings has decreased by 3 per cent between 2003 and 2011, led by improvements in the operation of buildings, improved energy efficiency standards, more efficient appliances and distributed energy (ClimateWorks 2013). However, these improvements have been offset by additional buildings and increased use of electronics in homes:

- Building standards have improved energy efficiency in new buildings in particular. For example, new offices now use about 32 per cent less energy than offices built 10 years ago (ClimateWorks 2013). Due to the slow turnover of stock, this is yet to have a significant impact on overall building energy use, although this will increase over time.
- While minimum standards on appliances have made an impact, gains have been offset by the increase in appliance ownership. For example, ownership of computer and IT equipment has increased from close to zero per household in 1990 to 1 per household by 2008 (BREE 2012).

In industry, higher energy prices combined with policy instruments like the Energy Efficiency Opportunities program (EEO) and minimum standards on some equipment are driving energy efficiency improvements. ClimateWorks 2013 reports that the falls in energy consumption for large industrial users over the last four years are equivalent to the energy use of about 800 000 households. Since 2008, industrial companies have been implementing about three times more energy efficiency improvements each year than they had previously. Process emissions have been substantially reduced and there has been more self-generation of electricity using gas. This has led to an estimated 10 per cent improvement in industrial emissions intensity, which has been offset by large increases in production. The factors that influence the uptake of energy efficiency were the subject of a recent report by ClimateWorks, detailed in Box 7.2.

7.3 THE FUTURE ROLE OF POLICY-DRIVEN EMISSIONS REDUCTIONS

The discussion above highlights that the emissions intensity of the economy has been falling consistently in the period 1990 to 2012 due to changes in the structure of the economy and to emissions reduction activities. There are a range of drivers for emissions reduction activities, such as minimising costs in a period of rapidly rising energy prices. However, policy has driven the majority of these activities in recent years; in particular, regulations in the land sector, the RET, gas schemes in the electricity sector and energy efficiency.

These policies, largely introduced in the years since 2000, have accelerated the rate of emissions intensity reductions (Table 7.2).

TABLE 7.2: FIVE-YEARLY AVERAGE REDUCTIONS IN EMISSIONS INTENSITY 1993–2012

YEAR	1993–1997	1998–2002	2003–2007	2008–2012	1993–2012
Average annual change in emissions intensity	-3.9%	-2.0%	-2.4%	-3.6%	**-3.0%**

Note: A high rate of falling emissions intensity in 1993–1997 is due to rapid reductions in LULUCF in this period.

The current rate of reduction in emissions intensity from both policy and economic drivers is unlikely to substantially reduce overall emissions to 2020. This is explored further in Part D of this report. Economic growth is projected to increase at an annualised rate of about 3.1 per cent between 2013 and 2020, a similar level to the average rate of reductions of emissions intensity over two decades between 1992 and 2012.

BOX 7.2: CLIMATEWORKS AUSTRALIA SPECIAL REPORT ON FACTORS INFLUENCING LARGE INDUSTRIAL ENERGY EFFICIENCY

In July 2013, ClimateWorks published a report on the factors that influence large industrial energy efficiency. This research involved in-depth interviews with 47 large industrial companies that account for 70 per cent of Australia's industrial energy use.

The report identified the key drivers of energy efficiency as higher energy prices, the carbon price, the EEO program and organisational changes:

- **Higher energy prices** – 87 per cent of respondents identified energy prices as an important driver of energy efficiency; companies with higher energy intensities reported that prices are a strong driver.
- **Carbon price** – While 81 per cent of respondents reported the carbon price having an impact, its financial impact has been relatively small. Respondents reported it focused their attention on energy and carbon management, and influenced their strategic approach to energy management; for example, consideration of fuel-switching opportunities.
- **EEO** – 80 per cent of respondents stated the EEO program was a key influence; in particular, that it provided a structure for energy management. Respondents mentioned that the program had catalysed energy efficiency and changed cultural attitudes to energy efficiency. The EEO had a greater influence on respondents from companies within sectors with higher profitability and growth profiles. This could mean that companies that are not under financial stress may respond more readily to compliance and reputational drivers.
- **Organisational factors** – Respondents with better internal practices in certain key areas demonstrate higher implementation of energy efficiency activity. For example, companies with energy data management, staffing and processes realised more potential for energy savings (by up to 275 per cent) than those without.

The report also investigated barriers to further uptake of energy efficiency, and found that access to internal capital, the long payback periods of energy efficiency projects and opportunity cost of alternative investments were the most prominent barriers. These would need to be overcome for a higher rate of energy efficiency to be achieved.

To reduce Australia's emissions in the future, policy efforts will have to be strengthened and accelerated. Research by ClimateWorks (2013) supports this finding, suggesting that the current rate of emissions reductions activities will result in about 80 Mt CO_2-e emissions reductions in 2020, but total emissions would still rise by 80 Mt CO_2-e (compared to 2011 levels).

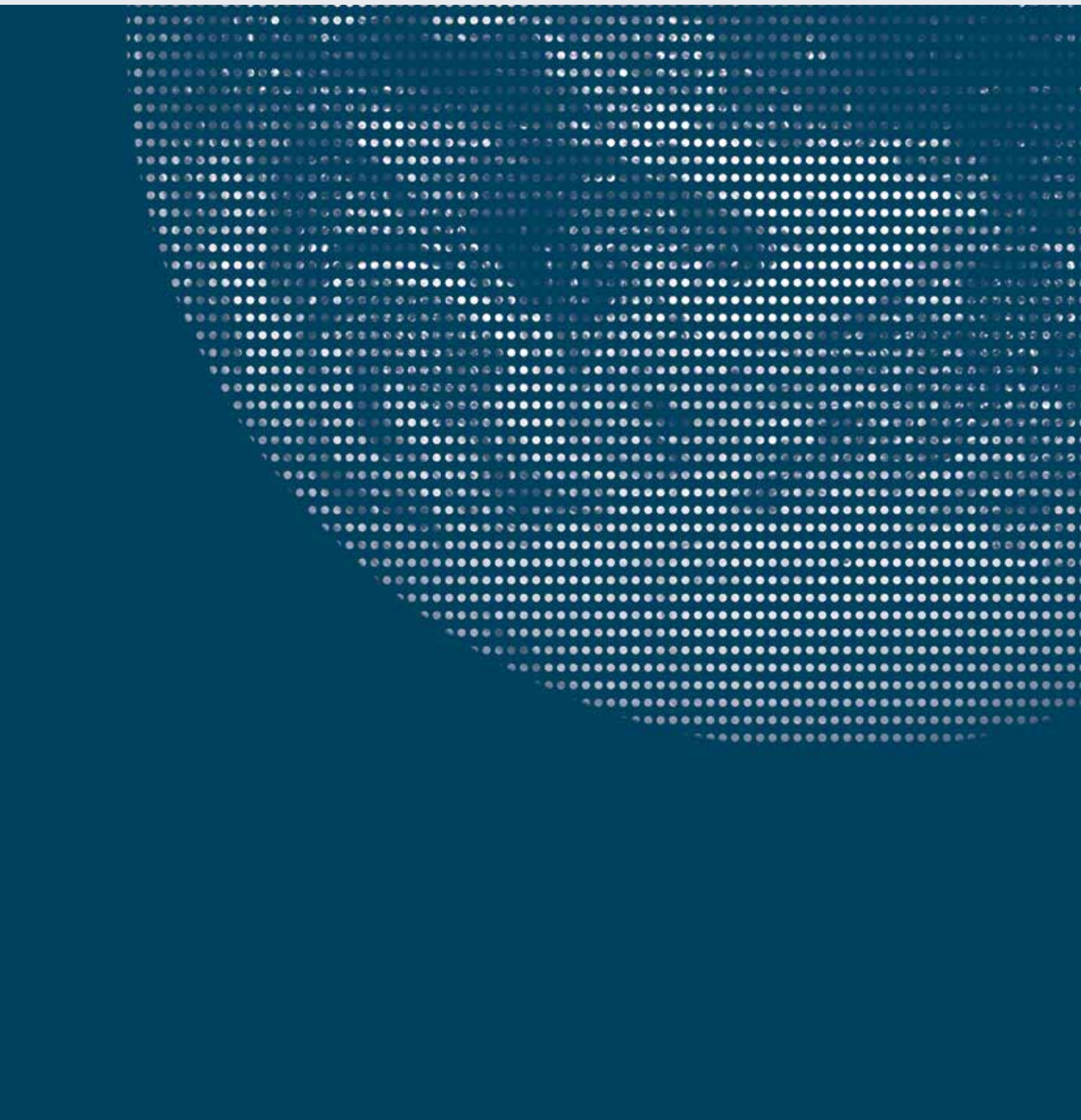
There is also a risk that the rate of emissions intensity reductions will slow. The Treasury and DIICCSRTE (2013) suggest that growth in mining and LNG processing will lead to new sources of emissions. To maintain the level of reductions overall, these new sources would need to be offset by stronger reductions in other sectors.

The level of emissions reductions required to meet future goals is discussed in Part C. The opportunities for reducing emissions are explored further in Part D and Appendix D.

DRAFT CONCLUSION

C.6 Australia has made progress toward decarbonising its economy – the emissions intensity of the economy (emissions per unit of GDP) has fallen by around 50 per cent since 1990.

C.7 The falling emissions intensity is in part due to the changing composition of the economy, away from emissions-intensive manufacturing. Policy has also played an important role, particularly in the land and electricity sectors.



PART C

AUSTRALIA'S EMISSIONS REDUCTION GOALS

In this Part, the Authority recommends a coordinated set of emissions reduction goals for Australia for the short, medium and long term. These include:

- **a long term national emissions budget to 2050, which would be subject to regular review; and**
- **emissions reduction goals to 2030, consisting of:**
  - **a 2020 target;**
  - **a national emissions budget and an indicative national emissions trajectory to 2020; and**
  - **a medium term trajectory range to 2030.**

In this Draft Report, the Authority outlines two options for each of the emissions reduction goals to 2030. The Authority will recommend a single set of goals to 2030 in its Final Report.

There is no formula for determining the right set of emissions reductions goals for Australia as it requires analysis of a range of considerations and judgement on how those factors should be weighed. That said, taking a budget approach provides an important overall constraint – Australia's short and medium term goals should keep open a feasible path to meeting its long term budget.

In developing its recommendations, the Authority was guided by Australia's clear interest in limiting global warming to below 2 degrees. As outlined in Part A, this goal remains achievable, but only with strong and immediate global action. It is in Australia's interest to set emissions reductions goals that support effective global action to limit warming, while retaining the flexibility to refine those goals as additional information becomes available.

In developing its recommended set of goals, the Authority considered evidence and expert and stakeholder views about a wide range of matters, including those the Authority must consider. This Part explores:

- **the form, scope and timeframes for Australia's emissions reduction goals (Chapter 8);**
- **Australia's fair share of the remaining budget of greenhouse gases the world can emit while preserving a likely chance of limiting global warming relative to pre-industrial levels to below 2 degrees, and the implications of a long term national emissions budget for Australia's 2020 goals (Chapter 9); and**
- **the costs of achieving Australia's 2020 emissions reduction target and how different targets would affect the Australian economy (Chapter 10).**

The evidence presented in this and preceding parts is synthesised into recommendations for Australia's emission reduction goals in Chapter 11.

CHAPTER 8 TIMEFRAME, FORM AND SCOPE OF AUSTRALIA'S EMISSIONS REDUCTION GOALS

The Authority recommends a set of emissions reduction goals that provide a degree of certainty in the short term and some predictability over the medium and long term, to support a smooth transition to a low-emissions economy. The future is not certain, and Australia needs to be able to change course to respond to changing circumstances. For this reason, the degree of flexibility – coupled with principles to guide the use of this flexibility – increases with time in the Authority's recommendations.

In its Final Report, the Authority will recommend a single 2020 target, and a corresponding budget and indicative national trajectory to this target. For longer term guidance, the Authority will recommend a 2050 emissions budget to provide a direct, transparent link between Australia's emission reduction goals and its overarching objective to limit warming to below 2 degrees. The Authority will also recommend a trajectory range to 2030 to improve policy predictability, increase clarity about effort over time and inform Australia's participation in international negotiations.

The scope of these recommended goals must be clearly defined. Chapter 8 sets out which emissions count towards the Authority's recommended goals, and how government purchases of international emissions reductions, voluntary action and Australia's performance against its first commitment period target under the Kyoto Protocol are taken into account. Australia's emissions were less than its target in the 2008–2012 Kyoto Protocol period, and the Authority is disposed to the view that Australia should use the surplus emissions rights to strengthen the 2020 emissions reduction target.

Chapter 8 sets out the Authority's draft conclusions on the timeframes, form and scope for emissions reduction goals, including:

- the case for the Authority recommending goals for 2020 and beyond 2020;
- the Authority's preferred form for medium and long term goals;
- how these goals should be reviewed and updated over time;
- the emissions included in Australia's goals;
- how voluntary action to reduce emissions should be taken into account; and
- how Australia should use its surplus emissions rights from the 2008–2012 Kyoto Protocol period.

8.1 A COORDINATED SET OF GOALS FOR AUSTRALIA

To recommend emissions reduction goals to 2020 consistent with its principles and Australia's national interest, the Authority's view is that it needs to consider Australia's overall emissions reduction goals to at least 2050.

The *Clean Energy Act 2011* (Cth) requires the Authority to recommend an indicative national emissions trajectory, a national emissions budget and caps for the carbon pricing mechanism to 2019–20. Apart from the caps (see Chapter 14), the legislation gives the Authority discretion over the nature and timeframe for its recommended emission reduction goals.

The Authority has considered the appropriate timeframes for its recommendations carefully. In particular, it has considered which timeframes and types of goals are important, both for recommending near term goals consistent with the Authority's principles and governing legislation, and providing timely advice to the Government on Australia's international commitments and undertakings.

There is little point in recommending near term goals that are inconsistent with long term objectives. Positioning 2020 within a longer timeframe helps ensure that recommended 2020 goals represent a credible step towards these objectives rather than too little or too much action towards the below 2 degrees goal.

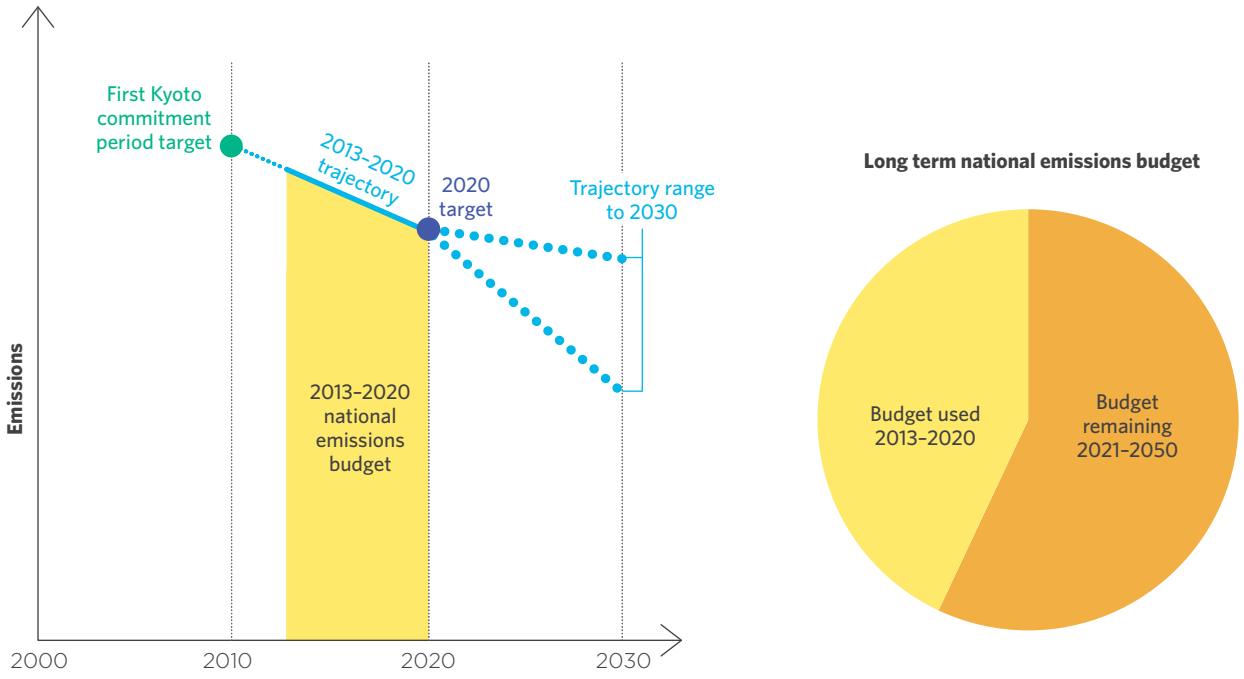
The Authority's recommendations are timely, as they can help inform the Government's upcoming decisions about Australia's international emissions reduction commitments, including:

- in 2014, the Government must review its 2020 target commitment and decide whether to strengthan this from 5 per cent; and
- in 2014 or 2015 Australia is likely to be required to indicate some form of post-2020 goal.

The Authority is therefore recommending a consistent set of emissions reduction goals that provide a degree of certainty in the short term, and some predictability and flexibility over the medium and longer term. The Authority will recommend (Figure 8.1):

- Clear short term goals that plot a sensible near term path consistent with Australia's national interest and inform Australia's international undertakings relating to a 2020 target. The Authority will recommend an emissions budget to 2020, a 2020 target and an indicative trajectory to 2020.
- A medium term trajectory range for 2020–2030, within which future targets and trajectories should be set, to increase policy predictability for business and other stakeholders. Options for short and medium term goals are discussed in Chapter 11.
- A long term emissions budget for 2013–2050, to anchor Australia's emission reduction pathway in its national interest in limiting warming to below 2 degrees. A long term emissions budget for Australia is recommended in Chapter 9.

FIGURE 8.1: THE AUTHORITY'S RECOMMENDED SET OF EMISSIONS REDUCTION GOALS



Source: Climate Change Authority

The Authority's advice in this Draft Report is based on the best available evidence and takes account of how circumstances and relevant factors may change over time. More information will become available as new research is conducted and projections are replaced with actual outcomes. New information should be considered in future reviews and goals beyond 2020 revised accordingly. Chapter 8 includes general guidance on how new information would affect future goals to make them more predictable.

The next two sections set out further detail on the potential benefits of post-2020 goals and the recommend form for those goals.

8.2 EXTENDING THE TIMEFRAME – THE CASE FOR POST-2020 GOALS

There is a compelling case for increasing the amount of guidance about Australia's post-2020 emissions reduction goals beyond the current, single-year target for 2050. In the Issues Paper, the Authority committed to assessing Australia's possible actions beyond 2020, and to consider making recommendations on emissions reduction goals beyond 2020. Recommendations on post-2020 goals were supported by a large number and wide range of stakeholders.

Additional post-2020 goals have five potential benefits:

- improving policy predictability and providing an early indication of future emissions reduction goals, which can assist in lowering risk and costs for business;
- improving environmental effectiveness by linking Australia's action more directly to a scientifically derived global emissions budget;
- increasing government accountability for achieving long term goals;
- informing international negotiations on the post-2020 framework, as Australia and some other countries are likely to begin indicating post-2020 goals in 2014 or 2015; and
- increasing transparency on the distribution of Australia's effort over time, and the implications of short term goals for intergenerational equity.

About half the submissions received in response to the Issues Paper provided views on post-2020 goals. Non-government organisations, individuals and most business submissions, including the Business Council of Australia (BCA) and the Australian Industry Greenhouse Network, were supportive of additional post-2020 guidance. The BCA commented that it:

> *... strongly supports the CCA's approach to look beyond 2020 to 2030 and 2050 – business needs policy frameworks that look forward at least 20 years, which is the 'bankable' timeframe for major low emission and emission abatement investment (Issues Paper submission,* p. 6*).*

Some business and individual submissions expressed concerns with setting goals beyond 2020. A report from Domanski Energy & Economics accompanying the Australian Chamber of Commerce and Industry's submission argues that 'setting targets for years beyond 2020 now is too uncertain and risky' (*Issues Paper submission*, p. ix). Santos wrote that pre-empting international negotiations was not beneficial.

If Australia set long term goals and did not revisit them, these concerns would have significant force. The *Clean Energy Act* requires – and the Authority recognises the value of – periodic reviews of medium and long term goals in light of new information. Further, recommendations for post-2020 goals are timely rather than pre-emptive. Australia is likely to have to put forward some form of post-2020 goal by 2015. Another concern was raised by Mr James Wight: 'Distant targets ignore the urgency and are easily undermined. It is more important to begin, in a single electoral term, systemic decarbonisation of the economy' (*Issues Paper submission*, p. 3). The Authority agrees that clear short term goals are necessary, and sees post-2020 goals as a complement to, rather than a substitute for, near term goals.

The Authority concludes that clear but flexible long term guidance on Australia's emissions reductions can help create a stable, predictable environment for Australia's transition to a low-emissions future.

8.3 FORM OF POST-2020 GOALS

The Authority considers a long term national emissions budget to 2050 and a trajectory range from 2020 to 2030 would provide clear long term guidance while maintaining flexibility to respond to new information. Combining a 2050 emissions budget with a medium term trajectory range capitalises on the advantages of each:

- A long term budget to 2050 provides a direct, transparent link between Australia's emission reduction goals and its overarching objective to limit warming to below 2 degrees. It can also increase government accountability by providing a simple measure of progress. The appropriateness of this 2050 budget should be subject to periodic review.

- A trajectory range balances flexibility and predictability for medium term policy by bounding the scope for future changes. A trajectory range also improves clarity about effort over time, provides guidance for international commitments and signals a willingness to take stronger action under the right conditions.

The Authority's approach incorporates many elements proposed by stakeholders. AGL Energy proposed a long term national emissions budget to 2050 complemented by a medium term trajectory range for potential future caps from 2020 to 2030. Energy Australia considered a trajectory range (also known as a gateway) could be useful to improve investor certainty and that 10 years of gateways from 2020 should be considered. The Energy Supply Association of Australia called for 'a gateway indicating a possible range of emissions levels out to 2025 or 2030' (*Issues Paper submission*, p. 1). Non-government organisations, including Oxfam, Australian Conservation Foundation and Climate Action Network Australia, were broadly aligned in support of a long term budget, interim targets and a longer term trajectory. Some stakeholders proposed medium term targets; for example, to 2030.

Stakeholders had different views about the merits of trajectories. Non-government organisations were broadly supportive, whereas the BCA recommended the Authority refrain from nominating trajectories because they would inhibit Australia making the most efficient distribution of emissions reductions over time. The Authority agrees that goals should provide some flexibility in the timing of emissions reduction effort. The purpose of a trajectory is to define a budget that can be met flexibly over time, not to set binding limits in each year. As a result, the Authority does not believe trajectories inhibit efficiency. That said, having recommended a long term budget to guide overall emissions reductions, the Authority considers a trajectory or range of trajectories that stretched beyond 2030 would be unnecessarily prescriptive at this time.

The Authority sees value in a set of emissions reduction goals that provide some predictability in the medium and long term while maintaining flexibility to respond to new information.

In order that post-2020 goals genuinely provide predictability and flexibility, they must be reviewed regularly and the reviews themselves should respond to changing circumstances in a reasonably predictable way. In particular, the latest information on climate science, international action and economic factors should be considered in periodic reviews, with those goals then updated as appropriate.

DRAFT CONCLUSION

C.8 The Authority proposes a set of emissions reduction goals for the long, medium and short term. This will provide a more predictable environment for businesses and others to act, with a degree of certainty in the short term, while maintaining greater flexibility in the longer term.

The Authority's recommended set of goals for Australia comprises:

- A long term national emissions budget to 2050, connected to Australia's national interest and subject to regular review, which will provide guidance for longer term planning.
- A medium term trajectory range for emissions reduction to 2030, subject to extension and revision over time, which will offer guidance within bounds, increasing predictability for investment.
- A short term emissions budget and trajectory to 2020 and associated 2020 target that will provide a degree of certainty for near term action.

Post-2020 goals require periodic review in order to fulfil their role in providing both clarity and flexibility to respond to new information.

The next four sections deal with recommendations on post-2020 goals in further detail, covering the shape of recommended trajectories and the trajectory range; the basis for setting the trajectory range; extending and narrowing the trajectory range; and criteria for revising medium and long term goals.

8.4 SHAPE OF THE INDICATIVE NATIONAL EMISSIONS TRAJECTORY AND THE TRAJECTORY RANGE

The Authority recommends straight-line indicative trajectories from 2013 emissions to the 2020 target and from the 2020 target to the either end of the 2030 range. Straight-line trajectories provide simple and predictable pathways to meet emissions reduction targets. They also make it easy to translate the 2020 target into a second commitment period goal for the Kyoto Protocol, should the Government wish to do so. As previously discussed, the trajectories do not set binding limits on emissions in each year, but are the basis for defining a binding budget.

Under the Kyoto Protocol, Australia has adopted an unconditional 2013-2020 budget (in the form of a Quantified Emission Limitation or Reduction Objective – 'QELRO'). This is based on a straight line from the midpoint of Australia's first commitment period target (108 per cent of 1990 levels in 2010) to its minimum, unconditional 2020 target of 5 per cent below 2000 levels (Commonwealth of Australia 2012). This gives a QELRO of limiting average annual emissions in the period 2013-2020 to 99.5 per cent of 1990 levels. The QELRO is in the form of a 2013-2020 budget rather than a year-by-year trajectory.

The Authority's recommended indicative national trajectory for 2013-2020 will follow the same approach; a straight line to its recommended 2020 target (Figure 8.1). Similarly, the Authority's recommended trajectory range for 2020–2030 will be formed by straight lines between the recommended 2020 target and the top and bottom of the trajectory range in 2030. It is the Authority's view that a curved trajectory range would create unnecessary complexity for little benefit over this time horizon.

8.5 BASIS FOR RECOMMENDING THE TRAJECTORY RANGE FOR 2020–2030

The principal advantage of a trajectory range is that it provides more information about future emissions reduction goals, while maintaining a degree of flexibility. As with Australia's 2020 target, Australia can usefully start with a 2030 trajectory range, and narrow the range over time. This could be particularly helpful for the Government as it considers Australia's post-2020 international commitments. Under the United Nations Framework Convention on Climate Change (UNFCCC) negotiations, many countries will put forward post-2020 goals in 2014 and 2015 (Section 4.5). Australia may choose to express a range for 2030 now and narrow this over time as the post-2020 international architecture becomes clearer and more countries put forward actions.

The width of the trajectory range is an important factor in achieving these outcomes. A trajectory range that is extremely wide provides little guidance, while an extremely narrow trajectory range provides little flexibility to respond to new information over time.

The Authority proposes a trajectory range that provides a clear link to long term goals, namely the recommended 2050 national emissions budget (see Chapter 9) and the currently legislated 2050 target. The recommended 2050 national emissions budget is based on the Authority's view of an equitable share of the global budget adopted as a reference for this Review, which is estimated to give a 67 per cent chance of limiting warming to below 2 degrees (see Chapters 3 and 9). The Authority proposes to define the 'bottom' or stronger end of its trajectory range as the 2020–2030 portion of a trajectory that meets its recommended 2050 emissions budget. The 'top' or weaker end of the trajectory range is based on the legislated long term target of 80 per cent below 2000 levels in 2050. Depending on the 2020 start point, tracking along this top trajectory could see Australia meeting a 2050 national emissions budget consistent with a less than 50 per cent chance of limiting warming to below 2 degrees. This would exceed the Authority's recommended 2050 emissions budget, but meet the 2050 goal in current legislation. The trajectory range is illustrated in Figure 8.2 and the relationship between the 80 per cent target and limiting warming to below 2 degrees is discussed further in Box 11.1. If adopted by Government, a range constructed in this way could help indicate that Australia is prepared to keep within its share of the global emissions budget. It would also maintain Australia's flexibility to take into account the latest information on climate science, international action and economic factors prior to making final decisions on medium term goals.

The Authority's overall approach to the trajectory range is similar to that recommended by the National Emissions Trading Taskforce (2007) and the Prime Ministerial Task Group on Emissions Trading (2007) but is applied to national emissions rather than caps in an emissions trading scheme.

8.6 REGULAR FUTURE REVIEWS OF MEDIUM AND LONG TERM GOALS

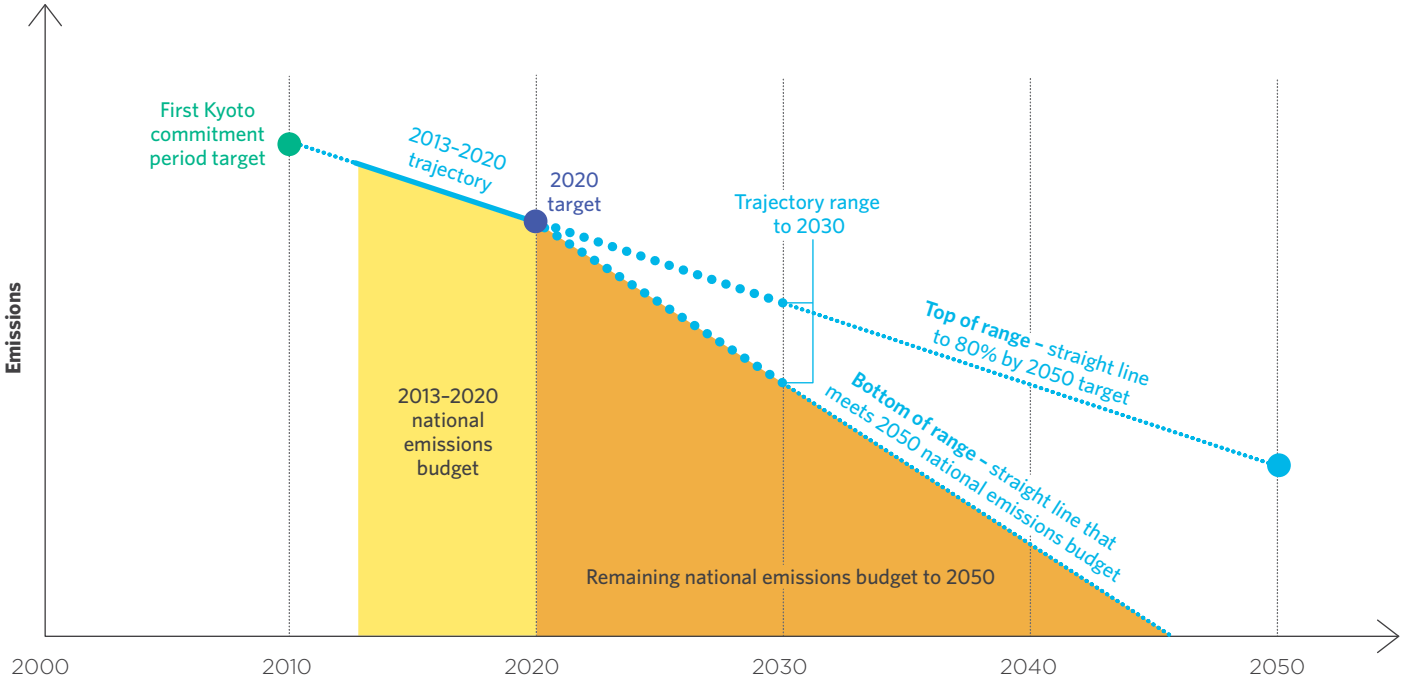
In order that they fulfil their role in providing both clarity and flexibility to respond to new information, the trajectory range and the 2050 emissions budget should be reviewed periodically.

As the *Clean Energy Act* currently provides, reviews of medium and long term goals should take place every five years, possibly with an extra review in about 2016 to take into account international developments on the post-2020 framework. Reviewing medium and longer time goals more frequently than this risks creating the kind of uncertainty for investors that reviews are designed to reduce. These five yearly reviews should:

1. Extend the trajectory range to maintain a similar amount of guidance over time. The recommended 2020 goals and trajectory range to 2030 in the Authority's Final Report will provide 16 years of initial guidance; similar guidance can be maintained by extending trajectories by five years at each five-yearly review.
2. Narrow the existing trajectory range to reduce uncertainty regarding future trajectories as more and better information becomes available. In truly exceptional circumstances, such as a dramatic change in climate science, economic factors or international action, a review could recommend the trajectory range move outside the previously defined range.
3. Review the 2050 emissions budget.

If the Government adopts a trajectory range to 2030, it will have to settle on specific points within this range at some stage. This could be to set down a new international commitment, such as a 2030 target or a new QELRO, or for the purposes of domestic policy. The best frequency for selecting specific points within a trajectory range will depend in part on domestic policy design; however, in the Authority's view it is desirable for business and other stakeholders to have at least five years of certain near term goals. In order to provide a more predictable policy environment, these points should be chosen according to clear, preannounced criteria. These criteria should also be used for extending and narrowing the trajectory range and reviewing the long term national emissions budget. They are discussed in the next Section.

FIGURE 8.2: HOW THE AUTHORITY'S RECOMMENDED TRAJECTORY RANGE IS CONSTRUCTED



Source: Climate Change Authority

8.6.1 CRITERIA FOR REVIEWING EMISSIONS REDUCTION GOALS

Identifying criteria for setting targets and trajectories within the trajectory range and updating medium and long term emissions reduction goals can help to increase policy predictability. The Authority considers three factors of particular importance here – new or changed information on climate science, international action on climate change and economic factors.

A further question is how specific criteria should be. More specific criteria can appear to add clarity, but in practice can become barriers to the very action they were designed to facilitate. For example, specific criteria may place undue importance on the form of an outcome rather than focusing on its substance. General criteria would identify the key factors that influence a decision but would not specify precise requirements. As such, they would be more robust to evolving circumstances. In combination with reviews that include broad consultation and transparent decision-making, general criteria can provide a more robust base for predictable goals.

The Authority's recommended criteria for setting future targets and trajectories within the trajectory range, extending and narrowing the trajectory range, and reviewing the long term national emissions budget are changes or new information in relation to:

- **Climate science.** New science that indicates the global budget is smaller than previously estimated could imply stronger action by Australia. Evidence that the global budget is larger than previously estimated could imply less action.
- **The level and pace of international action on climate change.** Stronger international action could imply stronger Australian action, and less international action could imply less Australian action. This criterion would take into account Australia's international obligations and undertakings. These act as a 'floor' to any future trajectories – allowing strengthening but not weakening.
- **Economic factors.** Higher than expected costs (for example, because of macroeconomic shocks or because low emissions technologies have not developed as expected) could imply weaker action by Australia, and lower than expected costs (for example, because low-emissions technology is cheaper than expected) could imply stronger action.

The Authority would expect the first two of these (changes or new information in relation to climate science and international action) to be the most relevant for reviews of the long term national emissions budget. The long term budget would be less affected by at least some economic factors such as shorter term fluctuations in the economic cycle. As the recommended long term national budget is also anchored in an approach that achieves eventual equality in emissions rights per person (see Chapter 9), it should also be periodically updated for changes in population projections.

DRAFT RECOMMENDATIONS

R.1 That the trajectory range and the national budget to 2050 be reviewed at least every five years. There could be an extra review in 2016 to take into account international developments on the post-2020 framework. As part of these reviews, the trajectory range would be extended and narrowed to maintain a similar period of guidance over time, and future targets and trajectories would be set within the range.

R.2 That the periodic reviews of the trajectory range and the national budget to 2050 have regard to the following general criteria – changes in or new information relating to climate science, the level and pace of international action and economic factors.

8.7 SCOPE OF TARGETS, TRAJECTORIES AND BUDGETS

The Authority must define the scope of its recommended targets, trajectories and budgets – which emissions count towards them and what emissions reductions may be used to offset them. This Section sets out:

- the Authority's intended approach, taking into account the international framework that applies to Australia's international obligations and undertakings under the Kyoto Protocol and UNFCCC; and
- the quantitative implications for Australia's emissions reduction goals arising from this approach, in terms of land sector emissions and removals, and the use of units 'carried over' from the first commitment period of the Kyoto Protocol.

8.7.1 THE AUTHORITY'S APPROACH TO ACCOUNTING

The Kyoto Protocol sets clear guidelines on which emissions count towards Kyoto Protocol emissions reduction commitments. Australia must follow these rules in order to meet its unconditional international target under the Kyoto Protocol to limit average annual emissions to 99.5 per cent of 1990 levels from 2013 to 2020. These rules are explained in Box 8.1.

Unlike the Kyoto Protocol, there are no centralised rules for accounting for 2020 targets under the UNFCCC (there are rules for reporting on emissions). Australia recently reported on its 2020 emissions reduction commitment, including the underlying assumptions in its 2013 *Sixth National Communication on Climate Change* (Commonwealth of Australia).

Discussions about an accounting framework for post-2020 emissions reduction commitments are part of the post-2020 framework negotiations. These discussions are still in their early stages. It is likely that accounting for markets will be more flexible to accommodate greater use of international emissions reductions from domestic and regional emissions reduction schemes and offset programs.

As the Kyoto Protocol rules are the most definitive and binding set of accounting rules, the Authority will assume these rules apply for gases, sectors and sources and markets when recommending emissions reduction goals. In submissions to the Issues Paper, stakeholders generally supported this approach.

The Government could choose to count a broader range of international emissions reductions towards a stronger 2020 target under the UNFCCC, or towards its post-2020 budget than allowed under the Kyoto Protocol accounting rules. For example, the Government could choose to count emissions reductions generated from funding projects to preserve forests in developing countries (reducing emissions from deforestation or forest degradation in developing countries), which do not generate units under the Kyoto Protocol rules. Such emissions reductions could be sourced either by the Government or by businesses or individuals to offset their emissions. Should the Government choose to take this approach, the Authority's recommended targets and budgets could be adjusted to take account of the additional emissions reductions.

There are two further issues that need to be addressed in more detail – the first is emissions from international aviation and shipping; the second is voluntary action.

EMISSIONS FROM INTERNATIONAL AVIATION AND SHIPPING

Some stakeholders specifically noted emissions from international aviation and shipping. For example, the Climate Institute noted that emissions from these sectors were growing and suggested the Authority 'identify and articulate a clear timeline and process for possible inclusion of these sectors under Australia's domestic emission cap as part of the [Authority's] 2016 review' (*Issues Paper submission*, p. 19).

BOX 8.1: KYOTO PROTOCOL ACCOUNTING FRAMEWORK

The Kyoto Protocol provides guidance about the emissions countries must count towards their Kyoto emissions reduction commitments and the units that can be used to meet a commitment. For the second commitment period, Kyoto Protocol rules count emissions:

- of seven greenhouse gases (carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons, sulphur hexfluoride and nitrogen trifluoride);
- from the sectors and sources of energy, industrial processes, solvent and other produce use, agriculture and waste;
- from the land sector, including afforestation, reforestation and deforestation and forest management; and countries have the option to elect cropland management, grazing land management and revegetation activities.

The Kyoto Protocol only allows units created under the UNFCCC and the Protocol to be used to meet Protocol emissions reduction commitments. This includes units generated from emissions reduction projects in developing countries under the Clean Development Mechanism. It does not, for example, include units generated from reducing deforestation in developing countries.

Emissions from international aviation and shipping are growing, but are not included in national commitments under the UNFCCC. Instead, they are addressed through the International Civil Aviation Organization and the International Maritime Organization, respectively (see Appendix A for further information). The Authority therefore proposes excluding these emissions from Australia's national targets, trajectories and budgets. To ensure they are accounted for at a global level, the Authority has deducted an allowance for emissions from international aviation and shipping from the global emissions budget before considering Australia's share of that budget (Section 9.4). This issue should continue to be monitored over time to take account of further information and international developments.

VOLUNTARY ACTION

Most emissions reduction activities within Australia help us meet national targets and international obligations and undertakings. Voluntary action, such as individuals and companies offsetting their emissions to become 'carbon neutral', and households buying GreenPower (a Government-accredited program for energy retailers to purchase renewable energy on behalf of customers), achieve emissions reductions additional to – that is, above and beyond – national targets.

Under the first commitment period of the Kyoto Protocol, Australia calculated the emissions reductions flowing from approved voluntary action, and cancelled an equivalent number of Kyoto units. This ensured voluntary action resulted in emissions reductions beyond the minimum required by Australia's target.

The Authority recommends that the Government continue this practice. This can be done by tracking the emissions reductions from recognised voluntary actions and, at the end of the second commitment period, cancelling an equivalent number of Kyoto units. The Authority has, in consultation with stakeholders, identified three forms of voluntary action that should be recognised – GreenPower purchases, voluntary cancellation of domestic units (for example, Australian carbon credit units generated under the Carbon Farming Initiative) and voluntary cancellation of renewable energy certificates generated under the Renewable Energy Target.

This approach will ensure voluntary action continues to deliver emissions reductions additional to Australia's national target. Voluntary action and GreenPower are discussed further in Appendix E.

DRAFT RECOMMENDATION

R.3 That the Government recognise voluntary action by cancelling one Kyoto Protocol unit for each tonne of emissions reductions achieved in the period 2013 to 2020 through:

- **the voluntary cancellation of domestic units;**
- **the voluntary cancellation of renewable energy certificates; and**
- **GreenPower purchases.**

8.7.2 HOW THE AUTHORITY'S APPROACH TO ACCOUNTING AFFECTS ITS RECOMMENDATIONS

This section considers the quantitative implications of adopting the Kyoto Protocol accounting framework to the emissions reduction recommendations.

LAND SECTOR ACCOUNTING

In 2012, Kyoto Protocol Parties agreed to rules for accounting for land sector emissions for second commitment period emissions reduction commitments. These rules make it mandatory for Parties to account for emissions and removals from forest management, and optional to account for emissions and removals from cropland management, grazing land management and revegetation. Australia has elected to count emissions from the optional land use activities, so the Authority will apply the same coverage for its recommended goals.

These accounting changes are expected to lead to net emission reductions of approximately 12 million tonnes of carbon dioxide equivalent (Mt CO_2-e) in 2020. The Government projects that forest management activities will be a net sink for Australia, reducing emissions by approximately 9 Mt CO_2-e in 2020. The election of optional land use activities is likely to result in a net reduction of approximately 3 Mt CO_2-e in 2020 as farming practices continue to improve (Department of Innovation, Industry, Climate Change, Science, Research and Tertiary Education 2013). Overall, the changes are expected to provide emissions reductions equivalent to around an additional 3 percentage points for the 2020 target (see Appendix C5).

CARRYOVER FROM THE FIRST COMMITMENT PERIOD OF THE KYOTO PROTOCOL

Australia's cumulative emissions over the first commitment period (2008–2012) were below its Kyoto Protocol commitment to limit annual average emissions to 108 per cent of 1990 levels. As a result, Australia has surplus units to 'carry over', currently estimated to be equivalent to 91 Mt CO_2-e.

The Authority has considered three options for using the carryover:

- using the carryover to strengthen Australia's 2020 target;
- voluntarily cancelling the extra units; and
- holding the extra units as insurance to help ensure Australia meets its second Kyoto target.

Each of these options has different implications for environmental effectiveness, Australia's international influence, government revenue and economic impacts.

A range of stakeholders indicated support for voluntarily cancelling the carryover, including the Australian Conservation Foundation (*Issues Paper submission*, p. 11). Others suggested the Government hold the carryover as insurance for unexpected events. On balance, however, the Authority is disposed to favour the carryover being used to strengthen Australia's target for the following reasons:

- the Authority carefully considered the risks of Australia exceeding its second Kyoto target and determined there is no need to hold the carryover as insurance (see Section 14.4 for more detail); and
- strengthening the target has the same environmental benefit as cancelling the carryover, but is more visible to other countries, so is more likely to influence other countries to increase their ambition for future emission reductions.

As a result, using the carryover to strengthen Australia's emission reduction goals maximises the potential environmental benefits through positive international influence. The carryover of 91 Mt CO_2-e represents a potential 3 percentage point contribution that might form part of a more ambitious 2020 target (that is, add 3 percentage points to what would otherwise have been the 2020 target) (Figure 8.3).

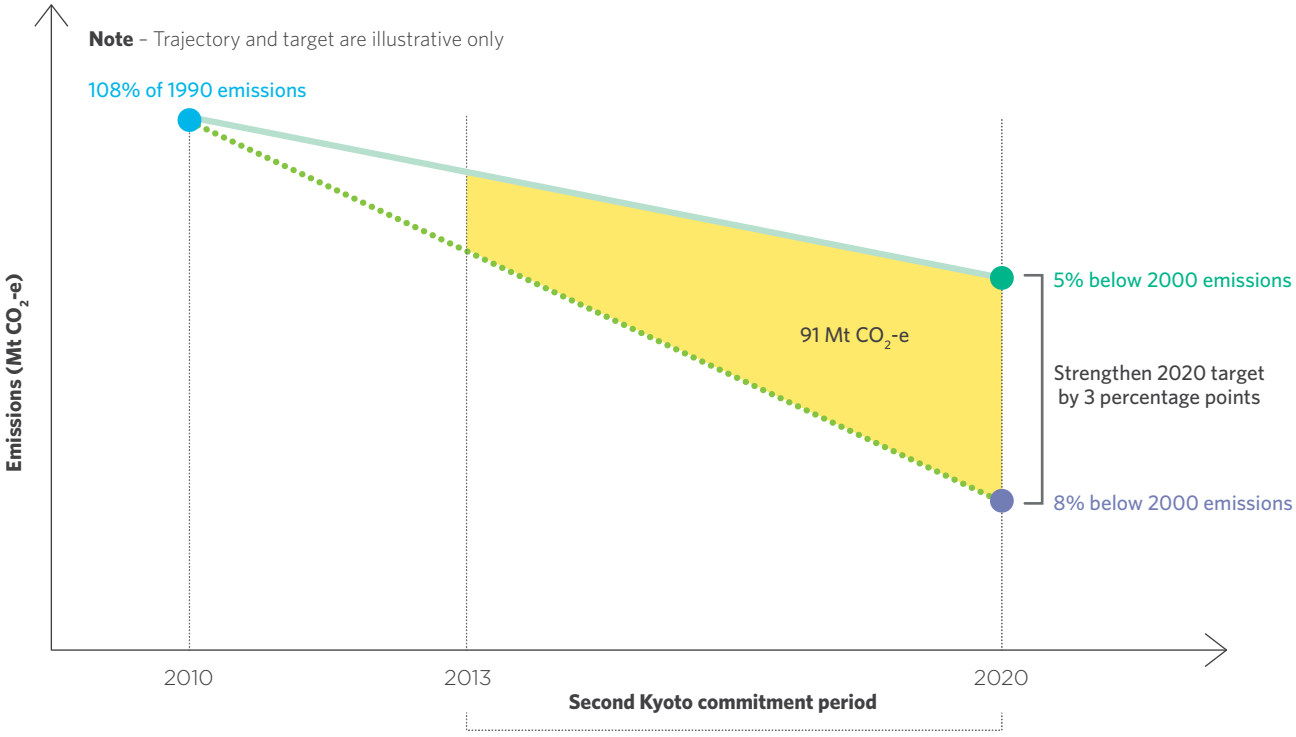
In terms of Australia's Kyoto Protocol unconditional second commitment QELRO (99.5 per cent reduction from 1990 levels over the period 2013 to 2020), the carryover of 91 Mt is equivalent to strengthening the QELRO by 2 percentage points (to 97.5 per cent) (Figure 8.4).

DRAFT CONCLUSION

C.9 Australia's carryover from the first Kyoto Protocol commitment period would be best used as a 3 percentage point contribution to a more ambitious 2020 emissions reduction target to be recommended by the Authority in its Final Report.

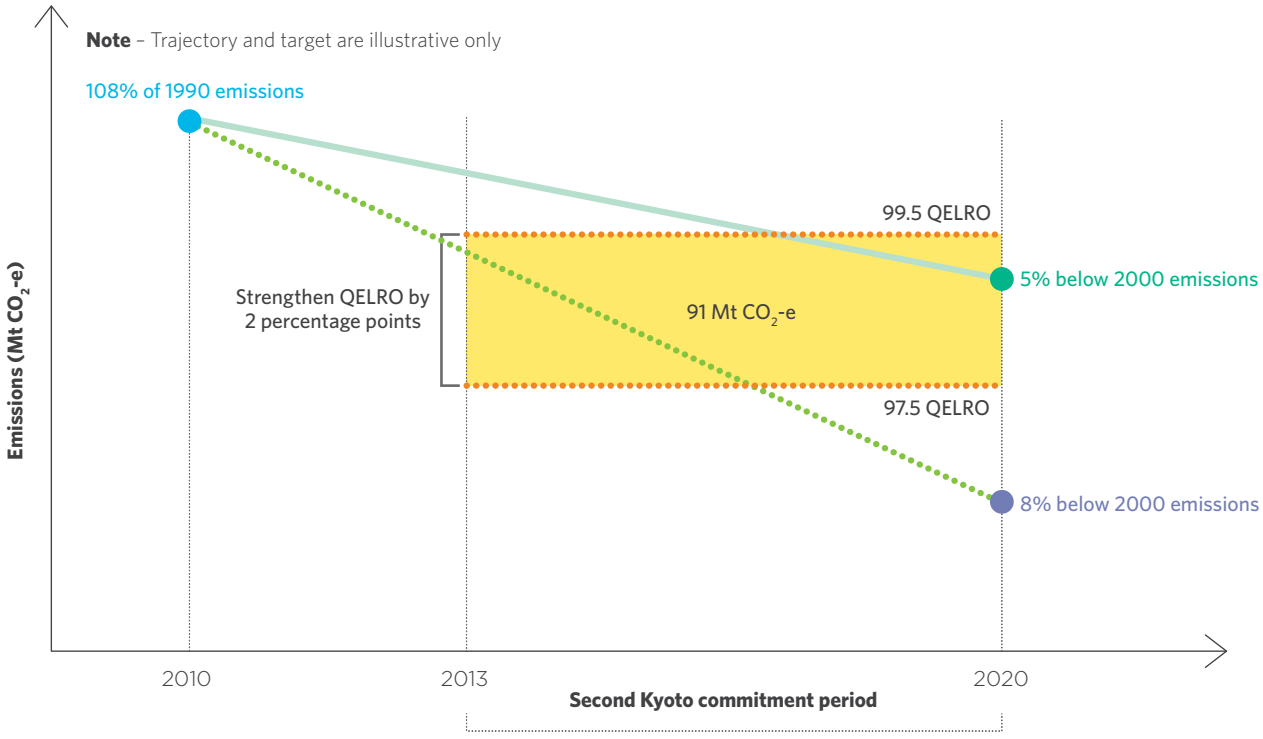
Having concluded what kinds of goals the Authority should recommend, Chapter 9 begins the task of considering the level of the goals by recommending a 2013–2050 emissions budget for Australia.

FIGURE 8.3: CARRYOVER RELATIVE TO THE 2013–2020 BUDGET AND 2020 TARGET



Note: As discussed in Section 8.4, the indicative national trajectory begins at 108 per cent of 1990 emissions in 2010 to be consistent with Australia's commitments under the Kyoto Protocol.
Source: Climate Change Authority

FIGURE 8.4: CARRYOVER RELATIVE TO AUSTRALIA'S SECOND COMMITMENT PERIOD TARGET



Note: QELRO is a Quantified Emission Limitation or Reduction Objective.
Source: Climate Change Authority

CHAPTER 9 AUSTRALIA'S EMISSIONS BUDGET TO 2050

In Chapter 3, the Authority set out the global emissions budget consistent with a likely chance of keeping temperature increases relative to pre-industrial levels to below 2 degrees. Chapter 9 considers Australia's fair share of this finite global emissions budget, and how this long term national emissions budget informs its short and medium term emissions reduction goals.

Equity is one of the Authority's legislated guiding principles, and deserves explicit consideration in setting Australia's emissions reduction goals. The Authority has considered various approaches to determining Australia's fair share of the global emissions budget adopted in Chapter 3, and how to use Australia's national budget over time.

Equality in emissions rights per person is desirable, but takes time to achieve. A 'modified contraction and convergence' approach gradually shifts from Australia's high current per person emissions to equal emissions rights in the long term; this is an equitable and feasible approach for Australia. As a share of the Authority's preferred global emissions budget, this implies a national emissions budget of 10 100 million tonnes of carbon dioxide equivalent (Mt CO_2-e) for the period 2013 to 2050. This is about 17 years of emissions at current levels.

Different ways of 'spending' the national emissions budget over time imply different costs and risks for Australians over the coming decades. A 5 per cent 2020 target would require an implausibly rapid acceleration of effort beyond 2020. If Australia adopted it and still wished to meet its fair share of the 2 degree budget, it would need to reduce emissions by a further 45 percentage points in the decade to 2030, and then would have only 14 per cent of its budget left for the next two decades. A 2020 target of not less than 15 per cent would keep Australia's future options open, including the option of Australians doing their fair share of the strong global action that is in the national interest.

The Authority's recommended emissions reduction goals for Australia, including the 2050 budget, are 'net' goals. That is, to the extent that Australia's domestic emissions exceed the budget, they must be offset by genuine emissions reductions purchased from overseas.

Chapter 9 takes the estimated global emissions budget adopted in Chapter 3 as its starting point. It considers Australia's fair share of the global budget and how Australia might use this share over time. It covers:

- different ways to share a global emissions budget, and their implications for Australia;
- the recommended long term national emissions budget; and
- the implications of this long term emissions budget for Australia's 2020 emissions reduction goals.

9.1 APPROACH TO DETERMINING AUSTRALIA'S SHARE

The internationally agreed goal of limiting global warming to below 2 degrees implies a tight constraint on global emissions. As discussed in Chapter 3, the Authority has adopted a global emissions budget to 2050 that provides at least a likely chance of limiting warming to below 2 degrees. This global budget of 1 700 gigatonnes (Gt) CO_2-e provides a reference point for considering Australia's national emissions budget to 2050 (our 'long term' national budget).

As discussed in Chapter 8, a long term national budget provides an important reference point for choosing short and medium term emissions reduction goals. If these goals were adopted without considering the long term constraint, Australia might emit so much in the near term that it would have no budget left for later.

Deciding how much of the global emissions budget Australia should allocate itself necessarily involves thinking about what constitutes a fair share. There are many different ideas about what is fair, and deciding on a fair share for Australia is necessarily a matter of judgement. The Authority has considered a range of approaches in coming to its judgement of an appropriate 2050 budget for Australia.

The Authority has also assessed the feasibility of different approaches to sharing global budgets, from two perspectives – whether the national budget implied by a particular approach is feasible for Australia, and whether the approach would help Australia play a constructive role internationally.

On the second of these, there is no international process that assigns national targets based on a specific allocation principle or approach. Rather, countries assess their own national interest, and take domestic actions and make international commitments accordingly. It is not the Authority's role to promote global action on climate change per se. That said, given that securing our national interest in limiting warming to below 2 degrees requires strong global action, the Authority can usefully consider how Australia can play a constructive role internationally. It is clearly in Australia's interest to persuade and encourage other nations to strengthen their contributions to international action; Australia is likely to be more persuasive and encouraging if its own goals are viewed as a fair contribution by others. Similarly, Australia is likely to be more persuasive if it adopts an approach that would strengthen global efforts if it were also adopted by other nations.

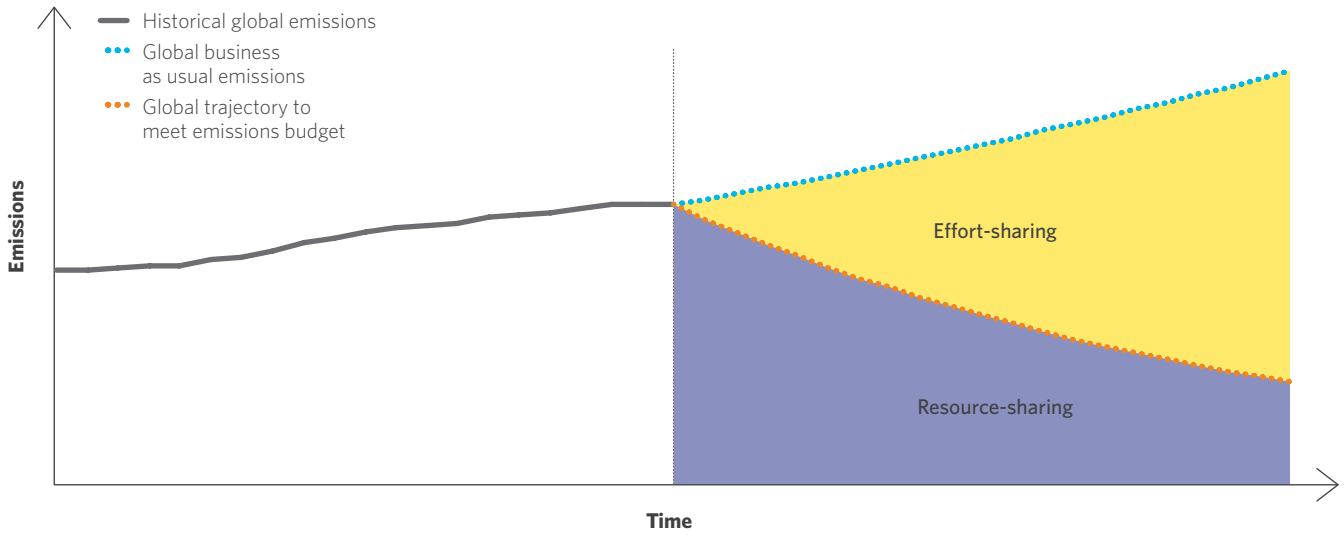
Careful analysis of equity has helped the Authority recommend a long term national emissions budget that represents Australia's fair share of the finite global budget. The following sections set out this analysis, providing a robust, transparent basis for determining Australia's long term budget and its use over time.

9.2 APPROACHES TO SHARING A GLOBAL EMISSIONS BUDGET

Countries have different levels of development and income per person and make different contributions to cumulative greenhouse gas emissions that are the cause of climate change. All countries have agreed that those with greater capacity to act and responsibility for emissions should lead action on climate change. This agreement is reflected in Article 3 of the United Nations Framework Convention on Climate Change (UNFCCC), which states 'the Parties should protect the climate system ... on the basis of equity and in accordance with their common but differentiated responsibilities and respective capabilities'.

There are two broad approaches to sharing emissions reduction efforts – sharing a desired global emissions budget ('resource-sharing') or sharing the emissions reductions required to meet that budget ('effort-sharing') (Figure 9.1). In some ways, the two approaches are similar – sharing the remaining budget implicitly sets a mitigation task and vice versa. But from a practical perspective, resource-sharing can often be more feasible – it requires only an estimate of the global emissions budget (discussed in Chapter 3) and equitable principles. In contrast, effort-sharing also requires an estimate of the global emissions trajectory in the absence of climate change action. As more countries take more action, this trajectory becomes increasingly abstract and difficult to estimate.

FIGURE 9.1: RESOURCE-SHARING VERSUS EFFORT-SHARING



Source: Climate Change Authority

The rest of this Section sets out the approaches that the Authority has considered. None of these approaches is prescriptive about where emissions reductions take place. Australia's domestic emissions could be higher than the allocation so long as additional emissions reductions are purchased from another country. This is consistent with the Authority's recommendation on the use of international emissions recommendations (see Chapter 13), accounting rules under the Kyoto Protocol and likely accounting under future international agreements for the period after 2020.

While almost all of the approaches are based on the emissions rights of individuals, none would allocate emissions budgets directly to individual Australians. Rather, these approaches develop budgets by starting with principles based on individuals, then aggregate to the national level.

9.2.1 RESOURCE-SHARING APPROACHES BASED ON EMISSIONS RIGHTS PER PERSON

There are four resource-sharing approaches based on equal emissions rights per person. Three involve a gradual move to equal emissions rights per person and the fourth involves immediate equality.

CONTRACTION AND CONVERGENCE

Under contraction and convergence, emissions per person contract over time in countries above the global average, and rise over time in countries below the global average, reaching a 'convergence level' of equal per person emissions in a specified future year. The convergence year is a key variable in this approach. A shorter convergence period results in smaller budgets for countries which, like Australia, start with above average per person emissions.

The Authority has used 2050 as its preferred convergence year when analysing these approaches, balancing the feasibility of the transition with the goal of equalising per person emissions rights.

MODIFIED CONTRACTION AND CONVERGENCE

This approach was proposed by Professor Garnaut in his 2008 Review. It involves two main modifications to simple contraction and convergence – developing countries are allowed increasing emissions per person for a transitional period; and developed countries reduce emissions more quickly to provide this headroom (Garnaut 2008). Specifically, it allows developing countries' allocations to grow at half their economic (gross domestic product) growth rate, if that is greater than the growth rate of their allocated emissions under the simple contraction and convergence approach.

Professor Garnaut proposed modified contraction and convergence because some rapidly growing developing countries are close to the global per person average for greenhouse gas emissions. Under simple contraction and convergence, they would have to either stop the growth in their per person emissions very soon or purchase large volumes of emissions reductions from other countries. Professor Garnaut argued that, for these nations, the first is difficult and the second is inequitable. The modified approach provides some 'headroom' to allow high-emitting developing countries to make a more gradual adjustment. All countries converge to equal per person shares by 2050.

COMMON BUT DIFFERENTIATED CONVERGENCE

Under this variant of contraction and convergence, developing countries are provided headroom through delayed reductions rather than larger allocations. Countries begin to reduce per person emissions when they reach a specified threshold of the (time varying) global average, then move linearly to the convergence level. Regardless of when countries begin to reduce emissions, they have the same amount of time to reach the convergence level.

The threshold level of emissions and the amount of time to reach the convergence level are policy choices that depend on the global emissions budget. For budgets that limit temperature increases to below 2 degrees there is no headroom for some higher emitting developing countries (Höhne and Moltmann 2009, p. 25).

IMMEDIATE CONVERGENCE

Contraction and convergence equalises per person emissions at a point in the future. Immediate convergence – also referred to as an equal cumulative per person emissions approach – equalises per person emissions straight away. The Authority has calculated indicative budgets using this approach, adjusting for changes in countries' share of the global population over time so that each person alive in a given year has an equal share of that year's available emissions.

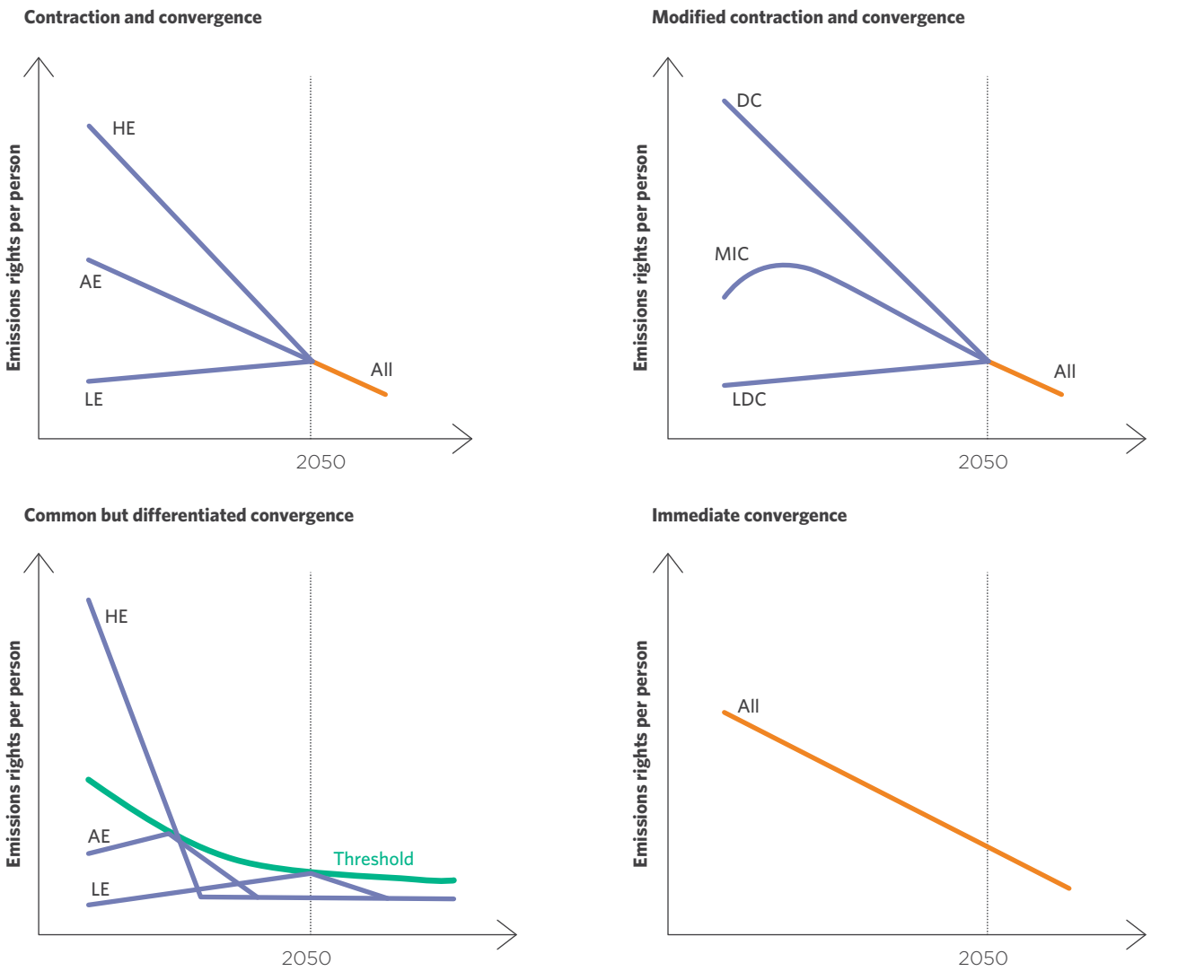
Some proposals for equal cumulative per person emissions do not adjust for population changes over time (see, for example, German Advisory Council on Global Change 2009). Instead, they allocate each nation a share of the global emissions budget equal to its share of global population in a single 'reference year'. These variants do not really give effect to the principle of equal emissions per person, so the Authority has not considered them in detail. Other proposals include historical emissions in the calculations; for example, Jayaraman, Kanitkar and D'Souza (2011) incorporate emissions from 1970. Under this approach, Australia's 2000–2050 emissions budget is negative. This means that Australia's past emissions have already more than exhausted its entitlements, and the right to all ongoing emissions would have to be purchased from countries with positive entitlements. The Authority's view is that distant past emissions should not be included as these occurred when their harmful effects could not be foreseen.

Figure 9.2 provides a stylised comparison of these four resource-sharing approaches. It shows how contraction and convergence and common but differentiated convergence are based on per person emission levels only, while modified contraction and convergence takes levels of development directly into account. Immediate convergence requires instant equality for all countries regardless of their characteristics.

Figure 9.3 illustrates the implications of the four resource-sharing approaches for Australia's long term national emissions budget, showing its share of the global 2 degree budget adopted in Chapter 3. It also shows two simple budgets to help put the others into perspective – a 'status quo share' based on Australia's current share of global emissions, and a 'population share' based on Australia's current share of the global population.

All four approaches give a budget comparable to or smaller than the one based on Australia's current share of global emissions. Modified contraction and convergence provides a budget around 20 per cent smaller than simple contraction and convergence, in part because it allows developing countries a greater share of the global budget. Immediate convergence provides a very small national emissions budget.

FIGURE 9.2: COMPARISON OF APPROACHES WITH EQUAL PER PERSON EMISSIONS RIGHTS



HE Country with high emissions per person
AE Country with average emissions per person
LE Country with low emissions per person
All All countries
DC Developed country
MIC Middle income country
LDC Less developed country

Source: Climate Change Authority based in part on Höhne and Moltmann 2009

The next Section discusses two effort-sharing approaches. These are not included in Figure 9.3 because allocations are not available over the period to 2050, so long term national budgets cannot be derived.

9.2.2 EFFORT SHARING APPROACHES

EQUAL PROPORTIONAL EMISSIONS REDUCTION COSTS

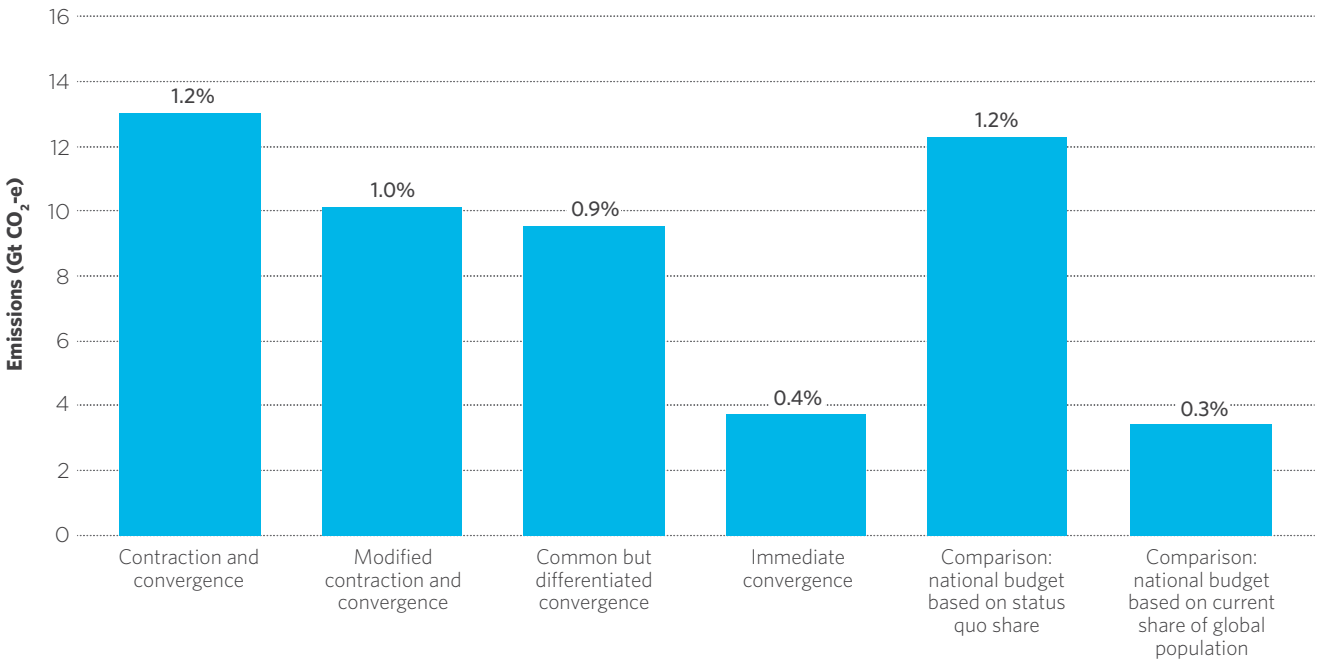
This approach seeks to equalise the wellbeing forgone when taking action to reduce emissions. It generally uses Gross Domestic Product (GDP) as a proxy for wellbeing, and allocates mitigation targets among developed countries so that each incurs the same total emissions reduction cost as a proportion of GDP.

The implications for targets depend critically on whether countries undertake all emissions reductions domestically or can source them internationally:

- If international emissions reductions cannot be used, developed countries facing higher total emissions reduction costs have weaker targets, and those facing lower costs have stronger targets, so that the cost as a share of GDP is the same in both countries.
- If international emissions reductions can be used, all countries can collectively achieve the emissions reductions at a lower cost, because reductions can take place wherever in the world they are cheapest. Developed countries with higher total costs would still have weaker targets under this approach than those with lower costs; however, the difference in targets would be smaller than without trade.

There are not many published studies that address the specific question of relative costs explicitly. While those that do vary, a common conclusion is that Australia faces relatively high total emissions reduction costs (see, for example, McKibbin, Morris and Wilcoxen (2010) and den Elzen et al. (2009)). This means that Australia's target under this approach would be relatively weaker than those of developed countries with lower costs.

FIGURE 9.3: AUSTRALIA'S LONG TERM NATIONAL EMISSIONS BUDGET UNDER VARIOUS APPROACHES (Gt CO_2-e) AND SHARE OF THE GLOBAL EMISSIONS BUDGET (PER CENT)



Notes: National emissions budget for 2013–2050. All approaches share a global emissions budget consistent with a 67 per cent probability of limiting temperature increases to 2 degrees. Australia's status quo share based on its share of global emissions including emissions from land use, land use change and forestry.

Source: Global budget: Authority calculation based on Meinshausen et al. (2009) adjusted using International Energy Agency (IEA) (2012a) and (2012b) and The Treasury and DIICCSRTE modelling (2013). Approaches: Authority calculations based on spreadsheet tool used for the Garnaut Review (2008) with updates for emissions, population and Gross Domestic Product from The Treasury and DIICCSRTE modelling (2013) (contraction and convergence; modified contraction and convergence); Höhne and Moltmann (2009) and inputs to spreadsheet tool (common but differentiated convergence); Authority calculations based on The Treasury and DIICCSRTE modelling (2013) and IEA (2012b) (other approaches).

GREENHOUSE DEVELOPMENT RIGHTS

The Greenhouse Development Rights approach takes differences in capacity within nations explicitly into account. Each country's share of emissions reductions is based on two things – how many people in that country have incomes above a 'development threshold' and how many emissions those people have generated since 1990. These are combined in a Responsibility-Capacity Index, which is used to calculate the country's share of the global emissions reduction task. Under this approach, short term targets for developed countries can be very strong indeed.

9.3 ASSESSMENT OF AUSTRALIA'S FAIR SHARE

All things considered, it is the Authority's view that:

- some approaches are not feasible for Australia;
- focusing solely on equalising costs has conceptual and practical problems;
- a budget based on eventual convergence to equal per person emissions rights is desirable; and
- modified contraction and convergence provides a budget for Australia that is both equitable and feasible.

9.3.1 SOME APPROACHES ARE NOT FEASIBLE FOR AUSTRALIA

Some approaches imply very small emissions national budgets and therefore unrealistically rapid emissions reductions for Australia. This includes immediate convergence (which implies a 2020 target of more than 70 per cent below 2000 levels) and the Greenhouse Development Rights approach (which implies a 2020 target of more than 55 per cent below 2000 levels), both of which received some support in submissions. The desirability and feasibility of very deep near term cuts depends in part on how much of Australia's emissions reductions can be sourced internationally. If there is a strong desire to undertake a large share of emissions reductions within Australia, then near term reductions of this magnitude are probably infeasible.

As an effort-sharing approach, there are also important practical problems with using Greenhouse Development Rights to inform budgets over long timeframes. As more countries take more action, the 'no action' trajectory required to calculate targets becomes increasingly abstract and difficult to estimate.

9.3.2 FOCUSING SOLELY ON EQUALISING COSTS HAS CONCEPTUAL AND PRACTICAL PROBLEMS

Approaches focusing on costs of emissions reductions received support from several stakeholders, including the Business Council of Australia (*Issues Paper submission*, p. 3), which recommended that the Authority 'adopt an approach to determining Australia's fair share of any global emissions budget that equates the economic costs that Australians are expected to pay with those of similar wealth', and the Australian Industry Greenhouse Network, which stated that:

> *The [Climate Change Authority] should consider reframing this discussion in terms of the relative economic burden of making emissions reductions, since such a metric more closely reflects the working reality that Australia must operate within in international negotiations. (Issues Paper submission,* p. 5*)*

Costs are undoubtedly important and the Authority takes the economic and social impacts of climate action seriously. Chapter 10 examines the potential costs of achieving different targets in detail. Nevertheless, cost-based approaches to sharing global climate action have three important conceptual and practical limitations.

First, costs are only one aspect of Australia's fair contribution to global action. Australia's capacity, responsibility and exposure to climate change are also relevant considerations. By international standards, Australia is a wealthy nation with high per person emissions relative to other countries and high exposure to climate damages. It is therefore fair that Australia take on some additional costs – particularly relative to developing countries, for which poverty eradication and improving living standards are the most important priority. If costs were to be equalised across developed countries only, then Australia's relatively high exposure to climate damages and responsibility for emissions still suggest it might take on additional costs. In this case, the practical difficulties of attempting to take on equal costs would be compounded by first having to determine a fair share for developed countries as a whole.

Second, the costs of emissions reductions – and their distribution across households and industry – depend heavily on policy design. As Chapter 10 shows, Australia can achieve strong targets at modest costs. Policies can be designed to assist households with increased costs and to moderate the impact on businesses. If countries choose to pursue more costly policies, it should not follow that their fair share of the global budget increases.

Third, economic models are not well suited to divining the long term equitable contribution of each country to the global mitigation task. Modelling involves making a wide range of assumptions about the future, including industrial composition, technology development and policy design across the world. Projections necessarily become more speculative over the longer term. This suggests that it would be difficult to identify emissions reduction targets that equalised proportional reductions in GDP across countries. Further, the results could be contested rather than useful, as countries would have a perverse incentive to inflate their estimated costs. These points were made by Macintosh (2013, p. 17), who concluded that:

> *Economic modelling is too unreliable, too subjective and too vulnerable to manipulation to provide a reliable and objective basis from which to set caps. Economic modelling has its uses, including in relation to the formulation of climate policy. The danger lies in exactly how it is used.*

The Authority therefore considers that the costs of emissions reductions – by themselves – are not an appropriate way to determine Australia's fair share of the global emissions budget.

9.3.3 A BUDGET BASED ON EVENTUAL CONVERGENCE TO EQUAL PER PERSON EMISSIONS RIGHTS IS DESIRABLE

On balance, the Authority's view is that eventual equality in per person emissions is fair. These approaches have received quite widespread support in Australia and among the international community. The 2008 Garnaut Review stated that:

> *... the approach that seems to have the most potential to combine the desired levels of acceptability, perceived fairness and practicality is one based on gradual movement towards entitlements to equal per capita emissions.* (p. 202)

Many submissions that discussed budget-sharing expressed support for equal emissions shares per person. For example, the Investor Group on Climate Change wrote that Australia should set:

> *... national reduction targets that reflect our fair share of the global effort required under the 'contraction and convergence' approach to limit global temperature increases to two degrees. (Issues Paper submission,* p. 1*)*

Despite the quite widespread support, there are some notable criticisms of equal per person emissions, including that it:

- **Creates perverse incentives for population growth.** Some suggest that allocating national rights based on population size may make countries increase their populations to gain a larger allocation.
- **Relies on unacceptably inaccurate population projections.** Errors in country level population projections 40 or 50 years ahead can be quite large.

The Authority does not find these criticisms convincing.

Regarding population growth, while national allocations increase one for one with population, staying within a larger budget with more people is unlikely to be much easier than staying within a smaller budget with fewer people. Moreover, emission rights could only ever be one of many factors influencing a country's population and immigration policy.

On the accuracy of future population projections, periodic review of longer term goals can include revisions to take account of new population projections and the Authority recommends this be incorporated in the regular review of Australia's post-2020 goals (see Chapter 8).

Two further criticisms warrant closer inspection – that equality in per person emissions:

- **Does not explicitly consider historical responsibility.** Approaches that achieve equality in emissions per person start from the status quo and as such do not take responsibility for previous emissions explicitly into account when determining emissions reduction goals.
- **Is unfair.** Stern (2012) argues that allocating one good (emissions rights) without taking account of peoples' other goods or characteristics (such as income) is counter to conventional public economics. He shows that a more conventional public economic approach would generally result in a larger allocation to lower income nations and smaller allocations for wealthy nations like Australia.

The Authority's view is that distant past emissions should not be included in determining a country's fair share – these emissions occurred when their harmful effects could not be foreseen. While the modified contraction and convergence approach does not directly account for historical emissions, it does place extra responsibilities on developed countries with high per person emissions. These countries reduce their emissions more rapidly to provide the 'headroom' for rapidly industrialising countries.

The modified contraction and convergence approach also goes some way to dealing with Stern's criticism, by taking countries' level of development as well as current emissions per person into account. More broadly, the Authority is inclined to agree with Stern's suggested way forward on this issue. He writes:

> *Whilst the poor countries have much the better of the argument on equity, between the rigidity and intransigence of [rich and poor nations], the future of their children is held hostage … And it is poor people who are at the most risk. But there is a way forward. It is not to drop the equity criteria but to embed them in the idea of rich country support in fostering the dynamic and attractive transition to the low-carbon economy in both their own countries and as a driver of growth and poverty reduction in the developing world.* (Stern 2012, pp. 101–2)

It is in that spirit that the Authority reiterates that equity on climate change has implications beyond Australia's emissions reduction goals. Australia already provides support for mitigation and adaptation to developing countries through its overseas development program and could enhance this contribution further if desired.

9.3.4 MODIFIED CONTRACTION AND CONVERGENCE PROVIDES A BUDGET FOR AUSTRALIA THAT IS BOTH EQUITABLE AND FEASIBLE

Of the equal per person approaches, the Authority finds that modified contraction and convergence is the most equitable and feasible.

A simple contraction and convergence approach implies too great a burden on developing countries. It implies, for example, that China's and Papua New Guinea's per person emissions would need to fall from now. A common but differentiated convergence approach implies very demanding emissions reduction goals for high-emitting developing countries for the smaller global emissions budgets that are in Australia's national interest.

Modified contraction and convergence is fairer than both simple contraction and convergence and common but differentiated convergence. By providing headroom rather than requiring immediate reductions, this approach allows rapidly developing countries somewhat more time to decarbonise their economic growth. By allowing all countries to transition from their current position, rather than move immediately to equal rights, it also implies stronger but manageable emissions reductions for developed countries. This approach therefore provides the best basis for determining Australia's appropriate share of the global emissions budget, and gives guidance on Australia's other emissions reduction goals.

9.4 AUSTRALIA'S NATIONAL EMISSIONS BUDGET

The Authority's recommended national emissions budget to 2050 based on Australia's fair share of the global budget is 10 100 Mt CO_2e.

To derive a national budget, first the 2000–2050 global emissions budget of 1 700 Gt CO_2e (see Chapter 3) is adjusted to remove historical global emissions from 2000–2012 (around 600 Gt CO_2e). Second, projected emissions from international aviation and shipping for 2013–2050 (about 50 Gt CO_2e), are removed, as these are not allocated to any individual country (see Section 8.6.1). Third, Australia's share of the resulting 2013–2050 global emissions budget is calculated as its share of emissions under a modified contraction and convergence approach. Appendix C6 provides further details. The Authority will carefully monitor new data with implications for the recommended national emissions budget and reflect relevant developments in its Final Report.

The Authority's recommended emissions reduction goals for Australia, including the 2050 budget, are 'net' goals (see Chapter 8). That is, to the extent that Australia's domestic emissions exceed the budget, they must be offset by genuine emissions reductions purchased from overseas. To put it in perspective, the budget represents about 17 years of current Australian emissions; Australia's domestic emissions could be higher if they are offset.

The Authority recommends that this budget be reviewed on a regular basis, taking into account developments in climate science, international action and the costs of reducing emissions.

DRAFT RECOMMENDATION

R.4 That the national carbon budget for the period 2013–2050 be 10 100 million tonnes of carbon dioxide equivalent (Mt CO_2-e), and be reviewed on a regular basis.

9.5 A RESPONSIBLE LONG TERM BUDGET INFLUENCES AUSTRALIA'S SHORT TERM CHOICES

This Section explores implications of long term national emissions budget for the distribution of Australia's effort over time.

As discussed in Chapter 8, in addition to the long term national emissions budget, the Authority will recommend a medium term trajectory range and goals to 2030, including a 2020 emissions reduction target. This set of goals must be internally consistent and provide reasonable steps from one milestone to the next. The importance of choosing internally consistent goals was raised by AGL Energy Limited *(Issues Paper submission)*. A stronger 2020 target provides greater flexibility in later reductions to stay within the 2050 budget. A weaker 2020 target requires stronger action to 2030 and beyond. This has implications for the costs and risks faced by Australians of different ages. Some trajectories imply a distribution of effort that is so uneven that recommending such a path would be inequitable and lack credibility.

The bottom of the Authority's recommended trajectory range indicates the scale of effort required between 2020 and 2030 to stay within the recommended national emissions budget. As described in Chapter 8, the bottom trajectory plots a straight-line pathway from the 2020 target to meet the recommended 2050 budget. Such trajectories provide a clear signal to the international community – Australia is prepared to do its fair share of the effort required to give the world a likely chance of staying below 2 degrees of warming.

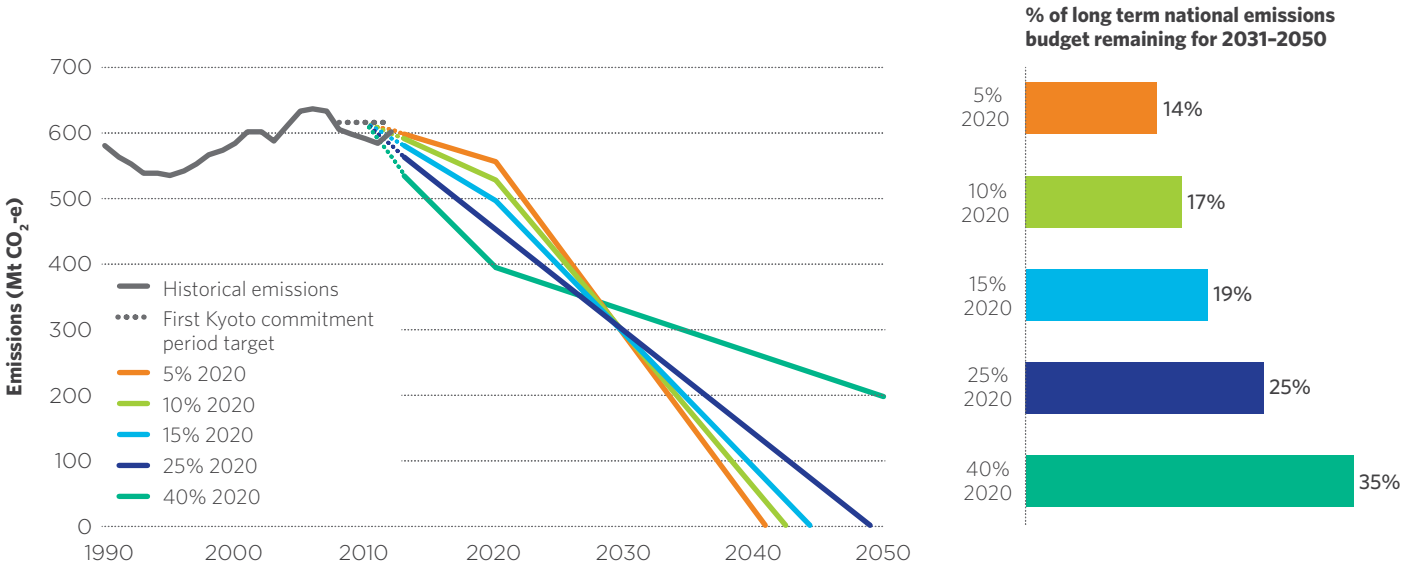
A 5 per cent 2020 target requires an implausibly rapid acceleration of effort between 2020 and 2030 to remain within the long term budget. A 25 per cent target sets a pace that needs to be maintained to 2030 and beyond; a 15 per cent 2020 target would require some acceleration after 2020.

The bottom trajectory ranges for these and two other 2020 targets (10 and 40 per cent) are shown in Figure 9.4. The figure also plots:

- the continuation of the straight-line trajectory past 2030, to indicate when the national emissions budget would be exhausted; and
- a straight-line trajectory to 2050 to illustrate the amount of the national emissions budget to 2050 remaining after 2030 for each target. These post-2030 trajectories are illustrative only, in part because the Authority recommends that the long term national emissions budget be reviewed on a regular basis (see Chapter 8). The Authority is not recommending a 2050 target in this Review, and a range of 2050 targets could be consistent with the Authority's recommended national emissions budget; see Box 11.1 for further discussion.

For example, with a 2020 target of 15 per cent and the recommended 2050 budget, the difference between the 2020 target and the bottom of the trajectory range in 2030 would be 35 percentage points. This jump seems challenging; the Authority considers changes greater than this to be implausibly large.

FIGURE 9.4: RELATIONSHIPS BETWEEN 2020 TARGETS, 2030 TRAJECTORIES AND NATIONAL EMISSIONS BUDGETS



Source: Climate Change Authority; historical emissions from The Treasury and DIICCSRTE 2013

Overall, Figure 9.4 shows that:

- **A 2020 reduction target of 5 per cent is not a fair or responsible next step to meeting the 2050 emissions budget.** If Australia adopted it and still wished to meet its fair share of the 2 degree budget, it would need to reduce emissions by a further 45 percentage points in the decade to 2030, and then would have only 14 per cent of its budget left for the next two decades.
- **The minimum 2020 target that can be credibly combined with the recommended budget is 15 per cent.** A 15 per cent 2020 target would require faster reductions in the 2020s than the 2010s, with a 35 percentage point change between the 2020 target and the bottom of the 2030 trajectory range. A 25 per cent target would involve a relatively constant rate of emissions reductions from 2010 to 2030.
- **If Australia adopted a 2020 target of 25 per cent it would keep open the possibility of pursuing a stronger 2050 budget or a lower warming limit in the future.** This is discussed further in Chapter 11.
- **A 40 per cent 2020 target would also keep open stronger budgets, but represents a very steep jump from Australia's current position.** The argument that anything more than a 35 percentage point jump between targets 10 years apart is too large rules out both 5 and 40 per cent 2020 targets for Australia.

In summary, a 5 per cent target for 2020 cannot credibly be described as a 'gradual start' to meeting Australia's 2 degree budget. A 5 per cent target would leave such large reductions for later that future Australians would either face a very large emissions reduction task or have to abandon the long term national emissions budget. This is inequitable in the first case and against Australia's national interest in the second. It is avoidable in both cases by adopting a 2020 target of not less than 15 per cent. This would preserve Australia's options and allow it to respond to a wide range of futures, including making its fair contribution to global action to limit warming to below 2 degrees. Chapter 10 considers the economic implications of moving from the 5 per cent target to one consistent with Australia's fair share of the global emissions budget geared to limiting warming to below 2 degrees.

CHAPTER 10 ECONOMIC IMPLICATIONS OF AUSTRALIA'S EMISSIONS REDUCTION GOALS

10

Australia can achieve stronger targets than the minimum 5 per cent at a relatively small cost.

Australia faces a substantial but achievable emissions reduction task to 2020. Emissions are projected to grow to 17 per cent above 2000 levels in the absence of a carbon price or new policy. This is less than the previous projection of 22 per cent above 2000 levels, making Australia's emissions reduction target range somewhat easier to achieve.

The Authority's analysis shows that Australia can achieve a 15 or 25 per cent reduction target while national income and the economy continue to grow. Under the current legislation, and with the minimum 5 per cent target, Gross National Income (GNI) per person is projected to grow by an average of 0.80 per cent annually over the period to 2020. GNI per person is projected to grow by an average of 0.78 per cent with a 15 per cent target, and by 0.76 per cent with a 25 per cent target. In dollar terms, GNI per person is projected to grow from about $62 350 in 2012 to about $66 450 in 2020 with a 5 per cent target; $66 350 with a 15 per cent target; or $66 250 with a 25 per cent target (all in real terms). This means GNI per person would reach the same level as the 5 per cent target ($66 450) less than three months later if Australia adopted a 15 per cent target; or five months later if Australia adopted a 25 per cent target.

The slightly slower growth associated with stronger targets represents the cost of Australia making its fair contribution to global efforts to limit global average warming to 2 degrees or less, relative to pre-industrial levels.

Economic costs, and the distribution of those costs across industries and households, will vary under different policy settings. The Government intends to replace the current legislation with the Direct Action Plan to reduce Australia's emissions. The details of this Plan are still being developed; the Authority has not speculated on its design. Nevertheless, the costs presented in this Chapter provide a useful comparative benchmark.

This analysis suggests using international emissions reductions to complement domestic reductions can help reduce the cost of meeting Australia's targets.

The preceding chapters considered the scale of global emissions reductions required to limit global warming to below 2 degrees, the action other countries are taking and how Australia's emissions reduction goals compare with other countries' goals. They also identified Australia's long term emissions budget and its implications for Australia's short term goals.

Chapter 10 adds to the analysis by examining the economic implications of achieving different 2020 targets. It:

- assesses the scale of Australia's emissions reduction task to 2020;
- considers how the economy would change if Australia moved beyond 5 per cent to a stronger target, and estimates the associated costs;
- examines how these costs are affected by the mix of domestic and international emissions reductions used to meet the target; and
- considers the longer term economic implications of 2020 targets.

10.1 EXAMINING THE ECONOMIC IMPLICATIONS OF DIFFERENT 2020 TARGETS

Australia's emissions reduction goals set the overall scale of its contribution to global action on climate change, and set the pace of Australia's transformation towards a low-emission economy.

Extensive analysis (such as Commonwealth of Australia 2011; Garnaut 2008), and Australia's own experience over the past two decades, shows it is possible to reduce emissions, grow the economy and improve wellbeing at the same time. As Chapter 7 shows, Australia's economic growth is gradually decoupling from emissions. Since 1990, the size of the Australian economy has approximately doubled, while emissions have remained relatively stable. This means the emissions intensity of the economy (emissions per dollar of Gross Domestic Product (GDP)) has halved.

Chapter 10 focuses on the cost of achieving different 2020 targets. The Authority has considered Australia's emission trends in the absence of a carbon price to understand the scale of the emissions reduction task and the broad economic implications of achieving different targets. The 5 per cent target is unconditional, so Australia's real choice is whether to stay with this minimum pledge or to adopt a stronger 2020 target. The 5 per cent target therefore provides an appropriate baseline for assessing the potential incremental cost of pursuing stronger targets.

10.1.1 USING MODELS TO ESTIMATE AUSTRALIA'S EMISSIONS AND ECONOMIC OUTLOOK

The Authority has used economic modelling to help assess the economic implications of different targets. The modelling explores Australia's emission trends, emissions reduction opportunities and economic outlook in the context of the global action required to reduce the risks of climate change. The modelling was conducted by the Commonwealth Treasury and the Department of Innovation, Industry, Climate Change, Science, Research and Tertiary Education (DIICCSRTE), in consultation with the Authority (referred to as The Treasury and DIICCSRTE modelling).

Economic models are useful for exploring the impacts of climate change mitigation policies, as they ensure internally consistent long term projections of economic activity and the resulting greenhouse gas emissions. While these models have their limitations, they integrate, in a comprehensive manner, economic and other data with economic theory about how the world responds to changing circumstances.

The Treasury and DIICCSRTE modelling uses a suite of global, national and sectoral models, including computable general equilibrium (CGE) models and detailed sector models for the electricity, transport and agriculture sectors. The detailed models provide granular analysis of the industrial sectors responsible for the majority of Australia's emissions, while the CGE models capture the longer term, economy-wide reallocation of resources over time. This approach is the most useful and appropriate framework currently available to assess the market costs of climate change mitigation in Australia. It builds on previous work to define Australia's goals and inform the design of Australia's policies (Garnaut 2008; Commonwealth of Australia 2011).

Further information on the modelling approach and assumptions is provided in The Treasury and DIICCSRTE modelling report (2013) at www.climatechangeauthority.gov.au.

In submissions responding to the Issues Paper, several stakeholders requested the potential costs of climate change itself be quantified and considered. For example, the Australian Conservation Foundation recommended that the Authority '[m]odel the social and economic costs of inaction on key ecosystem services in this and all subsequent reviews' (*Issues Paper submission*, p. 2).

The analysis presented in this Chapter is limited to the costs of reducing emissions; however, the Authority understands the importance of considering these in parallel with the benefits of action. Chapter 2 discusses the potential impacts of climate change at different levels of warming, including estimates of the potential social and economic costs. By moving to a stronger target, Australia can contribute to stronger global action to mitigate these negative economic, environment and social impacts, and help limit global warming to no more than 2 degrees. In making its recommendations for Australia's emissions reduction goals, the Authority has considered the benefits of stronger targets as well as the economic costs.

10.1.2 WHAT SCENARIOS HAVE BEEN MODELLED?

The Treasury and DIICCSRTE modelling examines a range of future scenarios to gauge Australia's potential economic and emissions outlook. The modelling makes assumptions about the future, including regarding the global economy, technology development, commodity prices and policy settings. These assumptions affect the identified emissions reduction opportunities in Australia and the estimated cost of achieving national emissions reduction goals. The assumptions draw on international and Australian analysis, expert advice and public consultation conducted in April 2013, and are set out in detail in the modelling report.

Assumptions regarding policy settings are especially challenging, as Australia's climate policy is currently being revised. The Government has indicated it intends to repeal the carbon pricing mechanism and implement its Direct Action Plan to reduce Australia's emissions, however, the details of this Plan are still being developed and the Authority has not speculated on its design.

The modelling has therefore assessed the economic impacts of achieving different targets under the current legislative settings. It remains informative, even if the policy settings change. The Authority has used high, medium and low carbon price scenarios; a scenario without the carbon price; and a number of sensitivity scenarios to explore the impacts on the economy and emissions (Box 10.1).

There are three reasons that the results of the modelling are informative, even if the policy settings change.

- First, the results estimate the scale of the **emissions reduction task to 2020** for the minimum 5 per cent target and the stronger targets being considered. The 'no price' scenario provides the basis for this estimate – it projects Australia's emissions with existing policies such as the Renewable Energy Target and energy efficiency standards, but excluding the carbon price.
- Second, the results estimate **the incremental cost of moving to stronger emissions reduction targets**. The modelling shows that stronger targets are achievable while maintaining economic growth. Though the modelling reflects a different policy framework to that planned by the Government, the costs provide a useful comparative benchmark.
- Third, the results indicate **emissions reduction opportunities** that might be available in the Australian economy at different incentive (price) levels, and the associated economy-wide costs. The modelling shows Australia has substantial emissions reduction opportunities across all sectors. While the results show the opportunities likely to be mobilised by the carbon price, many of these opportunities could be mobilised by other policies and incentives.

A key caveat on translating the modelling results to different policy settings is that the distributional effects for industry and households are highly sensitive to policy design. New analysis would be required to assess the distributional effects of the Direct Action Plan, once the detailed policy design is known. Again, the modelling presented here provides a useful benchmark against which to assess those effects.

The Authority will carefully monitor new policy developments, and their implications for the cost of achieving Australia's emissions reduction goals. Similarly, the Authority will review new emissions data and projections as they become available. It will reflect relevant developments in its Final Report.

Projections of Australia's emissions and economy from the modelling are used throughout this Draft Report. The next Section focuses on Australia's emissions outlook in the absence of a carbon price or new mitigation policy.

BOX 10.1: CARBON PRICE SCENARIOS IN THE MODELLING

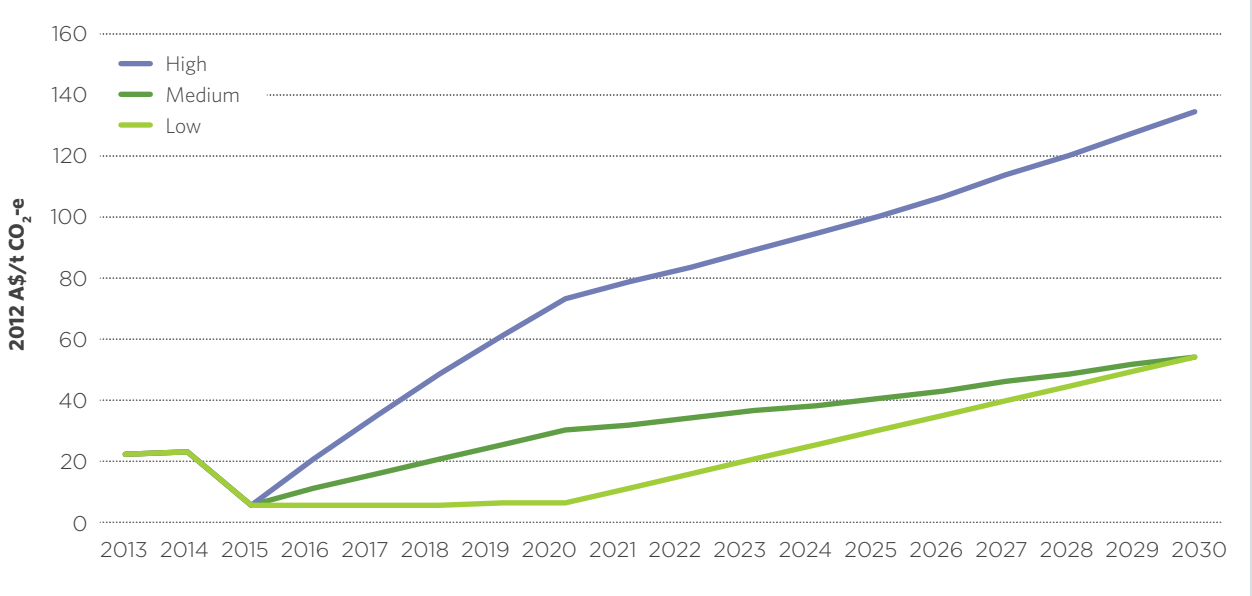
The Treasury and DIICCSRTE modelling examines four core scenarios – one without a carbon price and three different price levels. Table 3.1 of the modelling report provides details of the scenario assumptions.

The three price scenarios are largely based on the current legislation. Companies covered by the carbon pricing mechanism ('liable entities') have to pay for their emissions by surrendering emission units for each tonne of their emissions. The annual emissions cap determines the supply of Australian Carbon Units (ACUs); liable entities can also use Kyoto Protocol units (such as Certified Emissions Reductions (CERs)) to meet up to 12.5 per cent of their liability, and other eligible international units (such as European Union allowances, or EUAs) to meet up to 50 per cent of their liability. Emissions-intensive, trade-exposed industries receive some free emissions units; and sectors such as agriculture and forestry can generate carbon offsets for emissions reductions through the Carbon Farming Initiative.

The most important variable affecting emission levels is the price of ACUs (the carbon price). Given the links to international markets, the ACU price is assumed to follow the EUA price. The price outlook is uncertain and market forecasts vary. The scenarios therefore span a plausible range of prices, taking account of current carbon market conditions, market forecasts for international units and long term environmental goals.
The four scenarios presented in the modelling report and used in this Chapter are:

- **No price scenario** – assumes there is no carbon price and no Carbon Farming Initiative. This scenario includes emissions reductions from pre-existing measures such as energy efficiency measures and the Renewable Energy Target (RET).
- **Low scenario** – additionally assumes the carbon price and Carbon Farming Initiative are in place. The carbon price is fixed for two years, then moves to a flexible price. The flexible price begins at $5.49/tonne of carbon dioxide equivalent (t CO_2-e) in 2015, and grows at 4 per cent per year in real terms to reach $6.31 in 2020. The price then follows a linear transition to $54.48 in 2030.[1]
- **Medium scenario** – assumes the fixed price for two years, then a flexible price beginning at $5.49/t CO_2-e in 2015, and following a linear transition to $30.14 in 2020. From 2021 onward, the price follows the international price from the medium global action scenario, which grows at 4 per cent per year in real terms in US dollars.
- **High scenario** – assumes the fixed price for two years, then a flexible price beginning at $5.49/t CO_2-e in 2015, and following a linear transition to $73.44 in 2020. From 2021 onward, the price follows the international price from the ambitious global action scenario, which grows at 4 per cent per year in real terms in US dollars.

FIGURE 10.1: AUSTRALIAN CARBON UNIT PRICES FOR DIFFERENT SCENARIOS, 2013–2030



Source: The Treasury and DIICCSRTE 2013.

Kyoto units such as CERs currently trade at prices well below the prices used in these scenarios, and the modelling assumes there is a price difference between CERs and ACUs for the period to 2020. As a result, liable entities face an effective carbon price below the ACU prices in Figure 10.1; this effective price is a weighted average of the ACU and CER price each year, with weights reflecting the CER sub-limit.

The Authority notes that some assumptions in the modelled scenarios differ from the current legislation; for example, the legislation provides for a three-year fixed price. Sensitivity analysis indicated the differences have only a small impact on emissions and costs. The Authority therefore uses the modelled scenarios for its analysis of the economic impacts in this Chapter.

1 All dollar amounts (prices and costs) reported in this Chapter are 2012 Australian dollars, unless otherwise stated.

10.2 AUSTRALIA'S EMISSIONS REDUCTION TASK TO 2020

To assess the costs of achieving emissions reduction goals, we need to understand the scale of the task. To this end, the Authority has assessed the emissions outlook for Australia, taking into account existing policies such as the Renewable Energy Target (at its current legislated level) and energy efficiency programs, but excluding the carbon price and Carbon Farming Initiative. This is the 'no price scenario'. Figure 10.2 shows the national emissions reduction task – that is, the level of additional emissions reductions that Australia's new climate change policies will need to achieve to meet different 2020 targets.

In the no price scenario, Australia's emissions are projected to grow to 17 per cent above 2000 levels by 2020. Australia's international commitments relate to the period 2013 to 2020, so Australia needs to reduce its emissions every year to 2020. The cumulative emissions reduction task is 593 million tonnes of carbon dioxide equivalent (Mt CO_2-e) to achieve an emissions budget consistent with a 5 per cent target (131 Mt in 2020 alone); 898 Mt for a 15 per cent target; and 1 203 Mt for a 25 per cent target (Figure 10.2).

The national emissions reduction task to 2020 is substantial, but smaller than previous estimates. This reflects updates to historical emissions data, a lower outlook for electricity demand and lower rates of underlying growth in some emissions-intensive industries. It also reflects changes to the emissions accounting rules under the second commitment period of the Kyoto Protocol; these allow Australia to count a broader coverage of land sector activities toward its target (discussed in Section 8.7).

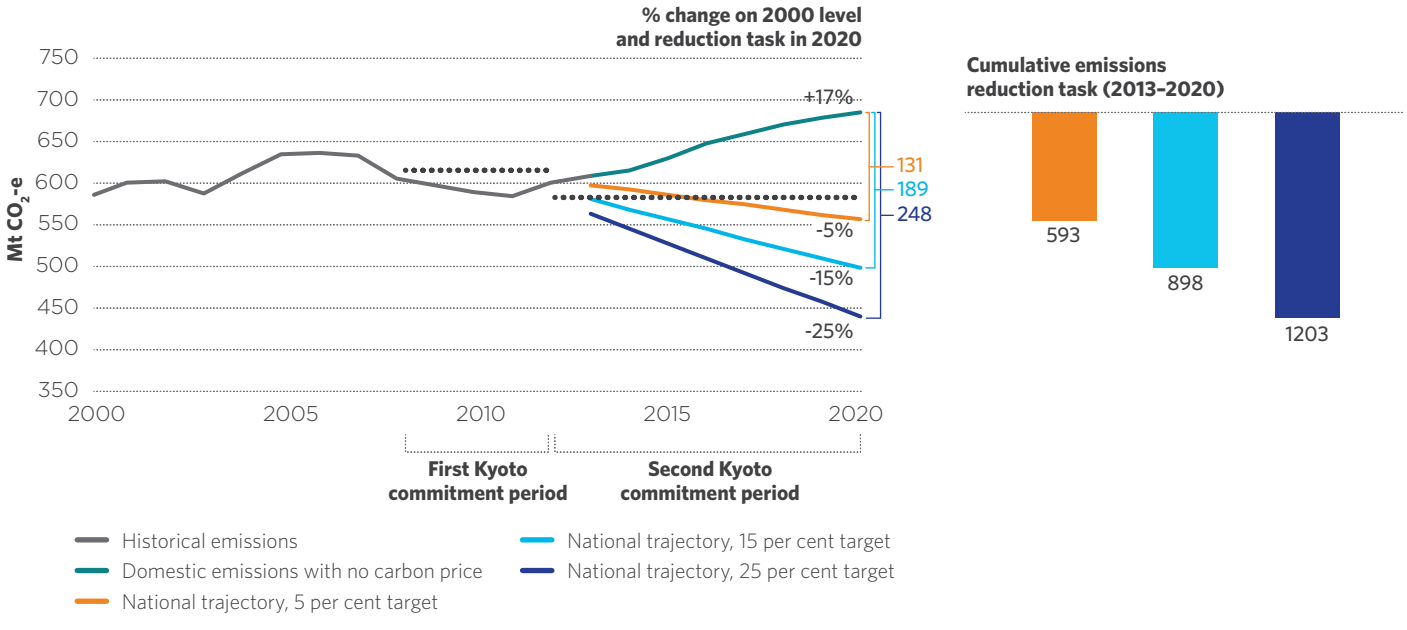
The smaller emissions reduction task makes it easier for Australia to pursue any particular target. For example, national emissions projections in 2012 suggested that Australia would need to cut its emissions by 754 Mt over the period 2013 to 2020, including by 155 Mt in 2020, to achieve the unconditional 5 per cent target (DCCEE 2012). If Australia reduced emissions by 754 Mt over the period to 2020, the latest projections suggest it would achieve an 11 per cent target instead. Adding Australia's carryover from the first commitment period of the Kyoto Protocol would increase this to a 14 per cent target (as discussed in Section 8.7.3)

DRAFT CONCLUSION

C.10 Australia's emissions reduction task for 2013 to 2020 is projected to be 593 Mt for the minimum 5 per cent target. This is substantial but achievable, and smaller than the 754 Mt task previously projected. If Australia reduced emissions by 754 Mt over the period to 2020, it would now achieve an 11 per cent target.

The next Section considers the incremental costs of adopting a target stronger than the minimum 5 per cent.

FIGURE 10.2: AUSTRALIA'S EMISSIONS REDUCTION TASK TO 2020



Notes: Emissions reduction task is in Mt CO_2-e. Dashed lines indicate Australia's Kyoto Protocol commitments: 108 per cent of 1990 emissions for 2008–2012; and 99.5 per cent of 1990 emissions for 2013–2020. The emissions reduction task has been adjusted (increased) to account for voluntary action (see Appendix E for estimates); it has not been adjusted for carryover from the first Kyoto commitment period (see Section 8.7.3 for estimates).

Source: Climate Change Authority, The Treasury and DIICCSRTE 2013.

10.3 COSTS OF MOVING BEYOND 5 PER CENT TO A STRONGER TARGET

This Section considers the incremental costs of moving from the minimum 5 per cent target to the stronger target options of 15 per cent or 25 per cent. It outlines the methodology for estimating these costs, distinguishing the economic impacts of the target from the impacts of the carbon price. It then presents the analysis, showing that Australia can achieve stronger targets at a relatively small cost.

The Authority recognises that the costs, and distribution of those costs, will depend on the policy implemented to achieve the targets. The Authority has assessed costs based on the current legislative settings; this provides a useful comparative benchmark.

The Authority's analysis assumes that a mix of domestic and international emissions reductions are used to achieve the target. Emissions are reduced within Australia if the marginal cost of achieving the reduction is less than or equal to the international carbon price. Section 10.4 examines the costs of achieving a greater share of the emissions reductions domestically.

10.3.1 THE IMPACT OF THE TARGET IS DISTINCT FROM THE IMPACT OF THE CARBON PRICE

To assess the costs of moving beyond the minimum 5 per cent target under the current legislation, it is important to distinguish between the economic impact of the carbon price and the impact of stronger targets.

THE LEVEL OF THE CARBON PRICE SETS THE INCENTIVE TO REDUCE EMISSIONS AND DETERMINES MOST OF THE ECONOMIC COSTS

Under current legislation, liable entities pay a price for their emissions. This increases the cost of emitting activities, so it encourages firms to reduce their emissions. The carbon price leads to changes in the economy, away from higher emissions-intensive activities towards lower emissions-intensive activities. The higher the carbon price, the more emissions reductions occur in the economy, and the higher the overall costs.

The level of the carbon price is what matters most to business and households. All else being equal, the carbon price determines the level of incentive to reduce emissions, the compliance cost for liable entities, and the costs passed through to consumers of emission intensive goods and services. Higher carbon prices create a larger incentive for firms to find ways to reduce their emissions, and for consumers to shift their consumption towards less emissions-intensive goods and services. As a result, higher carbon prices have a relatively larger impact on the economy.

In summary, the level of the carbon price determines the amount of emissions reductions that occurs in the economy.

MOVING TO A STRONGER TARGET DOES NOT CHANGE THE CARBON PRICE

Under the current legislation, the carbon price is not expected to be materially affected by the target. This seems counter-intuitive at first, but is a result of the links between the Australian carbon market and international markets.

The carbon price is a function of supply (the number of emissions units available to liable entities) and demand (emissions from liable entities). Changing the target would have a substantial effect on supply in a domestic-only market, but has a much smaller effect in a market linked to international markets.

- If Australia's carbon market was not linked to international markets, its target would determine the supply of emissions units – and, as a result, determine the level of emissions reductions required within Australia. Moving to a stronger target would reduce the supply of emissions units and increase the carbon price. The higher carbon price would drive greater emissions reduction efforts by liable entities, so that Australia's domestic emissions would fall to the target level. This extra effort would impose a relatively larger impact on the domestic economy.
- With international linking, Australia's target determines the supply of Australian carbon units. Moving to a stronger target would reduce the supply of Australian units, but have relatively little effect on global supply, as Australia is only a small share of the total market (Appendix C7 provides further detail). Moving to a stronger target is therefore not expected to have a material impact on the carbon price. If the carbon price does not change, incentives to reduce domestic emissions do not change; nor do the compliance costs faced by liable entities and the carbon costs passed through to consumers. Instead, liable entities would buy fewer Australian units and more international units (as long as they stayed within the overall 50 per cent limit on international units). Moving to a stronger target would drive additional emissions reductions – contributing to global climate action – but these would largely occur overseas rather than within Australia. Economic activity within Australia would be largely unchanged.

In summary, under the current legislation, the level of the carbon price (which is determined by international markets) is the primary determinant of economic costs, not the level of Australia's own target. Moving to a stronger target would not be expected to materially change domestic emissions and economic activity, and GDP would be largely unaffected.

A STRONGER TARGET DOES HAVE AN IMPACT ON THE ECONOMY

Under the current legislation, moving to a stronger target is expected to have three broad economic effects on Gross National Income (GNI):

- a **direct income transfer** from Australia to buy additional emissions units from overseas;
- a smaller indirect cost from the changes in the **terms of trade** due to this income transfer (the 'terms of trade effect'); and
- a smaller indirect cost associated with replacing the **government revenue** forgone due to selling fewer Australian carbon units (the 'revenue effect').

GNI is a broader measure of economic welfare than the more commonly used GDP. While GDP measures the total output of the Australian economy, GNI measures output, international income transfers and the impacts on the terms of trade. GNI therefore provides a more complete measure of Australians' current and future consumption possibilities – that is, what Australia can afford to buy.

The size of the **direct income transfer** would be equal to the number of additional international emissions reductions purchased from overseas to meet the stronger target, multiplied by the international carbon price. This income transfer would be small compared to the transfers associated with routine international income flows associated with commodity trade, foreign investment and other factors.

The direct income transfer would have a small additional impact because it would affect the balance of payments. Exports would have to be higher to generate the additional foreign currency, entailing lower export prices which would tend to reduce the **terms of trade**.

Moving to a stronger target also reduces **government revenue** by reducing the number of domestic units available for the Government to sell. To maintain the same level of government services, the forgone revenue would need to be replaced; this would typically involve an additional welfare cost reflecting the marginal excess burden of raising replacement government revenue.

The combined impact of these three effects on GNI is estimated to be 1.55 times the direct cost of the additional international units (The Treasury and DIICCSRTE 2013). For example, if changing the target requires an additional $100 of international emissions reductions, GNI is reduced by $155, comprising:

- $100 more emissions units bought from overseas – a direct income transfer;
- $30 through the terms of trade effect; and
- $25 due to the revenue effect.

The same costs would arise if the Government purchased international units directly, rather than liable entities purchasing international units under the carbon pricing mechanism. The only difference would be that instead of replacing auction revenue, the revenue effect would arise from raising funds to purchase the additional international units.

The impacts of the income transfer and terms of trade effect would be broadly distributed across the economy. The modelling results suggest the lower terms of trade would support growth in export-oriented and import-competing industries, such as agriculture, mining and manufacturing. On the other hand, more domestically focused industries, such as construction and services, would grow more slowly. The impact from the lower terms of trade associated with moving from the minimum 5 per cent target to a 15 or 25 per cent target is relatively small; changes in projected sector output levels in 2020 are less than 0.4 of a percentage point (The Treasury and DIICCSRTE 2013, p. 86). The distributional impact of the revenue effect would depend on how the additional revenue is raised.

The next Section estimates the cost to the economy of moving beyond the minimum 5 per cent target to a stronger target.

10.3.2 THE COST OF ACHIEVING A 15 OR 25 PER CENT TARGET

Australia needs to reduce emissions by an estimated total of 593 Mt over the period 2013 to 2020 to achieve the minimum 5 per cent target, as discussed in Section 10.2. Moving from 5 to 15 per cent requires an additional 305 Mt of emissions reductions (for a total of 898 Mt over the period). Moving from 15 to 25 per cent requires a further 305 Mt of emissions reductions (for a total of 1 203 Mt over the period).

Figure 10.3 shows Australia's domestic emissions under the medium scenario, where the carbon price starts at a fixed price of $23 in 2013, and reaches $30 in real terms by 2020 (Box 10.1). Australia's emissions grow to 6 per cent above 2000 levels by 2020; significantly less than the 17 per cent growth in the no price scenario. The remaining emissions reductions – reflected by the gap between domestic emissions and the indicative national trajectory – would be achieved by purchasing emissions reductions from overseas.

This suggests that, under the current legislation, Australia could meet the whole of the additional emissions reduction task associated with moving from 5 per cent to stronger targets through additional imports[2]. The costs presented in this Section are estimated on that basis.

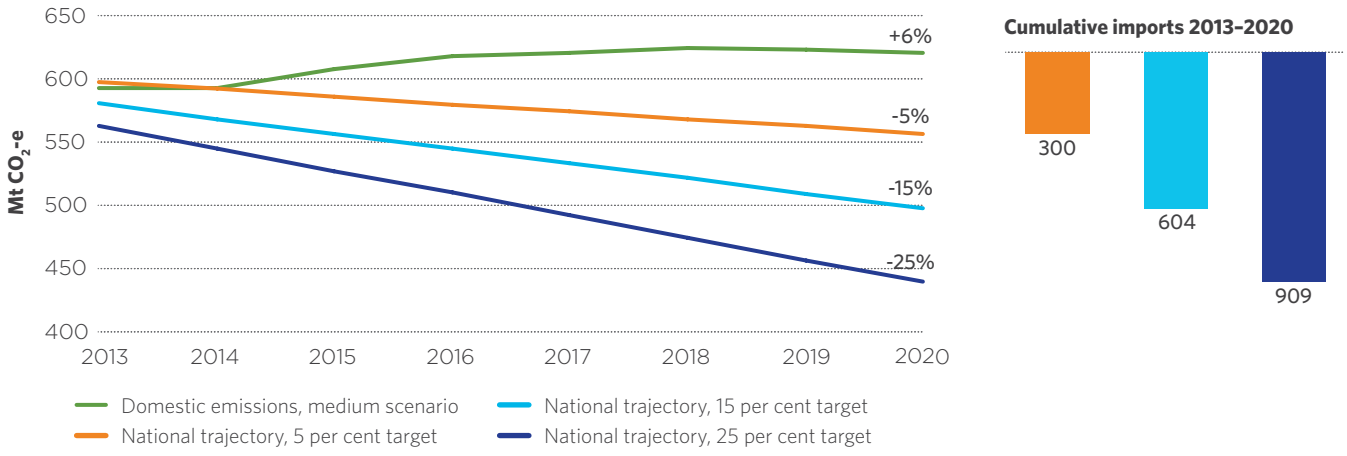
2 One important qualification applies – under the current legislation, liable entities can use international units to meet up to 50 per cent of their liability. This limit could become binding if Australia adopted a 25 per cent target (see discussion in Chapter 14), leading to higher domestic carbon prices and associated economic costs. Direct Government purchase of some international units would alleviate this risk. The caps recommended in Chapter 14 assume some Government purchase, so the 50 per cent limit should not bind.

Purchasing the emissions reductions required to move from the minimum 5 to 15 or 25 per cent targets would lead to a slowing of GNI growth (Figure 10.4), due to the transfer of funds overseas, the associated terms of trade effect and the impact on Government revenue.

The economic impact can be described using different metrics.

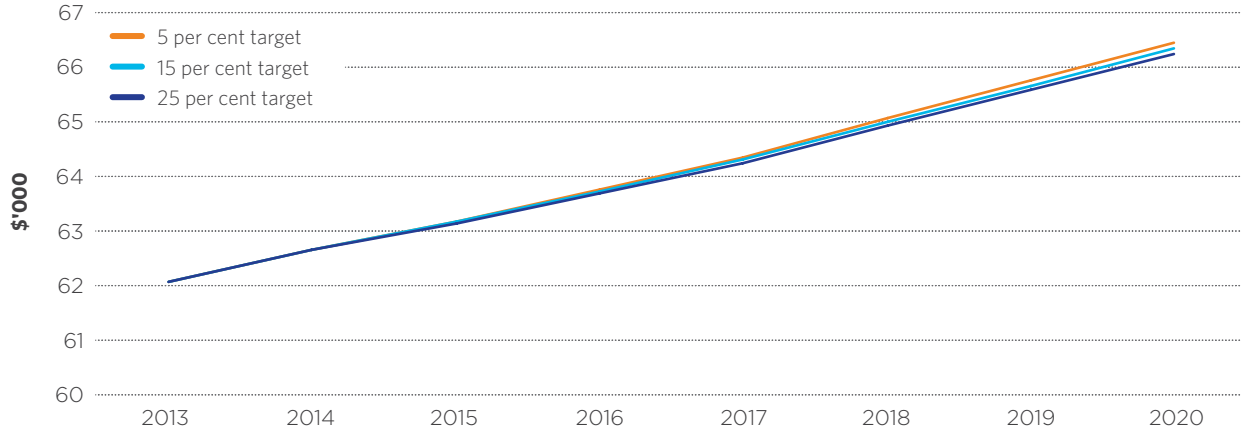
- **Growth in GNI per person** – With a 5 per cent target, GNI per person is projected to grow by an average of 0.80 per cent annually over the period to 2020. Moving to a 15 per cent target slows GNI per person growth to an average of 0.78 per cent; and moving to a target of 25 per cent slows GNI per person growth to 0.76 per cent.
- **Level of GNI per person** – In dollar terms, GNI per person is projected to grow from about $62 350 in 2012 to about $66 450 in 2020 with a 5 per cent target; $66 350 in 2020 with a 15 per cent target; or about $66 250 in 2020 with a 25 per cent target (Figure 10.4).
- **Time to attain the same level of GNI per person** – Average Australian income is projected to continue to rise even with a 25 per cent target, but at a slightly slower rate. The level of GNI per person in 2020 with a 5 per cent target ($66 450) would be attained less than three months later with a 15 per cent target; and five months later with a 25 per cent target.
- **Reduction in GNI level (economy-wide)** – GNI is projected to continue to grow even with a 25 per cent target, but at a slightly slower rate. With slower growth, GNI in 2020 would be $2.7 billion (0.16 per cent) lower with a 15 per cent target than it would have been with a 5 per cent target. With a 25 per cent target, GNI in 2020 would be $5.5 billion (0.31 per cent) lower than with a 5 per cent target

FIGURE 10.3: DOMESTIC EMISSIONS AND IMPORTS OF EMISSIONS REDUCTIONS FOR DIFFERENT TARGETS, MEDIUM SCENARIO, 2013–2020



Source: Climate Change Authority, The Treasury and DIICCSRTE 2013

FIGURE 10.4: GROSS NATIONAL INCOME PER PERSON FOR DIFFERENT TARGETS, MEDIUM SCENARIO, 2013–2020



Source: The Treasury and DIICCSRTE 2013

These impacts on GNI are small relative to other forces driving GNI. For example, the boom in Australia's mining sector and terms of trade is estimated to have added 1.2 percentage points to average annual growth in GNI per person since 2000 (Dolman and Gruen 2012). In contrast, moving to stronger emissions reduction targets is estimated to reduce average annual growth in GNI per person to 2020 by 0.02 percentage points for a 15 per cent target, and by 0.04 percentage points for a 25 per cent target.

DRAFT CONCLUSION

C.11 Stronger targets can be achieved with relatively small impacts on national income and economic growth. Under the current legislation, moving to a stronger target would slow annual growth in GNI per person to 2020 from 0.80 per cent (5 per cent) to 0.78 (15 per cent) or 0.76 (25 per cent).

As noted at the start of this Section, the costs of achieving targets depend on the policy implemented to achieve them. Nevertheless, if Australia achieved stronger targets by purchasing international emissions reductions, this analysis provides a robust estimate of the economic impact. The costs would be broadly the same if the Government purchased the emissions reductions directly rather than liable entities purchasing them under the carbon pricing mechanism. In both cases, the income transfer, terms of trade and revenue effects would be the same. The next Section explains how costs could be more or less depending on the price of international emissions reductions purchased.

THE PRICE OF INTERNATIONAL EMISSIONS REDUCTIONS MATTERS IN DETERMINING THE COST OF STRONGER TARGETS

In addition to the medium scenario used in the cost estimates presented in Section 10.3.2, the modelling also explored a high-price scenario. This high price applies to both domestic and international emissions reductions. In this scenario, more domestic emissions reductions occur, and fewer international emissions reductions are purchased to meet any given target.

The higher price of both domestic and international emissions reductions has a slightly larger impact on GNI than the costs outlined above. Under this scenario, average annual growth in GNI per person is projected to be 0.73 per cent over the period to 2020 if Australia pursues the minimum 5 per cent target (Authority analysis, see Appendix C7 for details).

- Moving to a 15 per cent target still requires an additional 305 Mt of emissions reductions (cumulative, 2013–2020); GNI per person growth slows to 0.68 per cent. GNI is projected to be $6.7 billion lower in 2020 (relative to the 5 per cent target).
- Moving to a 25 per cent target still requires an additional 609 Mt of emissions reductions (cumulative, 2013–2020); GNI per person growth slows to 0.63 per cent. GNI would be $13.3 billion lower in 2020 (relative to the 5 per cent target).

These impacts remain relatively small compared to other economic forces. The change to annual growth in GNI per person would be between 0.05 and 0.1 percentage points; about 10 times smaller than the change due to the mining boom.

The modelling also explored a low-price scenario. Again, this low price applies to both domestic emissions reductions and the price of international emissions reductions. The lower price has a smaller impact on GNI than outlined above. Under this scenario, average annual growth in GNI per person is projected to be 0.823 per cent over the period to 2020 if Australia pursues the minimum 5 per cent target (see Appendix C7 for details).

- Moving to a 15 per cent target still requires an additional 305 Mt of emissions reductions (cumulative, 2013–2020); GNI per person growth slows to 0.819 per cent. GNI is projected to be $0.6 billion lower in 2020 (relative to the 5 per cent target).
- Moving to a 25 per cent target still requires an additional 609 Mt of emissions reductions (cumulative, 2013–2020); GNI per person growth slows to 0.815 per cent, and GNI would be $1.1 billion lower in 2020 (relative to the 5 per cent target).

The type of international units purchased also affects the costs. The Authority's analysis and the cost estimates presented above are based on the modelled price for European units. Emissions reductions generated under the Kyoto Protocol are available at significantly lower prices (currently, Kyoto units are selling at less than $1.00). If Kyoto units were purchased to achieve the stronger target, the impact on the economy would be lower again.

This Section has shown Australia can achieve stronger targets at relatively small cost. One of the key reasons why the costs are small is because the Authority assumes Australia achieves its targets using a mix of domestic and international emissions reductions. The next Section considers Australia's emissions reduction opportunities, and how economic impacts would change if Australia pursued more reductions domestically.

10.4 USING A MIX OF DOMESTIC AND INTERNATIONAL EMISSIONS REDUCTIONS

The Government has committed to achieving Australia's minimum 5 per cent target through domestic emissions reductions. The modelling sheds light on the emissions reduction opportunities that may be available in Australia, and the associated economic impacts. It shows Australia has substantial potential to reduce its emissions, but suggests the costs of meeting stronger targets is likely to be lower if Australia uses some international emissions reductions to complement its domestic efforts. As long as the imported reductions represent genuine emissions reductions, the environmental outcome would be the same (see Chapter 13).

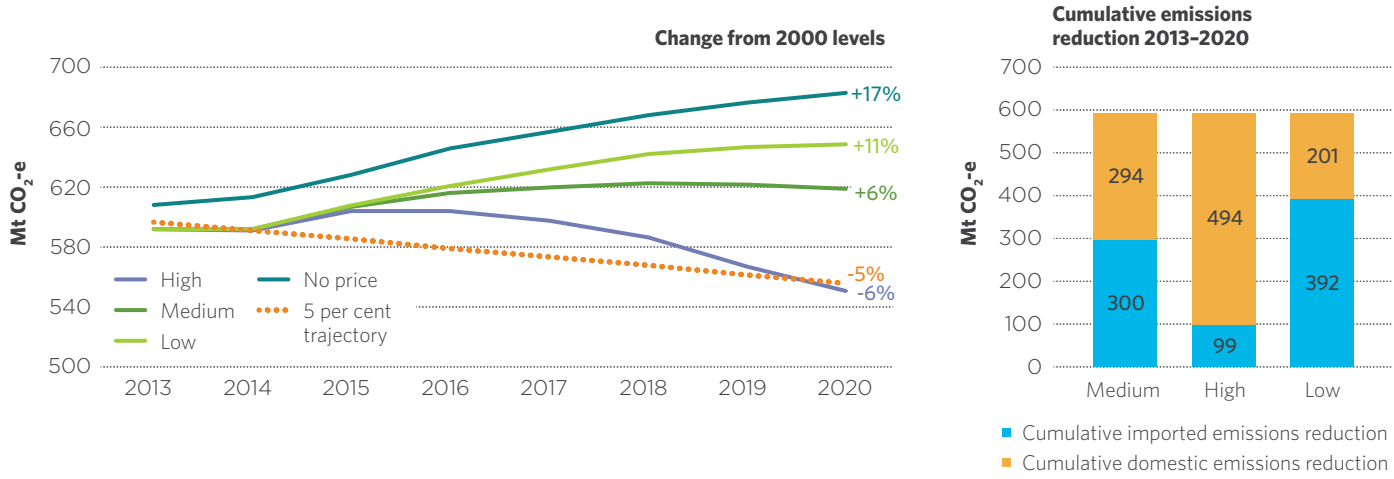
10.4.1 DOMESTIC EMISSIONS REDUCTIONS UNDER DIFFERENT SCENARIOS

The Authority has assessed the outlook for Australia's emissions and economy under three carbon price scenarios – high, medium and low – in addition to the no price scenario. The higher the carbon price, the more domestic emissions fall. While emissions in the no price scenario grow to 17 per cent above 2000 levels in 2020, in the low scenario they grow to 11 per cent above 2000 levels, in the medium scenario they grow to 6 per cent above 2000 levels, and in the high scenario they fall to 6 per cent below 2000 levels in 2020 (Figure 10.5). Reductions are projected to occur across all sectors, as discussed in Part D of this report.

These scenarios provide a broad indication of the emissions reductions opportunities that may be available over time at different prices. The results provide useful insights for the development of the Government's Direct Action Plan. While the scope and level of incentives are yet to be determined, in general, higher prices at auctions would mobilise more domestic emissions reductions.

None of the scenarios modelled achieves enough domestic emissions reductions to meet the 2013–2020 budget consistent with the minimum 5 per cent target (Figure 10.5). In the medium scenario, 294 million of the required 593 million tonnes of emissions reductions over the period to 2020 are achieved domestically[3]. The high scenario gets closest – a total of 494 million of the required 593 million tonnes of emissions reductions is achieved domestically[4]. While domestic emissions in the high scenario fall to 6 per cent below 2000 levels by 2020, emissions in the intervening years exceed the budget.

FIGURE 10.5: DOMESTIC EMISSIONS AND CUMULATIVE EMISSION REDUCTIONS FOR DIFFERENT SCENARIOS, 5 PER CENT TARGET, 2013–2020



Source: Climate Change Authority; The Treasury and DIICCSRTE 2013.

3 Figures may not add due to rounding.

4 Australia could use its carryover from the first commitment period of the Kyoto Protocol to close this gap and meet the 5 per cent target. The Authority considers, however, that the carryover should be used to strengthen Australia's target (see Section 8.7).

10.4.2 ECONOMIC IMPACTS OF REDUCING DOMESTIC EMISSIONS

As with emissions, each scenario generates a different economic outcome. This Section focuses on GDP rather than GNI, as the GDP results primarily reflect changes in domestic economic activity rather than the effects of international trade in emissions reductions.

All of the scenarios show the economy grows, even with strong action to reduce emissions in Australia and globally. The effects on GDP growth are relatively small (Figure 10.6), and scale with the carbon price. The high scenario involves the largest shift from high to low emission activities in the economy, and involves the greatest cost. Average annual growth in GDP to 2020 is 2.99 per cent in the high scenario compared with 3.06 in the medium scenario, and 3.08 per cent in the low scenario (The Treasury and DIICCSRTE 2013).

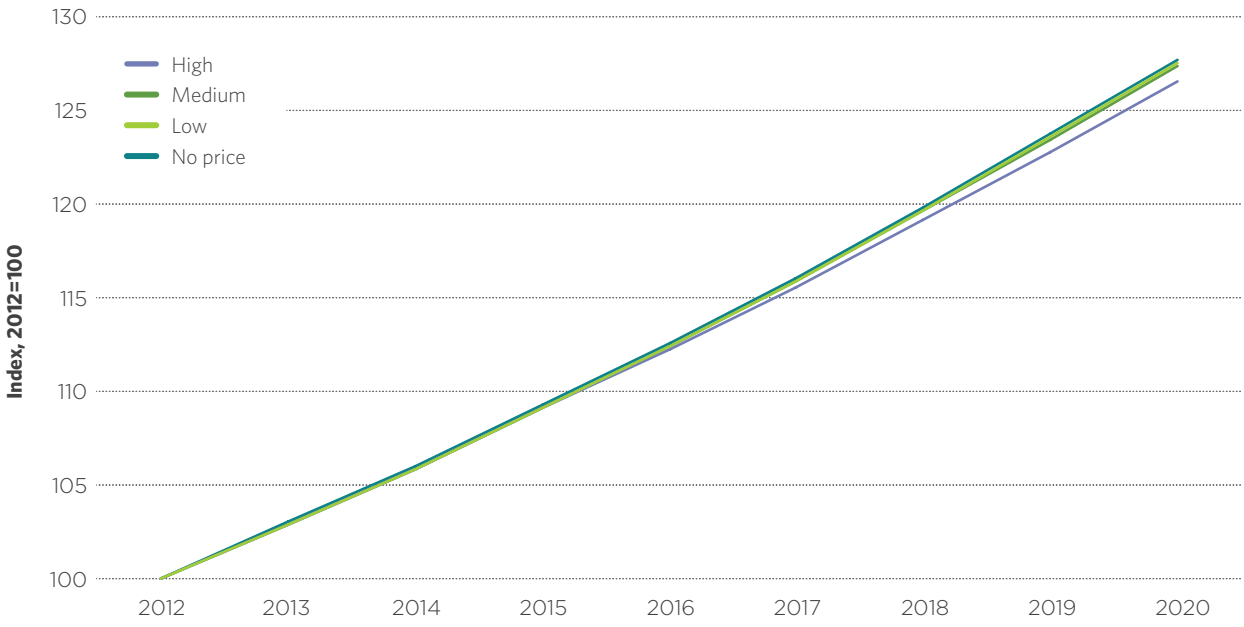
These costs provide a broad indication of the relative scale and change in potential macroeconomic impacts if a greater share of domestic emissions reductions is pursued. If emissions reductions were purchased by the Government using general revenue, the costs would be borne by taxpayers. The impacts on industries that generate emissions, and the consumers of those goods and services, would depend on the detailed policy design.

10.4.3 USING INTERNATIONAL EMISSIONS REDUCTIONS CAN REDUCE COSTS

While Australia could achieve the minimum 5 per cent target through domestic reductions alone, using international reductions to complement domestic reductions could lower the cost of achieving Australia's emissions reduction goals, and make stronger targets more affordable.

For example, the results of the high scenario suggest that an effective carbon price rising to over $65/t CO_2-e by 2020 would be required to achieve the minimum 5 per cent target through domestic reductions alone. In this scenario, GDP in 2020 is estimated to be 0.86 per cent lower than in the no price scenario[5]. In contrast, in the medium scenario Australia meets the minimum 5 per cent target using a mix of domestic and international emissions reductions; the effective carbon price is about $27/t in 2020, and GDP in 2020 is estimated to be 0.31 per cent lower than in the no price scenario.

FIGURE 10.6: GROSS DOMESTIC PRODUCT FOR EACH SCENARIO WITH A 5 PER CENT TARGET, 2012–2020



Source: Climate Change Authority; The Treasury and DIICCSRTE 2013

5 The high scenario in The Treasury and DIICCSRTE modelling assumes Australia achieves a 25 per cent target; the GDP result therefore reflects both the impact of the higher carbon price and a small additional impact from the purchase of international emissions reductions. The effective carbon price is the weighted average of the Australian carbon unit and the Kyoto unit prices; see Box 10.1.

Of course, it is difficult to project exactly how Australia's emissions and economy will develop over time, and which emissions reduction opportunities will emerge. Projections often overestimate future emissions and economic analysis often overestimates the costs of reducing emissions. The Authority examined previous national emissions projections and found that Australia has overestimated emissions by roughly 10 per cent on average[6]. Analysis by the Grattan Institute found that environmental markets routinely reduce emissions at lower cost than expected (Daley and Edis 2010). One reason is that, with credible incentives in place, business and households find new and unanticipated ways to reduce emissions. Box 10.2 discusses how technology innovation can affect the projections.

If Australia has more low-cost emissions reduction opportunities than projected in the modelling, the share of domestic emissions reductions would increase, and the cost of achieving any given target would fall. Nevertheless, it could remain cost-effective for Australia to use some international emissions reductions to help meet its target.

10.5 LONGER TERM ECONOMIC IMPLICATIONS OF 2020 TARGETS

The modelling results show the economy continues to grow in the period beyond 2020 even as carbon prices rise to achieve deep cuts in emissions.

Chapter 8 discusses the benefits of a long term emissions budget to 2050, and what that budget implies for 2020 targets. A weaker 2020 target may cost slightly less to achieve in the near term but would use more of the national budget available to 2050, and stronger targets would be required beyond 2020. In contrast, a stronger 2020 target may cost slightly more in the near term but retains more of the national budget for use beyond 2020.

The international carbon price is currently much lower than the projected long-run price consistent with limiting global warming to no more than 2 degrees. This suggests the carbon price could increase rapidly in the future, if the level of future action becomes clearer and stronger. In that case, it would be more efficient for Australia to have a stronger 2020 target, and buy more international units in the period to 2020, while prices are low. This would leave more of the national emissions budget available for the period beyond 2020, when prices could be much higher.

BOX 10.2: IMPACT OF INNOVATION ON THE OUTLOOK FOR EMISSIONS AND COSTS

The international analysis presented in the modelling shows that the cost and availability of low-emission technologies affects the cost of achieving global and national emissions reductions. For example, higher technology learning rates in the electricity and transport sectors would allow environmental objectives to be achieved with lower carbon prices and smaller reductions in Gross World Product. On the other hand, if carbon capture and storage proved commercially unviable, or construction of additional nuclear capacity was halted globally, carbon prices would need to be higher to achieve a given environmental goal, resulting in larger reductions in Gross World Product (The Treasury and DIICCSRTE 2013).

If the domestic technology costs are different to what is assumed in the modelling estimates, Australia's emissions outlook would also be different. As shown in the electricity sector sensitivity analysis, if technology costs for solar are lower than expected, then annual emissions could be about 50 Mt lower from the mid 2030s onwards compared to the medium scenario. This would reduce reliance on imported emissions reductions (ACIL 2013, p. 65).

6 The Authority compared projections for the period 2008-2012 from annual projections published between 2004 and 2007, to Australia's actual emissions in 2008–2012.

Of course, there is a risk that international action will not strengthen and carbon prices remain very low. In that case, stronger near term targets may not be more efficient than weaker targets. On balance, however, given very low current prices, and the trend of strengthening international action (discussed in Chapter 4), the Authority considers it is more likely that prices will rise and stronger near term action will prove cost-effective.

There is also a broader global rationale for taking stronger action sooner. As outlined in Chapter 3, delaying action reduces the chances of limiting global warming to no more than 2 degrees. Previous analysis showed that delaying action increases the long-run economic costs, because more emissions reductions must be achieved in less time to achieve the same environmental outcome (Commonwealth of Australia 2008). Luderer et al. (2013) quantify the costs associated with delaying coordinated global action from 2015 to 2030. They find that delay to 2030 not only increases the lowest feasible temperature goal that can be secured with a likely probability, but sharply increases the transitional costs associated with achieving the temperature goals that do remain feasible. For example, starting coordinated global action in 2030 rather than 2015 sees the short term change in growth associated with a likely chance of avoiding 2.1 degrees of warming become comparable to that of the Global Financial Crisis. Submissions to the Issues Paper also highlighted the costs of delaying action (for example, AGL Energy Limited *Issues Paper submission*, p. 2).

In summary, there are good economic reasons for Australia to take on stronger 2020 targets now.

Chapter 10 has assessed the economic implications of achieving different 2020 targets by first assessing the emissions reduction task to 2020, and then estimating the economic costs of achieving different targets. It then examined the impacts of achieving greater domestic emissions reductions. Chapter 11 will draw together the preceding analysis and make recommendations on Australia's emissions reduction goals.

CHAPTER 11 RECOMMENDED EMISSIONS REDUCTION GOALS FOR AUSTRALIA

11

The Authority has assessed the evidence and insights presented in this Draft Report and recommends a coordinated set of emissions reductions goals for Australia.

In the short term, the Authority recommends that Australia should aim to achieve more than the current unconditional 2020 target of a 5 per cent reduction in emissions. It is also recommends that Australia adopt a medium term pathway that is consistent with a long term national emissions budget geared to limiting global warming relative to pre-industrial levels to below 2 degrees. The Authority presents two options.

- a 2020 emissions reduction target of 15 per cent below 2000 levels, with a 2030 trajectory range of 35–50 per cent; or
- a 2020 target of 25 per cent with a 2030 trajectory range of 40–50 per cent.

The Authority will recommend a single 2020 target and a single 2030 trajectory range in its Final Report.

A coordinated set of goals can help guide Australia's progress to a low-emissions future, providing a degree of certainty in the short term and some predictability over the long term. At the same time, it preserves flexibility to respond to changing circumstances over time.

Chapter 11 presents the Authority's recommended emissions reduction goals. It:

- brings together the key lines of evidence from throughout this Draft Report to conclude that a 5 per cent 2020 emissions reduction target is inadequate when viewed against any of these key considerations; and
- compares two options for a medium term pathway (2020 target and 2030 trajectory range) that would be responsible next steps for Australia. They keep open the option of acting consistently with Australia's national interest in limiting warming to below 2 degrees without sharp changes in the level of action over time.

11.1 AUSTRALIA'S PATHWAY TO A LOW-EMISSIONS FUTURE

The Authority considers that Australia should adopt a coordinated set of emissions reduction goals that will guide Australia's journey to a low-emissions future. As outlined in Chapter 8, Australia needs goals that provide short, medium and long term milestones; linked by a credible pathway from each to the next. The goals need to be internally consistent and subject to review over time. As discussed in Chapter 9, adopting a 2050 emissions budget is especially important in this regard – it clarifies trade-offs between short, medium and long term action.

These goals could provide useful guidance to the Government as it makes important decisions on emissions goals in the months and years to come. The Authority has designed the goals to support a predictable and stable environment for businesses and others, balancing greater certainty in the short term and greater flexibility to respond to changing circumstances in the longer term.

As discussed in Chapter 9, the Authority recommends a long term national emissions budget to 2050 of 10 100 million tonnes of carbon dioxide equivalent (Mt CO_2-e), which is consistent with Australia's fair share of the estimated global emissions budget that provides a 67 per cent chance of limiting warming to below 2 degrees.

Chapter 11 recommends two options for a medium term pathway that preserves Australia's ability to stay within this budget – either:

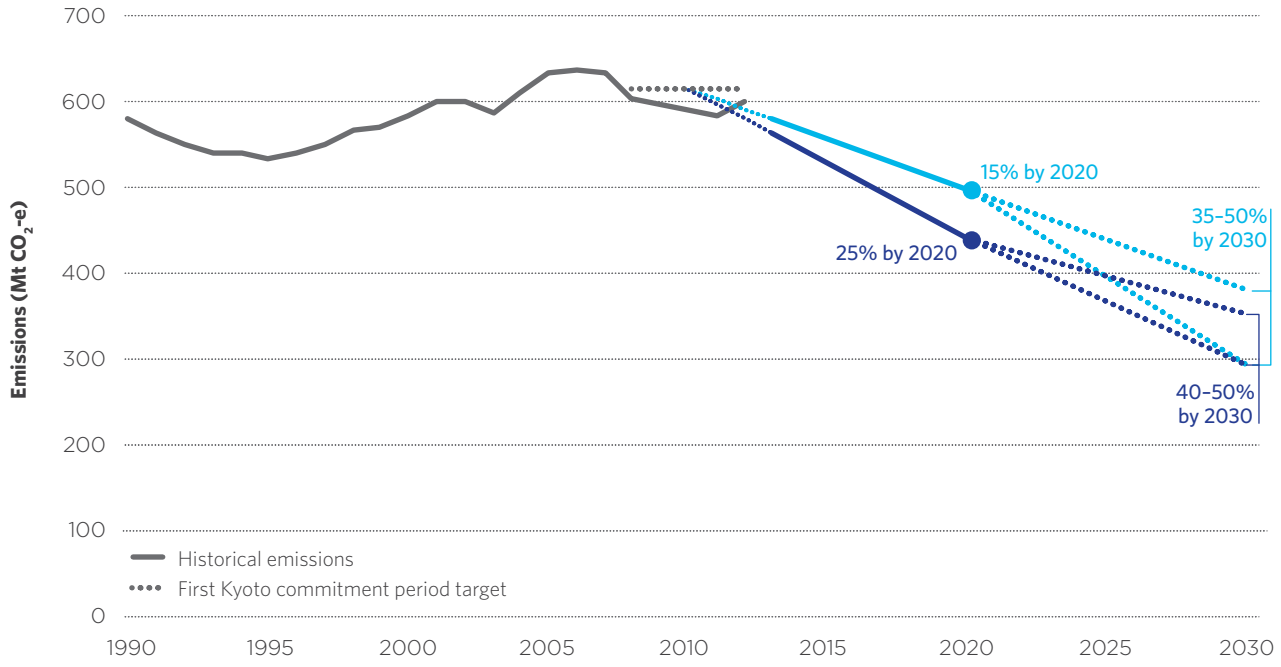
- an emissions reduction target for 2020 of 15 per cent below 2000 levels, combined with a 2030 trajectory range of 35 to 50 per cent below 2000 (the light blue line in Figure 11.1); or
- an emissions reduction target for 2020 of 25 per cent below 2000 levels, combined with a 2030 trajectory range of 40 to 50 per cent below 2000 (the dark blue line in Figure 11.1).

Post-2020 goals should be subject to periodic review to take account of changing information. In weighing different considerations, the Authority has reflected on how the future might unfold. The recommendations are made in the knowledge that understanding of the climate will continue to improve over time and that international action and economic factors will change, sometimes in unexpected ways. This uncertainty is not a reason to avoid making recommendations for post-2020 action. Instead, it suggests that the goals should allow for flexibility and be subject to periodic review according to clear criteria, as recommended in Chapter 8.

11.2 WHY AUSTRALIA SHOULD DO MORE THAN 5 PER CENT BY 2020

The Authority considers that Australia should adopt a stronger 2020 target than 5 per cent. This conclusion is based on all of the strands of evidence considered in this Review.

FIGURE 11.1: THE AUTHORITY'S OPTIONS FOR AUSTRALIA'S PATHWAY TO 2030



Note: All targets are percentage reductions from 2000 levels. Indicative trajectories for 2013–2020 and are based on a straight line from the mid-point of Australia's Kyoto Protocol first commitment period target (108 per cent of 1990 levels in 2010) to the 2020 target. The trajectory ranges are based on straight lines from the 2020 target to either end of the trajectory range in 2030. See Sections 8.4 and 8.5 for further details.
Source: Climate Change Authority; historical emissions from The Treasury and DIICCSRTE 2013

First, **a 5 per cent target does not keep pace with actions taken by other countries**. As discussed in Chapter 5, the Authority considers that **the Government's target range conditions for moving beyond 5 per cent have been met.** Looking more broadly, a 5 per cent target is weak compared with the targets of the United States and many of Australia's neighbours and trading partners. On most measures, the only key country targets less ambitious than Australia's 5 per cent are from countries that are much poorer than Australia, with lower levels of development and less governance capacity. A 5 per cent target also misses the opportunity of positively influencing other countries as they finalise their 2020 targets and consider 2030 goals.

Second, **a 5 per cent target is inconsistent with Australia's contribution to the long term goal to limit warming to below 2 degrees**. As discussed in Chapter 9, a 5 per cent target would result in Australia using 86 per cent of its national emissions budget in fewer than half of the years it was intended to cover. It leaves far too much of the emissions reduction task for later. Beyond 2020, Australians would either bear a very large share of emissions reductions or have to abandon the long term national emissions budget. This is inequitable in the first case and against Australia's national interest in the second. The minimum 2020 target that can be credibly combined with the recommended national emissions budget is 15 per cent.

Keeping global temperature rise below 2 degrees is strongly in Australia's national interest – it would be a false economy to take actions inconsistent with this goal. Australia cannot secure this goal by itself, but it is difficult to see how Australia could reasonably argue for others to do more if its own actions are inconsistent with the long term objective.

Third, **adopting stronger targets is easier than previously thought**. Three main factors contribute to this outcome:

- Official projections from 2012 suggested that Australia would need to cut its emissions by 155 Mt in 2020 and 754 Mt over the period 2013 to 2020 to achieve the unconditional 5 per cent target (Department of Climate Change and Energy Efficiency 2012). If Australia sustained the same amount of emissions reduction effort, the latest projections suggest it would now achieve an 11 per cent target instead. The 5 per cent target would require Australia to cut its emissions by 131 Mt in 2020 and 593 Mt over the period 2013 to 2020 (The Treasury and DIICCSRTE 2013).
- Australia could use its 'carryover' from the first commitment period of the Kyoto Protocol to strengthen its 2020 target by 3 percentage points, as discussed in Chapter 8.
- A wider set of land sector activities than before will count toward Australia's target under the second commitment period of the Kyoto Protocol. The changes are expected to provide emissions reductions equivalent to an additional 3 percentage points for Australia's 2020 target.

Any Australian action to reduce emissions is starting from a solid base, with the prospect of greater reductions to come. As discussed in chapters 7 and 12, Australia's emissions were below its 2008–2012 Kyoto Protocol commitment. Australia has made progress toward meeting the 5 per cent unconditional target and has the capacity to achieve more. The emissions intensity of the Australian economy is falling – while the economy and the Australian population have grown steadily since 1990, emissions have remained relatively flat. Significant, identified, low to medium cost emissions reduction opportunities are yet to be realised.

Fourth, **stronger targets can be achieved with relatively small impacts on the economy**. Chapter 10 sets out modelling estimates from The Treasury and DIICCSRTE (2013) that show stronger targets can be achieved while maintaining economic growth and rising incomes.

Overall, a 2020 emissions reduction target stronger than 5 per cent is desirable, feasible and affordable. The following section sets out the Authority's proposed options in more detail.

11.3 AUSTRALIA'S RESPONSIBLE NEXT STEP – A 15 OR 25 PER CENT PATHWAY

Chapter 9 showed that either a 15 or 25 per cent target would be a responsible next step in light of the Authority's recommended 2050 national emissions budget. Either would support a stable, predictable transition to a low-emissions future while maintaining the flexibility to respond to new information.

The Authority's preferred approach to the 2030 trajectory range is set out in Section 8.4 and illustrated in Section 8.5. The Authority proposes a trajectory range that provides clear links to long term goals, namely the recommended national 2050 emissions budget and the currently legislated 2050 target. If adopted by Government, a range constructed in this way could help indicate that Australia is prepared to keep within its share of the global emissions budget. It would also maintain Australia's flexibility to take into account the latest information on climate science, international action and economic factors prior to making final decisions on medium term goals.

The top and bottom edges of the trajectory range are straight lines that start at the 2020 target and end in 2030 (Figure 11.1). The 'bottom' or stronger end of the trajectory range follows the level required to stay within the recommended 2050 emissions budget. The 'top' or weaker end follows a straight line to the legislated 2050 target of 80 per cent reduction on 2000 levels. As discussed in Chapter 8, the top end of the trajectory range is not consistent with the Authority's recommended budget, but does meet the 80 per cent 2050 target in current legislation. The relationship between the 80 per cent target and the 2 degree warming limit is discussed in Box 11.1.

Table 11.1 compares trajectory ranges for the recommended and alternative national emissions budgets. In this Chapter, including in Table 11.1, the Authority has adopted a 'traffic light' grading of options for the purpose of comparison. These are indicative assessments based on the Authority's judgment when weighing the evidence. Green indicates a feasible option; amber indicates an option that creates tensions or may be challenging to achieve; and red options (none of which appear in Table 11.1) are not considered plausible.

Table 11.1 shows that both 15 and 25 per cent 2020 targets would require the bottom end of the trajectory range to track to 50 per cent below 2000 levels in 2030 to maintain Australia's ability to meet the recommended national emissions budget. With a 15 per cent target, stronger emissions reductions would be required after 2030 than with a 25 per cent target in order to meet the recommended national emissions budget (see Section 9.5).

TABLE 11.1: RELATIONSHIPS BETWEEN 2020 TARGETS AND 2030 TRAJECTORY RANGES FOR RECOMMENDED AND ALTERNATIVE NATIONAL EMISSIONS BUDGETS

	2030 TRAJECTORY RANGE (% REDUCTION FROM 2000 LEVELS)		
	Probability of staying below 2 degrees		
2020 target (% reduction from 2000 levels)	**50%**	**67% (recommended)**	**75%**
15	35*	35–50 (recommended)	35–65
25	45*	40–50 (recommended)	45–60

Notes: Trajectory ranges calculated as described in text and rounded to multiples of five. Shading indicates feasible (green) and less feasible (amber) combinations. Because the 25 per cent trajectory starts at a lower level in 2020 than the 15 per cent trajectory, the 2030 reduction relative to 2000 levels to meet the legislated 80 per cent reduction in 2050 is stronger, although the average annualised reductions are somewhat smaller (see Figure 11.1). *For a 50 per cent probability budget, the top and bottom ends of the Authority's proposed trajectory range would be very similar.
Source: Climate Change Authority

The right-hand column shows that a 25 per cent target could keep open the possibility of pursuing a higher probability budget or a lower warming limit in the future. Strong reductions in emissions to 2020 would allow a credible 2030 trajectory that achieves a 2050 budget based on a 75 rather than a 67 per cent probability of limiting warming to below 2 degrees. While the stronger trajectory would be challenging, it would involve the same decadal change post-2020 as the trajectory for a 15 per cent 2020 target to meet the 67 per cent probability budget.

A 25 per cent 2020 target with a wider 2030 trajectory range would also provide greater flexibility to respond to new information about the size of Australia's emissions budget. For example, if the estimated global emissions budget for a given probability of avoiding 2 degrees was revised downwards, the periodic review recommended in Chapter 8 could revise Australia's long term emissions budget. Stronger early action positions Australia better to manage these risks.

Using a trajectory range consistent with a higher probability budget would also increase the flexibility to respond to stronger international action. The international community has agreed to conclude a review in 2015 of whether the 2 degree limit should be strengthened to a 1.5 degree limit. The Authority's recommended national emissions budget is based on a likely probability of limiting warming to below 2 degrees, so provides some probability of limiting warming to no more than 1.5 degrees (Section 3.1 and 3.3). A stronger global budget would increase the probability of limiting warming to no more than 1.5 degrees, and stronger early action by Australia could accommodate these changes more easily.

The Authority will recommend a single 2020 target and single 2030 trajectory range in its Final Report. The rest of Chapter 11 compares these two pathways.

11.3.1 COMPARING THE 15 AND 25 PER CENT PATHWAYS

The Authority's two options for pathways to 2030 are compared below according to the key lines of evidence guiding this Review – climate science and Australia's contribution to the below 2 degree goal, international action on climate change and the economic implications of Australia's action.

First, the Authority has considered the two options in relation to the below 2 degree goal. Sections 9.5 and 11.3 compared these targets' distribution of effort over time and consistency with different long term emissions budgets. A stronger target in 2020 means that more of the national emissions budget will be available for use later. If Australia follows the bottom end of the trajectory range to 2030, a 2020 target of 15 per cent would leave 19 per cent of the emissions budget for use after 2030, while a 25 per cent target would leave 25 per cent of the budget. This means that a 15 per cent target requires steeper reductions after 2020.

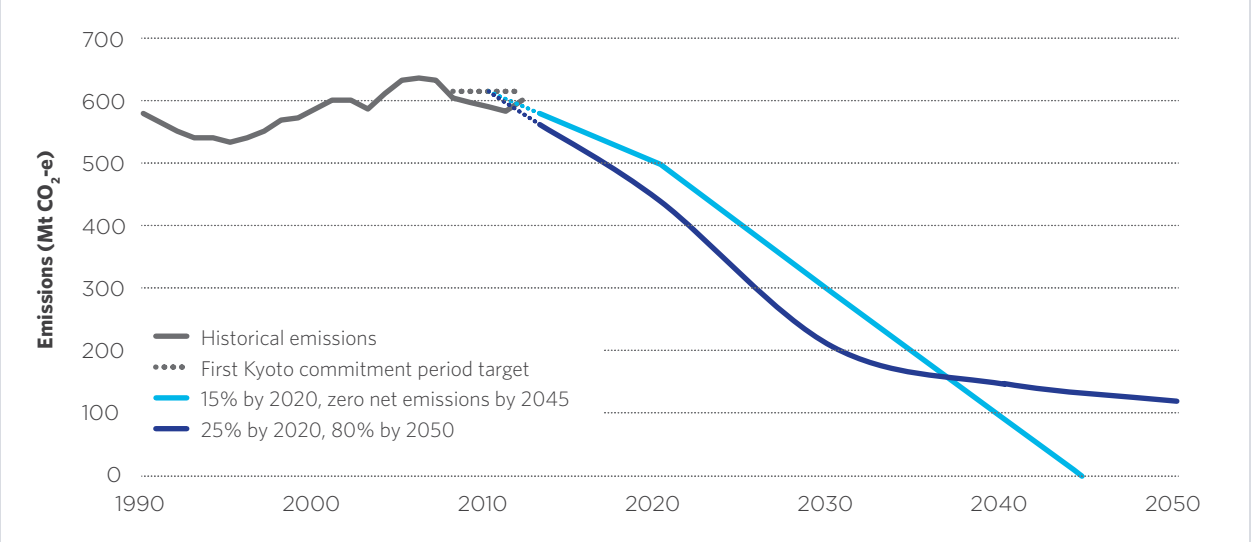
BOX 11.1: AUSTRALIA'S 2050 TARGET AND THE 'BELOW 2 DEGREES' GLOBAL GOAL

Australia has made an international commitment to a collective global goal to limit warming to below 2 degrees. This is recognised in the objects of the *Clean Energy Act 2011* (Cth), which also sets a long term goal for Australia to reduce emissions to 80 per cent below 2000 levels by 2050.

If the world is to stay below 2 degrees, there must be deep and rapid cuts in global emissions, and total global emissions from now until 2050 must stay within a tightly constrained global emissions budget (Chapter 3). The Authority recommends a long term national emissions budget for Australia based on its fair share of this finite global budget (Chapter 9).

If this long term national emissions budget remains the right one for Australia over the coming decades, the 2050 target may need to be strengthened. Whether the current, legislated 2050 target is appropriate for Australia will depend on how the world and Australia use their emissions budgets over time. Using more now implies there is less to use later, and vice versa. For example, Figure 11.2 illustrates two pathways to 2050 that would meet the recommended long term emissions budget. The light blue line shows a pathway that takes stronger action later (15 per cent emissions reductions by 2020, 50 per cent by 2030 and zero net emissions by 2045). The dark blue line shows a pathway with stronger action earlier (25 per cent emissions reductions by 2020, 65 per cent by 2030; and 80 per cent by 2050).

FIGURE 11.2: DIFFERENT PATHWAYS TO 2050 THAT MEET THE RECOMMENDED LONG TERM EMISSIONS BUDGET



Source: Climate Change Authority; historical emissions from The Treasury and DIICCSRTE 2013

While both trajectories meet the recommended 2050 emissions budget, emissions after 2050 are also relevant to limiting warming to below 2 degrees. Even if emissions follow the pathway illustrated by the dark blue line, Australia would need to reduce emissions further after 2050.

In the current Review, the Authority has focused on recommending a long term national emissions budget and medium term pathways that would keep Australia within this budget. Together these recommendations support a stable, predictable transition to a low-emissions future while maintaining the flexibility to respond to new information. The Authority recommends that Australia's post-2020 emission reduction goals, including the 2050 budget, are reviewed periodically and refined over time based on the best available information.

When considering how the options compare in relation to the below 2 degree goal, Australia's exposure to impacts is also relevant. Australia's high level of exposure to the impacts of climate change mean that it has a strong interest in avoiding temperature increases of 2 degrees or more. An early global peak is a key characteristic of global pathways that keep temperature increases below 2 degrees, and a stronger Australian 2020 target helps global emissions peak sooner (Chapter 3).

Second, considering international action, both options are broadly comparable to the actions of other key countries. The Government's target conditions for a 15 per cent target are closer to being met than the 25 per cent conditions. Looking more broadly, Australia's high level of development and high per person emissions relative to most other countries suggest stronger action by Australia is appropriate. Furthermore, greater international action is clearly in Australia's interest and a stronger target may positively influence other countries to increase their level of action. The international community is currently reviewing the level of global action – both to 2020 and beyond. Australia can have a positive or negative influence and, at this critical time, it is better for it to be positive.

Third, the relative effects on the economy of the two options must be considered. On economic impacts, The Treasury and DIICCSRTE modelling shows that Australia can achieve stronger targets at relatively small cost. Under current legislative arrangements, with a move to a 15 or 25 per cent target, the economy and incomes continue to grow. Gross National Income (GNI) per person is projected to grow by an average of 0.80 per cent annually to 2020 with a 5 per cent target, 0.78 per cent with a 15 per cent target and 0.76 per cent with a 25 per cent target.

The Authority's cost estimates:

- are based on the European carbon price, which is assumed to rise from $5.50 per tonne in 2015 to just over $30 per tonne in 2020. International emissions reductions are currently available at low prices and in high volumes; if Australia purchased alternative, lower cost international emissions reductions, the cost of achieving stronger targets could be significantly lower. Potential sources of international emissions reductions are discussed in Chapter 13; and
- include the cost of maintaining the same overall level of Government revenue, so there is no change to the Government's ability to provide other services.

TABLE 11.2: COMPARISON OF THE AUTHORITY'S OPTIONS AND THE 5 PER CENT 2020 TARGET

2020 TARGETS (% REDUCTION BELOW 2000 LEVELS)	5	15	25
2030 trajectory range (% reduction below 2000 levels)	30–50	35–50	40–50
Taking a prudent approach to 2 degrees			
Safest emissions budget compatible with this target (probability of limiting warming to below 2 degrees)	50%*	67%	75%
Sharing the global emissions budget			
Consistent with Australia's fair share of the 67 per cent global emissions budget?	No	Yes	Yes
Distributing Australia's effort over time			
Change in emissions from 2020 to bottom of trajectory range in 2030 (percentage point difference between 2020 and 2030 targets)	45 percentage points	35 percentage points	25 percentage points
Amount of 2050 emissions budget remaining after 2030 (following bottom of trajectory range)	14%	19%	25%
International action on climate change			
How Australia's target compares to other key countries; opportunity to positively influence global action			
Economic costs under legislated policy			
Real average annual growth in GNI per person 2013 to 2020 (medium scenario)	0.80%	0.78%	0.76%
Assessment against Australia's target conditions			
Authority's assessment of whether conditions for this target have been met	Conditions for moving beyond 5 per cent are met	Unclear – some elements are met; others are marginal.	Conditions not met

Note: Shading indicates feasibility of compared options – red indicates an option that is undesirable or not feasible; amber indicates an option that creates tensions or may be challenging to achieve; and green indicates a feasible option.

* Red because 50 per cent is less than the Authority's preferred 67 per cent probability.

Source: Climate Change Authority, The Treasury and DIICCSRTE modelling 2013

Chapter 10 also discussed the timing of Australian and global emissions reductions from an economic perspective. The international carbon price is currently much lower than the projected long-run price consistent with limiting global warming to below 2 degrees, suggesting that the carbon price could increase rapidly in the future, as the level of action becomes clearer. On balance, given very low current prices, and the trend of strengthening international action (discussed in Chapter 4), the Authority considers it is more likely that prices will rise and stronger near term action will prove cost effective.

The comparisons in this section are summarised in Table 11.2, which also shows the 5 per cent target. The shading represents a 'traffic light' assessment of the advantages or disadvantages of each target across the different considerations. Red indicates an assessment that the target option may not be desirable or plausible, based on that criterion; amber indicates that the target option may raise tensions; and green indicates an assessment that the target option is a reasonable one.

11.4 NEXT STEPS FOR RECOMMENDING EMISSIONS REDUCTION GOALS

The Authority will make a single recommendation for Australia's 2020 target, associated 2013–2020 emissions trajectory and budget, and 2030 trajectory range in its Final Report and will provide a clear rationale for its recommendations.

These draft recommendations should be read in conjunction with the Authority's recommendations in Chapter 8 on the future review of medium and long term goals. Future reviews would ensure Australia's goals respond flexibly to new information while continuing to provide clear guidance. In particular, the Authority recommends that the trajectory range should be extended and narrowed regularly to maintain a similar period of guidance over time, and future targets and trajectories should be set within the range by applying clear, general criteria.

This concludes Part C and the Authority's consideration of responsible emissions reductions goals for Australia over the coming decades. Part D surveys opportunities and challenges for realising the recommended goals.

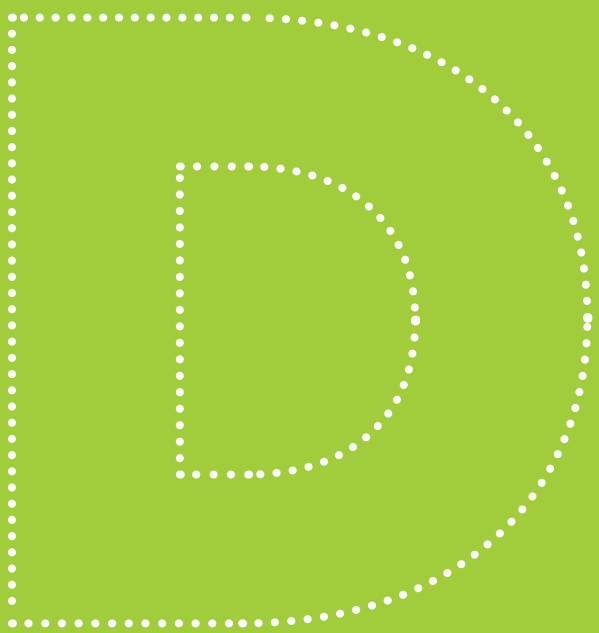
OPTIONS FOR DRAFT RECOMMENDATIONS

R.5 The Authority is canvassing two sets of options for emissions reduction goals at this time:

	Option 1	Option 2
2020 emissions reduction target	15 per cent below 2000 levels	25 per cent below 2000 levels
Indicative national emissions trajectory for the period 2013–2020	A straight line to the 2020 target. This line starts at Australia's first commitment period target under the Kyoto Protocol (108 per cent of 1990 levels) in 2010, and ends at 15 per cent below 2000 levels in 2020.	A straight line to the 2020 target. This line starts at Australia's first commitment period target under the Kyoto Protocol (108 per cent of 1990 levels) in 2010, and ends at 25 per cent below 2000 levels in 2020.
National carbon budget for the period 2013–2020	4 314 Mt CO_2-e	4 010 Mt CO_2-e
Trajectory range to 2030	Beyond 2020, reduce emissions within a trajectory range bounded by the paths to a 35 and 50 per cent reduction below 2000 levels in 2030.	Beyond 2020, reduce emissions within a trajectory range bounded by the paths to a 40 and 50 per cent reduction below 2000 levels in 2030.

PART D

REDUCING AUSTRALIA'S EMISSIONS – OPPORTUNITIES AND CHALLENGES



In considering Australia's emissions reduction goals, it is important to understand the outlook for domestic emissions, and how different sectors of the economy might contribute to meeting those goals. It is also important to understand the broader options, including the potential role of international emissions reductions.

As outlined in Chapter 10, Australia's emissions are projected to rise in the period to 2020 and beyond in the absence of strong policy drivers. Australia faces a substantial but achievable task to meet the 2020 targets being considered. Whichever 2020 target Australia adopts, using a mix of international and domestic emission reductions could help reduce the cost.

Part D presents a range of outlooks for Australia's emissions and emissions reduction efforts.

Chapter 12 focuses on Australia's domestic emissions outlook, at both an economy-wide and sectoral level. It describes opportunities for domestic emissions reductions in an environment of continued economic growth and rising international demand for Australian resource and agricultural exports. It builds on the understanding of historical changes in emissions and how Australia has progressed to date (described in Chapter 7), drawing on The Treasury and DIICCSRTE modelling scenarios. It outlines the emissions reduction opportunities that underpin the Authority's economic analysis of different targets (discussed in Chapter 10). It also identifies Australia's principal challenges to reducing emissions within the domestic economy.

Chapter 13 discusses using international emissions reductions to contribute to meeting Australia's emission reduction goals, including the associated risks and benefits. It considers the potential sources and volumes of international units available to Australia.

CHAPTER 12 AUSTRALIA'S EMISSIONS OUTLOOK

12

Without emissions reduction incentives, emissions from most sectors of the Australian economy are projected to rise – total domestic emissions are projected to grow to 17 per cent above 2000 levels by 2020, and 37 per cent above 2000 levels by 2030. Strong projected growth in population and the economy places upward pressure on emissions.

Australia has significant emissions reduction opportunities in the domestic economy. A price incentive can drive substantial emissions reductions, particularly in electricity generation, industrial processes and fugitive emissions. Stronger incentives would drive deeper emissions reductions. Stronger targets could be met using a mixture of domestic and international emissions reductions, using higher price incentives or by implementing other policies.

The most important sector for potential domestic emissions reductions is electricity. It has the largest share of Australia's emissions and the largest emissions reduction potential. Further emissions reductions could be delivered by removing non-price barriers to industrial, commercial, residential and transport energy efficiency.

Even with a strong incentive to reduce emissions, growth in export-oriented activity, such as liquefied natural gas (LNG) production and agriculture, is projected to increase absolute emissions in those sectors, despite emissions intensity improvements.

When considering what Australia's future emissions reduction goals should be, it is important to consider the outlook for future emissions and the opportunities and challenges in realising domestic emissions reductions.

Chapter 12 highlights the most significant opportunities and challenges, identifying the factors contributing to and driving projected changes in emissions, and assessing how they might change over time. It outlines:

- an overview of Australia's emissions outlook; and
- the opportunities and challenges to reducing domestic emissions at a whole-of-economy and sectoral level.

It also considers the emissions outlook from now to 2030. Appendix D presents a more detailed whole-of-economy and sectoral analysis of Australia's progress toward its emissions reduction goals.

As outlined in Chapter 7, Australia has made progress in reducing emissions in recent years, despite strong economic and population growth. Most of Australia's emissions reductions since 1990 have come from the land sector and, more recently, slower growth in electricity demand and a shift to less emissions-intensive electricity generation. Chapter 6 outlined Australia's existing policies, including the land clearing controls and renewable energy and energy efficiency initiatives that helped drive these outcomes. This provides context for understanding Australia's future emissions outlook.

Chapter 12 focuses on domestic emissions. Chapter 13 considers the benefits and risks of using international emissions reductions to complement domestic efforts.

12.1 WHY ANALYSE AUSTRALIA'S EMISSIONS OUTLOOK?

Assessing Australia's emissions outlook supports effective policy development by identifying opportunities for economically efficient, equitable and environmentally effective emissions reductions, as well as uncertainties, data gaps and challenges to realising those opportunities. Assessing Australia's emissions outlook also indicates whether Australia is on track to meet its emissions reduction goals and international commitments, and provides an early warning if not.

The Authority is obliged to review Australia's progress towards its emission reduction goals annually. The analysis of Australia's emissions outlook in this chapter, together with the analysis in chapters 6, 7 and 13, and Appendix D, relates to the current legislative requirements for reporting on progress.

The following sections explore possible future trends in sectors' emissions and potential contributions to Australia's emissions reduction goals. The outlook presented here does not prescribe or endorse specific outcomes, but instead identifies potential paths for future emissions reductions.

12.2 MODELLING UNDERPINNING THE EMISSIONS OUTLOOK

The Authority has used economic modelling to explore a range of future scenarios for Australia's economy and emissions. The four core scenarios modelled by The Treasury and DIICCSRTE (2013) and described in Chapter 10 involve different levels of incentives for emissions reductions. The no price scenario includes existing policies such as the Renewable Energy Target (RET), energy efficiency standards and land clearing controls, but excludes the carbon price and the Carbon Farming Initiative (CFI). The other three scenarios assume a low, medium and high carbon price, in addition to other existing policies and the CFI.

While the scenarios are largely based on the current legislative arrangements in the *Clean Energy Act 2011* (Cth), the carbon price can be seen as a broad proxy for incentive-based measures. The results show the potential scale and source of emission reductions available in Australia at different marginal costs. Depending on the policy design, the Government's Direct Action Plan may mobilise many of the same opportunities.

Each scenario sees emission reductions occur up to different marginal costs (Table 12.1), reflecting different carbon price pathways over time.

BOX 12.1: MODELLED EMISSIONS REDUCTIONS OPPORTUNITIES

The emissions reduction opportunities identified in the modelling reflect projected outcomes under different future carbon prices, relative to projected emissions without a carbon price.

Other policies, including the Direct Action Plan discussed in Chapter 6.3, could create price incentives to reduce emissions. Such policies may mobilise similar emission reductions opportunities to those identified in the modelling. There may also be a number of differences depending on the detailed policy design. In particular:

- The Treasury and DIICCSRTE modelling reflects outcomes that might arise when entities subject to the carbon price pay for emissions. If carbon prices are passed through to downstream markets, it may prompt a reduction in demand, leading to lower production of emissions-intensive goods and services. This effect is included in the modelled outcomes.
- The Treasury and DIICCSRTE modelling reflects the coverage of the carbon price under the current legislation. The Direct Action Plan may cover a different set of activities. In the low, medium and high scenarios, a price incentive applies to all emissions sources except fuel use by light vehicles, decommissioned mines, synthetic gases imported prior to July 2012 and facilities below the coverage threshold (generally 25 kt CO_2-e per year). Land use, land use change and forestry (LULUCF), agriculture, and waste deposited to landfill before 2012 can access a price incentive for emissions reductions through the CFI.

As discussed in Chapter 10, the modelling provides a useful benchmark for assessing the cost of achieving different targets, and identifies emissions reduction opportunities in the domestic economy at different prices. The actual emissions reductions realised in Australia in the future, and the associated economic cost, will depend on a range of factors, including the policies in place.

TABLE 12.1: MARGINAL EMISSIONS REDUCTION COST UNDER DIFFERENT SCENARIOS, 2020 AND 2030 ($/t CO_2-e)

	2020	2030
No price scenario	0	0
Low scenario	6.31	54.48
Medium scenario	26.73	54.44
High scenario	65.15	134.92

Note: Real $2012; t CO_2-e is tonnes of carbon dioxide equivalent. The marginal cost of emissions reductions in 2020 reflects the weighted average of the Australian Carbon Unit (ACU) and the Kyoto unit prices. In 2030 the marginal cost of emissions reduction is the ACU price.
Source: The Treasury and DIICCSRTE 2013

These four scenarios inform the Authority's assessment of possible emissions outcomes in the remainder of this Chapter and in Appendix D.

12.3 OUTLOOK FOR ECONOMY-WIDE EMISSIONS

12.3.1 AUSTRALIA'S TOTAL DOMESTIC EMISSIONS

Australia's emissions have remained relatively flat since 1990. As discussed in Chapter 7, most of the emissions reductions over that period are attributable to economic factors and policies enacted in the land sector. Electricity sector emissions have been falling by around 0.8 per cent per year since 2008, on average, due to lower demand growth and a shift towards less emissions-intensive generation (such as gas and renewables).

Under the no price scenario, Australia's emissions are projected to rise steadily, to 17 per cent above 2000 levels in 2020 and 37 per cent above 2000 levels in 2030. Figure 12.1 presents results of this and the low, medium and high scenarios, showing that the stronger the incentive, the greater the emissions reductions.

Figure 12.1 shows that it is only under the high scenario that Australia's projected emissions fall and then stay below 2000 levels. The high scenario gets closest to cumulative emissions reductions consistent with Australia's minimum 5 per cent emissions reduction commitment.

12.3.2 EMISSIONS INTENSITY

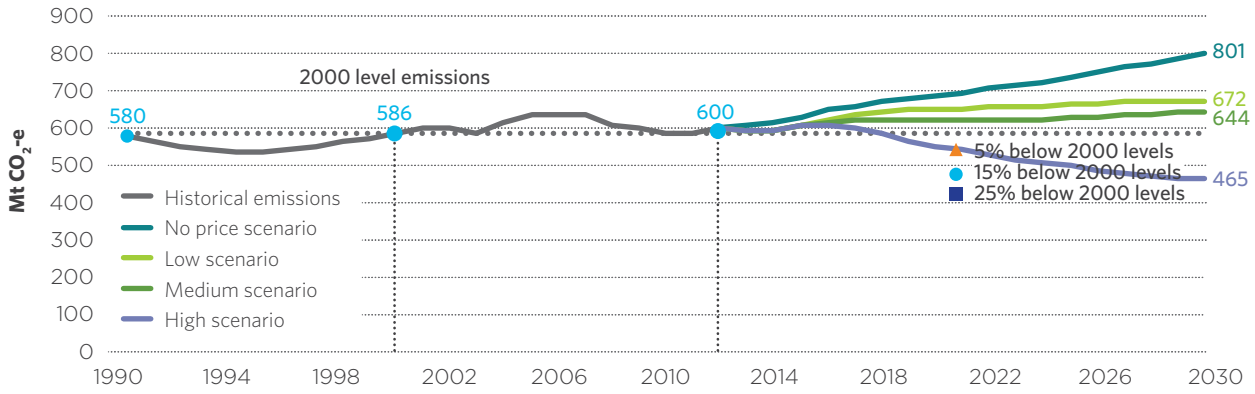
Figure 12.2 shows that the historical trend of falling emissions intensity of the economy is projected to continue under all scenarios. Emissions per person are also projected to fall in the low, medium and high scenarios, but rise slightly relative to current levels in the no price scenario (Figure 12.3). Emissions per person are approximately half 2000 levels by 2030 in the high scenario.

BOX 12.2: PROJECTED LOW, MEDIUM AND HIGH SCENARIO EMISSIONS REDUCTIONS

Relative to the no price scenario:

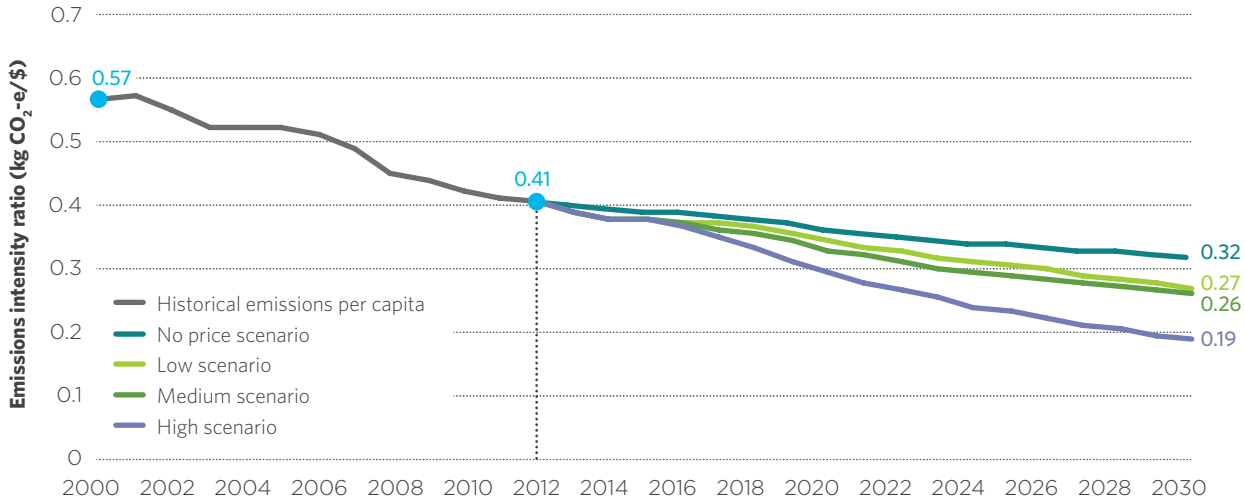
- The low scenario projects 201 million tonnes of carbon dioxide equivalent (Mt CO_2-e) cumulative domestic emissions reductions between 2013 and 2020 and an additional 809 Mt CO_2-e over the period to 2030. Australia's emissions in 2030 are projected to be 672 Mt CO_2-e, or around 15 per cent above 2000 levels.
- The medium scenario projects 294 Mt CO_2-e cumulative emissions reductions to 2020 and an additional 1 150 Mt CO_2-e to 2030. Emissions in 2030 are projected to be 644 Mt CO_2-e, about 10 per cent above 2000 levels.
- The high scenario projects 494 Mt CO_2-e cumulative emissions reductions to 2020 and an additional 2 490 Mt CO_2-e to 2030. Emissions in 2030 are projected to be 465 Mt CO_2-e, about 21 per cent below 2000 levels.

FIGURE 12.1: AUSTRALIA'S PROJECTED EMISSIONS UNDER DIFFERENT SCENARIOS, 1990–2030



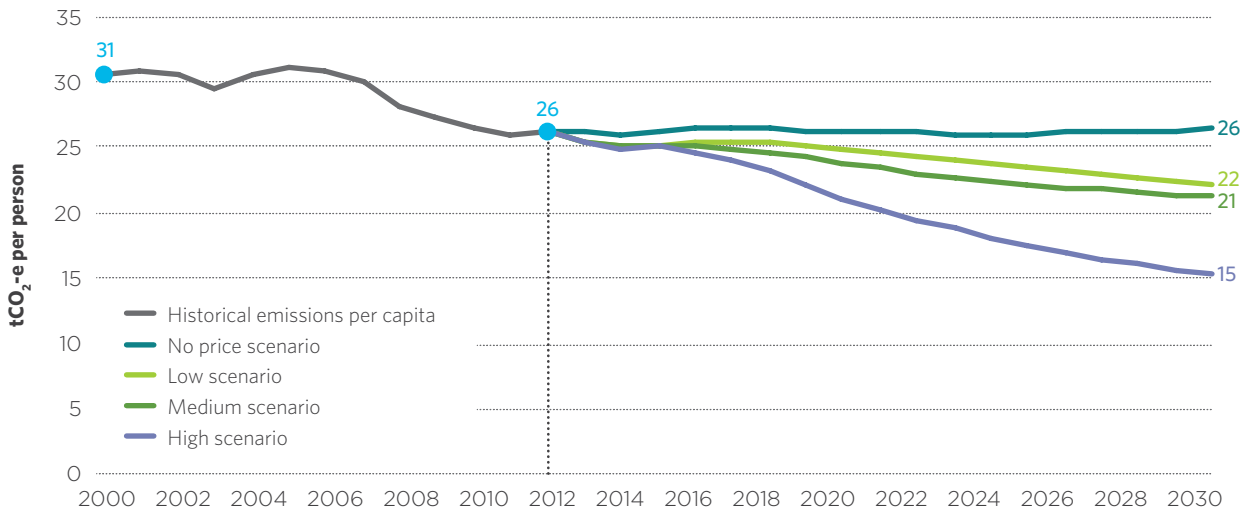
Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

FIGURE 12.2: AUSTRALIA'S PROJECTED EMISSIONS PER UNIT GDP, 2000–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

FIGURE 12.3: AUSTRALIA'S PROJECTED EMISSIONS PER PERSON, 2000–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

12.3.3 FACTORS INFLUENCING THE EMISSIONS OUTLOOK

Several factors will drive Australia's future emissions. Across all scenarios, irrespective of the choice of Australia's emissions reduction goals or the level of a price incentive, emissions will be influenced by:

- broad trends in the macro-economy, such as exchange rates, commodity prices, interest rates, income levels, renewal of building stock and equipment, and population growth. Australia's population and economy are projected to grow and to place upwards pressure on emissions as a result; and
- international demand for emissions-intensive commodities and resources, such as beef, liquefied natural gas (LNG) and coal. Projected growth in global demand is likely to increase Australian activity in these sectors and the associated emissions.

The outlook shows that government policy could have a substantial influence on emissions. Incentives for emissions reductions could be established at different levels of government, using a wide range of policy tools. The type of emissions reductions and the rate at which they are realised will be affected by the relative costs of low-emissions technologies.

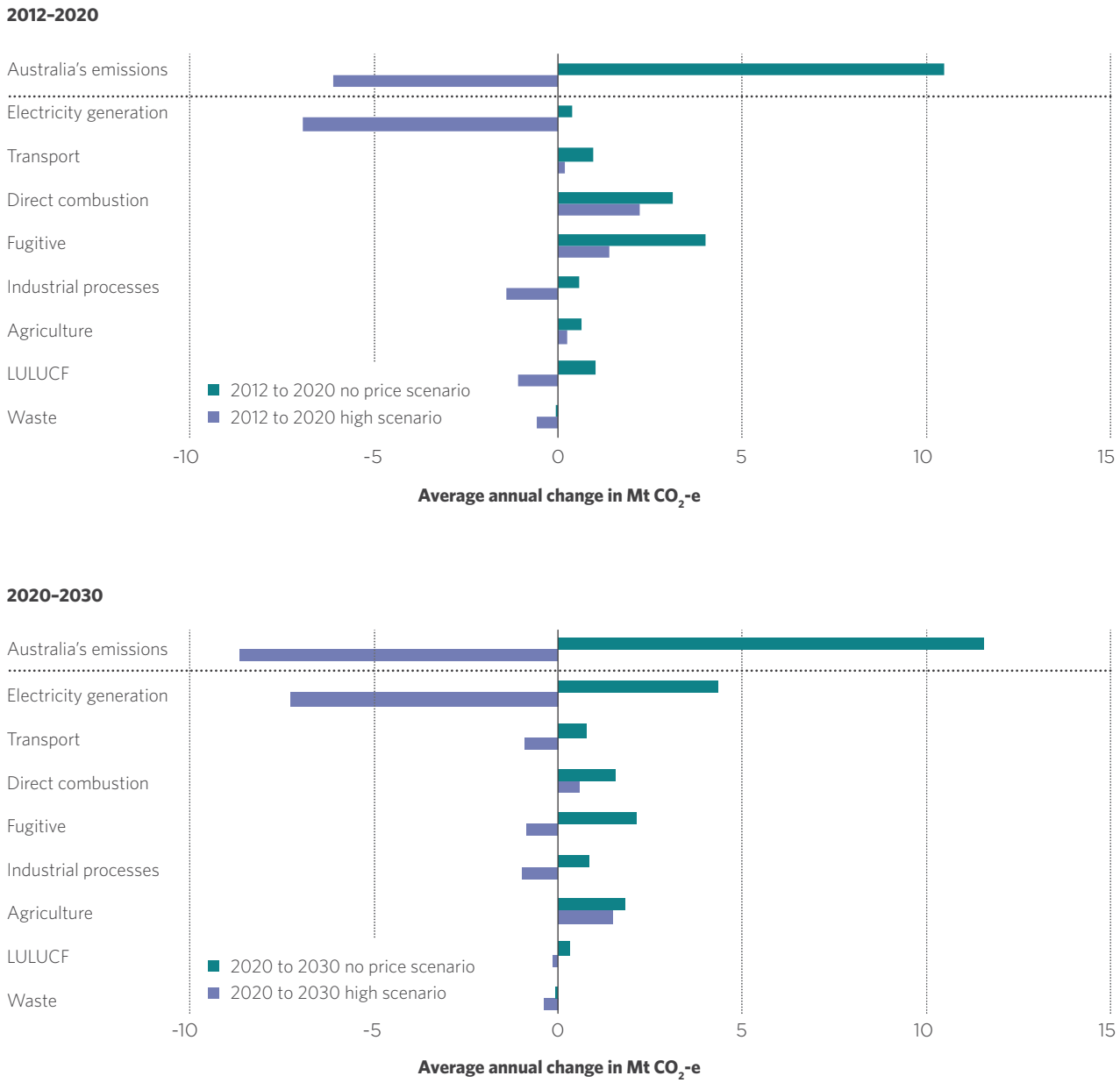
12.3.4 OVERVIEW OF SECTORAL OUTLOOK

Emissions reduction opportunities vary considerably by sector, depending on each sector's proportion of Australia's total emissions and its responsiveness to incentives. Figure 12.4 shows the range in projected sectoral emissions outcomes across the modelled scenarios. Specific sectoral emissions reduction opportunities are discussed further in Section 12.4 and Appendix D.

Figure 12.5 provides an insight into the emissions reductions that a price incentive (or equivalent) could drive. The major projected trends under the four scenarios are:

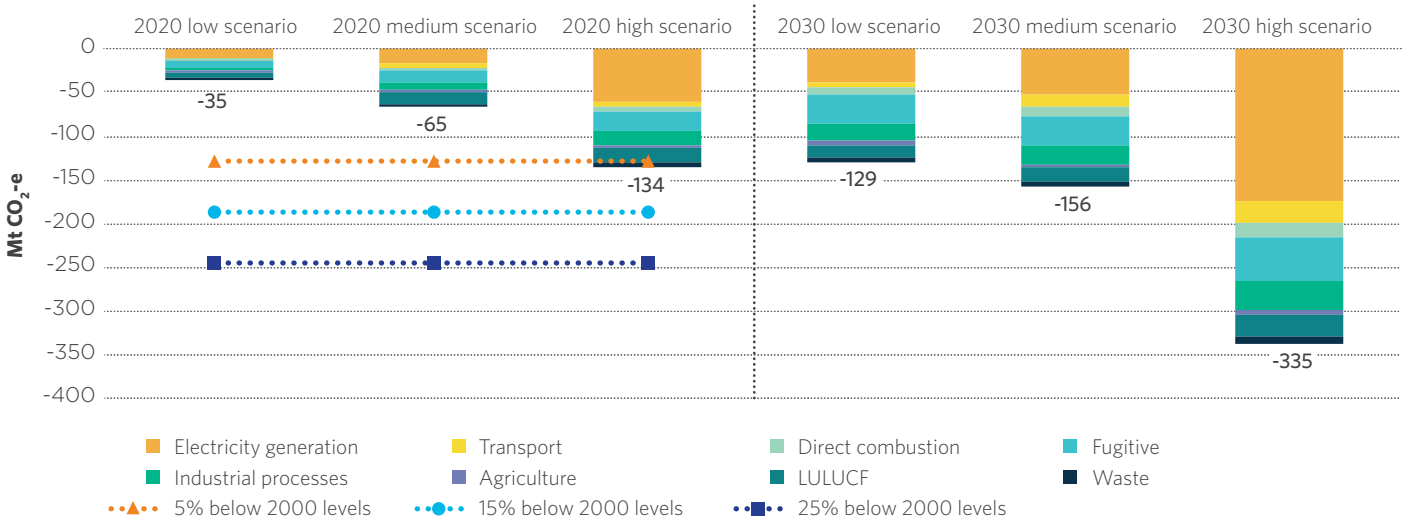
- Electricity remains the greatest single sectoral emitter under all scenarios until around 2030, accounting for about a third of national emissions. In a no price scenario, electricity emissions are projected to rise from current levels, despite the Renewable Energy Target (RET). With incentives, the electricity sector is projected to reduce its emissions. In the high scenario, electricity emissions could be reduced by 59 Mt CO_2-e in 2020 and by 174 Mt CO_2-e in 2030, relative to the no price scenario. This would be driven by a shift toward low-emissions electricity generation and a slowing of growth in electricity demand.
- Transport emissions are projected to rise marginally in the no price and low scenarios. While the majority of road transport does not face a price incentive under any of the modelled scenarios, emissions fall between 2020 and 2030 in the medium and high scenarios because of more fuel-efficient new vehicles and a switch toward lower emission fuels.
- Foreign demand for Australian resources, particularly LNG and coal, is projected to continue under all scenarios, even with strong global action on climate change. The projected five-fold increase in net exports of LNG from 2011 to 2020 (BREE 2013) is estimated to drive much of the projected growth in domestic emissions to 2030 through increases in direct combustion and fugitive emissions.
- Rising demand for beef and dairy products is likely to drive emissions growth from agriculture, under all scenarios, in the period to 2030. Greater reforestation and avoided deforestation, particularly under the high scenario, could deliver significant emissions reductions from the land sector.
- Industrial process emissions grow to about 39 per cent above current levels by 2030 under the no price scenario. Under the low and medium scenarios, emissions in 2030 are projected to be at least 25 per cent below 2012 levels. Under the high scenario, emissions in 2030 are about a third of 2012 levels.
- Waste emissions remain relatively stable in the period to 2030 in a no price scenario, as increased activity is being offset by emissions intensity reductions from new technologies. In the high scenario, emissions from waste fall significantly.

FIGURE 12.4: PROJECTED AVERAGE ANNUAL CHANGE IN EMISSIONS, BY SECTOR, 2012–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

FIGURE 12.5: PROJECTED EMISSIONS REDUCTIONS RELATIVE TO THE NO PRICE SCENARIO, 2020 AND 2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

TABLE 12.2: SECTORAL SHARES OF EMISSIONS REDUCTIONS RELATIVE TO THE NO PRICE SCENARIO, 2020 AND 2030

		ELECTRICITY	TRANSPORT	DIRECT COMBUSTION	FUGITIVES	INDUSTRIAL PROCESSES	AGRICULTURE	LULUCF	WASTE
2020	Low scenario	25.3%	6.3%	3.4%	24.2%	13.2%	4.0%	17.5%	6.0%
	Medium scenario	24.1%	6.9%	5.5%	21.3%	14.7%	4.0%	18.9%	4.8%
	High scenario	43.7%	4.8%	5.2%	15.6%	11.8%	2.5%	13.3%	3.1%
2030	Low scenario	28.3%	5.4%	6.8%	24.4%	16.2%	3.2%	11.0%	4.7%
	Medium scenario	32.7%	9.4%	6.0%	21.1%	14.5%	3.0%	9.1%	4.1%
	High scenario	51.9%	6.9%	5.0%	15.2%	10.1%	1.9%	6.7%	2.4%

Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013. Rows may not total 100% due to rounding.

12.4 SECTORAL EMISSIONS REDUCTIONS

12.4.1 OVERVIEW OF MAJOR OPPORTUNITIES AND BARRIERS

There are major opportunities to reduce Australia's emissions, at relatively low costs. The electricity sector, which is the largest contributor to Australia's emissions now and likely to remain so in the future, is emissions-intensive compared with much of the rest of the world, and can potentially deliver substantial emissions reductions. The modelling suggests that about half of the least-cost domestic opportunities to reach Australia's minimum 5 per cent emissions reduction target could be found in the electricity sector. Policies are needed to realise these potential emissions reductions. Section 12.4.3 describes non-price barriers that, if removed, could result in even greater emissions reductions in electricity emissions by improving energy efficiency and reducing electricity demand.

Australia's transport sector has not, to date, been subject to many of the measures used internationally to reduce light vehicle emissions. Substantial emissions reduction opportunities could be readily realised through available vehicle technologies. Regulation and standards could be particularly effective in improving the fuel efficiency of light vehicles, reducing emissions from transport.

Other sectors face greater challenges to reliably deliver large emissions reductions. Some export-driven sectors are projected to have rising emissions due to strong global demand. This includes emissions from direct combustion, fugitives, agriculture and industrial processes. In these sectors, improvements in emissions intensity are unlikely to be sufficient to offset the impact of greater activity. One exception is the substantial emissions reduction opportunities in industrial processes that could be mobilised if incentives are in place. The strong projected growth in direct combustion emissions to 2020 from rising global demand for energy resources is only slightly offset by the uptake of existing low-emissions technologies and practices, even if incentives are in place.

12.4.2 EMISSIONS REDUCTION OPPORTUNITIES BEYOND MODELLING

The modelling identifies emissions reduction opportunities up to a certain marginal cost, but does not identify the best policy to realise those opportunities. Policy instruments need to be matched to specific emissions reduction tasks and specific sectoral challenges. For example, a price incentive could be accompanied by policies to overcome non-price barriers.

The remainder of Chapter 12 outlines, for each sector, changes that contribute to the estimated emissions reductions in the scenarios modelled, and further opportunities beyond what is modelled. It also sets out key barriers to realising those opportunities.

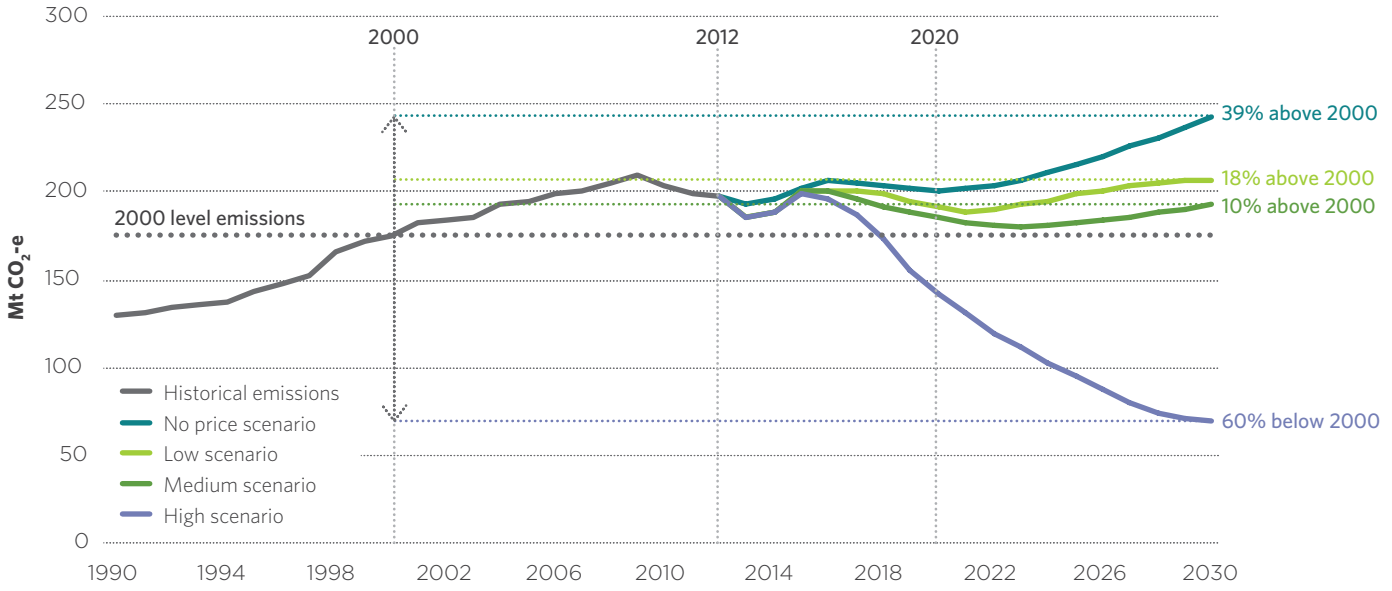
12.4.3 ELECTRICITY

Emissions in the electricity sector are released when fossil fuels, such as coal, natural gas and liquid fuels, are combusted to generate electricity. This sector includes generation that is connected to electricity grids such as the National Electricity Market (NEM) and generation for use on-site ('off grid'). The electricity sector accounted for 33 per cent of national emissions in 2012 (The Treasury and DIICCSRTE 2013).

Emissions from electricity are projected to rise steadily in a no price scenario, underpinned by economic and population growth. Electricity emissions could stabilise and then fall significantly after 2030 (low and medium scenarios) or, with sufficient incentive, could begin to fall in the near term (Figure 12.6).

The emissions reductions projected in the low, medium and high scenarios, relative to the no price scenario, reflect a shift towards less emissions-intensive sources of generation and lower electricity demand. The relative costs of generating technologies and fuels, and mitigation policies that affect these costs, will largely determine the timing and magnitude of the shift towards low emissions generation (ACIL Allen Consulting 2013, BREE 2012a, IEA 2012b).

FIGURE 12.6: ELECTRICITY EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013 and ACIL Allen Consulting 2013

OPPORTUNITIES FOR EMISSIONS REDUCTIONS FROM THE ELECTRICITY SECTOR

Modelling and other analyses suggest that, with incentives in place, the electricity sector could be the single largest source of domestic emissions reductions. Compared to the no price scenario, modelling suggests the electricity sector could reduce emissions by between 9 and 59 Mt CO_2-e in 2020 (in low and high scenarios, respectively) and by between 36 and 174 Mt CO_2-e in 2030 (low and high scenarios). This is additional to the emissions reductions due to the RET, at its current legislated level.

ClimateWorks Australia (2010) estimates that the electricity sector has 'realistic reduction' potential of up to 77 Mt CO_2-e in 2020, compared to business as usual, by reducing emissions intensity of supply.

A variety of sources highlight the importance of price incentives in driving changes in the emissions intensity of supply and in reducing demand (ClimateWorks 2013b, Garnaut 2008, IEA 2012a). Pitt & Sherry (2013a) estimates that about 40 per cent of the reduction in emissions from the NEM in the year to 2013 was due to lower electricity demand, and 60 per cent due to the uptake of lower emissions electricity generation. AEMO's (2013a) forecasts note the effect of the RET in lowering the emissions intensity of electricity supply.

In the near term, emissions reductions from reducing electricity demand through energy efficiency measures could be significant; The Treasury (2011) projected that over 40 per cent of the cumulative sectoral emissions reductions to 2020 could come from reducing electricity demand. The analysis presented in Appendix D reinforces these estimates for significant emissions reductions to be delivered by reducing electricity demand. In the longer term, improvements in supply intensity are likely to be increasingly important. If barriers to energy efficiency (described below) are overcome, there could be even greater emissions reduction opportunities.

Reducing emissions through lowering electricity demand

Australia's per person electricity consumption is well above the OECD average, and it lags on energy efficiency, highlighting the potential to reduce emissions through reducing electricity demand (IEA 2012b). Improving the efficiency of Australia's buildings and electrical appliances could provide emissions reductions in 2020 of about 12 and 20 Mt CO_2-e, respectively, under a scenario with a moderate price incentive in place (George Wilkenfeld & Associates 2009). AEMO reports that continuing the existing and planned building-related energy efficiency measures and minimum energy performance standards for electricity appliances could reduce electricity demand, in 2030, to a level that is about 20 per cent below demand in The Treasury and DIICCSRTE's no price scenario (AEMO 2013b).

Several sources suggest that reducing electricity demand can reduce emissions at low cost, or even at a positive net present value (Prime Minister's Task Group on Energy Efficiency 2010, Productivity Commission 2005, The Climate Institute 2013). Changing the profile or level of energy demand could reduce consumers' electricity bills and offer economic benefits; for example, the AEMC (2012) estimates that system expenditure could be cut by at least $4.3 billion over the next decade through reducing peak demand growth.

Reducing emissions intensity of electricity supply

At present, Australia's electricity supply is among the most emissions-intensive in the developed world and, since 2007, has exceeded China's electricity emissions intensity (IEA 2013a).

To at least 2020, existing and committed electricity supply is expected to be adequate to meet demand in the NEM (AEMO 2013c). Low demand growth suggests there will be little new investment in new electricity generation, except in response to policy drivers. In the near term, the RET is supporting some deployment of low-emissions technologies, including wind and solar.

Existing fossil fuel generators can also reduce emissions by upgrading turbines, modifying boiler operations, retrofitting plants with new coal-drying technologies and co-firing with low-emissions fuels. Several Australian generators plan to do so (DRET 2013). As the costs of low-emissions technologies fall, it is likely they will increase their share of generation. Depending on the level of incentive, by the 2030s the growing share of low-emissions generation could include emerging technologies such as geothermal and carbon capture and storage (CCS), which are currently relatively costly and facing other challenges to deployment (see below).

CHALLENGES TO REDUCING ELECTRICITY SECTOR EMISSIONS

Challenges to reducing electricity demand

There are several non-price barriers to reducing electricity demand, identified by the Productivity Commission (2005, 2013), Garnaut (2008), the AEMC (2012) and others. There is also considerable consensus about solutions, including:

- electricity consumption information and prices that better reflect actual costs of supply can help consumers understand their electricity use and manage spending; and
- standards for electrical appliances and buildings that lower electricity consumption. Standards help combat split or perverse incentives for investing in energy efficiency while still allowing consumers the same appliance functionality.

The Authority considers it important to determine how energy efficiency opportunities can be cost-effectively pursued in the new policy environment, including the most sensible mix of responsibilities across state and Commonwealth jurisdictions. Particular initiatives that have been identified in previous reviews are discussed in Appendix D.

Challenges to reducing emissions intensity of electricity supply

Several sources of low-emissions electricity generation have already been deployed, including wind and solar PV. The costs of low-emission generation generally remain higher than the costs of conventional sources. At present, new investments in low-emissions generation are not cost-competitive with the costs of existing generation (whose large upfront capital costs are now sunk). This, combined with an overcapacity of supply in the NEM, means that existing generators could operate economically for some time, and there will be little incentive for new investment in lower emissions (or any other) electricity generation. This suggests policy will be needed to reduce the emissions intensity of supply. The RET is accelerating deployment of renewable electricity generation; deployment could be further accelerated by policies that create a demand for low-emissions electricity investments and lower their relative cost. It is important that policies and incentives are stable, given the long life of electricity generation assets.

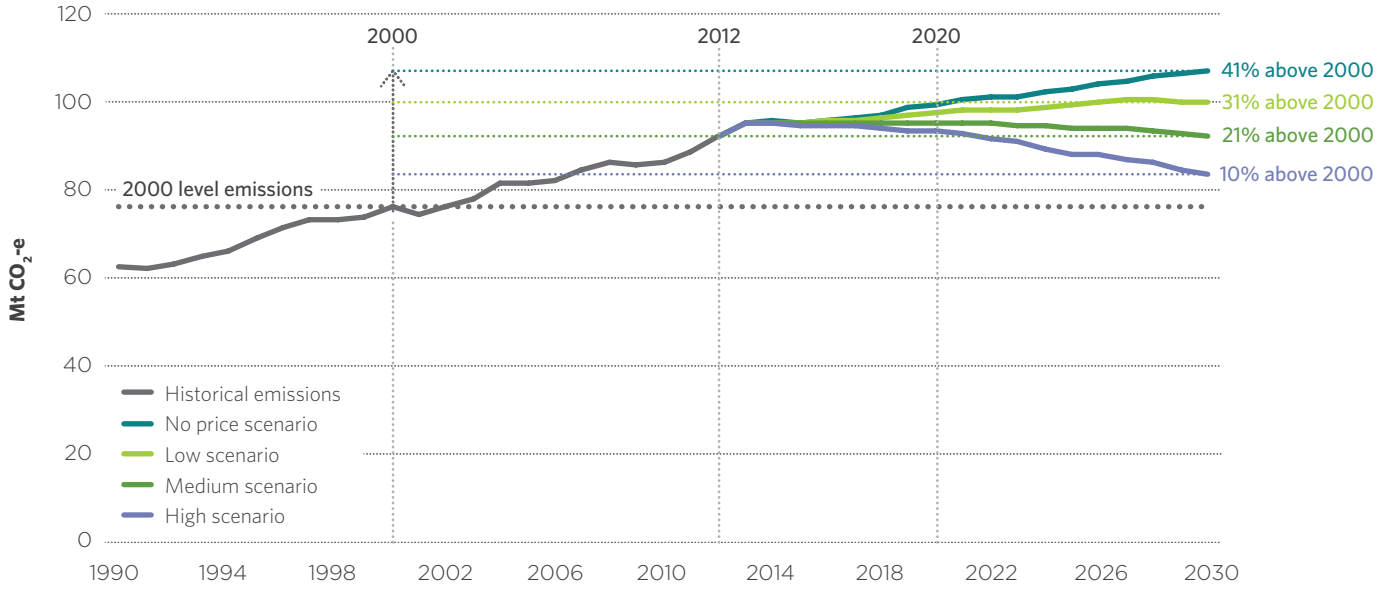
The deployment of emerging low-emissions technologies, such as geothermal and CCS, is high-risk and capital-intensive. Technical, price and logistical challenges have slowed progress on these particular technologies in recent years. As a result, electricity sector experts predict their deployment could occur later than was thought a few years ago and generally do not expect these technologies to contribute substantial emissions reductions in Australia until the 2030s, even if policy drivers exist to promote investments in lower emissions generation (ACIL Allen Consulting 2013, BREE 2012b).

A detailed analysis of progress in reducing electricity sector emissions is presented in Appendix D3.

12.4.4 TRANSPORT

Transport emissions are from vehicles combusting fuels to move people and freight, reported across four modes – road, rail, domestic aviation and domestic shipping. International aviation and shipping emissions are excluded from Australia's emissions. Emissions associated with producing and refining liquid and gaseous fuels, as well as generating electricity, are attributed to stationary energy sectors. The transport sector accounted for approximately 15 per cent of Australia's emissions in 2012.

FIGURE 12.7: TRANSPORT EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013 and CSIRO 2013

Transport sector emissions have increased by 29 Mt CO_2-e (46 per cent) since 1990. The Treasury and DIICCSRTE modelling projects that, under all scenarios, transport demand will continue to grow and, without sufficient policy drivers, this will lead to continued emissions growth. Under the low, medium and high scenarios, emissions dip or level out to the mid-2030s, due to reduced emissions intensity of passenger and road freight transport (Figure 12.7).

After 2030, emissions are projected to increase again as road transport activity continues to grow.

The modelled scenarios do not include a carbon price on light vehicle emissions, which currently account for approximately 63 per cent of transport emissions. Significant emission reductions are available for light vehicles at modest cost.

The Treasury and DIICCSRTE modelling suggests that price incentives may be effective in reducing emissions in the medium to long term, with emissions lower by 23 Mt CO_2-e in 2030 and 30 Mt CO_2-e in 2050 under the high scenario relative to the no price scenario. Most of the projected transport emissions reductions result from heavy vehicle efficiency and biofuels.

OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN TRANSPORT

Road transport, particularly light passenger vehicles, accounts for most transport emissions. Australia has a higher average emissions intensity of the passenger vehicle fleet than many other developed countries. Few policy drivers have targeted the sector's emissions; international evidence suggests that there is a substantial opportunity for emissions reductions. Some policy measures in the transport sector will, however, need to have regard to the specific characteristics of Australia, such as its relatively dispersed population across a large geographical area.

There is potential to reduce transport emissions through use of sustainable biofuels, vehicle electrification and mode shift; for example, from private vehicle transport to more rail and bus transport in urban areas.

Fleet-average fuel economy or carbon dioxide emissions standards for light vehicles have been adopted in many major markets, including the European Union, the United States, Canada, China, Japan and South Korea. Such standards warrant further investigation for Australia.

CHALLENGES TO REDUCING EMISSIONS IN THE TRANSPORT SECTOR

Even if new policies are introduced in the transport sector, emissions reductions might be slowed or prevented by:

- Supply constraints in biofuel production, such as lack of available land and competing food uses for the biofuel crops. Oil prices and other factors that influence competition with fossil fuels may lead to a fluctuation in consumption rates of biofuels.
- The cost of electric vehicle technology and the emissions intensity of electricity supply. The current high purchase price (and limited driving range) of electric vehicles relative to internal combustion engine vehicles is a hurdle to widespread adoption. If the emissions intensity of Australia's electricity supply remains high, it is possible that vehicle electrification could result in a net emissions increase compared with continued use of conventional light vehicles.
- The low population density of Australia's cities (relative to European and Asian standards). This presents a challenge to the investment in and use of alternatives to light vehicles for urban passenger movement.

A detailed analysis of progress in reducing transport emissions is presented in Appendix D4.

12.4.5 DIRECT COMBUSTION

Direct combustion emissions are released when fuels are combusted for stationary energy purposes, such as generating heat, steam or pressure (excluding electricity generation). These emissions are released by large industrial users, and by small, dispersed residential and commercial consumers. Emissions from direct combustion accounted for 16 per cent of national emissions in 2012 (The Treasury and DIICCSRTE 2013).

In each modelled scenario, direct combustion emissions are projected to rise strongly from current levels through to 2030 (Figure 12.8). In absolute terms, under all but the no price scenario, direct combustion emissions increase more than any sector of the Australian economy. This increase is driven by growth in energy extraction industries, including for LNG production at seven major new projects to come online by 2020. Price incentives could slow growth to some extent by encouraging greater uptake of low-emissions technologies.

OPPORTUNITIES FOR DIRECT COMBUSTION EMISSIONS REDUCTIONS

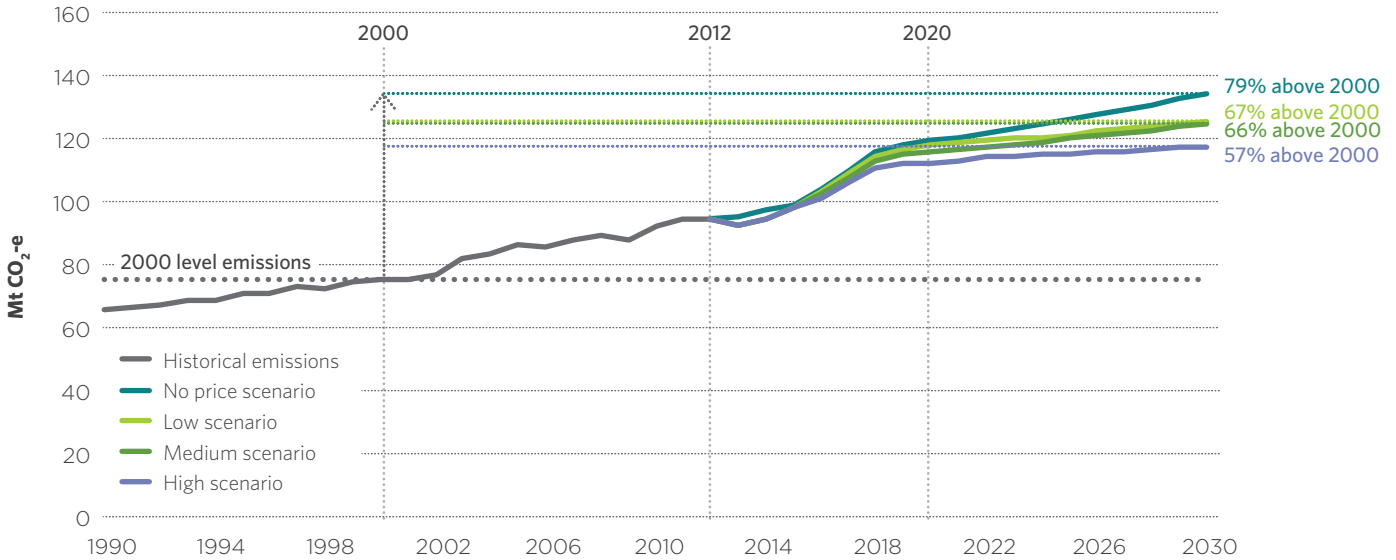
With strong growth projected in energy resources extraction, emissions intensity improvements are unlikely to be enough to reduce overall emissions from the sector. The Treasury and DIICCSRTE modelling suggests price incentives will have a relatively limited effect on direct combustion emissions. Even under the high scenario, the sector is expected to reduce emissions by only about 6 per cent (7 Mt CO_2-e) in 2020 and 12 per cent (17 Mt CO_2-e) in 2030, compared with a no price scenario. Reduced diesel use is expected to account for much of the emissions reduction.

The manufacturing and mining industries produce around three-quarters of direct combustion emissions. Activity in these industries; in particular, mining, is projected to grow, even with strong global action on climate change. Emissions reductions could come from improvements in emissions intensity, such as improving the efficiency of gas turbines and machinery, or capturing and using heat from gas turbine exhaust. With a price incentive, new investments could increasingly incorporate low emissions technologies that could deliver greater emissions reductions in the longer term (The Treasury and DIICCSRTE 2013).

The growth in residential and commercial direct combustion emissions, mainly from gas use, could be constrained through more efficient water and space heating appliances and more thermally efficient buildings. George Wilkenfeld & Associates (2009) suggest that ongoing and expanded mandatory efficiency standards for buildings and gas appliances, such as water heaters, could reduce cumulative emissions from residential gas use by 4.5 Mt CO_2-e between 2000 and 2020, though household churn from electric to gas appliances may offset these emission reductions.

Beyond efficiency improvements, the main opportunity to reduce direct combustion emissions could be to substitute alternative lower emission energy sources, such as biofuels. If the emissions intensity of electricity generation falls, as projected, with incentives in place, then moving from direct fuel combustion to electricity could, in the medium to longer term, significantly reduce emissions from residential, commercial and industrial consumers.

FIGURE 12.8: DIRECT COMBUSTION EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

CHALLENGES TO REDUCING EMISSIONS IN THE DIRECT COMBUSTION SECTOR

The challenges to reducing emissions from direct combustion include:

- locked-in, long term energy supply contracts in the LNG industry;
- investments in long-lived, high-value assets; and
- barriers to the take-up of energy efficiency, including lack of information on energy consumption and split or perverse incentives for investing in energy efficiency. Standards for gas appliances and buildings, and information provision, have been used to help overcome these non-price barriers.

A detailed analysis of progress in reducing direct combustion emissions is presented in Appendix D5.

12.4.6 FUGITIVES

Fugitive emissions are greenhouse gases emitted during the extraction, production, processing, storage, transmission and distribution of fossil fuels such as coal, oil and gas. Fugitive emissions accounted for 8 per cent of national emissions in 2012 (The Treasury and DIICCSRTE 2013).

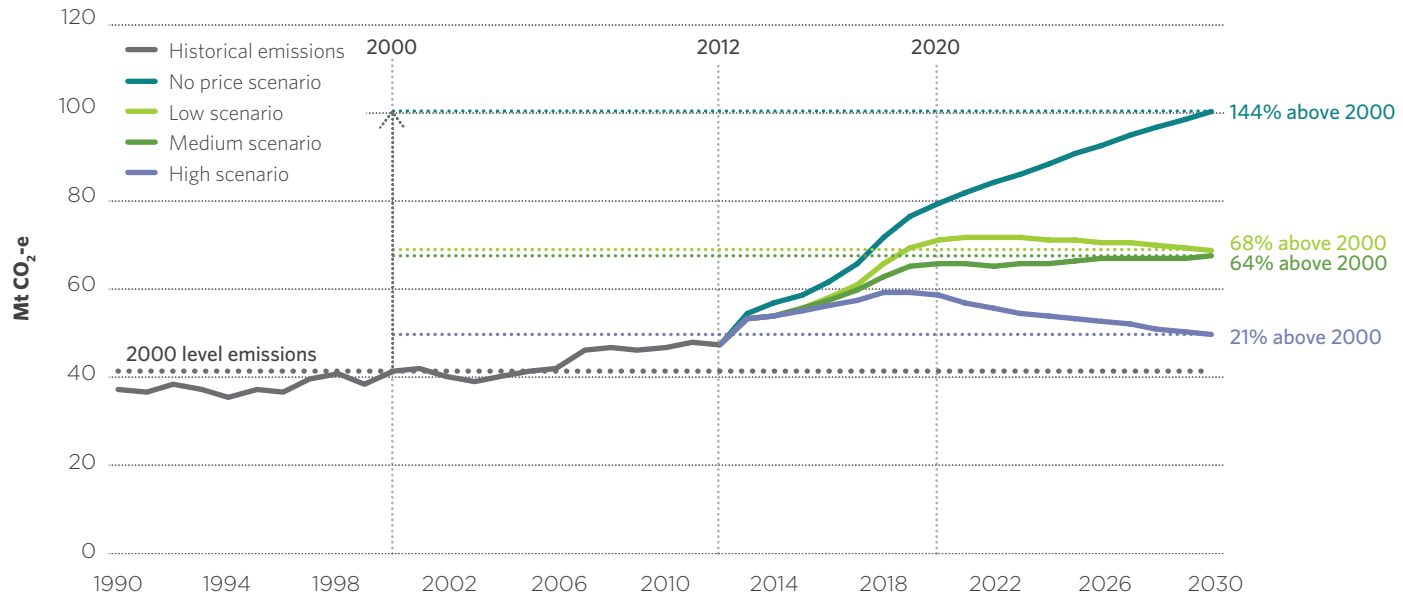
Without price incentives, fugitive emissions could rise rapidly, driven largely by strong export demand for LNG and coal. Substantial emissions reduction opportunities exist, however. In the modelled scenarios, the fugitive sector is projected to be the second largest source of emissions reductions over the period to 2030, providing 15 to 24 per cent of total expected emissions reductions, relative to the no price scenario (The Treasury and DIICCSRTE 2013).

OPPORTUNITIES FOR FUGITIVE EMISSIONS REDUCTIONS

Fugitive emissions could more than double to 2030, from 48 Mt CO_2-e in 2012 to 79 Mt CO_2-e in 2020 and 100 Mt CO_2-e in 2030, in a no price scenario. In low and high scenarios, the modelling shows that the fugitives sector could reduce emissions by 8 and 21 Mt CO_2-e in 2020, respectively, compared to the no price scenario. In 2030, the fugitives sector could contribute between 31 and 51 Mt CO_2-e emissions reductions.

Despite increased coal and gas production, improvements in emissions intensity can lower total fugitive emissions compared with the no price scenario. Coal mines are responsible for about three-quarters of fugitive emissions; a number of technologies are available to reduce emissions, including predraining to capture methane (which is a mature technology) and the oxidisation of ventilation air methane (which is at an early stage of development). With incentives, these technologies may be increasingly deployed after 2020 (ClimateWorks 2013a). In the short term, a price incentive to reduce emissions could encourage the relative expansion of lower emission mines. It could also drive the deployment of additional pre- and post-mine drainage, where gas could either be flared or used to generate electricity. These technologies could play a significant role in reducing fugitive emissions to 2020 and beyond.

FIGURE 12.9: FUGITIVE EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

Carbon capture and storage (CCS) in the oil and gas sectors could significantly reduce fugitive emissions, though it is not widespread today. The IEA highlights this potential at a global scale (IEA 2013b). The Gorgon LNG project in Western Australia is expected to capture and inject at least three million tonnes of carbon dioxide annually by 2015 (Chevron 2013). Incentives may encourage deployment of CCS technologies in new projects near geologically suitable injection sites. Recently announced Queensland LNG projects appear not to have access to suitable injection sites, and are not expected to use CCS.

Other opportunities to reduce fugitive emissions in the natural gas industry may include equipment changes and upgrades, changes in operational practices and direct inspection and maintenance (US EPA 2006).

CHALLENGES TO REDUCING FUGITIVE SECTOR EMISSIONS

The main challenge to reducing fugitive sector emissions is strong growth in LNG and coal production, which could outstrip improvements in emissions intensity. Australia's LNG production is projected to increase rapidly over the next decade, with seven major new projects identified as coming on line. Coal exports are also projected to grow (BREE 2012b).

Technologies to reduce emissions remain an additional cost for coal, oil and gas producers, compared to conventional production. Their uptake can be accelerated by policies or price incentives.

A detailed analysis of progress in reducing fugitive emissions is presented in Appendix D6.

12.4.7 INDUSTRIAL PROCESSES

The main sources of industrial process emissions are:

- metal production, such as iron, steel and aluminium;
- synthetic greenhouse gases, such as those used for refrigeration and as propellants;
- chemical processes in fertiliser and explosives manufacturing; and
- mineral production, particularly cement and lime products.

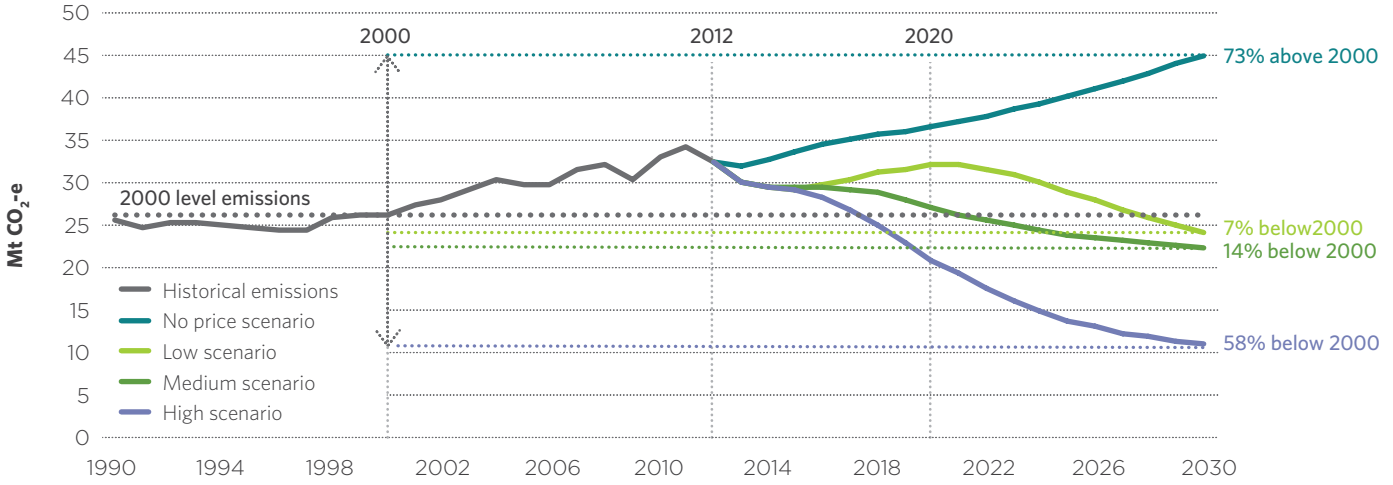
Industrial process emissions exclude energy-related emissions such as those from burning of fossil fuels for heat, steam or pressure. Emissions from industrial processes accounted for 5 per cent of national emissions in 2012 (The Treasury and DIICCSRTE 2013).

In the no price scenario, industrial process emissions are projected to rise. With price incentives, emissions stabilise or fall from current levels. In scenarios with price incentive, industrial processes contribute a proportionally large share of domestic emissions reductions through the adoption of readily available and relatively low-cost, low-emission substitutes, technologies and process improvements.

OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN INDUSTRIAL PROCESSES

The industrial processes sector could reduce 2020 emissions by between 5 Mt CO_2-e and 16 Mt CO_2-e, compared with the no price scenario (The Treasury and DIICCSRTE 2013). Emissions reductions opportunities are projected to be even greater in 2030, with 34 Mt CO_2-e under the high scenario (75 per cent lower than the no price scenario).

FIGURE 12.10: INDUSTRIAL PROCESS EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

Almost half of the estimated emissions reductions in the industrial processes sector in 2020 and 2030 could be delivered by nitrous oxide conversion catalysts for nitric acid production. This technology has already been deployed by Orica and is being trialled by Wesfarmers; they report that the technology could reduce emissions by 65 to 85 per cent (Orica 2012, Wesfarmers 2013). ClimateWorks (2013a) estimates that if this technology is taken up more widely it could reduce the emissions from nitric acid production by 44 per cent in 2020 compared with today, even with the expected increase in production. The regulation of nitric acid plants, including state-based environmental guidelines, is helping to reduce emissions in this sector.

The other significant emissions reduction opportunity is the destruction and replacement of synthetic greenhouse gases. These gases are used mainly in refrigeration, and account for about 27 per cent of industrial process emissions in 2012. Synthetic greenhouse gases may be superseded by alternative gases that have low to zero global warming potential. The rate of recovery and destruction of these gases, and the associated emissions reduction, will depend largely on incentives in place.

In the longer term, CCS could significantly reduce industrial process emissions. The International Energy Agency (IEA) suggests that by mid-century, around half of the global emissions reductions that it attributes to CCS could be from industries such as cement, hydrogen production, iron and steel (IEA 2013b).

CHALLENGES TO REDUCING EMISSIONS IN THE INDUSTRIAL PROCESSES SECTOR

The challenges to reducing industrial process emissions include:

- the cost of emissions reduction technologies. Financial incentives and other policies can accelerate uptake, as has occurred in recent years. These incentives could also apply to CCS for industrial applications where the technology is proven but still relatively expensive (IEA and Global CCS Institute 2012); and
- rising production – particularly in the chemicals sector – that could outstrip improvements in emissions intensity.

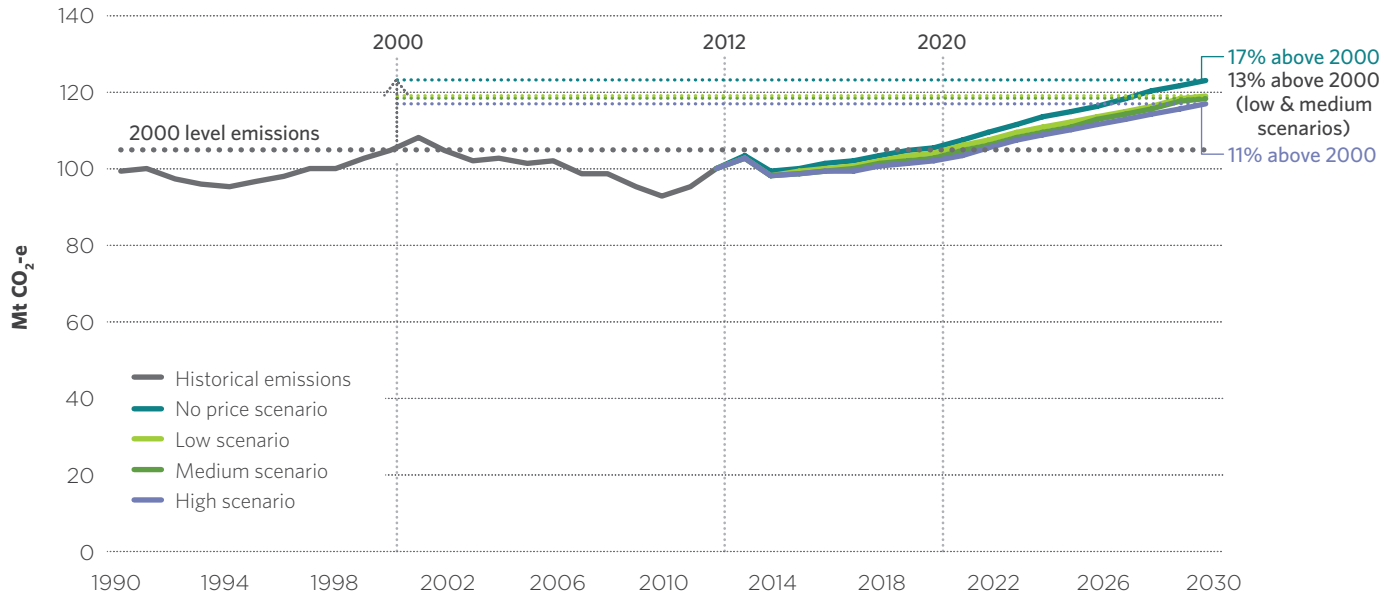
A detailed analysis of progress in reducing industrial process emissions is presented in Appendix D7.

12.4.8 AGRICULTURE

Agriculture emissions result from livestock digestive processes (enteric fermentation), manure management, nitrous oxide emissions from cropping and pastureland soils, prescribed burning of savannahs and burning of agricultural residues. The agriculture sector accounted for approximately 17 per cent of Australia's emissions in 2012.

Agriculture emissions have increased by 1 per cent since 1990. Under all modelled scenarios, agricultural emissions are projected to increase strongly in the longer term. These increases are driven by strong international demand for agricultural commodities, primarily from emerging Asian economies.

FIGURE 12.11: AGRICULTURE EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

While price incentives may reduce agriculture emissions intensity, the strong projected activity growth means total agriculture emissions could still grow.

OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN AGRICULTURE

The Treasury and DIICCSRTE estimate emissions would be about 1 and 3 Mt CO_2-e lower in 2020 under the low and high scenarios, respectively, relative to the no price scenario. Most of these emission reductions are from livestock.

ClimateWorks (2010) assessed the emissions reduction potential of agriculture and found greater opportunities – reductions of over 4 Mt CO_2-e in 2020 from livestock at a societal cost of $17/t CO_2-e or less. Further, ABARES analysis suggests that about 7 Mt CO_2-e of emissions reductions, at a cost of $73/t CO_2-e or less, might be available from livestock in 2020. Apart from manure management, however, most of the projected technologies and practices for reducing livestock emissions are still being developed and are not ready for commercial use. It should be noted, however, that the studies referred to have significant differences in assumptions relating to available technologies, level of uptake and associated costs.

Productivity improvements may also reduce the sector's emissions intensity. Australia has historically achieved production efficiency improvements of about 2 per cent annually in broadacre cropping.

CHALLENGES TO EMISSIONS REDUCTIONS IN AGRICULTURE

One of the major challenges for the agriculture sector is the development and implementation of emissions reduction technologies. Greenhouse gas emissions from the digestion of livestock were responsible for about two-thirds of emissions from the agriculture sector in 2012, for which there are currently limited emissions reduction technologies and practices available. Measurement of emission reductions is also an issue. Livestock and cropping emissions involve complex interactions within biological systems that are very difficult to measure with precision. A practice that reduces emissions on one farm may have a different effect at another, due to different local conditions such as pasture type and weather.

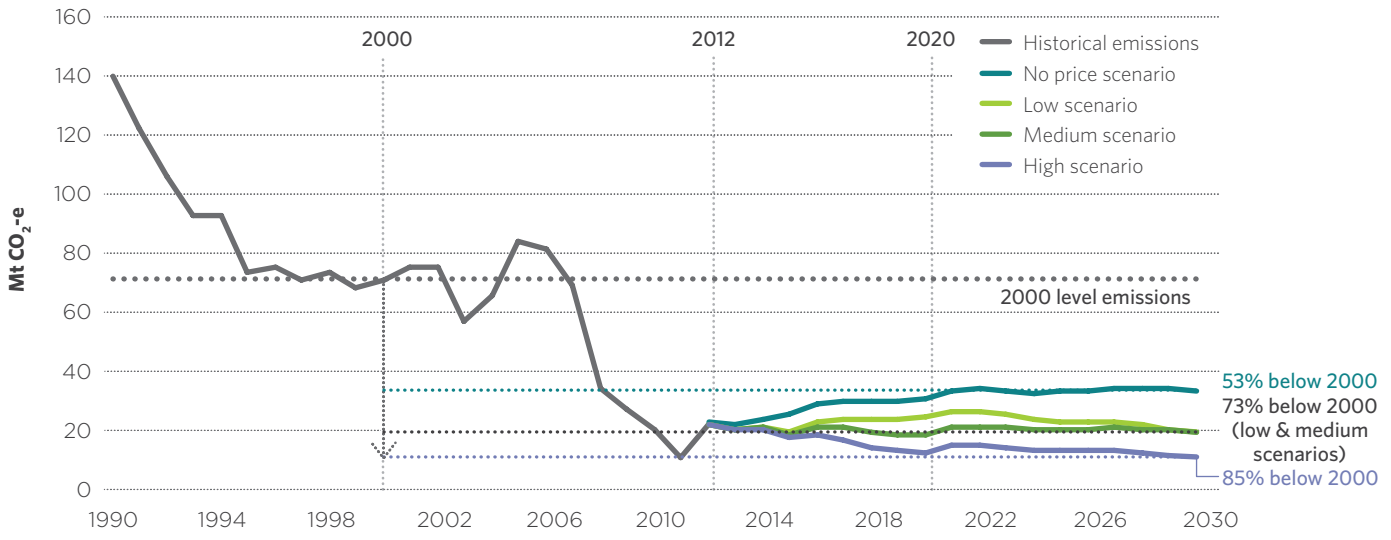
Continued research and technology development is important to support both development and uptake of emission reduction opportunities and general emissions intensity improvements.

Other challenges include limited access to capital. Small farms may be unable to achieve economies of scale and have limited access to information about emission reduction projects. These challenges are exacerbated by the presence of many small and dispersed participants in the sector.

A range of approaches could be taken to combat these barriers and challenges, such as providing information through rural networks, simplifying methodologies for projects, facilitating access to capital and facilitating the use of project providers to consolidate projects across multiple small farms. A trend in recent decades toward increasing farm sizes and the concentration of production in larger farms may also help reduce some of these challenges.

A detailed analysis of progress in reducing agriculture emissions is presented in Appendix D8.

FIGURE 12.12: LULUCF EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

12.4.9 LAND USE, LAND USE CHANGE AND FORESTRY (LULUCF)

Land use, and the biomass the land supports, forms part of the carbon cycle and affects atmospheric CO_2 levels. Reporting on land use, land use change and forestry sector includes emissions and sequestration due to the clearance of forested land for new purposes (deforestation), new forests on land that was unforested on 1 January 1990 (afforestation and reforestation), and the implementation of practices that change emissions and sequestration on other lands (forest management, cropland management and grazing land management). Combustion of fossil fuels from forestry and land management activities, such as diesel used in logging machinery, is covered in the direct combustion sector. LULUCF accounted for approximately 4 per cent of Australia's emissions in 2012.

LULUCF has been the biggest sectoral contributor to emissions reductions in Australia since 1990. Net emissions from the sector have declined by 85 per cent from 140 Mt CO_2-e in 1990 to 22 Mt CO_2-e in 2012.

Macroeconomic factors, such as farmers' terms of trade and prices of wood commodities, have been the main determinant of emissions from LULUCF. Land clearing restrictions in Queensland and New South Wales have also played a significant role in the last decade. The Queensland restrictions have recently been relaxed, with legislation in 2013 returning aspects of Queensland's land clearing framework to the conditions that applied prior to 2009. Policy incentives (such as Managed Investment Schemes) boosted forest plantations in the 1990s; however, it is unlikely all of these forests will be replanted once harvested. Over the medium to longer term, a combination of subdued forestry demand, reduced land clearing restrictions and upward pressure on deforestation due to increased cattle herd numbers after 2020 are all factors contributing to projected emissions trends.

The Treasury and DIICCSRTE (2013) and others suggest incentives can bring forward significant emission reductions in the sector.

OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN LULUCF

Price incentives could play an important role in LULUCF emissions reduction. Relative to the no price scenario, 12 Mt CO_2-e and 14 Mt CO_2-e of emissions reductions could be delivered by 2020 and 2030, respectively, under the medium scenario. Under the high scenario, emissions reductions may be 18 Mt CO_2-e in 2020 and 23 Mt CO_2-e in 2030.

ClimateWorks (2010) estimates much greater LULUCF emissions reductions potential – about 100 Mt CO_2-e in 2020 with price incentives consistent with the medium scenario. ClimateWorks found that forest planting, reduced deforestation, and pasture and grassland management are significant potential sources of emissions reductions (ClimateWorks 2010). These estimates also incorporate emission reductions from savanna burning, normally reported as agriculture emissions. If this potential was realised, 100 Mt CO_2-e of emissions reduction in 2020 would represent the largest single sectoral contribution to domestic emissions reductions, at about 17 per cent of 2000 levels.

Regulatory measures such as land clearing restrictions in Queensland and New South Wales have been one of the main drivers of significant emission reductions since 2005. Regulatory measures have also been very successful in reducing emissions in other countries; for instance Brazil has reduced deforestation by 82 per cent since the early 2000s, which has been credited to a combination of regulatory measures and lower agricultural prices (Climate Policy Initiative 2013).

Many of the LULUCF emission reduction opportunities could create other substantial environmental benefits such as reduced erosion, protection of biodiversity and improved water quality.

CHALLENGES TO LULUCF EMISSIONS REDUCTIONS

LULUCF emissions reductions face many barriers similar to those of agriculture. Effective methodologies to ensure that emissions reductions are measurable and robust are critical. Substantial research is likely to be required to design effective incentive measures that allow accurate measurement of emission reductions from changed land and forest management practices, and ensure that attributed emission reductions are robust and permanent.

For smaller scale operations, available returns may be insufficient to make adoption of emissions reductions technologies or practices worthwhile, and limited access to capital may also be a barrier. Requirements for 'permanence' in carbon sequestration projects, such as forestry, may also fix land uses for periods of a century or more. For activities such as forestry plantings on pasture lands, landowners will need to consider the value of alternative uses. Projected increased demand for agricultural commodities may make forestry investments less attractive, relative to investing in agriculture.

A detailed analysis of progress in reducing land use, land use change and forestry emissions is presented in Appendix D9.

12.4.10 WASTE

Waste includes solid waste and wastewater from residential, commercial and industrial activity. Waste emissions are mainly methane and nitrous oxide, which arise as organic waste decomposes in the absence of oxygen. The waste sector accounted for 3 per cent of Australia's emissions in 2012.

Waste sector emissions have decreased by 26 per cent since 1990 despite population growth and increased waste volumes. Under all modelled scenarios, waste emissions will continue falling. In the absence of a carbon price or any new policy measures, waste emissions are projected to fall marginally to around 15 Mt CO_2-e in 2030. Further emission reductions of between 6 Mt CO_2-e and 8 Mt CO_2-e (compared to the no price scenario) could be expected under the scenarios with a price incentive.

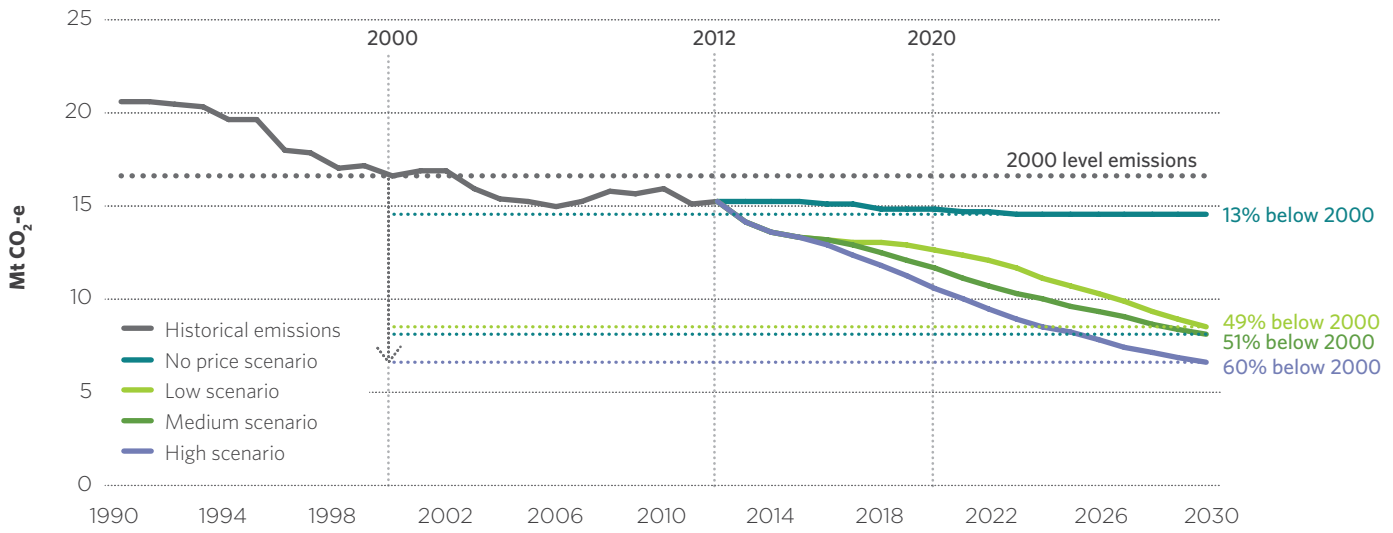
Historically, both regulatory and market-based measures have been successfully used to reduce emissions in the waste sector. Direct regulation of landfills for health and safety purposes has played a major role in driving implementation of gas capture technologies. Market incentives such as the New South Wales Greenhouse Gas Abatement Scheme and the Renewable Energy Target have also played a strong role in encouraging emissions reduction.

OPPORTUNITIES FOR EMISSIONS REDUCTIONS IN WASTE

The major emission reduction opportunity for waste is the expansion of alternative waste treatment facilities to reduce waste volumes being sent to landfill. This relies on development of new facilities and installation of new technologies, such as food waste treatment and other thermal energy recovery technologies. Further emission reductions could be generated by improving gas capture technology efficiency rates at landfill and wastewater facilities, and extending coverage of these technologies to smaller facilities. A price incentive would increase uptake of both gas collection and destruction and alternative waste treatment technologies. The CFI already provides incentives for destruction of methane emissions from 'legacy' waste (deposited at landfills before July 2012).

There is some evidence that increasing the cost of landfill disposal makes alternative waste treatment a more attractive option to pursue, driving waste streams away from landfill. This has been addressed via increased landfill levies in some Australian states and in the United Kingdom.

FIGURE 12.13: WASTE EMISSIONS, HISTORICAL AND PROJECTED, 1990–2030



Source: Climate Change Authority calculations using results from The Treasury and DIICCSRTE 2013

CHALLENGES TO EMISSIONS REDUCTIONS IN THE WASTE SECTOR

Australia has high levels of adoption of conventional emission reduction technologies such as gas capture and alternative waste treatment relative to other countries.

There are several barriers to the implementation of emission reductions in the waste sector:

- The installation of new technologies involves large capital costs that may take an extended operating period to recover. This suggests that a strong and stable price incentive, or a clear and enforceable regulatory requirement, would be needed to promote investment in these technologies.
- New waste treatment technologies and processes such as food waste treatment and thermal treatment plants may face hurdles of community acceptance, availability of suitable land, meeting local planning requirements and gaining sufficient funding.
- Alternative waste treatment and other emissions reduction technologies require a minimum scale to be cost-effective. Smaller towns in rural and regional areas often do not generate enough waste for local councils to justify the investment.

A detailed analysis of progress in reducing waste emissions is presented in Appendix D10.

DRAFT CONCLUSIONS

C.12 Economy-wide emissions are projected to rise to 17 per cent above 2000 levels in 2020, and 37 per cent above 2000 levels in 2030, without a price incentive or other policy mechanism.

C.13 There are extensive opportunities to reduce Australia's emissions, at relatively low costs. Policies are needed to realise these potential emissions reductions.

C.14 Electricity sector emissions are projected to grow strongly without a price incentive or other policy mechanism. With price incentives, the electricity sector could be the single largest source of domestic emissions reductions, through a mix of demand reduction and decreased generation emissions intensity.

C.15 Rapid growth in demand for road transport and domestic air travel is projected to drive increasing transport emissions, without a price incentive. With appropriate policies, fuel efficiency, biofuels and vehicle electrification could deliver significant transport emissions reductions.

C.16 Direct combustion and fugitive emissions are projected to rise strongly from current levels, driven by demand for Australian energy resources. Price incentives could slow emissions growth.

C.17 Industrial process emissions are projected to grow without a price incentive. The sector, however, is expected to be highly responsive to targeted policy and could deliver significant emissions reductions.

C.18 Agriculture emissions are projected to grow in the period to 2030 in all scenarios modelled, driven primarily by strong growth in demand for Australia's agricultural exports. Projected emissions reduction opportunities are relatively limited.

C.19 Regulatory measures such as land clearing restrictions in Queensland and New South Wales have been one of the main drivers of significant historical land sector emission reductions. There remains significant potential for emissions reductions in the land sector.

C.20 Waste emissions are generally expected to fall over time. Projected emissions reductions depend upon the level of price incentive.

Chapter 12 surveyed possible outlooks for Australia's domestic emissions. It showed there is great potential to reduce emissions, and that each sector has different challenges and opportunities. Emissions from some sectors are likely to be highly responsive to price incentives, while others may be less responsive.

It also identified where, when and how emissions reductions might occur in Australia. Chapter 13 considers the benefits and risks of using international emissions reductions to help meet Australia's emissions reduction goals.

CHAPTER 13 USING INTERNATIONAL EMISSIONS REDUCTIONS TO MEET AUSTRALIA'S GOALS

13

The United Nations Framework Convention on Climate Change (UNFCCC) allows countries, including Australia, to use some international emissions reductions to meet their emissions reduction targets. The Government has stated its intention to achieve Australia's minimum 5 per cent 2020 target domestically, but has not ruled out using some international emissions reductions to meet a 2020 target beyond 5 per cent.

There are benefits and risks to using international emissions reductions to help meet Australia's emissions reduction goals. Potential benefits include lowering the cost of meeting Australia's target, reducing competitiveness concerns and supporting broader Australian foreign and trade objectives. However, there are also risks – in particular, that international emissions reductions are not genuine and that using international reductions could detract from the task of transitioning Australia's economy to a low-emissions future.

The Authority recommends a balanced approach that retains the possibility of using some genuine international emissions reductions to meet our emissions reduction goals. This would help lower Australia's emissions reduction costs, while still allowing risks to be responsibly managed.

Stronger targets could be achieved by purchasing some international emissions reductions. Moreover, the Government could consider using genuine international emissions reductions to complement domestic efforts to achieve Australia's minimum 5 per cent commitment.

Chapter 10 showed that Australia can achieve strong emissions reductions at relatively small cost using a mix of domestic and international emissions reductions. Chapter 13 takes a closer look at the role of international emissions reductions in achieving Australia's emissions reduction goals. It discusses:

- the potential benefits and risks of using international emissions reductions; and
- the amount and sources of international emissions reductions available to Australia.

13.1 INTRODUCTION

Climate change is a global phenomenon – the atmosphere does not care where emissions are created or where they are reduced. From an environmental perspective, there is no special merit in reducing emissions in one country over another; it is the quantity of reductions that matters. This principle is recognised in the international climate framework, including the Kyoto Protocol, which allows countries to meet their targets through both domestic emissions reductions and by purchasing emissions reductions created in other countries.

The role of international emissions reductions in meeting Australia's goals is a policy choice and is the subject of much discussion in Australia. The Government has stated that Australia's 5 per cent 2020 target should be achieved domestically; it has not ruled out the possibility that stronger targets could be met in part through international emissions reductions. The details are currently under development.

The Authority has considered the consistency between the use of international emissions reductions and the Authority's guiding principles from the *Clean Energy Act* that measures to respond to climate change must (among other things) be economically efficient, environmentally effective, support the development of an effective response to climate change and be consistent with our foreign policy and international trade objectives.

13.2 BENEFITS AND RISKS OF USING INTERNATIONAL EMISSIONS REDUCTIONS

Using international emissions reductions to help meet emissions reduction goals has benefits and risks. Using international emissions reductions can:

- create access to a wider range of cost-effective, environmentally robust mitigation opportunities, lowering the overall cost of meeting Australia's targets;
- help to address competitiveness concerns for industry; and
- support international action by contributing to the development of broad and deep international markets and supporting low-emission activity in developing countries.

But using international emissions reductions could also:

- risk spending money on emissions reductions that are not genuine;
- introduce price risks that could detract from Australia's transition to a low-carbon economy.

Many submissions discussed Australia's use of international emissions reductions to meet its goals; all business groups and almost all non-government organisations supported some use of international emissions reductions. For example, the Australian Chamber of Commerce and Industry noted that:

> *The decision to link Australia's carbon price mechanism to overseas carbon markets … allows carbon to be abated more cost effectively for any given target and cap by providing access to lower cost forms of abatement (Issues Paper submission,* p. 10*).*

Notwithstanding this support, a variety of stakeholders have raised concerns with the use of international emissions reductions, including that low prices will delay Australia's domestic economic transition to a low-emissions economy, that low-emissions research and development will be adversely affected and that international emissions reductions are not genuine. The Climate Institute raised both the benefits and potential adverse effects of international prices in its submission:

> *… the development of ambitious carbon market coalitions provides an opportunity for Australia to be more ambitious in its emissions reduction commitments … [Carbon] markets offer the opportunity to drive substantial private sector financing in developing nations. However, there are risks associated with links to global markets. The current international market is immature. While this remains the case and global prices are low (or subject to substantial political risks), Australian investors may commit to long-term assets that are excessively emissions intensive. As a result, the nation risks deadweight losses from stranded assets and will have to spend on more costly abatement later on (Issues Paper submission,* p. 25*).*

Dr Frank Jotzo (*Issues Paper submission*, p. 5) highlighted both short term risks and long term benefits from using international emissions reductions, and argued that policy measures such as a price floor should be used to counter the risks. He noted that being 'part of an integrated system of international emissions trading when it exists will be in Australia's longer term interest' but argued that current European Union (EU) carbon prices are 'below most estimates of the marginal benefit in terms of avoided climate change damages' and as such 'should not determine the level of effort within Australia'.

The Authority has considered the benefits and risks of international emissions reductions relative to meeting Australia's targets purely domestically. For the potential benefits, the Authority has focused on lower costs to meet Australia's goals; competitiveness concerns and broader foreign and trade objectives are also noted. For the potential risks, it has focused on environmental integrity and sustained low carbon prices. The next sections consider the benefits and risks in more detail.

13.2.1 BENEFITS OF USING INTERNATIONAL EMISSIONS REDUCTIONS

LOWERING COSTS TO MEET AUSTRALIA'S EMISSIONS REDUCTION GOALS

Allowing international emissions reductions would reduce the cost of Australia's emissions reduction task, making it cheaper to attain any given target and increasing the target that can be achieved at a given cost. Industry groups were strongly supportive of access to international units for this reason. The Ai Group strongly supported international linkage of carbon markets, on the basis that it lowers the global cost of emissions reductions and broadens action. The Clean Energy Council supported using international emissions reductions to lower the costs of reducing emissions; the Australian Petroleum Production and Exploration Association argued that there should be no limits on the use of genuine international emissions reductions. At present, there are large volumes of genuine international emissions reductions available at low prices that Australia could use to contribute to its emissions reduction goals.

The direct benefits to Australia of using international emissions reductions depend on the size of the gap between:

- international carbon prices, which reflect global targets to reduce emissions and the opportunities to do so; and
- the carbon price or other price incentive required to achieve the national targets through domestic emissions reductions alone.

If the cost of emissions reduction is lower in other countries than in Australia, trade would lower the cost of Australia's emissions reduction task.

If Australia was to achieve its unconditional 2020 emissions reduction target or the Authority's recommended 15 or 25 per cent options domestically, it is likely to have a marginal cost of emissions reduction above the expected international carbon price. This is reflected in the carbon prices and corresponding domestic emissions reductions achieved in the modelling scenarios discussed in chapters 10 and 12.

Australia's emissions reduction task over the period 2013–2020 for a 5 per cent target is estimated to be 593 million tonnes carbon dioxide equivalent (Mt CO_2-e). In the medium scenario, 294 Mt of emissions reductions over the period to 2020 are achieved domestically at an effective carbon price rising to around $27 per tonne (in real terms) by 2020. In the high scenario, 494 Mt of domestic emissions reductions are achieved over the period to 2020 at an effective carbon price rising to around $65 per tonne by 2020.[1] This indicates that, if Australia's unconditional 5 per cent target was to be achieved through domestic emissions reductions alone, carbon prices may need to be more than twice as high in real terms in 2020.

HELPING TO ADDRESS LONG TERM COMPETITIVENESS CONCERNS

By equalising carbon prices (or incentives) across countries, international trade in emissions reductions helps to reduce industry competitiveness concerns. In turn, these benefits can reduce barriers to setting stronger emission reduction goals, and help foster joint (and potentially more stable) political commitment to action on climate change.

CONTRIBUTING TO BROADER FOREIGN AND TRADE OBJECTIVES

Direct Government purchases of international units can be tailored to meet other Government objectives, including foreign or trade objectives, and to support its broader climate change and development objectives. For example, the Government could target purchases towards projects and programs that also strengthen environmental governance in countries in our region. There are accreditation schemes, such as the Gold Standard program, which identify projects that benefit the economy, health and welfare of the local community hosting the emissions reduction project.

Other countries and organisations tailor their purchase of international units to meet broader objectives. For example, in the third phase of the European Union Emissions Trading System (the EU ETS), the EU will not accept Clean Development Mechanism (CDM) units from new projects unless they are established in least developed countries. The World Bank has established a number of funds to purchase CDM units from projects which promote sustainable development and 'learning by doing' by stakeholders (World Bank Group 2013).

13.2.2 RISKS OF USING INTERNATIONAL EMISSIONS REDUCTIONS

ENVIRONMENTAL INTEGRITY

It is important that international emissions reductions are genuine; otherwise, the environmental integrity of Australia's action is compromised.

Ensuring high levels of environmental integrity is more complicated for international emissions reductions than for reductions that occur in Australia. The Government can set its own rules to govern domestic projects and monitor compliance relatively easily. For example, offsets from the Carbon Farming Initiative are subject to a strict set of rules to ensure their integrity. Australia has less control over emissions reductions projects in other countries, making it more difficult to assess, monitor and address environmental integrity and fraud issues. Australia must work with other governments to establish effective governance arrangements that accommodate different legal frameworks and approaches. The reliance on third-party governance arrangements increases the risk that international emissions reductions Australia uses to meet its target are not environmentally credible.

1 The effective carbon price is a weighted average of the Australian carbon unit price and the Kyoto unit price, with weight reflecting the Kyoto sub-limit.

This risk can be mitigated by only allowing international emissions reductions from sources it considers credible. For example, Australia may choose to allow CDM units (generated under the Kyoto Protocol) because the CDM is a long-established mechanism, and has detailed rules and governance arrangements to ensure the integrity of its emissions reductions. The governance of the CDM has been strengthened recently – standards and requirements for eligible projects are now more stringent, to ensure emission reductions are real, measurable, verifiable and additional to what would have occurred without the project. The CDM project cycle involves extensive accreditation and third-party certification, and ultimately approval from the CDM Executive Board.

A wide range of projects from many different developing countries generates CDM units. If there were concerns about the environmental integrity of a particular project type, Australia could choose not to accept those units and only purchase units from projects it considered credible. For example, the EU currently excludes nuclear energy, afforestation or reforestation activities, projects involving the destruction of industrial gases, and hydroelectric projects have to comply with international criteria and guidelines from the World Commission on Dams (European Commission 2013). Australia also adopted these rules for compliance under the carbon pricing mechanism.

For international emissions reductions beyond the CDM, the Commonwealth Government could negotiate with other governments to establish rules for ongoing monitoring of projects and reductions – Japan and Norway have been exploring such agreements with developing countries.

Another concern of using international emissions reductions is the risk of fraud. For domestic projects, the Clean Energy Regulator is empowered to address fraud and manages fraud risks in line with the best practices of the Australian Government Investigations Standards. In an international context, Australia must work with other governments to address fraud. The risk of fraud is no different from other, more traditional, markets. Governments put in place a range of measures, similar to those in financial markets, to mitigate the risk of fraud.

In conclusion, while there are environmental integrity and fraud risks associated with the use of international emissions reductions, they are manageable. Australia can draw on its experience working with foreign governments in other contexts to establish systems to mitigate these risks.

WHAT IF INTERNATIONAL CARBON PRICES ARE 'TOO LOW'?

There are many different risks with the future path of carbon prices in Australia. The issues are complex and a full investigation is not possible for this first Targets and Progress Review. By way of preliminary analysis, the Authority has focused on risk that is caused or exacerbated by allowing the use of international emissions reductions. Specifically, it considers the risk that, if international prices were to rise rapidly and unexpectedly from their current low levels, Australian investments in long-lived, high-emissions capital could become stranded.

For its preliminary investigation, the Authority has focused on the electricity sector to illustrate more general points. The electricity sector is currently the largest contributor to Australia's emissions, has a large emissions reduction task and is characterised by long-lived assets, and therefore the potential to 'lock in' emissions (see Section 12.4.3). Comparing projections of the Australian electricity sector under different carbon prices illustrates the large differences in activity and infrastructure between scenarios these are.

Large differences between the capital investment profiles in the electricity sector under low and high price scenarios are a potential signal that sustained low carbon prices, driven by our use of international emissions reductions, could make any eventual price increase disruptive for the sector and the economy. Conversely, if the electricity sector is projected to look similar under both scenarios, the consequences of sustained low prices may be less serious.

Even if there was a disruptive price increase that would not have occurred without allowing international emissions reductions, and some high emissions assets were stranded as a result, it would not necessarily mean that the investment was privately or even socially suboptimal. This is because there is a benefit to having the higher emissions infrastructure during the period of low carbon prices as well as a cost if prices rise unexpectedly. In turn, this means that a full assessment of the best investment from a social point of view would need to compare the expected net benefits over time for the higher and lower emissions infrastructure. Here, the Authority has focused on the first step of this analysis, namely comparing the electricity generation infrastructure between scenarios.

Modelling conducted by ACIL Allen Consulting (2013) for the Treasury and the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) suggests that higher price incentives could drive several important differences in the sector. Comparing the high scenario to the medium scenario shows:

- **Lower electricity demand.** Electricity generation (as generated) is estimated to be almost 6 per cent lower in the high scenario in 2020 and 9 per cent lower in 2030.
- **A less emissions-intensive electricity supply and faster falls in emissions intensity.** With a higher price incentive, over the period to 2030 there would be:
  - An earlier and sharper reduction in coal-fired generation, likely due to faster retirement of existing plant. For example, in 2030 black coal's generation share is estimated to be 9 per cent in the high price scenario, compared to 47 per cent in the medium scenario.
  - More coal generation with Carbon Capture and Storage (CCS), with CCS technology estimated to appear in 2030 with a high price (but in the mid-2040s in the medium scenario).
  - Earlier increase in gas-fired generation, including with CCS.
  - Substantially more renewable generation. While renewable generation to 2020 will be largely driven by the Renewable Energy Target, under the high scenario renewable generation reaches about 69 per cent in 2030 compared to 25 per cent in the medium scenario. Higher cost sources such as geothermal and solar thermal come online sooner and increase their level of generation more quickly.

This comparison shows that the main impacts of higher price incentives in the electricity sector to 2030 are more rapid uptake of wind, solar and gas-fired generation, and a more rapid and sharper drop in coal-fired generation.

Several stakeholders raised the prospect that suboptimally low international carbon prices would 'lock in' emissions-intensive generation assets. As Appendix D explains, the current over-supply of generation and flat electricity demand suggest that, even without a price incentive to reduce emissions in place, it is unlikely that new coal-fired plants would be constructed in Australia's major grids until at least 2020. This suggests the risk of locking in new emissions-intensive generation plants is not material. Still, a low price incentive could make continued operation and retrofits of existing emissions-intensive plants viable.

Lock-in aside, there is also a concern that sustained low international prices could permanently hamper emissions reductions because they slow the development of critical low-emissions technologies. This is possible if low current prices create expectations of low future carbon prices, and reduce the likelihood of inducing the technological innovation necessary to make it feasible to limit global warming, relative to pre-industrial levels, to below 2 degrees.

While these risks are of concern, Australia is generally a technology taker, particularly in the electricity sector. Limiting access to international emissions reductions and driving higher domestic emissions reduction costs is unlikely to have any impact on the global rate of technological change.

The next Section discusses the sources of international emissions reductions available to Australia to help meet our emissions reduction goals.

13.3 POSSIBLE SOURCES OF INTERNATIONAL EMISSIONS REDUCTIONS

If the Government chooses to purchase international emissions reductions to help meet Australia's targets, there are several sources to choose from, including:

- purchasing units from UNFCCC and Kyoto Protocol market mechanisms, such as the CDM;
- creating its own bilateral offset mechanisms, whereby Australia works with another country to establish programs and projects that generate emissions reductions; and
- purchasing units from established emissions trading schemes; for example, the European Union.

Until 2020, the most reliable sources of units for Australia are established mechanisms, such as the CDM and the EU ETS. There is currently substantial, low-cost supply from these sources, which is highly likely to be able to meet projected demand from Australia for a 15 or 25 per cent target. Bloomberg (2013a) projects about 2 100 Mt of CDM units will be issued over 2013-20 with the price expected to hover around € 0.5 for the period. The EU carbon market is projected to have an oversupply of about 212 Mt of EUAs (Bloomberg 2013b).

Beyond 2020, there is a wide range of potential sources of units, including from new market mechanisms (for example, reducing deforestation programs), and emerging emissions trading schemes in, for example, China or the Republic of Korea.

13.3.1 UNFCCC AND KYOTO PROTOCOL MARKET MECHANISMS

The Kyoto Protocol allows countries to meet their targets through the use of international emissions reductions including from the CDM and Joint Implementation (JI). The mechanisms have been successful at encouraging emissions reductions – over 1 350 Mt CO_2-e emissions reductions and 800 Mt CO_2-e of emissions reductions have been issued from each program respectively since their introduction (Bloomberg 2013). Countries have agreed to continue CDM and JI in the context of the Kyoto Protocol second commitment period, which runs from 2013–2020.

The Kyoto Protocol mechanisms have the advantage of experience. The first project was registered under the CDM in 2001. As discussed in Section 13.2.2, the rules and governance arrangements of the CDM help ensure emission reductions are real, measurable, verifiable and additional to what would have occurred without the project. Many countries source international emissions reductions through the CDM. For example, the EU accepts CDM units under the Kyoto Protocol for compliance in its emissions trading scheme and to count towards the EU target.

There may also be opportunities to source emissions reductions through units generated by new UNFCCC market mechanisms currently under negotiation. This could include programs aimed at reducing deforestation and forest degradation (REDD) in developing countries. These mechanisms are unlikely to begin generating significant quantities of credible units until after 2020.

13.3.2 BILATERAL OFFSET MECHANISMS

The Commonwealth Government could explore opportunities with developing countries to establish emissions reductions projects and programs directly.

Several countries are exploring bilateral agreements, which allow emissions reductions generated in one country to be used in another. Japan is establishing the Bilateral Offset Credit Mechanism to allow domestic companies to obtain emissions reductions through the dissemination of low-emissions technologies and services to developing countries. The Norwegian Government has also indicated it intends to establish bilateral mechanisms in developing countries to generate emissions reductions to use for meeting its 2020 target.

Units from bilateral offset mechanisms could not currently be used to meet Australia's second commitment period target under the Kyoto Protocol. They could be used to meet a more ambitious commitment under the UNFCCC.

13.3.3 EMISSION TRADING SCHEMES

Over 30 countries and about 15 sub-national jurisdictions have emission trading schemes including the EU, California, Kazakhstan (in pilot form), New Zealand, Quebec, sub-national schemes in Japan and China, and the Regional Greenhouse Gas Initiative in the United States. Purchasing units from these schemes (and having them cancelled in the host country) would be a way of sourcing international emissions reductions.

Before 2020, the EU Emissions Trading System is the most likely source of credible units from a domestic or regional emissions trading scheme. The System has been in operation since 2005 and is one of the oldest trading schemes. It has established systems for ensuring a high level of environmental integrity. These units – provided they are backed with a Kyoto Protocol unit – could be used to meet Australia's second commitment period target under the Kyoto Protocol.

Beyond 2020, there are likely to be opportunities to source international emissions reductions from emissions trading schemes in a wide range of countries, including, for example, planned schemes in China and the Republic of Korea.

13.4 CONCLUSIONS ON RISKS AND BENEFITS OF INTERNATIONAL EMISSIONS REDUCTIONS

The Authority has considered international emissions reductions against its principles for climate change policy and concludes that:

- The benefits are potentially substantial – international emissions reductions can lower costs for Australia to meet its emissions reduction goals, helping us take on stronger targets at a critical time for international action on climate change. While there are extensive emissions reduction opportunities available in the domestic economy, the Authority's analysis shows that Australia can achieve its goals at lower cost by using some international emissions reductions to complement domestic efforts.
- The risks are real but manageable – the main risks of using international emissions reductions are whether they are genuine, and whether international prices might create more disruption to the Australian economy than a carbon price determined purely domestically. The risks around environmental integrity can be addressed through robust governance arrangements and ongoing review of any units used to meet Australia's target. The potential risks around excessively low international prices are also real in theory; however, at least in the electricity sector, they do not appear to be material in practice. Moreover, policy design can help Australia to keep the benefits of lower cost emissions reductions while mitigating sector specific risks of locking in emissions-intensive capital.

This suggests that, as long as the emissions reductions are genuine they should remain an option for helping to meet Australia's target. The Government intends to achieve Australia's minimum 5 per cent commitment domestically. Stronger targets could be achieved by purchasing some international emissions reductions. Moreover, genuine international emissions reductions could complement domestic efforts in achieving Australia's minimum 5 per cent commitment in a cost-effective way. For example, the Government could consider establishing a strategic reserve of genuine international emissions reductions. Given the substantial benefits of trade in international emissions reductions both in general, and at this critical juncture in global climate action, the Authority recommends that Australia should keep international emissions reductions available as one way to meet its goals.

This analysis of the risks and benefits of international emissions reductions concludes the Authority's review of the opportunities and challenges for Australia's emissions reductions. The next and final part of the Review fulfils the Authority's obligations under the *Clean Energy Act* to make recommendations about caps under the carbon pricing mechanism.

DRAFT CONCLUSION

C.21 Using international emissions reductions to contribute to meeting Australia's goals has substantial potential benefits and manageable risks:

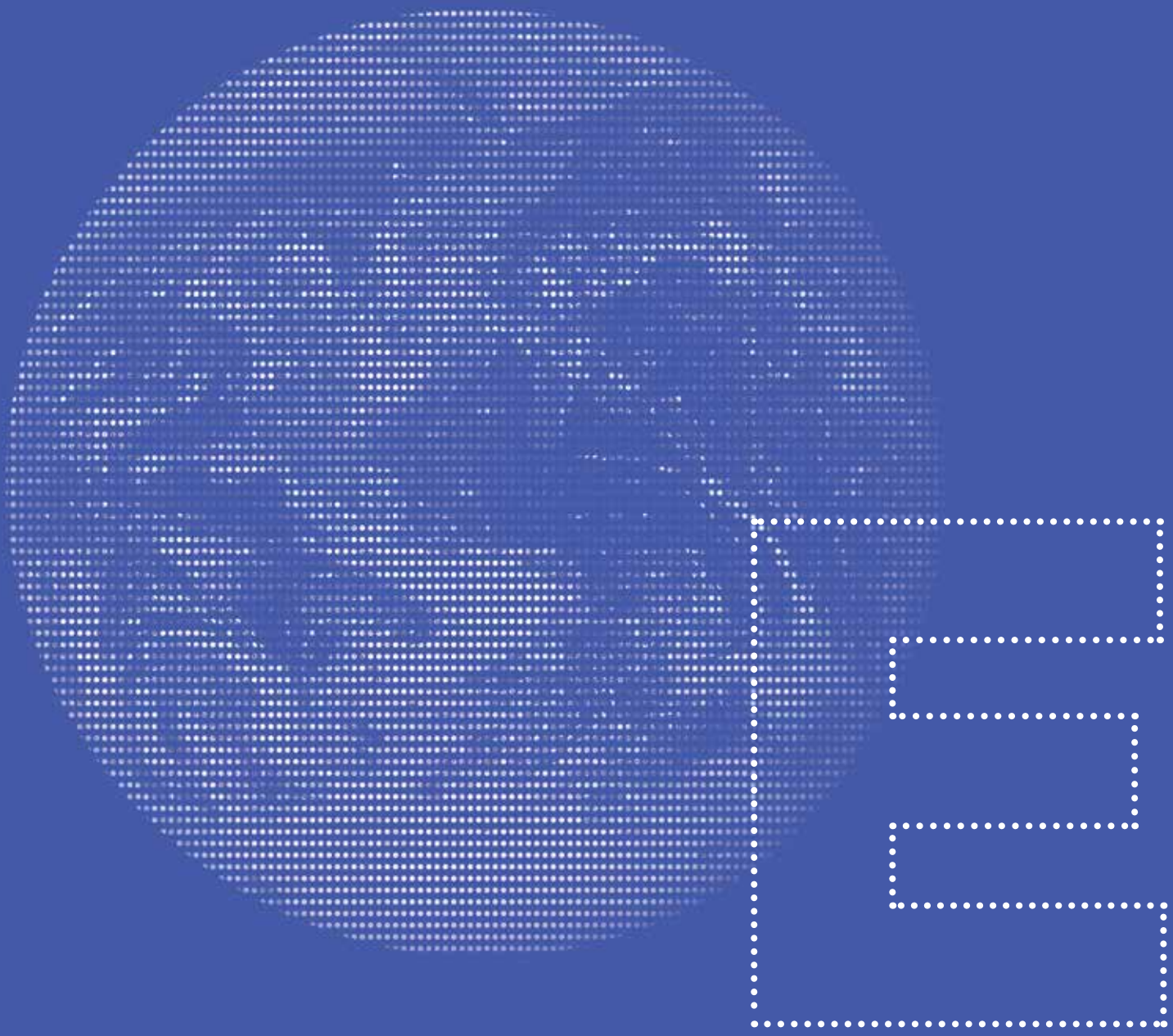
- International emissions reductions can reduce the cost of meeting emissions reduction goals, helping Australia take on stronger targets at a critical time for international action on climate change.
- Governance risks are real; however, robust governance arrangements and ongoing review of the environmental integrity of emissions reductions provides effective risk mitigation for Australia.
- Policy design can mitigate sector-specific risks such as locking in new emissions intensive capital.

DRAFT RECOMMENDATION

R.6 That the Government keep access to genuine international emissions reductions available where this is a cost-effective way of helping to meet its emissions reduction goals.

PART E

IMPLEMENTATION ISSUES UNDER THE CARBON PRICING MECHANISM



Australia's climate policy settings are under review. The Government has indicated it intends to repeal the carbon price and replace it with a Direct Action Plan to reduce Australia's emissions.

Under the current legislative arrangements, the carbon pricing mechanism is the primary way Australia would meet its 2020 targets. It imposes a limit on more than half of Australia's emissions. The Authority is required to recommend annual caps for the carbon pricing mechanism for the period 2015–16 to 2019–20.

There are many factors to consider when calculating and recommending caps, including the national emission reduction goals. Part E examines those factors, and calculates caps corresponding to the 15 and 25 per cent target options discussed in Part C of this report and being considered by the Authority.

CHAPTER 14
CAPS FOR THE CARBON PRICING MECHANISM

14

The Authority is required to make recommendations for caps under the carbon pricing mechanism. The Authority acknowledges that the Government intends to repeal the carbon price and replace it with a Direct Action Plan to reduce Australia's emissions.

Caps under the carbon pricing mechanism limit emissions from electricity generation, direct combustion, landfills, wastewater, industrial processes and fugitive emissions. These emissions represent more than half of Australia's total emissions.

Chapter 14 sets out caps consistent with the 15 and 25 per cent target options being considered by the Authority. The recommended caps take account of estimated emissions from sources outside caps, uncertainty in emissions estimates, free allocation of emission units and limits on the use of international units.

The *Clean Energy Act 2011* (Cth) requires the Authority to make recommendations for caps under the carbon pricing mechanism. This legislated requirement persists even though the Government intends to replace the carbon pricing mechanism with its Direct Action Plan. Chapter 14 sets out the Authority's approach to calculating caps that are consistent with either a 15 or 25 per cent target in 2020. It discusses:

- the carbon pricing mechanism and the role of caps;
- considerations in estimating the budget available for caps; and
- the year-by-year shape of caps.

It presents calculations and draft recommendations for annual caps corresponding to the two 2020 target options identified in Part C of this Report – a 15 and 25 per cent reduction relative to 2000 levels. Further details, including calculation methodologies and data, are set out in Appendix E.

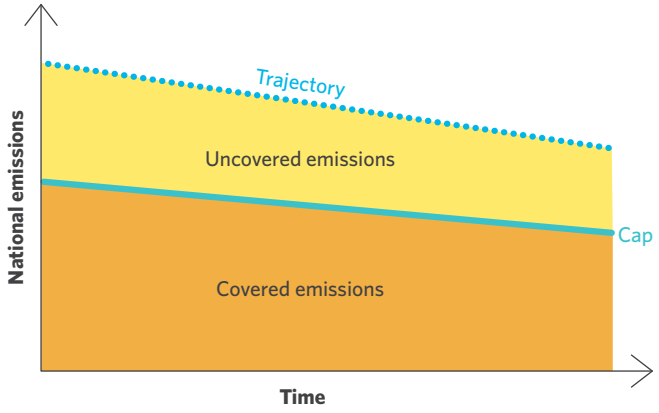
14.1 THE CARBON PRICING MECHANISM AND THE ROLE OF CAPS

The carbon pricing mechanism was established under the *Clean Energy Act* and covers more than half of Australia's emissions. Entities in covered sectors pay the carbon price if they emit at least 25 kilotonnes of carbon dioxide equivalent (kt CO_2-e) annually. The remaining uncovered sectors are subject to an equivalent carbon price, or do not face a carbon price (Table 14.1).

Under the existing legislation, the carbon pricing mechanism has a three-year fixed-price period from 1 July 2012 to 30 June 2015. When the fixed-price period ends, the legislation provides for annual caps on emissions covered by the carbon pricing mechanism ('covered emissions'). The gap between the trajectory and cap allows room in the emissions budget for emissions from sources outside the carbon pricing mechanism ('uncovered emissions') (Figure 14.1).

The cap determines the total number of Australian carbon units for a particular year to be issued by the Government. These units would be provided to entities as a free allocation or sold at auction, generating Government revenue.

FIGURE 14.1: THE RELATIONSHIP BETWEEN THE TRAJECTORY, CAP AND EMISSIONS



Source: Climate Change Authority

TABLE 14.1 COVERAGE OF THE CARBON PRICING MECHANISM

CARBON PRICING MECHANISM	EQUIVALENT CARBON PRICE	NO CARBON PRICE[2]
Emissions above the annual 25 kt CO_2-e threshold from: ◦ electricity generation ◦ direct combustion[1] ◦ industrial processes ◦ waste deposited since July 2012 ◦ fugitive emissions	Transport fuels used for: ◦ domestic aviation ◦ marine transport ◦ rail transport ◦ business in off-road transport ◦ non-transport business uses Synthetic greenhouse gases	Emissions from: ◦ agriculture ◦ land use, land use change and forestry ◦ fugitive emissions from decommissioned mines ◦ conventional road transport ◦ entities in sectors covered by the carbon pricing mechanism which fall below the 25 kt CO_2-e threshold

Notes: (1) Direct combustion excludes diesel, which is covered by the equivalent carbon price (unless opted in).
(2) Some sources are eligible to create offsets under the Carbon Farming Initiative (CFI).

If emissions covered by the carbon pricing mechanism exceed the caps, liable entities could purchase international units or domestic offsets to make up the difference. Approved international units could be surrendered to meet up to 50 per cent of an entity's carbon liability. At present, approved international units include European Union Allowances (EUAs) and Kyoto units (units generated under the Kyoto Protocol). A sub-limit of 12.5 per cent applies to Kyoto units. Domestic offsets include Australian Carbon Credit Units (ACCUs) under the CFI.

Under the *Clean Energy Act*, the Authority must recommend five years of caps, taking account of:

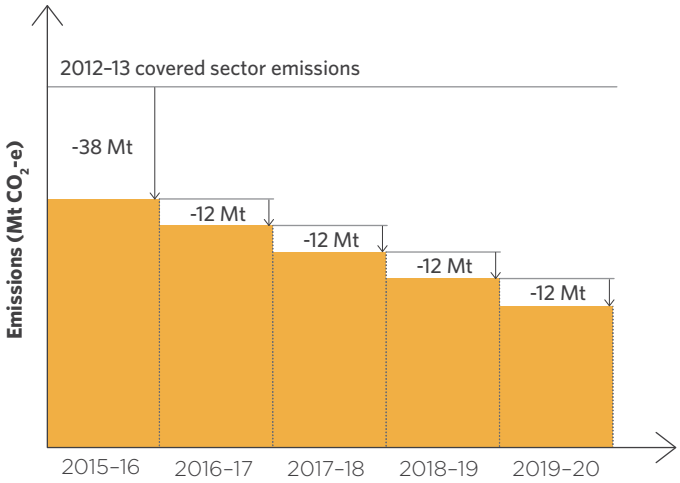
- voluntary action to reduce Australia's greenhouse gas emissions;
- estimates of greenhouse gas emissions that are not covered by the *Clean Energy Act*;
- the extent (if any) of non-compliance with the *Clean Energy Act* and the associated provisions;
- the extent (if any) to which liable entities have failed to surrender sufficient units to avoid liability for unit shortfall charge; and
- any acquisitions, or proposed acquisitions, by the Commonwealth of eligible international emissions units.

The current legislation requires the Minister responsible for climate change to take the Authority's advice and recommendations into consideration when setting caps, and to announce caps five years in advance.

In the event that regulations setting the caps are not made or disallowed, the *Clean Energy Act* provides for default caps. The first annual default cap equals total emissions covered by the carbon pricing mechanism in 2012–13, less 38 million tonnes of carbon dioxide equivalent (Mt CO_2-e). Following this, for each year that regulations were not made, the annual cap would be 12 Mt less than the previous compliance year (Figure 14.2).

Default caps were originally designed to be broadly consistent with the unconditional 5 per cent target. Since then, the 2000 base year emissions have been revised up, and projections for covered emissions for 2012–13 have been revised down. Based on the Authority's current assessment, default caps are now broadly consistent with a 15 per cent target in 2020.

FIGURE 14.2: DEFAULT CAP ARRANGEMENTS UNDER THE CARBON PRICING MECHANISM



Source: Climate Change Authority

14.2 OVERVIEW OF THE AUTHORITY'S APPROACH TO CAPS

The Authority will recommend annual caps that are consistent with its recommended 2020 national emissions budget (Box 14.1).

To this end, the Authority must first determine how much of the budget to reserve for emissions from the fixed-price period and uncovered emissions from the flexible-price period. The remainder of the budget is available for caps, and can be distributed across the flexible-price period to 2020. This approach gives confidence that Australia's total emissions will stay within its 2020 budget.

The Authority has used its best estimate of uncovered sector emissions, assuming existing legislation, to calculate caps. That is, the share of the budget allocated to uncovered sector emissions will be determined by a projection of what those emissions will actually be.

An alternative approach, suggested by the Business Council of Australia, is to set caps based on a proportional share of emissions, arguing that this would 'avoid a disproportionate shifting of the abatement burden onto covered sectors' (*Issues Paper submission*, p. 3).

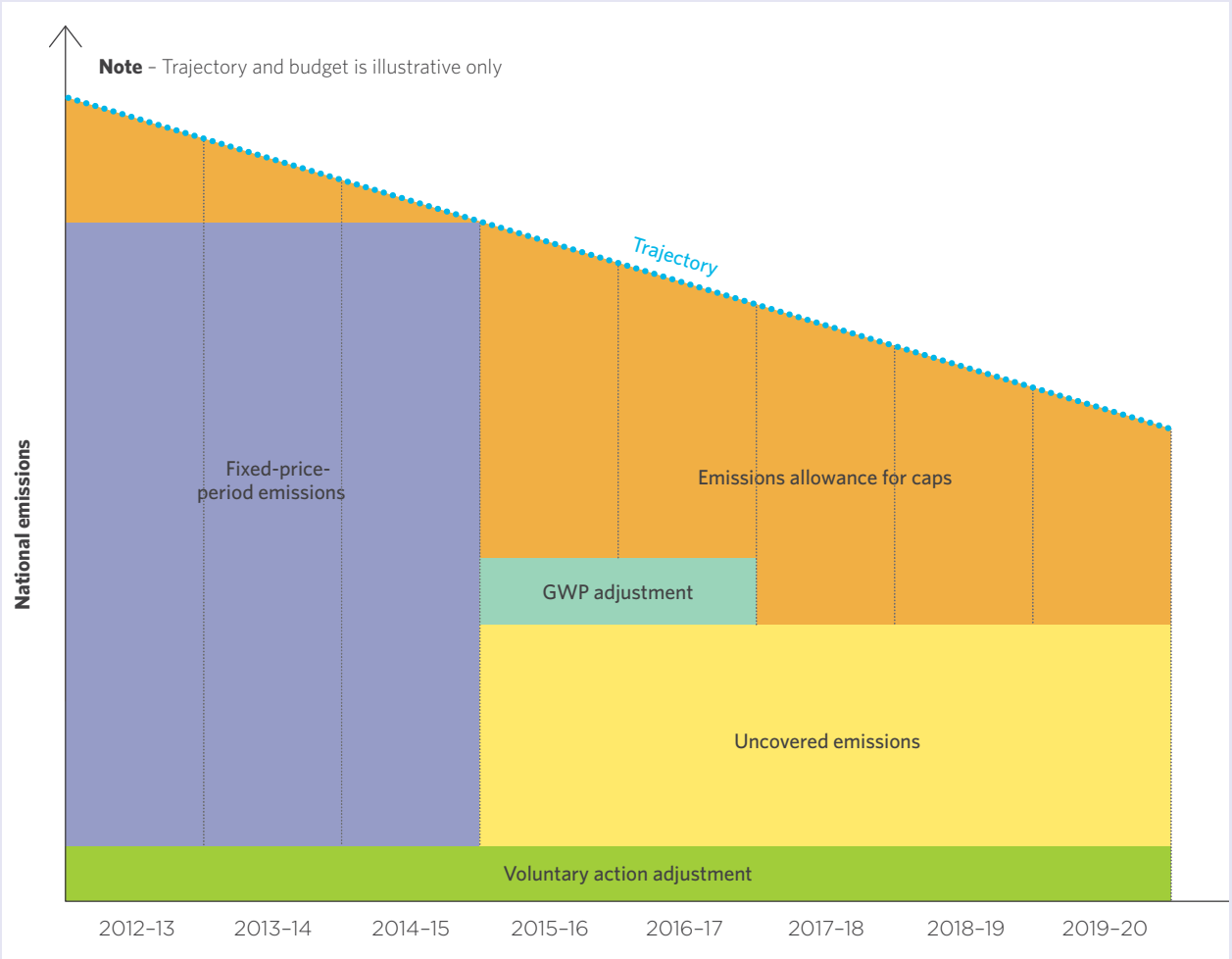
The Authority does not propose to adopt this approach because:

- encouraging equal shares of emission reductions across sectors is the wrong goal – it would not promote efficiency, because different sectors have different emissions reduction costs;
- it relies on estimates of business-as-usual emissions. Many emissions reduction policies have been in place for years, and have changed Australia's economy and emissions in permanent ways. As a result, business as usual becomes an increasingly abstract concept over time; and

BOX 14.1: FRAMEWORK FOR CALCULATING CAPS

In determining the number of units available for caps, the Authority has applied the following approach:

Emissions allowance for caps = National emissions budget (2013–20) **minus** *aggregate emissions from the fixed-price period* **minus** *uncovered emissions in the flexible-price period* **minus** *adjustment for Global Warming Potentials (GWPs)* **minus** *adjustment for voluntary action*



Note: The area under the trajectory is equal to the national emissions budget (2013–20).
Source: Climate Change Authority

- it would not give a high likelihood of Australia meeting its national emissions budget. If the approach required uncovered sectors to deliver a certain amount of emission reductions, but no policies were in place to ensure that happened, Australia would breach its budget.

This does *not* mean that the Authority considers that uncovered sectors have no role in meeting the national emissions budget, or that existing policies in uncovered sectors are ideal. The overall policy mix should be reviewed regularly and policies in uncovered sectors should aim to deliver an equivalent incentive to reduce emissions as the covered sectors face.

Even so, the Authority does not consider that its approach would impose a disproportionate burden on covered sectors. Uncovered sectors already contribute to reducing Australia's emissions. For example, between 1990 and 2012 emissions from the land sector (an uncovered sector) fell by 85 per cent, while emissions from electricity (a covered sector) increased by 53 per cent (see discussion in Chapter 12). Further, as discussed in Chapter 10, the level of the cap is not expected to affect the level of the carbon price (the burden that matters to firms) because of links to international carbon markets. As a result, the level of the cap would be unlikely to materially affect the burden faced by the covered sectors. The most significant impact is, instead, on Government revenue – providing the Government with a good incentive over time to ensure that appropriate policies apply to all sectors.

14.3 ESTIMATING EMISSIONS OUTSIDE THE CAPS

To estimate emissions outside the caps, the Authority must consider:

1. Fixed-price period emissions for the whole economy.
2. Uncovered emissions during the flexible-price period, taking into account:
   - emissions that do not face the carbon price;
   - emissions that are subject to the equivalent carbon price; and
   - emissions associated with non-compliance and payment of the shortfall charge.
3. Voluntary action and other adjustments.

The Authority has used the economic modelling discussed in Chapter 10 and Appendix C to estimate emissions. The medium scenario represents the best estimate of global and national economic activity. It therefore provides the best estimate of emissions, and has been used as the basis for calculating caps. Other scenarios have been used to test whether the resulting caps are robust across a range of possible future carbon market conditions. The Authority will monitor new emissions data and projections, and the implications for this analysis, and reflect relevant developments in its Final Report.

14.3.1 WHOLE-OF-ECONOMY EMISSIONS DURING THE FIXED-PRICE PERIOD

The Authority must estimate the whole-of-economy emissions that are likely to occur under the fixed-price period, since none of these emissions are covered by the caps. These emissions are subtracted from emissions available for caps. Based on the modelling, the Authority estimates fixed-price emissions to be 1 784 Mt CO_2-e.

14.3.2 UNCOVERED EMISSIONS DURING THE FLEXIBLE-PRICE PERIOD

The Authority must estimate the emissions from sources not covered by the carbon pricing mechanism. As illustrated in Table 14.1, some uncovered emissions do not face a carbon price at all; others face the equivalent carbon price.

The proposed treatment of these emissions in calculating caps is discussed below.

EMISSIONS THAT DO NOT FACE A CARBON PRICE

As set out in Table 14.1, a number of sectors do not face a carbon price. The Authority has made a best estimate of emissions from these sectors, then added estimated CFI credits and 'below threshold' emissions.

- The **CFI** is a carbon offset scheme. CFI projects reduce uncovered emissions, but allow for an equivalent increase in covered emissions through the generation and use of ACCUs. To avoid double counting, the Authority needs to add the credited emissions reductions back to uncovered emissions.
- Facilities in sectors covered by the carbon pricing mechanism that emit less than the 25 kt CO_2-e threshold do not face a liability; these are referred to as **'below threshold' emissions** and fall outside the caps. Below threshold emissions are difficult to estimate because many of those facilities are not required to report their emissions. The Authority has estimated below threshold emission by comparing covered emissions estimated from the national inventory with emissions that are liable under the carbon pricing mechanism.

EMISSIONS SUBJECT TO AN EQUIVALENT CARBON PRICE

As set out in Table 14.1, some liquid fuel use for the transport sector and synthetic greenhouse gases are subject to the equivalent carbon price. The Authority has made a best estimate of emissions from these sectors, deducting estimated 'opt-in' emissions.

'Opt-in' arrangements allow large end users of fuel to voluntarily take on direct liability under the carbon pricing mechanism rather than face the equivalent carbon price. When entities choose to opt in, their emissions move from outside to inside the caps. This, in turn, makes more of the national emissions budget available for caps. Opting in during the fixed-price period allows liable entities to pay a lower carbon price on average over the year (as they can defer payment of their carbon cost to the end of the financial year rather than pay the equivalent carbon price each month). These benefits diminish in the flexible-price period; however, companies that opt in have greater flexibility to manage their carbon liability.

The Authority considers that entities that have already opted in are likely to remain within the carbon pricing mechanism. Some additional entities might opt in in the future, particularly very large fuel users. The Authority has made a best estimate on this basis.

EMISSIONS SUBJECT TO NON-COMPLIANCE AND THE SHORTFALL CHARGE

The Authority has considered whether to make an allowance for non-compliance or payment of the shortfall charge – that is, for emissions that should have been covered by the cap but were not. Under the carbon pricing mechanism, liable entities are required to surrender an eligible unit, or pay the shortfall charge, for every tonne they emit. If they choose to pay the shortfall charge or simply do not comply, they would not surrender emission units and those emissions would be outside the cap.

The legislation creates strong incentives for liable entities to comply and surrender eligible units. For example, the unit shortfall charge is double the benchmark average auction price for Australian carbon units during the particular compliance year, making it unlikely that entities would choose to pay the shortfall charge. Non-compliance is also unlikely as legal penalties apply and the rate of compliance for similar legislation has been close to 100 per cent. As a result, most liable entities would be likely to surrender emissions units. The Authority will therefore assume emissions associated with non-compliance and payment of the unit shortfall charge are zero when recommending caps to 2020.

CALCULATING UNCOVERED EMISSIONS

Considering all these factors, the Authority estimates uncovered emissions during the flexible-price period to 2020 to be 1 379 Mt CO_2-e.

14.3.3 VOLUNTARY ACTION AND OTHER ADJUSTMENTS

The Authority has considered:

- accounting discrepancies between the carbon pricing mechanism, the CFI and the national greenhouse gas inventory;
- voluntary action – accounting for GreenPower and the voluntary cancellation of renewable energy certificates;
- Government purchase of international units; and
- carryover from the Kyoto Protocol first commitment period.

ACCOUNTING DISCREPANCIES – CHANGES IN GLOBAL WARMING POTENTIALS

The emissions reporting system used for the carbon pricing mechanism and the CFI is currently based on global warming potentials (GWPs) used in the first commitment period of the Kyoto Protocol. The international community has agreed to update GWP values for targets in the second commitment period; however; the accounting system used in the carbon pricing mechanism and the CFI will not be revised until 2017–18. As a result, there will not be a one-for-one relationship between the carbon pricing mechanism and CFI and the national emissions budget for the first two years of the flexible-price period.

The Authority has made its best estimate of this discrepancy and will deduct 16 Mt CO_2-e from the budget available for caps.

VOLUNTARY ACTION – ACCOUNTING FOR GREENPOWER AND THE VOLUNTARY CANCELLATION OF RENEWABLE ENERGY CERTIFICATES

As outlined in Section 8.7, the Authority considers three types of voluntary action should be recognised as additional to the national target – voluntary cancellation of domestic emissions units, GreenPower purchases and the voluntary cancellation of renewable energy certificates (RECs) under the Renewable Energy Target.

Only GreenPower purchases and the voluntary cancellation of RECs need to be considered when calculating caps. Voluntary cancellation of domestic units reduces caps directly; in contrast, GreenPower purchases and the voluntary cancellation of RECs reduce emissions from electricity generation, which is covered by the caps.

The Authority has made a best estimate of GreenPower purchases and voluntary REC cancellations over the period, and will deduct 16 Mt CO_2-e from the budget available for caps.

GOVERNMENT PURCHASE OF INTERNATIONAL UNITS

While the carbon pricing mechanism allows liable entities to buy and use certain international units, the Government could also purchase international units directly.

At this time, the Government does not have any plans to purchase international units under the carbon pricing mechanism. One reason direct purchase might be considered would be to loosen the caps required to meet any given target, and increase the number of Australian carbon units available for auction. This could reduce the cost of achieving any given target (for example, the Government could buy low-cost Kyoto units and sell additional Australian carbon units at a higher price). For strong targets, this could also reduce the risk that the 50 per cent limit on international units becomes binding.

As discussed in Section 14.5 below, Government purchase of international units provides a way to reduce the cost of achieving a 25 per cent target, and reduce the risk that the limit on international units would become binding.

As a result, the Authority has based its recommendations for caps for a 15 per cent target assuming no Government purchase of international units, and has based its recommendations for caps for a 25 per cent target assuming Government purchase of a total of 75 Mt CO_2-e of international units to supplement caps for the period to 2020.

CARRYOVER – THE FIRST COMMITMENT PERIOD UNDER THE KYOTO PROTOCOL

As outlined in Section 8.7, carryover from the first commitment period of the Kyoto Protocol could be used to strengthen the 2020 target by 3 percentage points. On current estimates, this would shift the national trajectory down and reduce the national emissions budget for 2013–2020 by 91 Mt CO_2-e. This would be directly offset by the carryover, which would then be available for caps. To illustrate the effect of adding the carryover, caps for an 18 per cent target would be broadly the same as those presented here for a 15 per cent target.

14.4 MANAGING UNCERTAINTY IN EMISSIONS ESTIMATES

All estimates in the previous section are based on projected future levels of emissions. Actual emissions will inevitably be higher or lower than these estimates. If actual emissions are higher than estimated, Australia's emissions could exceed the national budget to 2020. If actual emissions are lower, Australia would more than meet its budget to 2020, and the surplus units could be carried over and used after 2020.

The Authority's objective is to recommend caps to meet the 2020 budget. Therefore, the Authority's primary concern is whether actual emissions would be higher than estimated. If there was a material risk that uncovered emissions would be higher, the Authority could incorporate a buffer to guard against the risk. This approach had some support among stakeholders.

In the past, national emissions projections have tended to be too high rather than too low. For example, the Authority found that emissions projections for the first commitment period of the Kyoto Protocol overestimated emissions from uncovered sectors by 13 per cent on average. Further, future emission drivers are reasonably well understood and represented in models used. This suggests uncovered emissions are unlikely to be higher than estimated in the Authority's modelling.

Emissions trends could vary if policies affecting uncovered emissions change; however, the Authority has made a best estimate based on existing legislative settings.

On balance, given the history of overestimation, the Authority considers there is no need to create an emissions buffer.

14.5 YEAR-BY-YEAR SHAPE OF CAPS

After estimating the proportion of the 2020 budget available for caps, the Authority needs to consider the year-by-year pathway or 'shape' of caps.

The Authority considers that, in general, the shape of caps should follow the slope of the trajectory on a year-by-year basis (Figure 14.3). This is a straightforward and predictable approach that clearly aligns caps with national emission reduction goals.

Still, as stakeholders including the Australian Industry Group noted, it may be appropriate to change the shape when:

- caps are insufficient to accommodate the free allocation and early auction of Australian carbon units; or
- caps are at a level that could affect the carbon price, due to limits on international units.

14.5.1 ENSURING SUFFICIENT UNITS ARE AVAILABLE FOR FREE ALLOCATION AND EARLY AUCTION

To ensure consistency with the design of the carbon pricing mechanism, caps should be large enough to accommodate the allocation of free carbon units under the Jobs and Competiveness Program and the Energy Security Fund; and the scheduled early auction of carbon units. Where caps based on the slope of the trajectory are not sufficient to cover these allocations, the Authority will redistribute units across the period.

For a 25 per cent target, reshaping is required to accommodate free allocation and early auction. Units have been redistributed to ensure at least five million units are available beyond these minimum requirements, and to ensure the total number of units across the period remains the same. No reshaping is required for a 15 per cent target.

14.5.2 ENSURING SUFFICIENT UNITS ARE AVAILABLE TO MINIMISE THE IMPACT ON THE CARBON PRICE

The Authority identified two potential ways in which caps could influence the level of the carbon price, which could be addressed through shaping caps.

First, caps affect whether the 12.5 per cent sublimit on Kyoto units is binding. Liable entities can meet up to 12.5 per cent of their liability under the carbon pricing mechanism with units created under the Kyoto Protocol (Kyoto units). Kyoto units are currently trading at prices well below European prices. If liable entities are unsure whether they need to use the full 12.5 per cent allowance, the carbon price in Australia could be volatile, fluctuating between the Kyoto unit price and the European price. This could be avoided by shaping caps to ensure the sublimit was binding in every year.

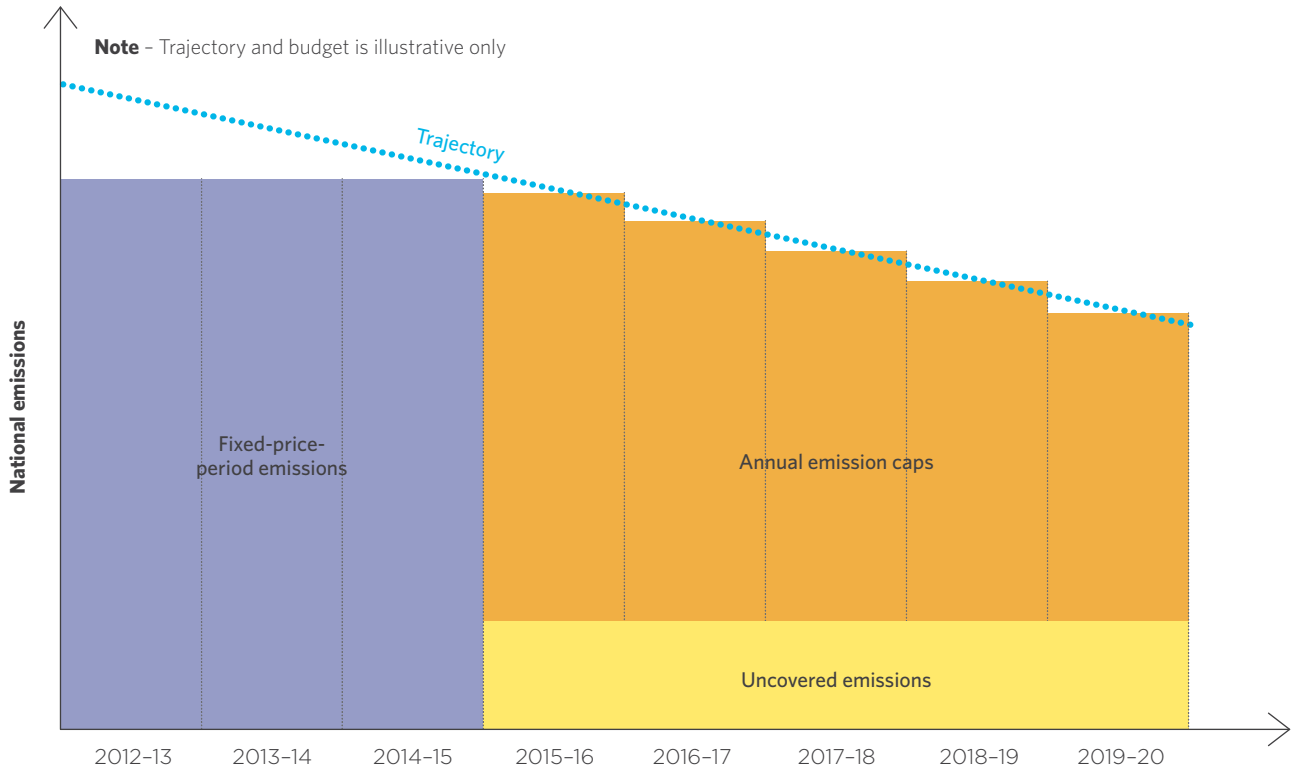
The Authority's analysis indicates the Kyoto sublimit would be binding in all years under a 15 and 25 per cent target, so there is no need to reshape caps.

Second, caps affect whether the overall 50 per cent limit on international units is binding. This limit applies until 2020. If domestic units are in short supply, and the 50 per cent limit becomes binding, the price of domestic units would need to rise above the European price. Caps could be shaped across the period to minimise the risk that the 50 per cent limit would bind in any year.

The Authority's analysis indicates the 50 per cent import limit would not bind for a 15 per cent target, so there is no need to reshape caps.

For a 25 per cent target, the analysis shows the 50 per cent import limit does bind in the later years. However, this cannot be corrected through reshaping caps, as there are insufficient units available across the period to 2020. The budget available for caps is 814 Mt CO_2-e, less than half the projected emissions from liable entities. Carbon offsets under the CFI would not be sufficient to cover the shortfall. If international carbon prices were lower, the shortfall would be even greater. As a result, the domestic carbon price would need to increase above the European price to drive additional emissions reductions within the domestic economy, leading to higher compliance costs for liable entities, and higher cost impacts on consumers.

FIGURE 14.3: SHAPE OF CAPS – RELEASING CARBON UNITS IN LINE WITH THE TRAJECTORY



Source: Climate Change Authority

The budget available for caps could be increased if the Government purchased some international units directly (as discussed in Section 14.3.3). This could reduce the cost of meeting the 25 per cent target, as the Government could purchase international units, increase the number of Australian carbon units available to auction and minimise the risk that the 50 per cent import limit was binding. The Authority's analysis indicates Government purchase of 75 million units would be sufficient to minimise the risk, even if international carbon prices remained low. The budgetary cost of purchasing these units would be offset by the additional revenue raised. The caps recommended in the next section for a 25 per cent target assume 75 Mt CO_2-e is added to the budget available for caps.

14.6 RECOMMENDED CAPS FOR 15 AND 25 PER CENT TARGETS

Taking into account the issues discussed in this Chapter, caps are recommended for the five years from 2015–16 to 2019–20. Table 14.2 outlines the 2020 budget that is available for caps for a 15 and 25 per cent target.

TABLE 14.2: BUDGET AVAILABLE FOR CAPS

	15 PER CENT TARGET	25 PER CENT TARGET
National budget (2013–2020)	4 314	4 010
Fixed-price period-emissions (2013–2015)	-1 784	-1 784
Uncovered emissions (2016–2020)	-1 379	-1 379
Global Warming Potentials adjustment	-16	-16
Voluntary action (GreenPower and voluntary cancellation of renewable energy certificates)	-16	-16
Government purchase of international units	0	75
Available for caps	**1 119**	**889**

Note: All figures in Mt CO_2-e. Totals may not sum due to rounding. Uncovered emissions include CFI estimates.
Source: Climate Change Authority, based on The Treasury and DIICCSRTE 2013 data and GreenPower 2013

DRAFT RECOMMENDATION

R.7 That the level of carbon pollution caps for each of the first five years of the flexible price period under the carbon pricing mechanism be:

	If Australia adopts a 15 per cent target (Mt CO_2-e)	If Australia adopts a 25 per cent target (Mt CO_2-e)
2015–16	234	193
2016–17	229	178
2017–18	224	182
2018–19	219	171
2019–20	214	165

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GLOSSARY

Accounting framework	The rules that specify how to estimate greenhouse gas emissions and what emissions count towards an emissions reduction target.
Agriculture emissions	Emissions resulting from livestock digestive processes (enteric fermentation), manure management, nitrous oxide emissions from cropping and pastureland soils, prescribed burning of savannahs and burning of agricultural residues.
Annex I countries/Parties	Industrialised countries and economies in transition listed in Annex I to the United Nations Framework Convention on Climate Change.
Australian carbon unit	An emissions unit established by the *Clean Energy Act 2011* (Cth), issued for the purposes of the carbon pricing mechanism. The total number of units issued each year does not exceed the cap.
Business as usual emissions trend	Emissions that would occur absent additional policy intervention.
Cap	The year-by-year limit on emissions from sources covered by the carbon pricing mechanism ('covered emissions').
Carbon dioxide equivalent	A measure that quantifies different greenhouse gases in terms of the amount of carbon dioxide that would deliver the same global warming potential.
Carbon Farming Initiative	An Australian emissions offset scheme that credits emissions reductions from certain sources that are not covered by the carbon pricing mechanism, such as forestry and agriculture.
Carbon price	The price of an emissions unit.
Carbon pricing mechanism	An emissions trading scheme that puts a price on Australia's greenhouse gas emissions. It was introduced by the *Clean Energy Act* and applies to Australia's biggest emitters (called liable entities).
Carryover (Kyoto Protocol)	The accounting framework under the Kyoto Protocol allows a country that performs better than its Kyoto target to 'carryover' the extra emission units to the next commitment period.
Certified Emission Reduction	An emissions unit issued under the Clean Development Mechanism, for emission-reduction projects in developing countries. These CERs can be traded and sold, and used by industrialized countries to a meet a part of their emission reduction targets under the Kyoto Protocol.
Cumulative average growth rate	A constant rate of growth that delivers equivalent change over a period.
Direct Action Plan	The Government's proposed policy to reduce greenhouse gas emissions and establish a clean-up and environment conservation program. A central element of the plan is the Emissions Reduction Fund.
Climate system	A highly complex system consisting of five major components: the atmosphere, the hydrosphere, the cryosphere, the land surface and the biosphere, and the interactions between them.
Commitment period	The first five year commitment period of the Kyoto Protocol was from 2008–2012. The second eight year commitment period is 2013–2020.
Covered emissions	Emissions from sources covered by the carbon pricing mechanism.
Direct combustion emissions	Emissions released when fuels are combusted for stationary energy purposes, such as generating heat, steam or pressure (excluding electricity generation). These emissions are released by large industrial users, and by small, dispersed residential and commercial consumers.
Electricity emissions	Emissions released when fuels, such as coal and natural gas, are combusted to generate electricity.
Eligible international emissions unit	An international unit that is accepted for compliance under the carbon pricing mechanism, including Kyoto Protocol certified reduction units, emissions reduction unit or removal unit, and other units identified by the Government under the legislation.
Emissions budget	A cumulative emissions allowance over a period of time.
Emissions intensity	A measure of the amount of emissions associated with a unit of output, for example, emissions per unit of gross domestic product.
Emissions reduction	The act or process of limiting or restricting greenhouse gas emissions.
Emissions Reduction Fund	A $3 billion fund proposed by the Government, to allocate money in response to emission reduction tenders to projects designed to reduce emissions.

Emissions reduction goal	Any emissions reduction objective, such as an emissions reduction target or target range, an emissions budget or an emissions trajectory. Includes a pledge to reduce or limit emissions under the United Nations Framework Convention on Climate Change.
Emissions reduction target	A goal for national emissions in a specific year.
Emissions rights	The rights of individuals or countries to emit greenhouse gases.
Emissions trading scheme	A market-based approach to reducing emissions that places a limit on emissions allowed from all sectors covered by the scheme. Emissions trading allows entities to trade emissions units with other entities. In general, trading can occur at the domestic, international and intra-company levels.
Emissions unit	Represents a unit of one metric tonne of carbon dioxide equivalent.
Equivalent carbon price	Certain liquid fuels and synthetic greenhouse gases are subject to an equivalent carbon price applied through adjustments to fuel excise arrangements and to the *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989* (Cth). The equivalent carbon price paid will be equal to the effective carbon price paid by liable entities under the carbon pricing mechanism.
European Union Allowance	An emissions unit issued in the European Union Emissions Trading System.
Feedbacks	An interaction mechanism between processes in the climate system, when the result of an initial process triggers changes in a second process that subsequently influences the first process. A positive feedback intensifies the original process, and a negative feedback reduces it. An example of a positive feedback is the warming of the climate melting permafrost, which releases methane into the atmosphere, which reinforces the initial warming by contributing to the greenhouse effect.
Fugitive emissions	Greenhouse gases emitted during the extraction, production, processing, storage, transmission and distribution of fossil fuels such as coal, oil and gas.
Global emissions budget	The total amount of emissions projected to result in a given rise in global temperature. Expressed in terms of probabilities to reflect uncertainties about the exact temperature effect of a given amount of emissions.
Global warming potential	An index measuring the radiative forcing of a well-mixed greenhouse gas in the atmosphere, relative to carbon dioxide, in order to compare its equivalent contribution to global warming.
Greenhouse gas	Any gas (natural or produced by human activities) that absorbs infrared radiation in the atmosphere. Key greenhouse gases include water vapour, carbon dioxide, nitrous oxide, methane and ozone.
Gross Domestic Product	A measure of the value of economic production in the economy.
Gross National Income	An economic measure that reflects Gross Domestic Product, the terms of trade and international income transfers.
Industrial process emissions	Emissions from industrial processes including: metal production; synthetic greenhouse gases; chemical processes; mineral production and other processes. Excludes emissions from combustion for energy purposes.
Land use, land use change and forestry emissions	Emissions associated with human-induced changes in land use, such as deforestation, afforestation and forest management.
Kyoto Protocol	An agreement adopted under the United Nations Framework Convention on Climate Change in 1997. It entered into force in 2005.
Kyoto Unit	Emissions units eligible for compliance with Kyoto Protocol targets – these include Assigned Amount Units (AAU); Certified Emission Reduction units (CER); Emission Reduction Units (ERU); and removal units.
Marginal cost of emissions reduction	The cost of reducing emissions by one additional tonne.
Mitigation	A reduction in the source of, or enhancement of, the sinks for greenhouse gases.
National carbon budget	Australia's cumulative emission allowance over a period of time, referred to in the *Clean Energy Act*. This report uses 'national emissions budget'.
Parts per million	A measure of the concentration of greenhouse gases in the atmosphere. One part per million is equivalent to one cubic centimetre of gas per cubic metre of air.
Pledge	Undertakings to take some form of mitigation action, which are not binding under international law.
Pre-industrial	Pre-industrial and industrial refer to the periods before and after 1750.
Quantified Emission Limitation or Reduction Objective	A legally binding emissions reduction or limitation target under the Kyoto Protocol.
Radiative forcing	A measure of the influence that a factor has on the energy balance of the climate system. Positive forcing tends to warm the surface, while negative forcing tends to cool it.
Stationary energy	Electricity generation and direct combustion.
Target conditions	The conditions the Commonwealth Government has specified in relation to its emissions reduction target for 2020, and reflected in international agreements.
Terms of trade	The ratio of the price of a country's exports relative to its imports.
Trajectory	An indicative year-by-year emissions pathway to an emissions goal.
Trajectory range	A range within which future trajectories may be set.

Transport emissions	Emissions from vehicles combusting or otherwise converting fuels to move people and freight, reported across four modes: road, rail, domestic aviation and domestic shipping. International aviation and shipping emissions are excluded from Australia's emissions.
Uncovered emissions	Emissions from sources not covered by the carbon pricing mechanism.
Unit shortfall charge	If a liable entity under the carbon pricing mechanism does not surrender a sufficient number of emissions units then they must pay a charge equal to the unit shortfall multiplied by a specified amount greater than one. The charge provides an incentive to surrender the unit.
United Nations Framework Convention on Climate Change	An international treaty that commits signatory countries to reduce human-induced greenhouse gas emissions to levels that would prevent dangerous interference with the climate system.
Voluntary action	The autonomous decision of individuals, companies or governments to reduce greenhouse gas emissions.
Waste emissions	Emissions that arise as organic waste decomposes in the absence of oxygen, mainly methane (CH_4) and nitrous oxide (N_2O).

ABBREVIATIONS AND ACRONYMS

ACCU	Australian Carbon Credit Unit
AR2	Second Assessment Report from the Intergovernmental Panel on Climate Change
AR4	Fourth Assessment Report from the Intergovernmental Panel on Climate Change
BAU	business as usual
CO_2	carbon dioxide
CO_2-e	carbon dioxide equivalent
CCS	carbon capture and storage
CER	Certified Emission Reduction
CFC	chlorofluorocarbon
CFI	Carbon Farming Initiative
CGE	computable general equilibrium (model)
CH_4	methane
COAG	Council of Australian Governments
CSG	coal seam gas
DIICCSRTE	Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education
EEO	energy efficiency opportunities
EOR	enhanced oil recovery
EUA	European Union Allowance
EU ETS	European Union Emissions Trading Scheme
EV	electric vehicle
GDP	Gross Domestic Product
GGAS	Greenhouse Gas Reduction Scheme
GNI	Gross National Income
GJ	gigajoule (energy, one billion (10^9) Joules)
Gt	gigatonne (mass, one billion (10^9) metric tonnes)
GTEM	Global Trade and Environment Model
GW	gigawatt (power, one billion (10^9) watts)
GWh	gigawatt-hour (energy, equal to 3.6 TJ)
GWP	global warming potential
HCFC	hydrochlorofluorocarbon
HEV	hybrid electric vehicle
ICEV	internal combustion engine vehicle
IPCC	Intergovernmental Panel on Climate Change
kt	kilotonne (mass, one thousand metric tonnes)
LCOE	levelised cost of electricity
LNG	liquefied natural gas
LULUCF	land use, land use change and forestry

MMRF	Monash Multi-Regional Forecasting (model)
MJ	megajoule (energy, one million (10^6) Joules)
Mt	megatonne (mass, one million metric tonnes)
MW	megawatt (power, one million watts)
MWh	megawatt hour (energy, equal to 3.6 GJ)
N_2O	nitrous oxide
NEM	National Electricity Market
NGER	National Greenhouse and Energy Reporting
PFC	Perfluorocarbon
PHEV	plug-in hybrid electric vehicle
PJ	petajoules (energy, 10^15 joules)
ppm	parts per million
QELRO	Quantified Emission Limitation or Reduction Objective
REC	renewable energy certificates
RET	Renewable Energy Target
t	tonne (mass, one metric tonne)
TJ	terajoules (energy, 10^12 joules)
TWh	terawatt-hour (energy, equal to 3.6 PJ)
UNFCCC	United Nations Framework Convention on Climate Change

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