



Australian Government
Climate Change Authority

TOWARDS A CLIMATE POLICY TOOLKIT: SPECIAL REVIEW ON AUSTRALIA'S CLIMATE GOALS AND POLICIES

AUGUST
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Australian Government
Climate Change Authority

31 August 2016

The Hon. Josh Frydenberg, MP
Minister for the Environment and Energy
Parliament House
CANBERRA ACT 2600

Dear Minister

In accordance with section 60 of the *Climate Change Authority Act 2011* (Cth), the Climate Change Authority submits to you "*Towards a climate policy toolkit: Special Review on Australia's Climate Goals and Policies*".

As also required by the Act, the report will be published on the Authority's website (www.climatechangeauthority.gov.au).

Yours sincerely

A handwritten signature in black ink, appearing to read 'Wendy Craik'.

Wendy Craik AM
Chair

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The Authority would like to thank the many individuals and organisations that contributed time and expertise to this review. These contributions have enhanced the quality of the review and provided evidence to inform the Authority's recommendations.

A number of government departments and public agencies provided technical expertise to the Authority in its preparation of this review. They include: the Department of the Environment and Energy, the Department of Foreign Affairs and Trade, the Department of Industry, Innovation and Science, the Productivity Commission, the Commonwealth Science and Industrial Research Organisation and the Treasury. The views and dispositions in the review are the Authority's own and should not be taken as the views or positions of any of the agencies listed above.

A range of industry and government stakeholders provided valuable input to the Authority's electricity research report which informed the Special Review. These stakeholders are acknowledged in full in the electricity research report.

The Authority would also like to thank the many stakeholders who provided submissions to the reports of the Special Review and who participated in consultation.

CONTENTS

Acknowledgements	iv
Chair's foreword	ix
Summary	1
Recommendations and conclusions	20
Chapter 1. Introduction	28
1.1. The challenge of climate change	28
1.2. The Climate Change Authority	29
1.3. About the Special Review into Australia's climate action	29
1.4. Public consultation	30
1.5. Structure of this report	30
Chapter 2. International actions and outcomes of the Paris Conference	32
2.1. The world is acting to reduce greenhouse gas emissions	36
2.2. Greater efforts are required to meet climate goals	39
Chapter 3. Australian context	41
3.1. Australia's climate change commitments	41
3.2. Australia's emissions reduction challenge	41
3.3. Australia's main emissions reduction policies	45
3.4. Measures for long-term emissions reductions	49
Chapter 4. A policy toolkit for Australia	50
4.1. Evaluating policy options	51
Chapter 5. Market mechanisms and enhanced safeguards	54
5.1. Using market mechanisms in the policy toolkit	55
5.2. The electricity sector should be covered by an emissions intensity scheme	66
5.3. Enhancing the safeguard mechanism to promote policy stability	69
5.4. Reviewing the enhanced safeguard mechanism in 2022	71
Chapter 6. International permits and credits	76
6.1. Benefits of using international permits and credits	77
6.2. Risks of using international permits and credits	80
6.3. International permits and credits as part of Australia's toolkit	83
Chapter 7. Energy efficiency	85
7.1. Australia's energy use is its largest source of emissions	86
7.2. Energy efficiency measures as part of the policy toolkit	87
7.3. Energy efficiency policies can be tailored to capture different low-cost emissions reductions	93
Chapter 8. Innovation support	99
8.1. Innovation support is an important part of the climate policy toolkit	100
8.2. Early research, development and demonstration	103
8.3. Deployment and commercialisation	106
8.4. International cooperation	108

Chapter 9. Possible additional policies for the electricity sector	110
9.1. The costs and risks of additional policies are likely to outweigh their benefits	111
9.2. Technology pull policies	113
9.3. New generator emissions standards	115
9.4. Regulated closure	115
Chapter 10. Transport	117
10.1. Existing policies can help to reduce transport emissions	118
10.2. Vehicle emissions standards could help improve efficiency	119
10.3. Further work is needed on less emissions-intensive fuels	122
10.4. Infrastructure and cities planning can enable mode shifting and help reduce transport use	125
Chapter 11. The land sector and offsets under the emissions reduction fund	127
11.1. The land sector is suited to offset schemes	128
11.2. Offset schemes can help meet targets at reduced cost	130
11.3. Offsets under the Emissions Reduction Fund	131
11.4. Land use regulations can be environmentally effective	134
Chapter 12. Waste and synthetic greenhouse gases	136
12.1. Waste	136
12.2. Synthetic greenhouse gases	139
Chapter 13. International competitiveness	141
13.1. Policy differences with other countries can have undesirable effects	142
13.2. Persistent policy differences between countries justify competitiveness measures	144
13.3. Some assistance for businesses in emissions-intensive and trade-exposed industries is warranted	147
13.4. Access to international permits and credits can reduce competitiveness concerns	149
13.5. Further competitiveness measures may be required under a future market mechanism	150
Chapter 14. Impacts on Australia's economy	155
14.1. Designing a cost-effective policy toolkit	156
14.2. Overall economic impacts are expected to be modest	157
14.3. Distribution of economic impacts	161
Chapter 15. Moving to the recommended policy toolkit	165
15.1. Principles for transition	166
15.2. The Authority's recommended toolkit	168
Chapter 16. Further work	175
16.1. Governance and implementation	175
16.2. Policies that require further consideration	175
16.3. Matters outside the scope of the Special Review	176

Appendix A. Terms of Reference	177
Appendix B. Public consultation	180
Appendix C. Recent closures of emissions-intensive and trade-exposed facilities	183
Glossary of terms	186
Abbreviations and acronyms	194
References	196

Figures

Figure 1	Transition to the policy toolkit	6
Figure 2	Countries that have submitted Paris targets	33
Figure 3	The Paris Agreement five-yearly review process	36
Figure 4	The emissions gap implied by countries' Paris targets	40
Figure 5	Australia's domestic emissions, 2000–2030	42
Figure 6	Direct costs of market mechanisms	57
Figure 7	Direct costs for other policy options	57
Figure 8	Comparing emissions intensity schemes to cap and trade schemes	60
Figure 9	Final energy use and final energy use emissions by sector, 2013–14	87
Figure 10	How policies encourage improvements in energy efficiency over time	89
Figure 11	Barriers to energy efficiency	90
Figure 12	The role of government support across the innovation chain	100
Figure 13	Pledges by the 20 mission innovation countries	109
Figure 14	Passenger vehicle CO ₂ emissions intensity, selected countries, 2000–2025	120
Figure 15	Emissions intensity of conventional and electric light vehicles in the national electricity market	123
Figure 16	Stylised relationship between carbon leakage and competitive distortions for businesses or industries	144
Figure 17	Long-term economic impact of climate policy: projected national income under 'no action' and central policy scenarios	159
Figure 18	Transition to the policy toolkit	172

Tables

Table 1	Key countries' and regions' Paris targets	34
Table 2	Key countries' and regions' policy toolkits	38
Table 3	Australia's emission sources, 2014	43
Table 4	Australia's main emissions reduction policies	45
Table 5	Direct costs: comparing other policies to market mechanisms	58
Table 6	Projections of gross national income relative to cap and trade (lump sum)	65
Table 7	Types of energy efficiency policies	88
Table 8	Innovation support mechanisms used by the Australian Government	102
Table 9	Australian landfill emissions regulations	137
Table 10	Emissions intensity and trade exposure of Australian industries, 2012–13	148
Table 11	Analysis of Climate Change Authority Special Review Terms of Reference	178
Table 12	Submissions received: Report Two of the Special Review	180
Table 13	Recent EITE facility closures in Australia	183

Boxes

Box 1	The Emissions Reduction Fund	48
Box 2	Stakeholder support for market mechanisms	55
Box 3	Types of broad-based market mechanism	60
Box 4	Some market mechanisms have serious deficiencies	63
Box 5	Lessons from international market mechanisms	73
Box 6	Australia's carbon pricing mechanism	74
Box 7	International trade in emissions under the Paris Agreement	77
Box 8	Additionality under the Clean Development Mechanism over time	81
Box 9	Australian Government support for solar research was an important input to the development of affordable solar photovoltaic technology	104
Box 10	Outlook for electricity storage	107
Box 11	Low-emissions investment in Australia requires policy support	112
Box 12	Reducing emissions from international aviation and shipping	118
Box 13	Offset credits can be used in voluntary action	129
Box 14	Carbon storage in the land sector in Australia	131
Box 15	Opportunities to reduce emissions from landfill	138
Box 16	Assistance measures under international emissions reduction policies	146
Box 17	Studies of decarbonisation by ClimateWorks and CSIRO	160

CHAIR'S FOREWORD

The Climate Change Authority is pleased to release the third and final report of its Special Review into the actions or policies that Australia should take to implement outcomes flowing from the historic Paris climate change agreement.

This report is the culmination of nearly two years of research, analysis and policy consideration. It builds on previous reports, released in July and November 2015, that examined the targets Australia should take to the Paris conference and options for the policies that could be adopted to achieve the Paris Agreement emissions reduction goals.

The Authority is recommending that the Government puts in place a policy toolkit that builds carefully on current policies like the Emissions Reduction Fund and the safeguard mechanism, and adopts some key new measures to form a long term and durable solution to Australia's climate change challenge. The overarching architecture for the toolkit would remain stable to help provide investment certainty while the measures themselves evolve and strengthen over time.

The emissions reduction policy toolkit needs to take account of Australia's climate policy history, be suited to the emissions opportunities and challenges in individual sectors and be able to be scaled up in the future to meet the emission reduction challenges in the Paris Agreement. That agreement makes it clear that countries' emissions reductions will need to go beyond their 2025 or 2030 pledges to achieve deeper reductions in the decades ahead, and Australia's emissions will need to decline much more rapidly in the near future than they have in the past.

For the electricity generation sector, the Authority found that a market mechanism in the form of an emissions intensity scheme is the best policy fit. The Authority is also recommending that an enhanced safeguard mechanism be put in place as an effective, pragmatic and durable way of reducing emissions across a range of industrial, manufacturing and resource sectors.

For households, vehicles and buildings, the Authority recommends that energy efficiency standards be put in place or strengthened. For the land sector, the Authority found that voluntary offsets are the best tool for the task, given the large number of landholders and the differences between farming operations.

In this report, as flagged in the Authority's Special Review final report on targets, the Authority has not sought to provide further advice on emissions reduction targets.

Emissions reduction targets are very important parts of the emissions reduction armoury but without effective policy action they will remain aspirational rather than determinative for the way ahead.

In the Authority's view, it is now imperative that Australia takes strong policy action to reduce emissions, decarbonise its economy and play its part in global action on climate change. This report and its recommendations are intended as a guide to Australia's low emissions future.

Authority staff have worked tirelessly and professionally to complete this report. Their commitment and approach has been exemplary and I would like to thank them all.

Wendy Craik AM

SUMMARY

About this Review

The Climate Change Authority has conducted a wide-ranging Special Review into Australia's climate change policies. As required by the Review's terms of reference (Appendix A), this third report recommends what action Australia should take to deliver on the commitments that flow from the United Nation's Framework Convention on Climate Change (UNFCCC) Paris conference held in late 2015.

In the Authority's view, the main action required is to build on our current emissions reduction measures to establish a set, or 'toolkit' of policies that will allow Australia to meet its Paris commitments to reduce emissions while maintaining strong growth in living standards and employment opportunities.

An emissions reduction toolkit is required because there is no single emissions reduction policy that can achieve everything. Australia's emissions reduction goals are best achieved by a coordinated set of policies crafted to suit the characteristics of different sectors and emissions reduction opportunities (of which there are many). This report sets out the Authority's recommended toolkit and the transition pathway that should be taken to put these measures in place.

The Review has benefited from extensive consultations with a diverse range of stakeholders and the Authority thanks all those who contributed.

What the Paris Agreement means for Australia

Burning fossil fuels, clearing land and other human activities produce gases—mainly carbon dioxide and methane—that trap heat and cause climate change. Australia's long standing position in the international climate negotiations is that we should play our part in international efforts to reduce greenhouse gas emissions so as to avoid the worst impacts and risks of climate change. As a comparatively hot and dry country that is subject to climate extremes, Australia stands to benefit more from effective global action to reduce emissions than many other developed countries. There will be costs from reducing emissions but they can be expected to be far outweighed over the long term by the benefits to Australians of a more stable and liveable climate that supports thriving agricultural industries and healthy ecosystems.

The UNFCCC is the main focus of international efforts to agree on actions to mitigate climate change. At the most recent UNFCCC conference, all 195 countries that are Parties to the Convention adopted the Paris Agreement, which establishes a framework for climate action beyond 2020. Under the Agreement, countries strengthened previous goals by agreeing to limit warming to ‘well below’ 2 degrees, and to pursue efforts to limit the temperature increase to 1.5 degrees. The Agreement also indicates what this requires for global emissions: countries agreed that global emissions need to peak as soon as possible, to rapidly reduce thereafter, and to reach ‘net zero’ emissions between 2050 and 2100 (net zero emissions means that any remaining emissions are matched by removals of greenhouse gases from the atmosphere).

The Paris Agreement requires both developed and developing countries to undertake emissions reduction efforts. Almost all countries have made specific commitments to do this. These are known as Intended Nationally Determined Contributions (INDCs) and mostly take the form of quantified targets.

Australia’s Intended Nationally Determined Contribution to the Paris Agreement is to reduce emissions by 26 to 28 per cent on 2005 levels by 2030.

Collectively, the Paris commitments would mean that global emissions remain well above a level that would give a realistic prospect of limiting temperature increases to below 2 degrees.

In a significant development, however, the Paris Agreement architecture establishes a cycle of reviews that will require all Parties to review and progressively increase their emission reduction commitments every five years, with reference to the global emissions goals. This set of obligations offers a real prospect of reaching the global goal of zero net emissions in the second half of this century.

Accordingly, as well as needing policies to meet its 2030 target, Australia will need policies that are capable of being scaled up to meet more ambitious goals in the decades ahead and to play its part in action to decarbonise the global economy.

In an encouraging sign that countries take their commitments seriously, most countries that set emissions reductions targets for the first commitment period of the Kyoto Protocol met or surpassed their targets. Many countries have put emissions reductions policies in place and are now taking steps to strengthen

them. Generally as part of a suite of policies, market mechanisms to reduce emissions (like cap and trade schemes or carbon taxes) have been introduced in about 40 countries and over 20 cities, states, and regions, with plans for more.

So, what does the Paris Agreement mean for Australia? Firstly, it confirms that the world is acting on climate change and is moving towards the level of action that is in Australia's public interest. Secondly, it makes it clear that Australia faces a large and ongoing emissions reduction task beyond its current Paris INDC. Australia has already made some progress, but emissions will need to decline more steeply than they have in the past. This will have costs, but will also open up new opportunities.

Australia's toolkit to meet the Paris Agreement

Australia currently has a range of policies in place to reduce emissions and to promote the more efficient use of energy. The Authority is of the view that a toolkit that contains both new and strengthened policies will be needed to meet the emission reduction challenges in the Paris Agreement.

The Authority recognises that climate policy in Australia has been marked by frequent changes of direction and uncertainty in recent years. One of the key advantages of building on current policies is that it would send a signal to business, investors and the broader community that action to reduce emissions is entering a new phase of stability as Australia makes the transition to the policy toolkit that can deliver on the Paris commitments.

The Authority has addressed stability concerns in its recommended toolkit in several ways. First, it has recommended a toolkit that can be scaled up over time. Australia would then be able to increase its emissions reduction efforts without major changes to the policy architecture. Second, when recommending the toolkit, the Authority has selected a number of policies that can respond flexibly to unexpected changes. This improves the likelihood that the policies will continue to be cost and environmentally effective as technologies and economic conditions change over the decades to come, which increases the likelihood that policies will remain stable. Third, the Authority recommends continuing and building on existing measures, such as the Emissions Reduction Fund (ERF) and its safeguard mechanism, as well as energy efficiency and innovation support measures.

The ERF's purchasing and crediting mechanism is a voluntary scheme where the Government buys emissions reductions from eligible projects via competitive

auctions. In the three auctions held to date, 143 million tonnes of future emissions reductions have been contracted at an average cost of \$12.10 per tonne. The ERF's project-based crediting and purchasing arrangements provide demand for domestic offsets from a range of projects including reducing emissions from savanna fires, landfill waste, reducing land clearing, forest and vegetation establishment or regeneration, energy efficiency, transport and soil carbon. The ERF safeguard mechanism is a regulatory measure that is intended to prevent emissions reductions from ERF purchasing being cancelled out by increased emissions elsewhere in the economy. It is not projected to deliver significant emissions reductions in the short term but it has the potential to play an expanded role to reduce emissions in the future.

The Renewable Energy Target (RET) is a legislated policy that supports both large- and small-scale renewable energy generation. The RET has had an uncertain history in recent years. That said, it remains a significant element of Australia's emissions reduction policy and is projected to deliver around 200 million tonnes of emissions reductions over the period from 2015 to 2030.

Many energy efficiency and low-carbon innovation programs are also projected to make a significant contribution to the emissions reduction task. For example the Greenhouse and Energy Minimum Standards program encompassing standards and labelling for appliances and lighting is projected to reduce emissions in the order of 60 to 70 million tonnes between 2014 and 2020. While attributing reductions to low-carbon innovation programs is complex as other policies are often the main driver, the Clean Energy Finance Corporation notes that projects in its portfolio are projected to achieve around 77 million tonnes of reductions over their lifetime.

The Authority's recommended toolkit

Given Australia's recent history of significant climate policy uncertainty, it is particularly important that the transition to an effective toolkit is predictable and provides confidence that the policy architecture will endure. It will also be important that good progress to reduce emissions and decarbonise the economy is made in the next five years, after which time the Authority recommends that the policy settings in the toolkit as a whole (and some of the measures themselves) are subject to a substantive review.

The review in 2022 should be the first of a series of five-yearly reviews to assess Australia's progress in reducing its emissions, and the emissions reduction actions that other countries, particularly our major trading partners, are taking to meet their Paris commitments. The Authority recommends however that most of the broad policy architecture should remain stable to help provide investor certainty.

The Authority recommends that the transition from current policies to the enhanced or new measures in the toolkit should be guided by the principles laid out in its legislation, in particular with respect to the public interest, supporting the global effort on climate change, cost effectiveness, environmental effectiveness and equity. Predictability is also important for a stable transition to the toolkit. These criteria broadly align with the Authority's principles for assessing policies in this review (see Chapters 4 and 15).

The Authority's recommended toolkit is described here; Figure 1 shows the relationship between current policy settings and the Authority's recommendations for each of the main sectors that produce emissions.

FIGURE 1 TRANSITION TO THE POLICY TOOLKIT

	Current policies	Toolkit
Electricity supply		Emissions intensity scheme from 2018 <i>Intensity baseline declines linearly over time, reaching zero well before 2050</i> <i>Eligible energy efficiency credits can be used to meet obligations</i> Chapter 5
		Renewable Energy Target Chapter 9 <i>Ends 2030</i>
Direct combustion	Emissions Reduction Fund (ERF) - crediting and purchasing	Enhanced safeguard mechanism <i>Baselines decline consistent with Australia's commitments</i> <i>ERF credits from agriculture, land use and safeguard sectors can be used to meet obligations</i> Chapter 5
		Enhanced safeguard or market mechanism Chapter 5
Industrial processes		ERF auctions in safeguard sectors and transport
Fugitive emissions		
Transport		Carbon dioxide standards for light vehicles Chapter 10 Standards continue; 2022 review to consider transport coverage under enhanced safeguard or market mechanism Chapter 5
		Cost-benefit analysis of carbon dioxide standards for heavy vehicles
Agriculture		ERF crediting Chapter 11 <i>ERF auctions for agriculture and land use</i>
Land use		
Waste	Regulation and standards	ERF auctions; Regulation to further reduce emissions Chapter 12
Synthetic greenhouse gases	Safeguard mechanism	
Cross-cutting policies	State-based white certificate schemes	Efforts to harmonise white certificate schemes for use as offsets under emissions intensity scheme Chapter 7 ERF crediting and auctions for energy efficiency Chapter 7 New or enhanced energy efficiency measures for buildings, industry, households Chapter 7 Innovation support focussed on R&D for low-emissions technologies Chapter 8
	Energy efficiency measures for buildings, industry, households	
Reviews	Innovation support	First toolkit review in 2022 Five-yearly reviews thereafter <i>Reviews to assess Australia's progress and that of key countries</i>

Note to Figure 1: Dotted boxes indicate areas where there appears to be a case for including a policy in the toolkit but further investigation is required. This diagram focuses on Commonwealth and nation-wide policies; some state-based policies that reduce emissions are not included here for simplicity. ERF auctions continue: in sectors covered by the enhanced safeguard mechanism to provide transitional assistance; in the land sector until the enhanced safeguard mechanism provides a source of demand; for ERF energy efficiency projects until the emissions intensity scheme provides a source of demand; for transport projects until light vehicle standards are in place; and for waste and synthetic greenhouse gas projects until enhanced regulation is in place. **Source:** Climate Change Authority.

The electricity generation sector

The electricity generation sector is important for meeting Australia's emission reduction goals because it is both the largest source of emissions and a significant source of emissions reduction opportunities.

In the Authority's view, to reduce electricity sector emissions, a market mechanism in the form of an emissions intensity scheme should be part of Australia's toolkit. Mechanisms of this type are capable of making significant emissions reductions in a way that is both flexible and scalable. A market mechanism for electricity would enable Australia to meet its emissions reduction goals at a lower cost to the community than would be possible without such a policy in the toolkit.

Electricity generation emissions are readily measurable and come from a relatively small number of sources, and significant emissions reductions are feasible using known technologies. This means the sector is well suited to a market mechanism to reduce emissions.

The Authority recommends that an emissions intensity scheme should be introduced for electricity generators in 2018 to drive cost-effective emissions reductions in Australia's electricity supply (Chapters 5 and 9). The emissions intensity baseline should decline linearly to reach zero well before 2050 consistent with Australia's Paris Agreement obligations.

The nature of an intensity scheme means that the price impacts on Australian households and businesses will be lower than with other types of market mechanisms (such as a cap and trade scheme).

Most stakeholders that made submissions to the Special Review on policies for electricity generation support a market mechanism of some sort to reduce emissions from this sector.

The Authority's electricity sector modelling suggests that price impacts from an emissions intensity scheme will be manageable. Residential spending on electricity is projected to be around eight per cent higher on average over the period to 2050 (relative to the reference case) when such a scheme is used to reduce emissions, consistent with keeping temperature increases below 2 degrees. This should be viewed in context however: household disposable income is projected to grow almost 40 per cent over the same period.

Generators should be able to use credits from eligible energy efficiency projects (including from the ERF and state white certificate schemes) to meet their obligations under the emissions intensity scheme. This could help lower costs of compliance for generators while driving cost-effective emissions reductions from energy demand.

The emissions intensity scheme should be closed to international credits and permits and domestic offsets (other than eligible energy efficiency credits) to increase certainty and support investment in low-emissions electricity.

The existing RET should stay in place. This would encourage investment in new large-scale renewable energy generation until 2020 (after which large-scale generation targets are fixed until 2030). Support for small scale technologies should continue and phase out as planned.

Given the importance of investor confidence for making the transition to a low-emissions electricity sector and the policy uncertainty that has characterised emission reduction policy in the last decade or so, the Authority considered whether other electricity sector policies (beyond the RET) might be warranted to support the emissions intensity scheme. The Authority reached the view that investor confidence is best met by introducing a scalable, cost-effective policy which remains stable and adding further policies in the electricity generation sector risks policy interactions that could undermine this key objective of policy stability.

Direct combustion, fugitive gases and industrial processes

The Authority has identified three sectors that are well suited to a common emissions reduction measure. These are: direct combustion (for example, burning gas to generate heat), industrial processes (for example, emissions from cement production) and fugitive emissions (for example, gases released during coal mining). While some of the emissions from these individual sectors are relatively

small, when taken as a whole, emissions from these sectors make up almost one-third of Australia's overall emissions profile.

These key sectors should be covered by an enhanced version of the existing safeguard mechanism. If strengthened, the safeguard mechanism could provide a stable and pragmatic way of making progress towards Australia's 2030 target in a way that the Authority considers to be in line with the public interest (Chapter 5).

The following changes should be made to strengthen the safeguard mechanism while addressing competitiveness concerns:

- Lower thresholds. The safeguard currently sets a limit on direct emissions from facilities that emit 100,000 tonnes of carbon dioxide equivalent (t CO₂-e) or more (this limit is expressed as a 'baseline'). Under the Authority's recommended toolkit in 2018, the coverage of the safeguard should extend to facilities that emit 25,000 t CO₂-e or more, because broader coverage increases the cost effectiveness and environmental effectiveness of the scheme. The 25,000 t CO₂-e threshold also aligns with reporting required from facilities under the National Greenhouse and Energy Reporting system (NGERs). Building on the NGERs thresholds and reporting obligations will reduce the impact of transaction costs associated with complying with the measure.
- Declining baselines. Baselines for all facilities should decline linearly at a uniform rate consistent with meeting Australia's INDC to reduce emissions by 26 to 28 per cent below 2005 levels by 2030 and to position these sectors for the further emissions reductions that are likely to be needed beyond 2030 in line with Australia's obligations under the Paris Agreement.
- No further baseline revisions. Under the safeguard, baselines can currently be adjusted to allow facilities to emit more in a number of circumstances. To make the emissions outcome of the safeguard policy more predictable and to bring it in line with Australia's targets, the ability to allow facilities to emit more by changing their baselines should cease from 2017 onwards.
- Access to international units. Safeguard facilities should be able to use international permits and credits to meet their baselines with a quantitative limit to ensure that the transition to a low carbon domestic economy is not delayed. There should be strict qualitative limits to help ensure that permits and credits

are genuine (see ‘International permits and credits’, below). Access to international permits and credits will likely mean relatively lower compliance costs for safeguard facilities.

- Land sector offsets. Safeguard facilities should also be able to use domestic land use and agriculture offsets issued through the ERF to reduce emissions if they exceed their baselines (Chapter 11). Offsets help reduce compliance costs and create a market based assessment of emissions reduction opportunities. They also create a source of demand for abatement opportunities that are not covered by other measures in the toolkit.

ERF auctions would continue to assist safeguard facilities to make investments and support their transition to a lower emissions economy. The Government has said it will consider future funding for the ERF in future budgets.

Safeguard facilities could use credits from their ERF projects to help meet their safeguard obligations and current rules to prevent double counting of emissions reductions resulting from these ERF contracts should continue to apply.

Because of additionality concerns and to avoid penalising early movers, other than as a result of ERF projects (which have stringent additionality tests), credits should not be issued to safeguard facilities for any differences between their baselines and their actual emissions (see Chapter 15).

The Authority notes that that the transition to the Authority’s recommended toolkit means that ERF purchasing would need to perform proportionately less of the emissions reduction task over time.

Safeguards and the way forward

The Authority recommends that the emissions intensity scheme for electricity and the enhanced safeguards should be reviewed as part of the broad 2022 review of the toolkit.

Analysis suggests that market mechanisms to reduce emissions—such as emissions intensity or cap and trade schemes—would allow Australia to meet its emissions reduction targets at a lower cost to the community than would be possible otherwise. This proposition met with broad agreement from the diverse range of stakeholders that engaged with the Authority for the Special Review.

While applying market mechanisms beyond the electricity sector would help meet Australia's targets at lower cost, the Authority notes that, in the safeguard mechanism, Australia has a broad-based regulatory architecture in place which can be progressively strengthened and enhanced to achieve emissions reductions that can be scaled up over time. That said, applying the safeguard mechanism in this fashion may not deliver emissions reductions with the degree of cost effectiveness that could be secured if a market mechanism was used.

Allowing liable facilities to meet their safeguard obligations with domestic offsets and international permits (with some restrictions) would however allow the safeguard mechanism to occupy a middle ground between more traditional forms of command and control regulation and market based measures. In particular this approach could secure cheaper abatement opportunities in domestic sectors not covered by the safeguard itself or the emissions intensity scheme for electricity generation.

A review in 2022 ahead of the scheduled 2023 review under the Paris Agreement should assess Australia's progress towards its goals and whether the enhanced safeguard mechanism should continue or whether another policy instrument such as a market mechanism should be applied in the direct combustion, industrial processes and fugitive emissions sectors. In the Authority's view, the two most prospective options for a market mechanism are an emissions intensity or a cap and trade scheme. Both have advantages and disadvantages. Given their similarity, good design of any scheme is more important than the particular type.

Transport

The Authority is of the view that Australia's climate policy toolkit should include measures to harness cost-effective opportunities in the transport sector, including supporting and encouraging more efficient vehicles, less emissions-intensive fuels and modes of transport, and reducing the need for transport while maintaining or enhancing living standards (Chapter 10).

In the short term Australia should introduce a mandatory carbon dioxide emissions standard for light vehicles. This could deliver substantial, low-cost emissions reductions, with net economic benefits. The sector as a whole should continue to be covered by ERF crediting and purchasing until light vehicle standards are in place. There also appears to be a case to pursue heavy vehicle standards in line

with developments in the US, Canada, China and Japan, and these should be considered following a cost benefit analysis.

In the longer term, covering transport under an enhanced safeguard mechanism or another policy instrument like a market mechanism would help to reduce Australia's transport emissions cost effectively. The 2022 review of the toolkit should consider transport coverage.

Further work would be useful to consider what else governments can do to encourage the use of less emissions-intensive transport fuels. One example is to examine the appropriate roles of public and private providers in delivering electric vehicle recharging infrastructure.

Infrastructure investment and effective city planning can help reduce travel distances and the need for transport, and encourage greater use of low-emissions options. Continuing collaboration between all levels of government, the private sector and communities should occur over the coming years to plan and build sustainable cities.

Energy efficiency

Energy efficiency offers significant emissions reduction potential at low cost or net savings across all sectors of the economy.

A range of barriers exist to prevent uptake of energy efficiency improvements. Where these barriers warrant government intervention, effective regulations and information programs can unlock cost-effective emissions reductions.

Australia should continue and expand its energy efficiency programs as part of the policy toolkit. Energy efficiency regulation and information programs should be regularly reviewed and strengthened to ensure continued, cost-effective emissions reductions from buildings, appliances, households and industry (Chapter 7).

Australian governments should again seek to harmonise white certificate schemes across jurisdictions to promote a more uniform approach to energy efficiency incentives across the country. Australian Government rules or standards that build on the current ERF crediting methods for energy efficiency should be used to establish eligibility for state white certificate scheme credits that can be used to meet obligations under the emissions intensity scheme for electricity generation.

This would help the effort to harmonise existing state and territory schemes while increasing demand for certificates and driving more energy efficiency.

Energy efficiency projects should remain eligible for ERF crediting and for purchasing until the emissions intensity scheme provides a source of demand.

Synthetic greenhouse gases and landfill waste

Synthetic greenhouse gases (SGGs) and emissions from landfill waste share characteristics that, in the Authority's view, make them well suited to an emissions reduction approach that builds on current regulations.

Reducing emissions from SGGs is best achieved through existing international agreements given effect through domestic regulation. This approach is straightforward and enjoys strong support from affected industries. Australia should therefore continue to phase down synthetic greenhouse gases and adopt an accelerated phase down of hydrofluorocarbons.

The waste sector presents opportunities for emissions reductions, despite its small contribution to Australia's total emissions. Emissions from the sector are already regulated for odour and safety by state governments. Strengthening and harmonising regulations to align with Australia's emissions reduction targets could promote further efficient emissions reductions in the sector.

Australian governments should commence work to harmonise regulation of emissions from landfill waste facilities (Chapter 12). Designed well, such regulation could be an environmentally effective and straightforward way to reduce emissions in this sector. Consideration should be given as to how best to deal with smaller regional landfills given they tend to emit lower volumes of greenhouse gases and some abatement options may not be feasible. It will also be important to avoid creating perverse outcomes like waste being transported from one region to another to avoid the impact of regulation.

Landfill waste and synthetic greenhouse gas reduction projects (SGGs) should be eligible for ERF purchasing and crediting until enhanced regulation is put in place in these sectors.

Land sector

Australia has substantial opportunities for emissions reductions in agriculture and land use.

An offsets scheme is a good way to reduce emissions from the land sector because emissions arise from a high number of relatively small emitters, which can mean high transaction costs.

Offset schemes can complement other policy instruments and reduce the cost of meeting Australia's targets. Risks to environmental integrity can be managed through robust methods and governance.

The offsets crediting and purchasing arrangements under the ERF have created emissions reductions in the land sector. ERF offset crediting should continue to cover the land sector, and the Australian Government should support new method development and associated research to reduce emissions.

Safeguard facilities should be able to use domestic land use and agriculture offsets issued through ERF crediting to reduce emissions if they exceed their baselines. Over time this would create an additional source of demand for land-based offsets; ERF purchasing arrangements should continue until the enhanced safeguard provides a source of demand.

The interaction between land sector emissions reduction policies and natural resource management arrangements offers opportunities for synergies and efficiencies. The Australian Government should lead a review with state and territory governments of how natural resource management policies could better encourage farm productivity, carbon storage and reduce emissions in the land sector.

Innovation

The Authority is of the view that targeted Government support for low-emissions innovation can help alleviate innovation barriers and address market failures not resolved by an enhanced safeguard mechanism or market mechanisms to reduce emissions (Chapter 8).

The early stages of low-emissions innovation—particularly research, development and demonstration—are a priority, and support through targeted public funding should continue. Debt and equity funding for the deployment of low-emissions projects and technologies should also continue. Other policies in the toolkit could also assist in overcoming difficulties associated with policy and project risks at the deployment and commercialisation stages.

International cooperation can foster efficiency in countries' innovation efforts. Australia should continue collaborating on low-emissions innovation with other countries.

International permits and credits

Credible international emissions reductions in the form of tradable units could complement Australia's domestic climate action, particularly in the short term. Units are available in two forms: credits from offsets projects or permits from emissions trading schemes.

Using credible international permits and credits could lower the cost of meeting Australia's emissions reduction goals. Trade in international permits and credits may also reduce international competitiveness concerns for Australian businesses by providing access to a wider range of low-cost emissions reductions opportunities.

It will be important to ensure that the use of these permits and credits does not delay Australia's transition to a lower emissions economy. Australia could manage this risk through limiting the volume of international permits and credits that can be used to meet obligations under the safeguard mechanism and other policy instruments.

Using international permits and credits could erode the environmental integrity of Australia's climate policies if they are not genuine reductions. To address this risk, Australia should only allow robust sources of international permits and credits to be used to meet toolkit obligations, and set strict eligibility criteria for permits and credits based on their environmental integrity.

The Authority recommends the Government undertake further work to determine appropriate qualitative and quantitative limits on international credits and permits. In particular, to ensure the environmental effectiveness of Australia's toolkit, restrictions should be used to encourage purchase of credits from new projects and prohibit use of international credits from some emissions reduction projects that may carry a higher risk of lacking environmental integrity. For example the destruction of some synthetic greenhouse gases and fertiliser manufacture and

some large-scale hydroelectricity projects have been excluded from some international schemes because of such concerns.¹

As a risk assurance measure to guard against policy uncertainty and higher than expected emissions growth, the Authority also recommends the Government establish a fund to purchase international offset credits and permits and help meet its 2030 emissions reduction target.

Promoting international competitiveness

The policy toolkit recommended by the Authority will, over time, increase the competitiveness of low emissions firms and decrease the competitiveness of high emissions firms. Of concern, however, are the undesirable competitiveness effects that can result from policy differences between countries. The two related problems are:

- carbon leakage, where Australia's emissions reductions efforts are eroded by them leading to emissions increases in other countries
- competitive distortions, where production and investment shift between countries because of policy differences, rather than differences in costs of reducing emissions.

While the risk of carbon leakage is still present, it is decreasing as more countries take on emissions reduction targets. By contrast, the risk of competitive distortions appears likely to persist for the foreseeable future as Australia's major trading partners are likely to continue to use a diverse range of policies to meet their targets.

Assistance should be provided to industries that are both emissions intensive and trade exposed (EITE) to reduce the residual risk of carbon leakage and the extent of competitive distortions. Such industries are likely to include the aluminium, alumina, steel, petroleum refining and cement industries, among others. The aim should not be to eliminate all competitive distortions by precisely aligning the policy costs for Australian firms with those of their international competitors. For one thing, this would be extraordinarily difficult to achieve, given the number of countries involved and the diverse range of measures they use to cut emissions.

¹ More specifically, non-eligible projects could include the destruction of trifluoromethane, the destruction of nitrous oxide from adipic acid plants or from large-scale hydroelectricity projects not consistent with criteria adopted by the European Union based on the World Commission on Dams guidelines.

More importantly, such an approach would likely reduce overall cost effectiveness by increasing costs on the broader community. The aim should be to strike a balance between assisting EITE industries and the effect of this assistance on the Australian community overall.

To address competitiveness concerns, the Authority recommends that EITE firms be allowed to surrender international permits and credits that are subject to strict eligibility rules for any emissions above their safeguard mechanism baselines without quantitative restrictions. The 2022 toolkit review should assess the use of international permits and credits, and consider whether a quantitative limit that declines over time should apply.

Allowing EITEs to access internationally traded permits and credits to manage their emissions reduction obligations can help alleviate competitiveness concerns as it helps align carbon prices faced by Australian EITE businesses with those of their competitors. The Authority is of the view that any assistance to address competitiveness should be carefully targeted, maintain incentives to reduce emissions, subject to regular review and time limited.

If the 2022 or a subsequent review resulted in a market mechanism being implemented in sectors that have EITE businesses, further assistance (such as free allocation of permits based on firms' output levels) could be considered depending on the type of market mechanism implemented.

Assisting regions and households

Under the Authority's recommended toolkit it is highly likely that economic activity and employment would continue to grow in the large majority of regions. Some regions are likely to be adversely affected, however. Impacts on regions should be assessed and where it can be demonstrated that adverse economic impacts are due to emissions reduction policies, transitional assistance to support affected regions should be considered. This could be in addition to the income support payments, job search assistance and training subsidies that are generally available.

The Authority's recommended choice of an emissions intensity scheme for electricity generation will help keep cost of living increases low, but there is potential for costs to fall disproportionately on lower-income households. To some extent assistance will occur through the normal cost of living increases to

government social security payments, and households participating in white certificates schemes can benefit from energy efficiency improvements that help contain costs. The Government could consider additional support, noting that most households assisted under the carbon pricing mechanism in 2012 still receive this assistance. If the 2022 or a subsequent review resulted in a market mechanism that raises government revenue being implemented outside the electricity sector (such as a cap and trade scheme) a proportion of this revenue could be used to assist low-income households. If a broad-based emissions intensity scheme is implemented, cost increases will be lower than under a cap and trade scheme and further assistance may not be needed.

The Authority's view is that governments should consider energy efficiency programs targeted at low-income households as they offer a way to improve equity and access to cost-effective energy efficiency opportunities. Low-income households spend a higher proportion of their income on energy bills; improving their energy efficiency would help them save money. The range of non-price barriers to energy efficiency faced by low-income households highlights the importance of an integrated policy strategy which ensures that measures to target specific barriers work together effectively.

The outlook is positive

There is strong evidence that Australia will be able to achieve substantial cuts in emissions over time while continuing to achieve strong growth in living standards and employment. Over the long term, coordinated international action on climate change can be expected to be good for our economy as well as for the environment.

There is also some cause for optimism for Australia's emissions reduction efforts. Consultations for the Special Review have revealed an encouraging level of agreement among stakeholders on the need for Australia to respond to the Paris Agreement by putting a durable and effective climate policy toolkit in place.

The Paris Agreement and the global imperative it reflects means that it is now urgent for Australia to make strong progress in the task of reducing emissions, decarbonising its economy and playing its part in the global effort to keep temperature increases at well below 2 degrees—and the Authority has kept this firmly in mind when making its recommendations for this review.

The recent history of policy to reduce emissions in Australia has been marked by frequent changes of direction, which in turn has led to significant investor uncertainty and, in some cases, created barriers to action.

In its work the Authority has been guided by the terms of reference for the Special Review. Appendix A provides detail on how the Authority has met the terms of reference for the review.

As required by the terms of reference, this third and final report of the Special Review has focused on the action or policies that Australia should take to implement the outcomes flowing from the Paris Agreement. In the Authority's view, the public interest is best served by putting in place a predictable pathway to a stable and scalable toolkit to reduce Australia's emissions. The Authority is proposing starting the transition now to a pragmatic yet durable set of policies that is in Australia's best interests.

The Government has announced that it will commence a review of climate change policy in the coming months. The Authority hopes that the recommendations and analysis contained in this report will help inform and influence that review.

RECOMMENDATIONS AND CONCLUSIONS

		CHAPTER
C.4	The world is taking action to address climate change; substantial further effort is needed over the coming years to limit global warming to the Paris Agreement goal of 'well below 2 degrees Celsius'.	2
C.2	Around the world, a wide range of policies are used to reduce emissions, including: market mechanisms, offsets, regulation and innovation support.	2
C.3	Countries tend to use a range of emissions reduction policies rather than a single policy.	2
C.1	The Paris Agreement's five-yearly reviews aim to encourage stronger global ambition over time.	2
C.5	To meet Australia's emissions reduction goals, Australia's emissions will need to decline more steeply in the coming years than they have in the past.	3
A POLICY TOOLKIT FOR AUSTRALIA		CHAPTER
C.6	The policy toolkit should be scalable and designed to fit Australia's legal, economic and political circumstances. The toolkit should be in the public interest, cost-effective, environmentally effective and equitable. It should seek to promote Australia's economic prosperity and minimise international competitive distortions.	4
C.7	No single policy can meet all the criteria in all sectors and circumstances.	4

- R.1** The Authority recommends that a toolkit of policies to meet Australia's emissions reduction commitments in the Paris Agreement should be put in place that features: **4**
- a durable policy architecture that builds carefully on existing policies and incorporates new policies in a phased transition, and that can be scaled up to meet the requirements of the Paris Agreement's ongoing reviews that are aimed at increasing the ambition of countries' target commitments.
 - five-yearly reviews of the policy settings within the toolkit to assess Australia's progress in reducing emissions and emissions reduction actions that other countries, particularly major trading partners, are taking to meet their Paris commitments. Most of the policy architecture itself should remain stable to help provide investment certainty.

THE ELECTRICITY SECTOR

CHAPTER

- R.2** An emissions intensity scheme should be implemented in the electricity generation sector because, as a market mechanism, it will allow Australia to meet its emissions reduction goals and decarbonise the electricity sector at lower cost than would be possible otherwise. **5**
- C.8** An emissions intensity scheme would increase electricity prices less than a cap and trade scheme. It could achieve significant emissions reductions and be scaled up to deliver further emissions reductions over time. **5**
- R.3** An emissions intensity scheme covering the electricity generation sector should be introduced in 2018. The emissions intensity baseline for electricity should decline linearly over time and reach zero well before 2050, consistent with Australia's Paris Agreement obligations. **5**
- R.4** Facilities with liabilities under the emissions intensity scheme should be able to use credits from eligible energy efficiency projects including from the Emissions Reduction Fund (ERF) and state and territory white certificate schemes to meet their obligations. The Australian Government should set eligibility criteria for the energy efficiency projects. Other than the eligible energy efficiency credits, the emissions intensity scheme should be 'closed' to enhance investor certainty. Liable facilities should not be able to meet their liabilities using international permits or credits, or other domestic offsets. **5**

- R.22** To promote policy stability and investor certainty the existing Large-scale Renewable Energy Target (LRET) should be unchanged to 2020 and remain in place until 2030. Support for small scale technologies through the Small-scale Renewable Energy Scheme (SRES) should also continue and phase out as planned. **9**

DIRECT COMBUSTION, INDUSTRIAL PROCESSES AND FUGITIVES		CHAPTER
C.9	The safeguard mechanism has the potential to play a significant role in reducing emissions and helping to meet Australia's Paris commitments.	5
R.5	Safeguard baseline coverage should continue in the direct combustion, industrial processes and fugitive emissions sectors and be extended to cover facilities that emit 25,000 tonnes of CO ₂ -e per year from 2018. Safeguard baselines should not be reset to allow for more emissions after 2017 and baselines should decline linearly to allow fewer emissions over time in line with Australia's obligations in the Paris Agreement.	5
R.7	Credits for facilities covered by the safeguard mechanism should not be issued unless they meet the ERF method requirements. This is to avoid penalising early movers and crediting non-additional emissions reductions.	5
R.8	ERF crediting for the land sector, and projects in sectors covered by the safeguard mechanism, should continue and the resulting credits could be used as offsets for facilities with obligations under the safeguard mechanism.	5
R.9	ERF purchasing for sectors covered by the safeguard mechanism should continue to provide transitional assistance to safeguard facilities to invest in lower emissions technologies and practices. ERF purchasing for land based offsets should continue until the enhanced safeguard mechanism is in place and provides a source of demand for these offsets.	5
R.10	The Government should review the policy toolkit as a whole in 2022 to assess its effectiveness including whether the enhanced safeguards should remain in place or whether another policy instrument such as a market mechanism of some sort be introduced to cover the direct combustion, industrial processes, fugitive emissions and transport sectors.	5

TRANSPORT		CHAPTER
R.25	Australia should introduce a light vehicle CO ₂ emissions standard as part of its policy toolkit.	10
R.26	The Government should carry out a cost-benefit analysis of heavy vehicle CO ₂ standards for Australia with a view to determining if these should be added to the toolkit.	10
R.27	There should be further research into the best roles of public and private providers in delivering electric vehicle recharging infrastructure.	10
R.23	ERF crediting and purchasing for the transport sector should continue until light vehicle standards are put in place.	10
R.24	The Government should consider covering transport under either the enhanced safeguard mechanism or with another policy instrument such as a market mechanism as part of the 2022 review.	10
ENERGY EFFICIENCY		CHAPTER
R.13	Standards should establish eligibility for energy efficiency projects including from the Emissions Reduction Fund (ERF) and state and territory white certificate schemes, and the resulting credits could be used to meet liable facilities' obligations under the emissions intensity scheme.	7
R.14	ERF crediting of energy efficiency projects should continue. Purchasing of energy efficiency projects should continue until the emissions intensity scheme is in place and provides a source of demand for credits from energy efficiency projects.	7
R.15	The Commonwealth and states should pursue harmonisation of white certificate schemes through the COAG Energy Council.	7
R.16	States and territories that have not done so should consider setting energy efficiency targets to provide a market for white certificates.	7
C.10	Evidence suggests that energy efficiency disclosure programs for buildings are environmentally and cost-effective. The Authority supports the current COAG process to examine these issues.	7

R.17 Regular, scheduled updates to the national construction code offer an important opportunity to improve the energy efficiency of Australia's built environment over time, and should continue. **7**

R.18 Energy efficiency standards for appliances are an important way to improve energy productivity and reduce emissions. They should continue to be regularly updated and be expanded where it is cost-effective for further improvements to be made. **7**

C.11 Where they can be provided cost-effectively, programs that help businesses improve their energy productivity may help reduce the cost of meeting Australia's emissions reduction targets. **7**

INNOVATION

CHAPTER

R.20 Australia should continue to support low-emissions innovation through targeted public funding for research, development and demonstration as a priority and through debt and equity funding for the deployment of low-emissions projects and technologies. **8**

R.21 Australia should continue to cooperate with other countries to support low-emissions innovation, focusing in particular on areas where innovation is in Australia's strategic interest. **8**

LAND USE AND AGRICULTURE

CHAPTER

R.28 The land sector (land use and agriculture) should be covered by the Emissions Reduction Fund crediting mechanism. Credits could be used as offsets for facilities with obligations under the safeguard mechanism and the sector should be covered by the ERF purchasing mechanism until the safeguard mechanism provides a source of demand. **11**

R.29 The Australian Government should support new ERF method development and associated research to reduce emissions in the land sector. **11**

R.30 The Australian Government should lead a review involving states and territories and other key stakeholders to provide guidance on how natural resource management policies at both the national and farm levels could encourage carbon storage and reduce emissions from the land sector, and deliver increased productivity as well as enhanced natural resource management outcomes like improved biodiversity, water quality and soil conservation. **11**

LANDFILL WASTE AND SYNTHETIC GREENHOUSE GASES

CHAPTER

R.31 Regulations that set limits on methane emissions from landfill waste should be harmonised across Australia. Consideration should be given as to how best to cover small and regional landfills and avoid creating distortions. **12**

R.32 Australia should continue to phase down synthetic greenhouse gases and adopt an accelerated phase down of hydrofluorocarbons. **12**

R.33 Emissions reduction projects from landfill waste and synthetic greenhouse gases should be eligible for ERF purchasing and crediting until enhanced regulation is put in place for these sectors. **12**

INTERNATIONAL PERMITS AND CREDITS

CHAPTER

R.11 Australia should strictly exclude international credits and permits assessed as having poor environmental quality to ensure the environmental integrity of the toolkit. **6**

R.6 Safeguard facilities should be able to use international credits and permits to meet their safeguard obligations, subject to qualitative and quantitative eligibility restrictions. The Australian Government should conduct further work to determine the appropriate restrictions including on the level of the quantitative limit, the types of projects that would be eligible and the commencement date of eligible projects. **5**

R.12 The Government should establish a fund to purchase international offset credits and permits and help meet the 2030 emissions reduction goal. **6**

INTERNATIONAL COMPETITIVENESS		CHAPTER
R.34	Australia should use carefully targeted competitiveness measures to improve the cost effectiveness of Australia's emissions reduction policy and to reduce residual risks of carbon leakage.	13
R.35	Competitiveness assistance to emissions-intensive, trade-exposed (EITE) industry businesses with obligations under the safeguard mechanism should be provided by allowing unlimited access to international permits and credits with strict qualitative restrictions. The toolkit review in 2022 should assess EITE access to international permits and credits and consider whether a quantitative limit that declines over time should apply.	13
R.36	Further competitiveness measures could be considered if another policy instrument such as a market mechanism is implemented after the recommended 2022 review. Any further assistance should be output-based to ensure that businesses receiving assistance are rewarded for reducing emissions and those that take early action to reduce emissions will gain a competitive advantage over those that do not.	13
R.37	The level of competitiveness assistance should be set in a simple and transparent way that strikes a balance between the benefits of assisting EITE industries and the alternative uses of this assistance.	13
R.38	EITE-focused competitiveness measures should be subject to review, time limited, and withdrawn according to a predictable timeframe.	13
TRANSITIONAL ASSISTANCE FOR COMMUNITIES AND HOUSEHOLDS		CHAPTER
C.12	The cost of the recommended policy toolkit to the Australian economy will be relatively modest, and far lower than the long-term cost of unmitigated global climate change.	14
C.13	The costs of meeting Australia's emissions reduction goals may fall more heavily on particular industries, regions, households and individuals. Impacts on households in particular will depend to some extent on policy choice and design.	14
R.19	The Australian Government should investigate best practice domestic and international approaches to improving the energy efficiency of low-income homes, including innovative models for financing the up-front costs of retrofits.	7

- R.39** Impacts on regions should be assessed and, where it can be demonstrated that adverse economic impacts are due to emissions reduction policies, transitional assistance to support affected regions should be considered. This would be in addition to the income support payments, job search assistance and training subsidies that are generally available. **14**
-
- R.40** The Government could consider additional support for low-income households for the impacts of emissions reduction policies, noting that for recipients, assistance will occur through the normal cost of living increases to government social security payments and that most households assisted under the carbon price mechanism in 2012 still receive this assistance. **14**
-
- R.41** If the 2022 or a subsequent review resulted in a market mechanism that raises government revenue being implemented outside the electricity sector a proportion of this revenue could be used to assist low-income households. If a broad-based emissions intensity scheme is introduced, further assistance to households may not be necessary. **14**
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CHAPTER 1. INTRODUCTION

This is Report Three of the Special Review into Australia's climate action. The review was commissioned by the then Minister for the Environment, the Hon. Greg Hunt MP, in December 2014.

This report makes recommendations about what action Australia should take to implement outcomes flowing from the United Nations Framework Convention on Climate Change (UNFCCC) Paris conference in December 2015.

This chapter explains the challenge of climate change and why it is in Australia's interest to continue to contribute to global efforts to avoid dangerous climate change. It provides some background information about the Authority and the Special Review.

1.1. THE CHALLENGE OF CLIMATE CHANGE

Climate change is a serious global challenge, and poses major risks to the Australian community, economy and environment. Climate change is already having effects in Australia and around the world.

Human activity is causing the climate to warm. Some activities, such as burning fossil fuels and clearing land, produce greenhouse gases, which trap heat like a greenhouse. As concentrations of greenhouse gases increase, more heat is retained and the climate gets warmer. While there is global scientific consensus that humans are the dominant cause of warming since the mid-20th century (95–100 per cent certainty); the climate system is complex and there are uncertainties, particularly around how much the climate will change in the future, the pace of change, and the likely impacts of that change (IPCC 2014).

Australia is already experiencing the effects of climate change. As more greenhouse gases are released and the climate continues to change, these impacts will become more severe. In Australia, we are likely to see higher temperatures, reduced snow cover, and increased frequency and intensity of fires, floods and droughts, with effects varying between regions (Hennessy et al. 2008; Cleugh et al. 2011). As temperatures rise and Australia's rainfall patterns change, Australia's agricultural production is likely to be affected—with some previously productive areas becoming marginal (Cleugh et al. 2011).

The economic consequences of climate change are hard to estimate because many of the costs of climate change (or benefits of avoiding it) are difficult to define and measure. To understand the potential implications of climate change policy for Australia, scientific and economic frameworks must be combined to estimate impacts of both the changing climate and action to reduce emissions (Garnaut 2008). This is difficult. The Garnaut Climate Change Review (2008) drew on a wide range of expertise and models to estimate the costs of climate change in different scenarios, including the impacts on agriculture and several aspects of human health and infrastructure. In addition, it considered non-quantified costs of climate change, such as the risk of extreme weather events and impacts on the environment that do not necessarily have a

direct monetary effect. The study found that, even just considering the measurable effects, the cost of climate change was considerably more than the cost of strong action to reduce emissions. When immeasurable effects were also considered, there was a strong case to reduce emissions even more.

The global community is acting to address climate change. At the UNFCCC Paris conference in December 2015, 195 countries agreed to a global goal to hold the increase in global average temperatures to 'well below 2 degrees Celsius above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 degrees Celsius... recognising that this would significantly reduce the risks and impacts of climate change' (UNFCCC 2015a).

These temperature goals are significant. With less than 2 degrees of warming, Australia is more likely to be able to adapt to and manage the impacts of climate change, such as additional sea level rise and more frequent heatwaves and drought (Cleugh et al. 2011). The more temperatures rise above 2 degrees, the more severe these impacts become and adaptation can be expected to become increasingly challenging and costly.

Sustained global action is required to limit global warming to 'well below 2 degrees'. While the world is not yet on track to achieve this goal, countries are making progress and their efforts are increasing over time (Chapter 2). Emissions reduction targets and policies that allow Australia to play its part in this international response are a prudent risk management strategy, given likely climate change impacts on Australia.

1.2. THE CLIMATE CHANGE AUTHORITY

The Climate Change Authority provides independent, expert advice to the Australian Government and Parliament on policies and measures to reduce the risks of climate change. The Authority comprises nine members, including the Chief Scientist. There is one associate member for this Special Review.

Further information about the Authority and its members can be found on the Authority's website—www.climatechangeauthority.gov.au.

1.3. ABOUT THE SPECIAL REVIEW INTO AUSTRALIA'S CLIMATE ACTION

This report is the third part of the Authority's wide-ranging Special Review into Australia's climate action. The then Minister for the Environment, the Hon Greg Hunt MP, requested the Review in December 2014; the terms of reference are at Appendix A. Previous reports from the Review are available on the Authority's website.

The Special Review Draft Report: Australia's future emissions reduction targets (hereafter 'Special Review draft report on targets') (CCA 2015a) focused on Australia's emissions reduction targets for the period beyond 2020. In this part of the special review, the Authority drew on its long-term national emissions budget for Australia of 10.1 Gt CO₂-e for the period 2013 to 2050. This represented the Authority's assessment of Australia's share of global action that is estimated to provide a likely chance (67 per cent probability) of achieving the 2 degree goal, and provides a long-term backdrop to setting short- and medium-term targets. The Authority noted that in line with this emissions budget, modest efforts by Australia to reduce its emissions over the years immediately ahead will necessitate much more intensive efforts in the years beyond 2020, and will need to be sustained thereafter if Australia is to make this contribution to achieving the global 2 degree goal. Following consultations with stakeholders, the Authority

released its final report on Australia's future emissions reduction targets which recommended Australia commit to:

- a 2025 target of 30 per cent below 2000 levels (equivalent to 36 per cent below 2005 levels)
- further reductions by 2030 of between 40 and 60 per cent below 2000 levels (equivalent to 45 to 63 per cent below 2005 levels).

The Final Report on targets flagged that subsequent reports for the Special Review would focus on the actions or policies Australia should adopt to meet its Paris obligations.

The Special Review Second Draft Report: Australia's climate policy options (hereafter 'Report Two of the Special Review') set out policy options for how Australia could meet its targets (CCA 2015c). The report described and discussed a range of options and proposed a framework for evaluating policies based on the principles of cost effectiveness, environmental effectiveness and equity. It proposed using these to assess policy options' effects on the international competitiveness of Australian businesses. The report also noted that a 'toolkit' of policies—that is, a targeted suite of measures to reduce emissions—was likely to be best placed to reduce emissions across Australia's various sectors and abatement options, and discussed the fit between policies and sectors based on their characteristics.

This report is accompanied by the Special Review research report, Policy options for Australia's electricity supply sector (hereafter the 'electricity research report'), which evaluates post-2020 emissions reduction policies for the electricity sector. The analysis and modelling in the electricity research report informed the conclusions and recommendations in this report.

The Authority intends for this report to contribute to the Government's ongoing policy processes, including the development of its National Energy Productivity Plan, the planned 2017–18 review of climate policy and future consideration of Australia's longer-term emissions reduction targets.

1.4. PUBLIC CONSULTATION

The Authority consulted widely as part of the Special Review. Feedback from stakeholders was invaluable in informing this report and its recommendations. The Authority thanks all individuals and organisations that contributed.

The Authority sought stakeholder views on the policy options and proposed approach to evaluation in Report Two of the Special Review. The Authority also met a wide range of stakeholders, including through roundtable discussions, public forums, expert workshops and individual meetings.

Public submissions for all consultations are available on the Authority's website and details of the Authority's consultations for this review are at Appendix B.

1.5. STRUCTURE OF THIS REPORT

The rest of this report is structured as follows:

- Chapters 2 to 4 introduce the report and set the context for the Authority's analysis and recommendations. They consider the outcomes from the UNFCCC Paris conference, Australia's emissions, emissions reduction commitments and policies, and the Authority's approach to assessing policies.
- Chapters 5 to 13 set out the Authority's recommendations for a policy toolkit for Australia. The report assesses a range of policies against the Climate Change Authority's assessment

criteria and proposes a range of measures to meet Australia's Paris Agreement obligations, including measures to address the international competitiveness effects of the toolkit.

- Chapters 14 to 16 consider the likely economic impacts of the recommended policy toolkit and how to manage them, the transition from current policies to the toolkit, and further work that could inform the policy conversation.

CHAPTER 2. INTERNATIONAL ACTIONS AND OUTCOMES OF THE PARIS CONFERENCE

The world is acting to address climate change. The Paris Agreement is an important milestone that confirms and strengthens the trend of increased global action. The Agreement includes an enhanced goal to limit global warming to 'well below' 2 degrees, and to 'pursue efforts to limit warming to less than 1.5 degrees'. The Agreement includes five-yearly reviews to help scale up national and global efforts over time.

Almost all countries in the world pledged emissions reduction contributions in the lead up to the UNFCCC Paris conference, most setting measurable targets. Many countries have already implemented a range of policies to reduce their greenhouse gas emissions. Some of these policies have been in place for more than a decade and have helped countries meet their previous targets. Many countries implement a variety of policies to help realise emissions reduction opportunities, including market mechanisms and other incentives focused on innovation, low-emissions technologies and energy efficiency.

The emissions reductions countries have achieved and pledged so far are not enough to meet the Paris Agreement's global goals. All countries will need to pursue stronger emissions reduction targets in the future, and policies to achieve those targets.

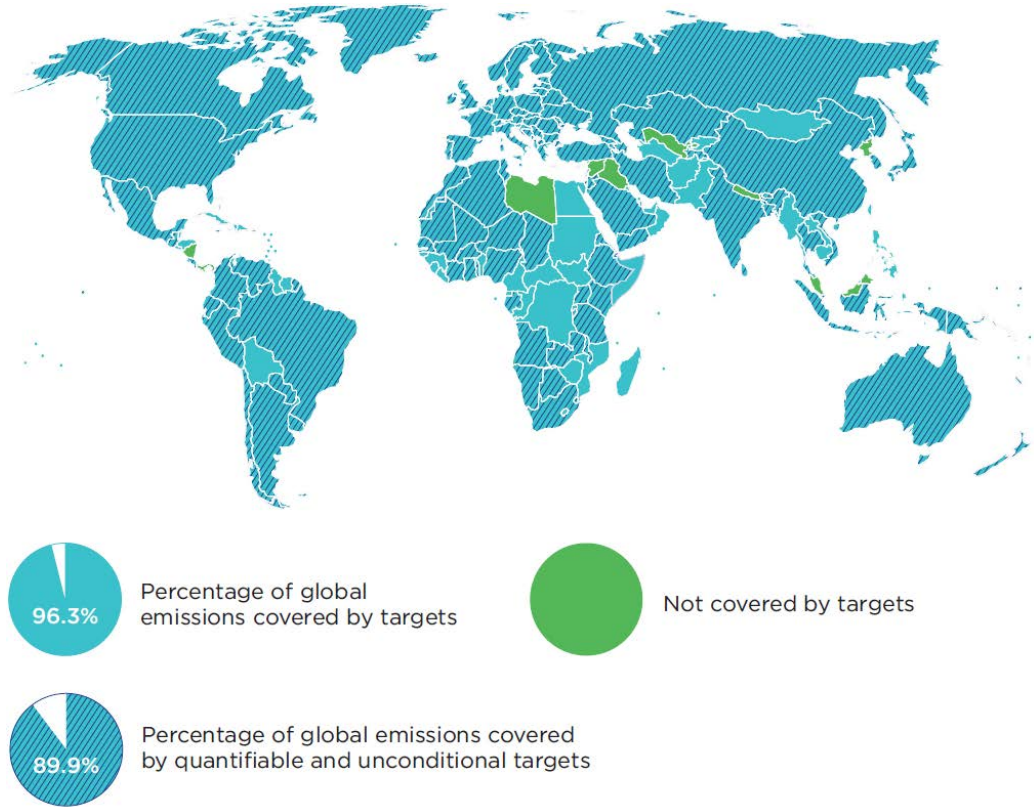
The 2015 Paris Agreement establishes a framework for all countries to continue climate action beyond 2020 (UNFCCC 2015a). At the Paris conference all 195 countries party to the United Nations Framework Convention on Climate Change (UNFCCC) adopted the Agreement, which will succeed the Kyoto Protocol. The Agreement opened for signature in April 2016 and so far, 180 Parties have signed and 22 Parties have ratified (UNFCCC 2016b). To enter into force, 55 countries representing 55 per cent of global emissions must ratify the Agreement (UNFCCC 2015a Art. 21.1).

A major achievement of the Paris Agreement was the strengthening of the global temperature goal. The UNFCCC's ultimate objective is to prevent dangerous climate change. To achieve this goal, countries previously agreed to limit warming to less than 2 degrees above pre-industrial levels. Under the Paris Agreement, countries agreed to limit warming to 'well below' 2 degrees, and to 'pursue efforts to limit the temperature rise to 1.5 degrees'. The Agreement also indicates what this requires for global emissions: countries agreed to peak emissions as soon as possible, to rapidly reduce emissions thereafter, and to reach net zero emissions between 2050 and 2100.

The Paris Agreement requires all countries to undertake emissions reduction efforts. Almost all Parties to the UNFCCC nominated Intended Nationally Determined Contributions ('Paris targets') to reduce their emissions as part of the global effort (Figure 2). Most developed countries have committed to reduce their emissions in absolute terms, while most developing countries have committed to reduce emissions compared to business as usual trends, or to reduce the

emissions intensity of their economies. Paris targets for fourteen key countries and regions are listed in Table 1.

FIGURE 2 COUNTRIES THAT HAVE SUBMITTED PARIS TARGETS



Note: Quantifiable and unconditional targets contain an element which is unconditional and quantify an emissions target, through specifying an absolute emissions reduction, a reduction from business as usual (BAU), an emissions intensity target or a peaking year. A BAU trend predicts future emissions in the absence of new policy.

Source: DFAT 2016.

The Paris Agreement's requirement for all countries to undertake emissions reductions broadens the coverage of international climate action; under the Kyoto Protocol only developed countries have emissions reduction targets.

TABLE 1 KEY COUNTRIES' AND REGIONS' PARIS TARGETS

COUNTRY/ REGION	SHARE OF GLOBAL EMISSIONS	PARIS TARGET	IMPLIED CHANGE IN TOTAL EMISSIONS 2005-2030
China	22.4%	Peak carbon dioxide emissions by around 2030, making best efforts to peak early. Lower carbon dioxide emissions per unit of GDP by 60 to 65 per cent compared to 2005 levels by 2030	+72 to +96%
United States	12.2%	Reduce emissions by 26 to 28 per cent compared to 2005 levels by 2025	-35 to -39%
European Union	8.7%	Reduce emissions by 40 per cent compared to 1990 levels by 2030	-34%
India	6.1%	Lower emissions per unit of GDP by 33 to 35 per cent compared to 2005 levels by 2030	+199 to +208%
Russian Federation	4.7%	Reduce emissions by 25 to 30 per cent compared to 1990 levels by 2030	+29 to +39%
Indonesia	4.2%	29 per cent below business as usual (BAU) emissions trend by 2030	+14%
Brazil	3.8%	Reduce emissions by 37 per cent compared to 2005 levels by 2025, 43 per cent compared to 2005 levels by 2030	-43%
Japan	2.5%	Reduce emissions by 26 per cent compared to 2013 levels by 2030	-25%
Canada	1.8%	Reduce emissions by 30 per cent compared to 2005 levels by 2030	-30%
Mexico	1.6%	22 per cent below BAU emissions by 2030	0%
Iran	1.5%	4 per cent below BAU emissions by 2030	+63 to +65%
Australia	1.4%	Reduce emissions by 26 to 28 per cent compared to 2005 levels by 2030	-26 to -28%
Republic of Korea	1.4%	37 per cent below BAU emissions by 2030	+2 to -4%
New Zealand	0.1%	Reduce emissions by 30 per cent compared to 2005 levels by 2030	-30%

Note: Emissions include the land sector except where noted below. Share of global emissions is based on 2012 emissions levels. A BAU trend projects future emissions in the absence of new policies. For Brazil, Canada, Australia, New Zealand and Japan, implied change in total emissions is taken directly from Paris targets, for other countries change is Climate Change Authority calculation. For China and India the range shown is an indicative estimate based on projected growth in real GDP. For China, projected change in total emissions is based on its Paris target for CO₂. For Republic of Korea, the range shown is an estimate based on its 2005 emissions including and excluding land use. The US figure is a linear extrapolation from its 2020 target through its 2025 target to 2030. Paris targets from Mexico and Indonesia include a BAU emissions projection, enabling calculation of change on 2005 using those countries' own projections. Iran's Paris target does not include a BAU emissions projection; an alternative source was used for this projection. For Iran, the range shown is an estimate based on emissions including and excluding land use.

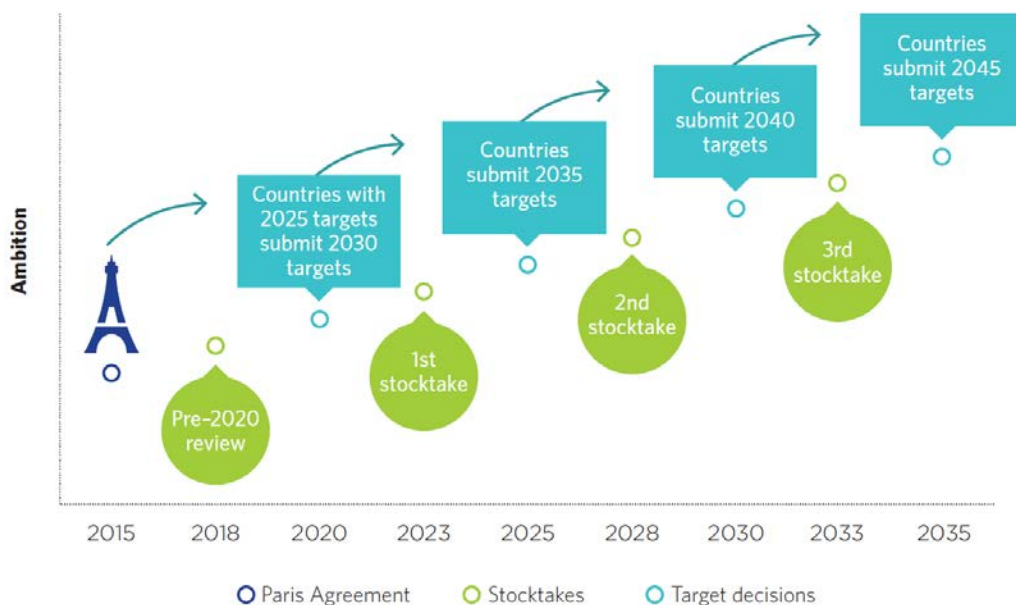
Source: Share of global emissions: WRI 2015. Paris targets: UNFCCC 2015b. For Climate Change Authority calculations of implied change in total emissions column: Historical emissions: China, India, Republic of Korea and Brazil: WRI 2015; Mexico and Iran: Meinshausen & Alexander 2016b, 2016a; United States: US EPA 2016; Remaining countries: UNFCCC 2016a. China and India GDP: OECD 2014b. Iran BAU emissions projection: Meinshausen & Alexander 2016a.

The Paris Agreement includes five-yearly reviews to help scale up global efforts over time. 'Global stocktakes' will take place every five years to assess the combined impact of countries' efforts in limiting greenhouse gas emissions and global warming. Individual countries' progress towards meeting targets will be scrutinised through measurement, reporting and verification processes. Each country must submit a new target every five years. Each update must be a progression beyond the country's current effort and reflect its highest possible ambition (Figure 3). Through this five-yearly review process, the Paris Agreement creates an enduring platform for future climate action. This differs from the Kyoto Protocol under which legally binding targets can only be strengthened through amending the Protocol's annex, which requires adoption by all Parties at a UNFCCC conference.

CONCLUSION

- C.1. The Paris Agreement's five-yearly reviews aim to encourage stronger global ambition over time.

FIGURE 3 THE PARIS AGREEMENT FIVE-YEARLY REVIEW PROCESS



Note: While the five-yearly review process was established in the Paris Agreement, it is not yet certain whether countries will set targets for five-year or ten-year intervals.

Source: Climate Change Authority.

2.1. THE WORLD IS ACTING TO REDUCE GREENHOUSE GAS EMISSIONS

Countries around the world are taking meaningful action to address climate change. A survey of 99 countries found that there were more than 800 climate change policies and laws in place at the domestic level, around 80 countries have set targets for renewable energy uptake, and around 40 have implemented or are implementing a price on carbon (Kossov et al. 2015; Nachmany et al. 2015). Countries have implemented policy toolkits to promote a range of emissions reduction opportunities across different sectors.

Countries' responses to their past targets also help provide confidence in their future action. Most countries have met, or surpassed, their emissions reductions targets to date. Under the Kyoto Protocol, all 36 countries that retained first commitment period targets have met them (Canada withdrew from the Kyoto Protocol, while the United States did not ratify) (Shislov et al. 2016). While it is too early to definitively say whether countries will meet their 2020 targets, around half of G20 countries with 2020 targets are on track, or very close to on track, to meet these targets using current policies (UNEP 2015). This proportion is likely to increase, as countries begin to take action consistent with the deeper reductions required under the Paris Agreement.

Private companies and subnational governments are also participating in the trend towards stronger action on climate change. As part of the Paris conference, the UNFCCC established a Non-state Actor Zone for Climate Action (NAZCA). As of June 2016, the NAZCA has recorded over 10,000 commitments, including commitments from more than 2,000 companies, and more

than 2,200 cities (UNFCCC 2015c). For example, the City of Melbourne is aiming to be carbon neutral by 2020, the City of New York has committed to reducing its emissions to 80 per cent below 2005 by 2050, and the City of Berlin is committed to reducing its emissions to 85 per cent below 1990 by 2050. Under the Science Based Targets Initiative, over 170 companies have signed up to develop targets to reduce emissions in line with limiting global warming to less than 2 degrees. Participating companies include National Australia Bank, Westpac and Origin Energy (Science Based Targets 2016). In addition, more than 1,000 companies have disclosed to their stakeholders that they use an internal price on carbon, or intend to do so in the next two years (CDP 2015).

There is increasing evidence that a global shift toward a lower emissions economy is underway. Investment in renewable energy has almost quadrupled in the last ten years and renewables are now the world's second largest source of electricity after coal (IEA 2015e; FS-UNEP Collaborating Centre 2016). The emissions intensity of the global economy declined by an average of 1.3 per cent annually since 2000, and 2.7 per cent in 2013–14 (Johnson et al. 2015).

In requesting the Authority to carry out the Special Review, the Minister asked the Authority to consider the climate policies of the United States, China, Japan, the Republic of Korea and the European Union. The Authority has also examined policies in India, Russia, Indonesia, Brazil, Canada, Mexico, Iran and New Zealand. All of these countries have nominated targets under the Paris Agreement (Table 1) and have implemented a range of policies to address climate change (Table 2). The Authority has drawn on the experience of these countries, and others, in making its policy recommendations.

CONCLUSIONS

- C.2. Around the world, a wide range of policies are used to reduce emissions, including: market mechanisms, offsets, regulation and innovation support.
- C.3. Countries tend to use a range of emissions reduction policies rather than a single policy.

Table 2 Note: SN indicates policies that are in place at the subnational level. For the European Union (EU), a tick indicates that a policy is in place either at the EU level, or at a national level in one or more EU countries. 'Emissions reduction market mechanisms' refers to cap and trade schemes, emissions intensity schemes and carbon taxes. 'International permits and credits' indicates countries that use international permits and credits to offset domestic emissions. 'Offsets' indicates countries that generate offsets for domestic or international use. 'Tariffs for renewable energy' are administratively set feed-in tariffs. For the United States and Canada, the connection between the California and Quebec market mechanisms allows trading of international units at a subnational level. For New Zealand, some forestry entities can choose to opt-in to the emissions trading scheme, this is considered equivalent to allowing domestic offsets. For Mexico and Brazil, net metering of renewable energy generation allows households and businesses to gain credits on their electricity bills—this is considered roughly equivalent to a tariff for renewable energy. China does not have a renewable energy target with tradable certificates, but may be moving towards this policy. **Source:** Nachmany et al. 2015; BNEF 2015a; IEA 2015d; ICAP 2016; country and state government websites.

2.2. GREATER EFFORTS ARE REQUIRED TO MEET CLIMATE GOALS

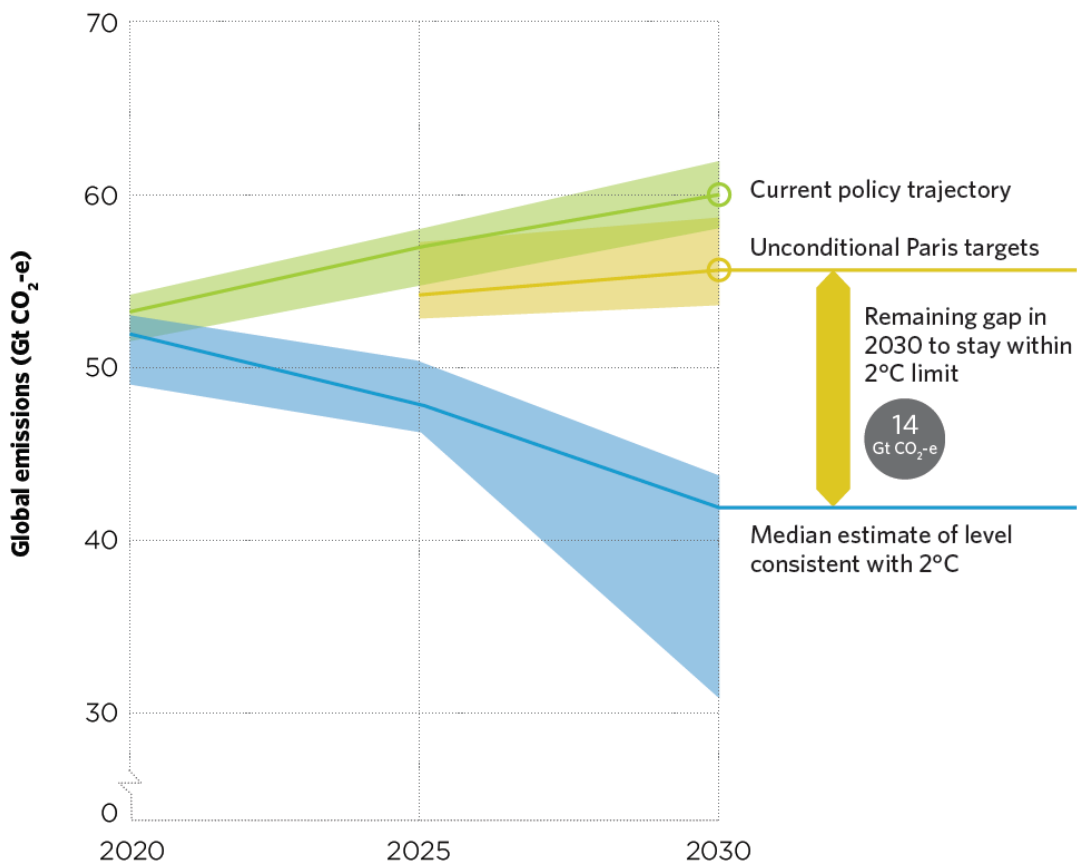
Countries will need to take stronger action if the world is to limit warming to 'well below 2 degrees' noting the Agreement also requires countries to implement measures with the aim of 'pursu(ing) efforts to limit the temperature rise to 1.5 degrees'. While countries' Paris targets represent additional effort to existing policies, they are not sufficient to achieve these goals (Figure 4). For the world to be on a path consistent with less than 2 degrees of warming, emissions in 2030 would need to be 14 Gt CO₂-e lower than implied by existing commitments.

Analysts estimate that current national commitments are consistent with a temperature increase of 2.6 to 3.1 degrees by 2100, while currently implemented policies are consistent with 3.1 to 3.4 degrees of warming (Rogelj et al. 2016).

The Paris Agreement aims to strengthen the global response to climate change by pursuing efforts to limit warming to 1.5 degrees. Relatively few studies of global emissions pathways consistent with 1.5 degrees have been undertaken to date; the UNFCCC has requested the Intergovernmental Panel on Climate Change publish a special report on this topic in 2018.

The Paris Agreement's five-yearly reviews aim to close the gap between countries' targets and the global temperature goals. Countries will be required to strengthen their long-term emissions reduction targets in line with the global temperature goal aiming for net zero emissions in the second half of the century. Australia and other countries face a substantial emissions reduction task in coming decades as part of this framework for global action.

FIGURE 4 THE EMISSIONS GAP IMPLIED BY COUNTRIES' PARIS TARGETS



Source: Climate Change Authority based on UNEP 2015.

CONCLUSION

C.4. The world is taking action to address climate change; substantial further effort is needed over the coming years to limit global warming to the Paris Agreement goal of ‘well below 2 degrees Celsius’.

CHAPTER 3. AUSTRALIAN CONTEXT

The Paris Agreement requires all countries including Australia to review their targets and increase their emissions reduction efforts over time. Australia's emissions will need to decline more steeply in the coming years than they have in the past.

Australia has a range of policies in place. To meet its Paris Agreement obligations, Australia will need a policy toolkit that builds on existing measures, adopts some new measures and is capable of being scaled up over time.

3.1. AUSTRALIA'S CLIMATE CHANGE COMMITMENTS

Australia's Intended Nationally Determined Contribution to the Paris Agreement is to reduce emissions by 26 to 28 per cent on 2005 levels by 2030.

The Authority previously assessed goals for Australia's emissions reductions with reference to its global carbon budget as outlined in report one of the special review (see Section 1.3).

The Paris Intended Nationally Determined Contributions (INDCs) are also known as targets or other emissions reduction commitments. Collectively, the Paris commitments would mean that global emissions remain well above a level that would give a realistic prospect of limiting temperature increases to below 2 degrees.

In a significant development, however, the Paris Agreement architecture establishes a cycle of reviews that will require all Parties to review and progressively increase their emission reduction commitments every five years, with reference to the global emissions goals. This set of obligations offers the prospect of reaching the global goal of zero net emissions in the second half of this century.

Accordingly, as well as needing policies to meet its 2030 obligation, Australia will need policies that are capable of being scaled up to meet more ambitious goals in the decades ahead and to play its part in action to decarbonise the global economy.

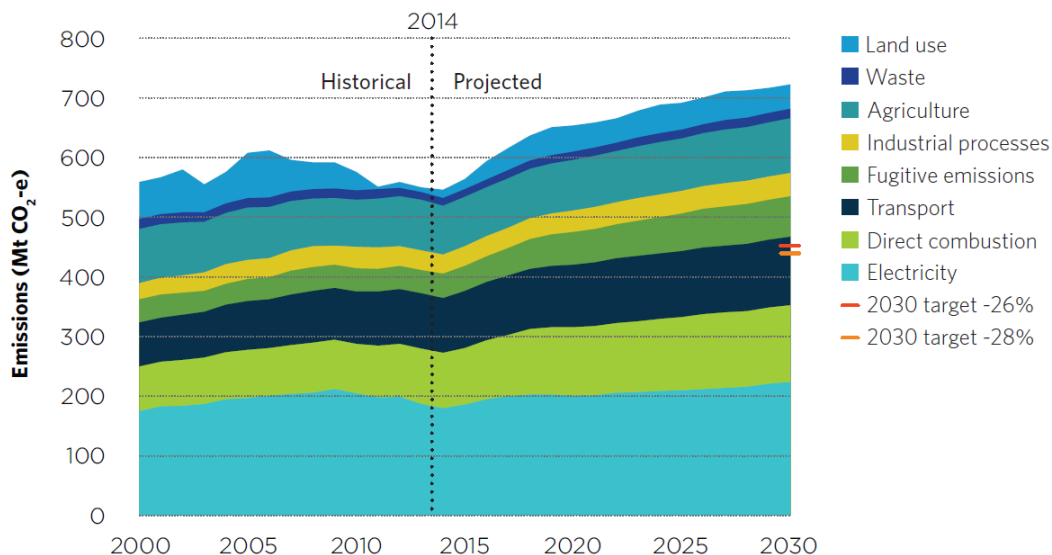
3.2. AUSTRALIA'S EMISSIONS REDUCTION CHALLENGE

To meet its INDC commitment, Australia's emissions will need to decline more steeply in the coming years than they have in the past.

Australia's total emissions remained fairly flat over the last 15 years, with emissions in 2014 about five per cent below those in 2000 (Figure 5). Over this period emissions from energy increased by 12 per cent and emissions from industrial processes increased by 21 per cent. This increase was slightly more than offset by a 47 per cent decrease in emissions from the land use, agriculture and waste sectors (Table 3). Land use emissions fell steeply due to less land clearing, improved land management practices and changes in the forest products industry such as a shift towards new plantations and less native forest harvesting (DoE 2015e).

Similarly, Australia's emissions were broadly the same in 2014 as in 1990. Over this period, emissions from energy increased by 39 per cent and emissions from industrial processes increased by 24 per cent. This was offset by a 63 per cent reduction in emissions from land use, waste and agriculture emissions. Over the same period the size of Australia's economy doubled. This means that the emissions intensity of the economy (emissions per dollar of GDP) has halved.

FIGURE 5 AUSTRALIA'S DOMESTIC EMISSIONS, 2000–2030



Note: ‘Direct combustion’ emissions are the emissions released when fuels are combusted to generate heat, steam or pressure. ‘Fugitive emissions’ are gases that are leaked or vented during the extraction, production and distribution of fossil fuels such as coal, crude oil and natural gas. ‘Industrial processes’ includes emissions from metal and mineral production, and chemical processes. ‘Waste’ includes emissions from landfills, and waste water treatment. ‘Land use’ constitutes emissions from land use, land-use change and forestry. This source included savanna burning within agriculture, it is now within land use. This chart presents the most recent official projections to 2030, which were released in March 2015. Subsequent official projections, which extend to 2020, project domestic emissions to 2020 to be around 10 per cent lower.

Source: DoE 2015d.

Energy dominates Australia's emissions profile, contributing about 77 per cent of national emissions in 2014. Energy includes four subsectors: electricity, direct combustion, transport and fugitive emissions. The remaining quarter of Australia's emissions come from the agriculture, industrial processes, waste and land use sectors.

TABLE 3 AUSTRALIA'S EMISSION SOURCES, 2014

SOURCE ACTIVITIES: MT CO ₂ -E	MT CO ₂ -E	% OF EMISSIONS	% CHANGE FROM 2000	OUTLOOK TO 2020
Electricity	181	35	3	steady
Direct combustion				
Manufacturing: 47				
Metals: 17				
Chemicals: 9	94	18	26	↑
Other: 21				
Energy/mining: 24				
Residential and commercial: 16				
Other: 7				
Transport				
Light vehicles: 57				
Heavy vehicles: 22	93	18	25	↑
Aviation: 9				
Other: 6				
Agriculture				
Beef and dairy: 42	72	14	-8	↓
Other livestock: 14				
Other: 16				
Fugitives				
Solid fuels: 25	38	7	-1	↑
Oil and natural gas: 13				
Industrial processes				
Synthetic greenhouse gases: 11	32	6	21	↑
Metal production: 10				
Other: 12				
Waste				
Solid waste: 9	12	2	-22	↓
Waste water: 3				
Land use				
Afforestation reforestation, deforestation: 26	1	0	-99	↑
Forest management: -22				
Cropland and grazing land management: -3				
TOTAL	523	100	-4	↑

Note: 'Direct combustion' emissions are the emissions released when fuels are combusted to generate heat, steam or pressure. 'Fugitive emissions' are gases that are leaked or vented during the extraction, production

and distribution of fossil fuels such as coal, crude oil and natural gas. 'Industrial processes' includes emissions from metal and mineral production, and chemical processes. 'Waste' includes emissions from landfills, and waste water treatment. 'Land use' constitutes emissions from land use, land-use change and forestry, and includes savanna burning under Kyoto Protocol accounting rules. Totals may vary slightly due to rounding.

Source: Emissions - DoEE 2016, Outlook - DoE 2015e.

Many factors influence Australia's emissions levels, including economic conditions, social trends and climate change policies.

- So far, the Emissions Reduction Fund (ERF) has contracted projects to reduce emissions by 143 Mt CO₂-e between 2015 and 2026 (CER 2016b) while the Large-scale Renewable Energy Target is projected to reduce emissions by about 200 Mt CO₂-e from 2015 to 2030 (Climate Change Authority calculation based on ACIL Allen Consulting (2014)).
- Emissions associated with the extraction and processing of coal and liquefied natural gas (LNG)—both for export and domestic energy consumption—contributed to historical emissions growth in the direct combustion and fugitives sectors. This growth is expected to continue to 2020.
- Since 2000, Australia's manufacturing sector has continued to contract as a share of economic activity, with significant industrial closures in the aluminium and petroleum refining sectors. This reflects a structural shift in the Australian economy from manufacturing products to service delivery.
- Australia's population grew by almost five million between 2000 and 2015 (ABS 2016a), increasing the number of households using electricity and natural gas, which in turn increased emissions from electricity generation and direct combustion. Similarly, population growth was a factor in the increased use of passenger vehicles and domestic aviation, leading to higher transport emissions. Efficiency improvements offset this effect to some extent, so while energy sector emissions have grown in absolute terms, they have declined on a per person basis.

3.3. AUSTRALIA'S MAIN EMISSIONS REDUCTION POLICIES

Australia has a range of emissions reduction policies in place, some at the federal level and others at the state, territory and local levels. Table 4 includes policies at the federal, state and territory levels. Box 1 explains the ERF in more detail. The Government has indicated it will take stock of its climate change policies in 2017.

TABLE 4 AUSTRALIA'S MAIN EMISSIONS REDUCTION POLICIES

POLICY	APPLICATION	DETAILS	ESTIMATED EMISSIONS REDUCTIONS
ERF (crediting)	National Covers all sectors	Voluntary scheme where the Government issues emissions reduction credits to eligible projects	See ERF (purchasing) below
ERF (purchasing)	National Covers all sectors	Voluntary scheme where the Government buys emissions reduction credits from ERF projects	143 Mt CO ₂ -e of future emissions reductions contracted in three auctions held to date. Contracts run for up to 10 years (CER 2016b)
ERF safeguard mechanism	National Covers facilities emitting over 100,000 t CO ₂ -e per year	Regulation that requires covered facilities to stay below specified baseline emissions levels. Up to 370 facilities are expected to be covered by the safeguards mechanism (CER 2016c).	Safeguard started 1 July 2016
Targets for renewable energy uptake	National Covers electricity sector	'Technology pull' scheme that requires liable entities to buy renewable energy certificates. The scheme supports large-scale and small-scale renewable energy generation.	The Renewable Energy Target (RET) is projected to reduce emissions by about 200 Mt CO ₂ -e (cumulatively) between 2015 and 2030 (CCA calculation based on ACIL Allen Consulting (2014))
	State-based (ACT, South Australia, Queensland and Victoria) Covers electricity sector	Targets at state level for the use or production of renewable energy. The ACT has committed to achieve 100 per cent renewable energy by 2020, South Australia to 50 per cent by 2025, Queensland to 50 per cent by 2030 and Victoria to 40 per cent by 2025. Policy methods to achieve these targets vary. The ACT uses long term contracts awarded through auctions. Victoria has also indicated it will use auctions. South Australia has primarily relied on the Commonwealth RET. Queensland has appointed an expert panel to investigate ways to achieve its target.	Not available

POLICY	APPLICATION	DETAILS	ESTIMATED EMISSIONS REDUCTIONS
Energy efficiency target ('white certificate') schemes	Schemes operate in NSW, Victoria, South Australia and the ACT Covers electricity sector (NSW scheme also covers gas)	Schemes that require electricity retailers or suppliers to meet an energy savings obligation, often by undertaking activities to improve energy efficiency or buying certificates that represent energy savings. Each scheme has an energy savings target.	NSW scheme is estimated to have reduced emissions by about 2.8 Mt CO ₂ -e between 2009 and 2013 (NSW Government 2015) Victorian scheme is estimated to have reduced emissions by about 8 Mt CO ₂ -e between 2009 and 2012 (DSDBI Vic 2014) SA scheme is estimated to have reduced emissions by about 0.64 Mt CO ₂ -e between 2009 and 2011 (pitt&sherry 2013) ACT scheme is estimated to have reduced emissions by about 0.74 Mt CO ₂ -e from 2013 to 2015 (ACT Environment and Planning Directorate 2016)
Energy efficiency regulations and standards	National Applies to electrical goods, and building construction	Regulations setting minimum energy performance standards for appliances, lighting and electrical equipment. Energy efficiency requirements for buildings in the National Construction Code.	The Greenhouse and Energy Minimum Standards program (which encompasses standards and labelling requirements for appliances, lighting and electrical equipment) is projected to reduce emissions by 60 to 70 Mt CO ₂ -e between 2014 and 2020 (Databuild 2015)
Energy efficiency labelling	National Applies to appliances	Information program requiring energy rating labels on appliances showing energy performance information	See above
Carbon Neutral Program	National	A voluntary scheme that certifies products, business operations and events as carbon neutral against the National Carbon Offset Standard	Estimated to offset about 1 Mt CO ₂ -e per year (Hunt 2015)
Land clearing regulations	State-based Covers landholders	Regulations that restrict the clearing of vegetation. Details vary by state. The objectives of these regulations are generally to protect biodiversity and other environmental values, as well as to reduce carbon emissions.	Land clearing regulations in NSW, Queensland and Western Australia, along with economic conditions, reduced clearing rates and contributed to an emissions decline. Emissions from deforestation* fell from 81 Mt CO ₂ -e in 1990 to 34 Mt CO ₂ -e in 2014 (DoEE 2016)

POLICY	APPLICATION	DETAILS	ESTIMATED EMISSIONS REDUCTIONS
Clean Energy Finance Corporation (CEFC)	National Covers renewable energy, low-emissions technologies and energy efficiency projects	Innovation support through Government corporation that co-finances and invests in renewable energy and energy efficiency projects and technologies	Projects in the CEFC portfolio (as at 30 June 2015) are projected to achieve 77 Mt CO ₂ -e of emissions reductions over their lifetime (CEFC 2015a). Attributing reductions here is complex as the national RET is an important policy driver for many CEFC projects
Australian Renewable Energy Agency	National Applies to renewable energy activities	Provides innovation support for renewable energy activities including research and development funding	Not available

Note: * Deforestation figures are emissions reported under the 'deforestation' Kyoto Protocol classification. This category only includes direct human-induced conversion of forest to alternative land uses since 1 January 1990.

Source: Climate Change Authority based on sources listed.

BOX 1 THE EMISSIONS REDUCTION FUND

The Emissions Reduction Fund (ERF) has three interrelated elements: crediting, purchasing and safeguards.

Crediting—businesses, community organisations, local councils and others undertake eligible activities that reduce emissions and receive ‘credits’ for the reductions. To be eligible, the activity must conform to the requirements of an emissions reduction ‘method’. So far, methods have been established for activities such as: reducing emissions from agriculture, reducing emissions from transport, combustion of coal mine waste gas, reducing fugitive emissions from oil and gas, improving the energy efficiency of commercial buildings and industrial facilities, reducing energy demand of small users, flaring landfill gas, alternative waste treatment, reforestation and revegetating land and managing savanna burning (DoE 2016a).

Purchasing—provides the main source of demand for ERF credits. The Government uses a competitive process to purchase credits at the lowest available cost. The Government has committed \$2.55 billion for purchasing credits (DoE 2015d), with further funding to be considered in future budgets. So far, the Government has contracted 143 Mt CO₂-e of emissions reductions from 348 projects at an average price of \$12.10 per tonne (CER 2016b).

Participants register a project and can then bid into auctions run by the Clean Energy Regulator. The Government enters into contracts of up to 10 years duration with successful bidders. If a project does not earn sufficient credits to meet the contractual obligations, the project proponent may need to ‘make good’ by buying credits from someone else.

The **safeguard mechanism** began on 1 July 2016 and is a regulatory measure that requires large emitters to keep their net emissions below a baseline level. Up to 370 facilities with direct emissions of more than 100,000 t CO₂-e per year are covered. Baselines for existing facilities will reflect the highest level of reported emissions over the five years ending in 2013–14. Baselines can be increased to accommodate economic growth, natural resource availability and other circumstances. Baselines will also be set for new investments. For new investments that commence operation after 2020, baselines will be set with reference to best practice (DoE 2016d; CER 2016c).

Firms will have three options for meeting their obligations under the safeguard mechanism. For example, they could:

- keep their emissions below the baseline
- exceed the baseline in one year, provided average emissions over two or three years are below the baseline (in certain circumstances)
- exceed the baseline emissions level and purchase offset credits so that their net emissions are below the baseline (this option potentially creates another source of demand for ERF credits).

Facilities covered by the safeguard mechanism are also eligible to undertake emissions reduction projects and generate credits under the crediting element of the ERF. The Government has designed the safeguard mechanism to avoid double counting when using offset credits generated by facilities covered by the safeguard (DoE 2015c).

3.4. MEASURES FOR LONG-TERM EMISSIONS REDUCTIONS

The size of the future emissions reduction task for Australia is uncertain. Beyond climate policy, many factors influence Australia's emissions levels including economic growth, global trade, technology developments and social trends. The interplay between these factors is complex and uncertain, which makes estimating Australia's future emissions challenging, particularly over the time scales relevant to climate policy analysis.

Future estimates of emissions growth or reductions are known as projections and, like other key economic indicators such as Gross Domestic Product (GDP), are difficult to predict. In recent years, official government emissions projections and projections by other commentators like Bloomberg New Energy Finance may have overestimated emissions growth to 2020 and 2030 (Treasury 2008; DoE 2015d). Some of these projections were subsequently revised downwards (DoE 2015e).

Recent projections show that Australia's emissions are expected to grow over the coming years (DoE 2015e). New Government projections are expected in the latter half of 2016. Expected emissions growth is likely to mean that meeting Australia's INDC commitment is a substantial task. Achieving net zero emissions in line with the Paris Agreement will require even greater efforts, but is achievable (Hatfield-Dodds et al. 2015).

CONCLUSION

- C.5. To meet Australia's emissions reduction goals, Australia's emissions will need to decline more steeply in the coming years than they have in the past.

CHAPTER 4. A POLICY TOOLKIT FOR AUSTRALIA

To meet its commitments under the Paris Agreement, Australia will need a stable and effective policy toolkit that is capable of being scaled up to meet future emissions goals. The Authority therefore recommends a policy architecture that builds carefully on existing measures and incorporates new policies in a phased transition, with regular review points to assess Australia's progress towards the Paris goals and that of other countries, particularly our trade competitors.

In evaluating possible policy options the Authority has considered the principles set out in the *Climate Change Authority Act 2011*. For the purposes of assessing measures, the Authority has focused on the principles of economic efficiency, environmental effectiveness and equity, as well as considering the impacts of policies on Australia's international competitiveness. In recommending the policy toolkit the Authority has considered whether the measures as a whole are in the public interest and support the development of an effective global response to climate change.

In the Authority's view, given the importance of Australia making strong progress in reducing its emissions, the public interest suggests a degree of pragmatism is also required when choosing which policies to implement.

To achieve its emissions reduction goals, Australia's emissions must decline more steeply in the coming years than they have in the past. Australia will need a set of emissions reduction measures that are targeted to emissions reduction opportunities or constraints in different parts of the economy. Emissions in some sectors may be best addressed by regulation. A combination of regulation and information programs can help drive energy efficiency, and government support may be necessary to encourage innovation, particularly for early stage research, development and demonstration (see Chapters 7 and 8). These separate policies can be designed as a whole, to deliver a cohesive and cost-effective transition to a lower emissions economy—in other words, a 'policy toolkit'.

The Authority is not making its recommendations in a vacuum: in order to be in the public interest, it is important the policy toolkit fits Australia's legal, economic and political circumstances. The Authority recommends that the Government build on Australia's existing climate policies, as well as putting in place new measures to complement and enhance them. The rest of this report sets out the Authority's recommendations for a climate policy toolkit. This chapter explains the Authority's evaluation criteria for assessing different policy measures.

The Authority is of the view that aspects of the policy toolkit will need to be recalibrated over time in response to developments in science and technology as well as domestic and global economic circumstances and with reference to the progress Australia and other key countries are making towards their Paris Agreement obligations. For these reasons the Authority considers that the toolkit should be subject to reviews every five years.

Chapters 5 to 13 set out the Authority's recommendations. Chapter 15 summarises how the Government could build on existing policies to make a predictable transition to the Authority's recommended toolkit.

4.1. EVALUATING POLICY OPTIONS

Report Two of the Special Review explored a range of emissions reduction policies, including:

- market mechanisms that price emissions, such as emissions intensity schemes, cap and trade schemes, and carbon taxes
- voluntary carbon pricing or offsets
- other market-based policies such as renewable energy targets or contracts for difference to encourage low-emissions electricity generation
- regulation
- information programs
- innovation support.

In making its recommendations, the Authority has considered the principles set out in the *Climate Change Authority Act 2011* (Cth) that any measures 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 and
- be consistent with Australia's foreign policy and trade objectives.

For the purposes of assessing measures, the Authority has focused on the principles of economic efficiency, environmental effectiveness and equity, as well as considering the impacts of policies on Australia's international competitiveness. Taking account of the impacts on households, business, workers and communities has been part of the Authority's equity considerations (see Chapters 5 and 14). In the Authority's view, it is in the public interest to establish a durable, scalable architecture for meeting Australia's climate policy goals, and that this is best achieved by building carefully on existing policies.

When assessing different policy options, the Authority has interpreted the first three principles as follows:

- **Cost effectiveness:** policies should help Australia meet its emissions reduction goals at least cost as efforts are scaled up over time, taking account of: the direct costs of reducing emissions; the costs of administering and complying with policies; and indirect or flow-on costs of policies on the economy as a whole.
- **Environmental effectiveness:** policies should achieve real emissions reductions at the national and global level.

- Equity: policy design should take account of—and support an equitable distribution of—impacts and risks across households, businesses and communities.

When comparing policies the Authority has also considered the cross-cutting issue of ‘scalability’, and international competitiveness.

It is important that the policy toolkit be capable of being scaled up to meet future emissions reduction goals. As a result of the Paris Agreement Australia will need to accelerate its emissions reduction efforts over time, to contribute to the global goal of net zero emissions by the second half of the century.

At the same time, policy stability is important to support long-term investment in low-emissions projects and technologies. This point was made consistently by stakeholders—for example, AGL Energy noted that:

For the electricity generation sector, with long investment horizons and large upfront capital costs, well telegraphed and consistent policy that provides reasonable insight into the investment environment over the medium term is a pre requisite to minimise the impact of emission reductions on energy consumers. (Report Two submission, p. 2)

A scalable policy toolkit provides a stable policy framework for investors, but allows flexibility within this framework—for example, by increasing or decreasing baselines, standards or incentives over time. Where policy settings are adjusted in response to new information on the economy, the advent of new technologies or because of new scientific information, such changes should be made in the context of a preannounced extension or review process as businesses and other affected stakeholders will need time to adjust.

Given Australia’s recent history of significant climate policy uncertainty, it is particularly important that the transition to an effective toolkit is predictable and provides confidence that the policy architecture will endure. It will also be important that good progress to reduce emissions and decarbonise the economy is made in the next five years, after which time the Authority recommends that the policy settings in the toolkit as a whole (and some of the measures themselves) are subject to a substantive review.

The review in 2022 should be the first of a series of five-yearly reviews to assess Australia’s progress in reducing its emissions, and the emissions reduction actions that other countries, particularly our major trading partners, are taking to meet their Paris commitments. The Authority recommends however that most of the broad policy architecture should remain stable to help provide investor certainty. In the Authority’s view, the criteria used to guide the development of this report (listed above) should also be used as the basis for further reviews.

The terms of reference for the Special Review (Appendix A) require the Authority to consider the possible effects of climate policies on the international competitiveness of Australian businesses. The Authority has considered both the likely effects of its recommended policy toolkit on Australia’s international competitiveness and also examined the consequences of approaches to dealing with competitiveness issues in Chapter 13.

Most stakeholders supported the Authority’s evaluation criteria, although a number suggested the Authority take account of a wider range of factors. For example, ClimateWorks proposed that long-term emissions reduction goals, policy flexibility and policy review also be considered; and the Climate and Health Alliance emphasised the importance of co-benefits (Report Two submissions, p. 5, p. 6).

The Authority is of the view that its principles and evaluation criteria—along with consideration of scalability and international competitiveness—cover most of the factors raised by stakeholders. For example, environmental effectiveness and scalability capture the need for Australia to meet more ambitious emissions reduction goals in future, as well as the need for policy flexibility and review. Similarly, a broad interpretation of ‘cost effectiveness’ should capture both co-benefits and the Australian Chamber of Commerce and Industry’s proposal for ‘assessing the long-term costs and benefits to the Australian economy of the various options’ (Report Two submission, p. 7).

In assessing different policies against these criteria and the Authority’s principles, the Authority has taken into account stakeholder feedback, international experience, and other evidence from a wide range of sources, including commissioned modelling of the performance of different electricity sector policies on the sector and economy as a whole (see Chapters 5 and 9).

The rest of the report outlines the Authority’s recommended policies.

CONCLUSIONS

- C.6. The policy toolkit should be scalable and designed to fit Australia’s legal, economic and political circumstances. The toolkit should be in the public interest, cost-effective, environmentally effective and equitable. It should seek to promote Australia’s economic prosperity and minimise international competitive distortions.
- C.7. No single policy can meet all the criteria in all sectors and circumstances.

RECOMMENDATION

- R.1. The Authority recommends that a toolkit of policies to meet Australia’s emissions reduction commitments in the Paris Agreement should be put in place that features:
- a durable policy architecture that builds carefully on existing policies and incorporates new policies in a phased transition, and that can be scaled up to meet the requirements of the Paris Agreement’s ongoing reviews that are aimed at increasing the ambition of countries’ target commitments.
 - five-yearly reviews of the policy settings within the toolkit to assess Australia’s progress in reducing emissions and emissions reduction actions that other countries, particularly major trading partners, are taking to meet their Paris commitments. Most of the policy architecture itself should remain stable to help provide investment certainty.

CHAPTER 5. MARKET MECHANISMS AND ENHANCED SAFEGUARDS

If well designed, market mechanisms can help Australia to meet its emissions reduction obligations under the Paris Agreement in a way that is flexible, scalable and at a lower cost to the community than would be possible otherwise. Such mechanisms can be designed to be environmentally effective, equitable and deal appropriately with concerns about international competitiveness.

The Authority recommends that an emissions intensity scheme (a form of market mechanism) be introduced for the electricity sector in 2018. The emissions intensity baseline for electricity should decline linearly over time and reach zero well before 2050, consistent with Australia's Paris Agreement obligations. An emissions intensity scheme would cause smaller price increases for electricity relative to other market mechanisms, which may make an emissions intensity scheme more acceptable to the community and have advantages from an economic perspective.

The Authority recommends enhancing the existing safeguard mechanism to reduce emissions in the direct combustion, industrial processes and fugitive emissions sectors. If strengthened, the safeguard mechanism could provide a stable and pragmatic way of making progress towards Australia's 2030 target in a way that the Authority considers to be in line with the public interest. Coverage should be extended to cover facilities that emit 25,000 tonnes of CO₂-e per year from 2018, and facility baselines should decline linearly over time in line with Australia's commitments in the Paris Agreement. Liable entities could meet their safeguard obligations with domestic offsets and international permits (with some restrictions).

The Authority recommends that the enhanced safeguard arrangements are assessed as part of the five-yearly review of the toolkit in 2022. The review should include considering whether to maintain these arrangements or introduce another policy instrument such as a market mechanism in the direct combustion, industrial processes, fugitive emissions and transport sectors.

Market mechanisms have been advocated by many economists, business and environment groups and multilateral organisations to reduce emissions, and in one form or another have been adopted in a wide range of countries (Chapter 2). In principle, well-designed market mechanisms can reduce emissions at lower cost than would be possible otherwise. Many submissions to Report Two of the Special Review said that Australia should introduce a market mechanism, with this support spanning business and environment groups and other stakeholders (Box 2).

The Authority's view is that the electricity sector is most suitable for the introduction of a market mechanism in the near term. While in theory, applying market mechanisms beyond the electricity sector could help meet Australia's targets at lower cost, to achieve Australia's emissions reduction goals across other sectors such a policy instrument would need to be durable. The Authority notes that in the safeguard mechanism, Australia has a broad-based regulatory architecture already in place which can be progressively strengthened and enhanced to achieve emissions reductions that can be scaled up over time.

This chapter covers:

- the in-principle case for using market mechanisms to reduce emissions in suitable sectors of the economy
- introducing an emissions intensity scheme in the electricity sector in 2018
- enhancing the safeguard mechanism in other key sectors in the near term
- assessing the enhanced safeguard arrangements as part of the 2022 review of the policy toolkit.

BOX 2 STAKEHOLDER SUPPORT FOR MARKET MECHANISMS

Many submissions to Report Two of the Special Review supported using market mechanisms to reduce emissions. Some examples are provided below.

Whilst Origin has consistently supported a broad-based carbon pricing scheme of some form, for practical reasons we recognise that this may take time to develop. (p. 2)

WWF advocates the use of a mandatory price and limit on carbon pollution, such as a cap and trade scheme as a central pillar of Australia's efforts to tackle climate change. A price on carbon emissions is widely recognized by economists as the most cost effective way of driving down economy-wide emissions. (p. 3)

The ACTU is of the view that the most efficient and effective policy mix to achieve emission reductions across the economy (and thus maximise the opportunities across the economy) includes: ... A price on carbon pollution (in the form of a broad based Emissions Trading Scheme) that covers all major polluting sectors of the economy, and more equitably distributes the responsibility to reduce emissions. (p. 3)

Business Council of Australia: To deliver a suite of durable, integrated energy and climate change policy measures, the CCA should focus on building a carbon pricing mechanism from the existing regulatory frameworks. (p. 2)

Whilst AIGN does not promote any single policy measure, it does recommend a market-based, economy-wide approach to reducing emissions, potentially comprising a range of different policy measures that share the task of reducing emissions across the economy. (p. 2)

A number of individuals supported the use of market mechanisms in submissions to Report Two.

5.1. USING MARKET MECHANISMS IN THE POLICY TOOLKIT

Market mechanisms to reduce emissions make high emissions activities more expensive, with some also making low-emissions activities cheaper. Such policies can create incentives for firms and households to find the lowest-cost ways to reduce emissions. The family of policies that do so includes cap and trade, emissions intensity schemes and carbon taxes, and is discussed in this chapter. Box 3 explains how these schemes operate.

Other market-based approaches, such as renewable energy targets, have similarities with market mechanisms like cap and trade or emissions intensity schemes that have reducing emissions as their key objective. An important difference, however, is that these other market-based approaches provide an incentive for a narrower set of emissions reduction opportunities.

This section considers the case for using market mechanisms to reduce emissions, and to what extent their theoretical advantages are likely to be borne out in practice. It then considers the relative advantages and disadvantages of the main types of market mechanism.

5.1.1. THE CASE IS STRONG IN PRINCIPLE

It is in everyone's interests that Australia meets its future emissions reduction commitments by taking up lower cost opportunities to reduce emissions. Market mechanisms can contribute to this by creating an incentive for opportunities that cost less than the emissions price to be taken up. Figure 6 illustrates this using a stylised 'marginal abatement cost curve'. Such curves show the set of emissions reductions opportunities in an economy—wider rectangles represent bigger opportunities and higher rectangles more costly ones. The more opportunities under a given cost per tonne of emissions that a policy encourages, the more cost-effective it will be.

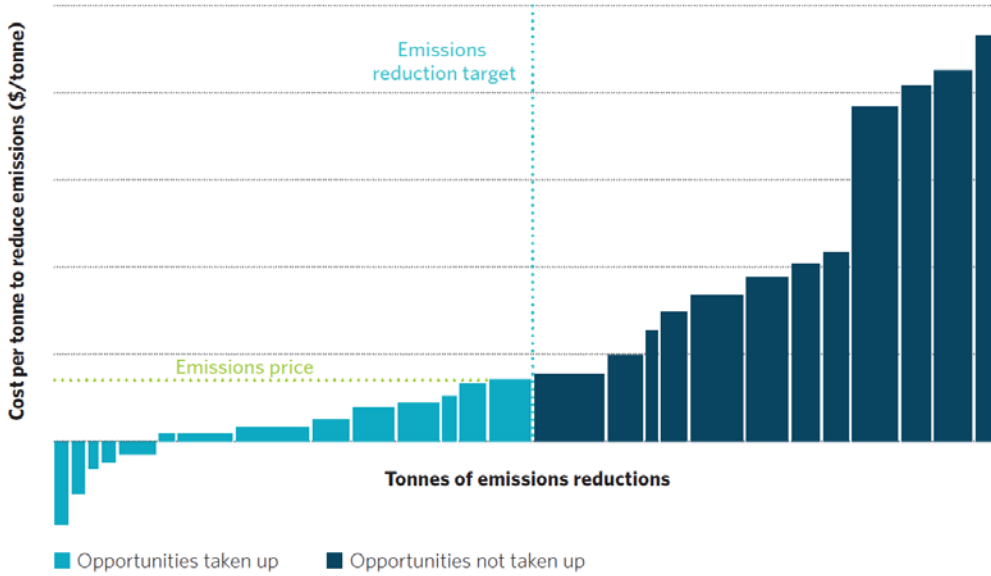
If a market mechanism is put in place, firms can be expected to use their ingenuity to find the cheapest possible ways to cut emissions so as to reduce the amount they have to pay. If the policy is expected to endure and continue to operate in a reasonably predictable way, the mechanism will start to alter investment decisions in favour of lower-emissions alternatives straight away. Rewards for low-emissions activities (such as generating electricity from renewable sources) will increase at the same time that those for high-emissions activities (such as generating electricity from burning coal) decline. While this will cause the pattern of economic activity and employment to change over time, the overall cost to the community will tend to be minimised.

Market mechanisms may not work well in all circumstances. In sectors where there are a large number of small emitters, administrative and compliance costs (sometimes known as 'transaction costs') may be so high as to outweigh the potential advantages. In addition, these market mechanisms cannot overcome the 'non-price barriers' to reducing emissions that exist in some areas (Chapter 7). A substantial proportion of Australia's emissions, however, are accounted for by large emitters that would be expected to be responsive to the investment signal.

In such areas there are good reasons to expect a market mechanism to generally be able to reduce emissions at lower direct cost than other policy options. This is because they create more consistent incentives for the least cost emissions reduction opportunities to be taken up, and devolve decision making to those with the best information. Rather than government deciding where and how emissions are cut, firms and households decide according to what is best for them.

Other policy options are likely to miss some of these low-cost opportunities as explained in Table 5. The more low cost emissions reductions that are not taken up, the higher up the cost curve it will be necessary to go for Australia's Paris Agreement obligations to be met (Figure 7).

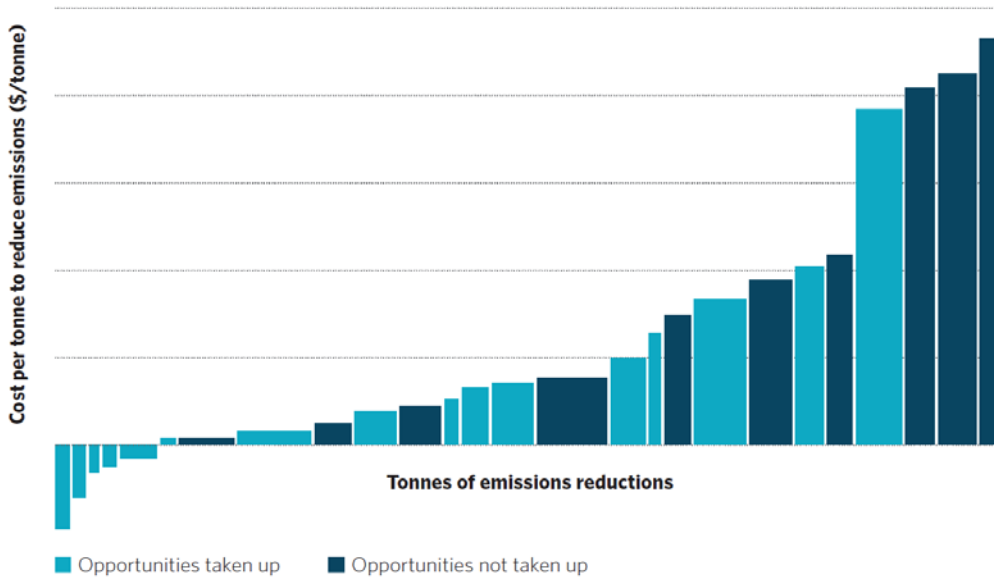
FIGURE 6 DIRECT COSTS OF MARKET MECHANISMS



Note: In practice, there are sometimes non-price barriers that can prevent the uptake of some emissions reduction opportunities that cost less than the emissions price. In this case, additional policies can encourage uptake. See Chapter 7 for further details.

Source: Climate Change Authority.

FIGURE 7 DIRECT COSTS FOR OTHER POLICY OPTIONS



Source: Climate Change Authority.

TABLE 5 DIRECT COSTS: COMPARING OTHER POLICIES TO MARKET MECHANISMS

Regulation	<p>Under a regulatory approach, governments have a larger say over which emissions reductions opportunities are taken up. These could be more prescriptive regulations such as requiring particular technologies and equipment to be installed, or less prescriptive regulations setting overall emissions limits or benchmarks for particular industries or activities. The first kind of regulation is often not cost-effective because in many areas it is not possible for governments to obtain sufficient information to craft regulations that would cause the least costly emissions reduction opportunities to be taken up. In general the best information is held by individual firms—market mechanisms harness this information, while regulations can necessitate governments making judgements based on imperfect information. Less prescriptive regulations—those that set overall emissions limits or benchmarks for particular industries or activities—do not prescribe technologies and equipment to the same extent and are likely to be relatively more cost-effective. In certain circumstances, regulation may be preferred to a market mechanism. This includes when governments have good information about the least-cost emissions available to firms, and/or where the operation of a market mechanism may be problematic: for example, where large numbers of small emitters face high transaction costs, or where significant non-price barriers exist.</p>
Voluntary carbon pricing/offsets	<p>Voluntary carbon pricing (for example, through a domestic offset scheme or government purchase) involves a market-based assessment of emissions reduction opportunities, which is an advantage compared to regulation. To make pricing voluntary, however, firms are paid for reducing emissions below what they would otherwise be. Accordingly, there need to be rules to guard against firms being paid for emissions reductions that would have occurred in the absence of the policy (so-called ‘non-additional’ emissions reductions) otherwise the environmental effectiveness of the policy would suffer. In some sectors, this can work reasonably well. However, because projects that are ‘non-additional’ are likely to be low cost, market-based arrangements can tend to create incentives for these projects (Burke 2016). Further, because additionality rules cannot be developed for all emissions reduction opportunities, some low-cost opportunities will inevitably be missed.</p>
Other market-based policies	<p>Other market-based approaches, such as renewable energy targets, have similarities with market mechanisms like cap and trade schemes, emissions intensity schemes or carbon taxes that have reducing emissions as their key objective. An important difference, however, is that they provide an incentive for a narrower set of emissions reduction opportunities. For example, in the electricity sector cap and trade schemes, emissions intensity schemes and carbon taxes can provide an incentive to switch to lower emissions fuels, close high-emissions generators and build new low-emissions plant, while a renewable energy target only directly supports the last of these. This explains why the Authority’s electricity modelling showed that emissions pricing could achieve emissions reduction targets at a lower cost than a renewable energy target, or other market-based policies, such as a low-emissions target.</p>
Innovation support	<p>Government support for research and development into low-emissions technologies can result in new or lower cost technologies becoming available. In some cases these technologies can be commercially viable without any incentives from other climate change policies. However, the main role of policies to support innovation is to expand the range and reduce the cost of emissions reduction technologies for use in the medium to longer term rather than meeting shorter term targets. As such, they should be seen as a complement, rather than an alternative, to market mechanisms.</p>

Information programs	Information programs, such as energy efficiency 'star ratings' on appliances, can be effective where people are doing things that are not in their own best interest, such as buying appliances and equipment that are slightly cheaper, but much costlier to run than more energy-efficient alternatives. Most of the time, however, emissions come about from decisions that are in people's own interests. For example, the cheapest way to produce electricity in Australia is usually the high emissions option of burning coal. Providing information will not alter such decisions because lack of information is not the problem. Accordingly, providing information can have a useful, but quite limited role in efforts to meet emissions reduction targets.
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Source: Climate Change Authority.

This conclusion is borne out in modelling conducted by the Authority, which compared the cost effectiveness of various emissions reduction policies when applied to Australia's electricity sector (CCA 2016). This modelling shows that market mechanisms achieve a given emissions budget (that is, a fixed limit on total emissions over a multi-year period) at lower direct cost than other policies including regulation and other market-based policies (including a renewable energy target and low emissions target).

As well as being cost effective, in theory, market mechanisms can more readily be scaled up to meet more ambitious emissions reduction targets than some other policies. The Paris Agreement requires Australia, along with other countries, to review targets with a view to strengthening them over time. With a cap and trade or emissions intensity scheme this is achieved by reducing the number of permits (either by tightening the cap or reducing baselines), which will tend to increase the emissions price, making it in firms' financial interests to take up more emissions reduction opportunities. Under a carbon tax, the government increases the emissions price directly.

As discussed in Chapter 4, there are three types of costs that need to be factored into assessments of cost effectiveness: direct costs, transaction costs and indirect costs. As explained above, high transaction costs count against market mechanisms in some sectors but not others, while direct costs for liable firms are likely to be lowest with market mechanisms, at least where non-financial barriers to emissions reductions are not substantial. This leaves indirect costs, which can result from flow-on effects of the policy throughout the economy. The indirect costs of different types of market mechanism are discussed further in Section 5.1.3.

Taking all types of costs into account, there are a number of in-principle reasons to expect that a policy toolkit that deployed market mechanisms would have a lower overall cost to the community than would be possible otherwise.

5.1.2. PRACTICAL EXPERIENCE IS MORE MIXED

The widespread support for emissions pricing among economists, and other analysts and stakeholders, is partly due to the in-principle or theoretical arguments discussed above. When it comes to direct international experience with using market mechanisms to reduce greenhouse gas emissions, the evidence is more mixed. Emissions trading schemes (ETSs) or carbon taxes have been introduced in about 40 national jurisdictions and over 20 cities, states and regions (Kossoy et al. 2015). Chapter 2 provides information on the policies used in key countries. There are two main lessons that can be drawn from this international experience that bear on the question of whether Australia should introduce market mechanisms that reduce emissions.

BOX 3 TYPES OF BROAD-BASED MARKET MECHANISM

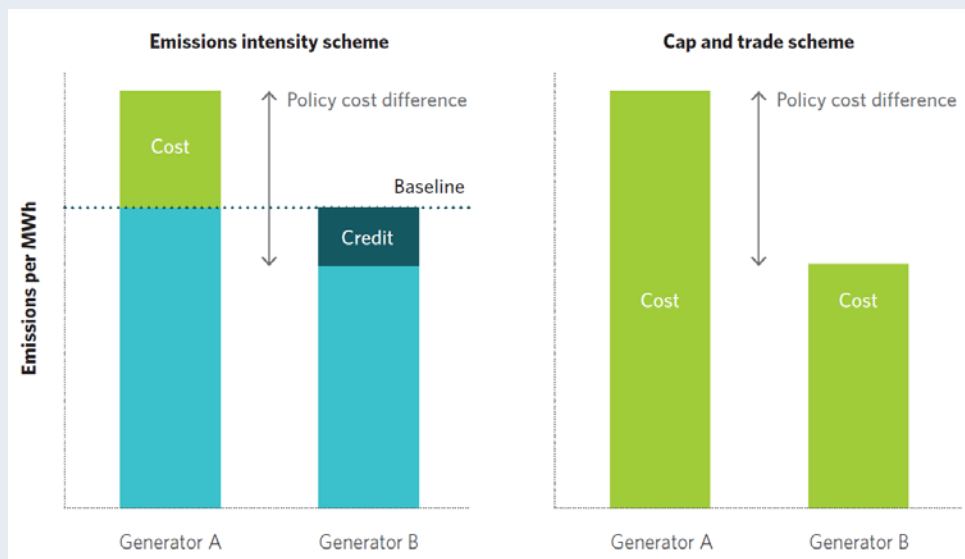
Cap and trade schemes

Under a cap and trade scheme, the government sets an annual cap (or limit) on emissions, which can be calibrated to its national emissions reduction target. It then creates permits for the right to emit that, in total, add up to the limit set by the cap. By auctioning the majority of permits the government can capture their value and use it for public purposes. Liable parties (usually firms that emit large quantities of greenhouse gases) are required to relinquish one permit to the government for each tonne they emit. With the cap set below what emissions would otherwise be, permits are scarce, so firms will be prepared to pay for them and a price can be set through auctioning and subsequent trade. Cap and trade schemes are the most widely used type of market mechanism.

Emissions intensity schemes

Emissions intensity schemes are similar to cap and trade schemes, and provide the same incentive for substitution from higher to lower emissions technologies and practices. The key difference is that in a cap and trade scheme, firms will face a cost for all emissions, but under an emissions intensity scheme they only face a cost for emissions above the target emissions intensity (Figure 8). In the simplest form, the government will set a target emissions intensity baseline for each industry. For example, a baseline for electricity generation could be in terms of tonnes of carbon dioxide per megawatt hour of electricity produced. All liable firms in that industry receive the same free allocation of permits per unit of production (effectively a production subsidy). The lower overall policy cost for liable parties will translate to lower price increases for electricity and other emissions-intensive products. Unlike cap and trade schemes and carbon taxes, emissions intensity schemes do not raise government revenue.

FIGURE 8 COMPARING EMISSIONS INTENSITY SCHEMES TO CAP AND TRADE SCHEMES



Source: Climate Change Authority.

Carbon taxes

Under a carbon tax, the government explicitly sets an emissions price that liable firms are required to pay through the tax system. Firms would respond to a carbon tax in much the same way as they would to the permit price under an ETS. That is, they would look to take up opportunities to reduce emissions where this was cheaper than paying the emissions price. When a carbon tax is introduced, it cannot be known precisely what quantity of emissions will occur as this depends on how markets respond. Eighteen countries and one Canadian province have legislated a carbon tax (Kossov et al. 2015).

First, consistent with in-principle reasoning, the costs of ETSs and carbon taxes have generally been low, both in terms of the cost per unit of emissions reductions and the overall cost to the countries concerned. In a research study that considered a wide range of emissions reduction policies in key economies (including the United Kingdom, the United States, Germany, New Zealand, China, India, Japan and the Republic of Korea) the Productivity Commission found emissions trading schemes to be relatively cost effective, with some other policies having substantially higher per unit costs (PC 2011). At the aggregate level, the effect on overall economic growth has generally been relatively small. For example, meeting the European Union's 2020 goals was originally estimated to result in a one-off reduction of economic growth of about 0.5 per cent of gross domestic product (GDP) in the period up to 2020. With emissions prices having been generally lower than expected the actual cost is likely to have been much lower than this (Grubb et al. 2014, p. 251).

Second, the ability of ETSs and carbon taxes to drive substantial changes in long-term investment decisions towards lower emissions alternatives has yet to be demonstrated in practice. For this to happen, investors must have the confidence to allocate billions of dollars to projects that would be uneconomic if the policy were repealed or watered down in the future. Policy stability and credibility is crucial. To date, ETSs and carbon taxes do not appear to have influenced long-term investment decisions in a large-scale way. In countries where major investments in low-emissions infrastructure have occurred (including the United Kingdom, Germany and Australia), other policies (such as feed-in tariffs and renewable energy targets) have played a more important role (Grubb et al. 2014, p. 357).

In principle, market mechanisms (cap and trade schemes, carbon taxes or emissions intensity schemes) could largely take over this role and achieve more cost-effective sequencing of investments. For this to happen, they will need to create credible expectations that they will endure and strengthen in a way that is consistent with longer-term targets. The high levels of volatility that have been prevalent, most notably in the EU ETS, will need to be overcome.

Overall, the evidence is that market mechanisms have allowed emissions to be reduced at low cost. That said, existing schemes are far from perfect and there are important policy design lessons for Australia. A central challenge is to design the schemes in a way that builds public confidence and credibility in the eyes of business. This is essential to give business the confidence to make the long-term investments that are necessary for Australia to cost-effectively meet its Paris Agreement obligations and transition to a lower emissions future. The recent history of emissions policy in Australia suggests that this could be challenging to achieve.

5.1.3. ASSESSING THE DIFFERENT TYPES OF MARKET MECHANISM

In principle, cap and trade schemes, emissions intensity schemes and carbon taxes have more similarities than differences, with each capable of contributing to Australia's emissions reduction goals being met at a relatively low cost. Report Two of the Special Review considered the use of cap and trade schemes, emissions intensity schemes, carbon taxes, and some variants on these. The Authority's electricity sector research paper provides further analysis on using some of these options in the electricity sector (2016).

It is the Authority's view that at present, the disadvantages of a carbon tax are likely to outweigh the advantages. Carbon taxes have the inherent advantage of providing greater price certainty in the short term, which can increase investor confidence. Carbon taxes also have the key disadvantage of providing less certainty around the quantity of emissions in covered sectors. The most important drawback of a carbon tax at present, however, is that Australia's recent climate policy history means that public appetite for a carbon tax is likely to be low.

Based on input from stakeholders, international experience, Australia's policy history and the Authority's analysis, the two most prospective market mechanisms are:

- a cap and trade scheme (with most permits auctioned)
- an emissions intensity scheme.

The following discussion compares these schemes against the evaluation criteria. Box 4 considers some other variants of market mechanisms.

Environmental effectiveness

Cap and trade schemes and emissions intensity schemes are both capable of playing a substantial role in meeting Australia's Paris Agreement obligations and contributing to the transition of the Australian economy to a low-emissions future.

Cap and trade schemes are often identified as providing the greatest certainty over emissions levels because they cap annual emissions in sectors covered by the scheme. The annual caps can be reduced each year in line with national targets. However, cap and trade schemes are often designed in a way that introduces some uncertainty. For example, some schemes put a ceiling on emissions prices and, once the ceiling is reached, additional permits are released at that price, meaning that emissions will exceed the cap.

Emissions intensity schemes provide somewhat less certainty than cap and trade schemes without price controls because they allow emissions to vary with production levels. Baselines would be set so that emissions would be consistent with the target, provided that production in emissions-intensive sectors was close to expected levels. However, if production in these sectors was generally higher (or lower) than expected, emissions would be higher (or lower) than planned. This uncertainty could be managed by adjusting baselines each year so as to iterate towards the target. As for a cap and trade scheme, policy design can affect the degree of certainty of emissions.

The Authority notes that no market mechanism can give absolute certainty about the level of emissions because it is unlikely to be feasible to cover all sectors. Emissions in uncovered sectors will be uncertain and will depend on economic conditions and the emissions reduction policies that are put in place in these sectors.

BOX 4 SOME MARKET MECHANISMS HAVE SERIOUS DEFICIENCIES

The market mechanisms that the Authority considers to be least prospective for Australia are:

- cap and trade schemes that allocate all (or most) permits for free
- baseline and credit mechanisms that use absolute emissions baselines, and without further requirements like strict additionality tests
- baseline and credit mechanisms that use facility-specific emissions intensity baselines.

Cap and trade schemes in which all permits are allocated for free cause equivalent price increases for electricity and other emissions-intensive products as schemes in which permits are auctioned. Households face higher prices, but the government receives no scheme revenue to use to assist them. The price rises may seem counterintuitive but were clearly demonstrated in the early years of the EU ETS (Grubb et al. 2014, p. 245). When firms receive permits for free with no conditions attached they treat them as being valuable because they can cut back production to free up permits to sell. Such mechanisms are highly inequitable because they result in some firms receiving windfall profits. In addition, indirect costs tend to be high because there is no scope to use revenue to finance efficiency-enhancing tax cuts.

Baseline and credit mechanisms that use absolute emissions baselines allow firms to emit a fixed quantity of emissions without incurring any liability (typically, these baselines are set based on historical emissions for each facility). If a firm's emissions are below its baseline it receives 'credits' for the difference, which can be sold to firms that exceed their baseline. Such schemes are similar to cap and trade schemes that allocate permits for free in that the baselines act much like a free allocation of permits. Because of this, baseline and credit mechanisms that use absolute baselines can result in windfall gains, raising equity concerns. The current safeguard mechanism could be turned into this type of baseline and credit mechanism, but the Authority does not favour that option and recommends a pathway for transition that avoids these problems. Instead, firms will be able to earn credits for emissions reductions that meet additionality tests under ERF crediting requirements.

Under baseline and credit mechanisms that use facility-specific emissions intensity baselines (such as Alberta's current scheme) the amount that firms can emit without incurring a liability depends on how much they produce. Such schemes cause lower price increases than the above market mechanisms because firms cannot free up credits to sell by cutting back production. This tends to make such schemes less inequitable, although they create only a limited incentive for investment in low-emissions technology. Setting industry-wide rather than facility-specific emissions intensity baselines can create a consistent incentive for firms to move to low-emissions production methods—Alberta has announced this is what it intends to do for large industrial emitters (Alberta Government 2016; Harvie 2015).

Cost effectiveness

Assessments of the cost effectiveness of emissions reduction policies need to take account of the direct costs of reducing emissions, transaction costs and indirect costs on the economy as a whole. It is also important to consider how these costs will play out over time in the presence of uncertainty.

In principle, cap and trade schemes minimise direct costs because the carbon price applies to all opportunities to reduce emissions in the sectors they cover. As illustrated by the Authority's electricity sector modelling (2016), emissions intensity schemes result in smaller increases in the price of electricity than cap and trade schemes. Lower prices mean that households and firms have less incentive to economise on the use of these products or to move to lower emissions substitutes. However, to compensate for this, policies that promote energy efficiency could be implemented to capture 'demand-side' emissions reductions (Chapter 7).

All market mechanisms create some transaction costs, but differences in transaction costs between cap and trade and emissions intensity schemes are likely to be relatively small. In addition to direct costs and transaction costs, market mechanisms have indirect costs, including due to interactions with the tax system. Taxes or price rises of all kinds—even those intended to address a policy problem like greenhouse gas emissions—dampen economic activity. These indirect costs are more important to the cost effectiveness of emissions reduction policies than has generally been recognised (Goulder 2013).

For cap and trade schemes, indirect costs result from price increases for electricity and other emissions-intensive goods. These increases lead to slower growth in overall employment and investment in the economy. The economic cost of this is made larger than it would otherwise be because of existing taxes on labour and capital (sometimes termed a 'tax interaction effect') (CCA 2016). On the other hand, cap and trade schemes raise government revenue that could be used to fund cuts to other taxes, causing an indirect benefit (sometimes termed a 'revenue recycling' benefit) that could at least partially offset the indirect costs. Emissions intensity schemes do not raise revenue but would be expected to have lower indirect costs because they result in lower price increases.

In order to gain insights into indirect costs and benefits, the Authority commissioned economy-wide modelling of policy options. This modelling provides an overall assessment of the cost effectiveness of different market mechanisms when applied in the electricity sector, taking into account direct costs, and indirect costs and benefits throughout the economy. The modelling results show that a cap and trade scheme with all revenue recycled through tax cuts is likely to be somewhat more cost-effective than an emissions intensity scheme, while a cap and trade scheme with revenue returned to the community through 'lump sum' payments (for example, increases in government payments) is likely to be the least cost-effective of the three (CCA 2016).

This is illustrated in the modelling results in Table 6, which shows that, compared to a cap and trade scheme with lump sum recycling, projected gross national income (GNI) is higher for both an emissions intensity scheme and for a cap and trade scheme with revenue recycled through tax cuts. The differences in GNI are large in absolute terms, but small as a proportion of the overall economy.

It would be too simplistic to conclude from this modelling that the best market mechanism for Australia would be a cap and trade scheme that recycles all revenue through tax cuts. First, this would mean that low-income households, particularly those whose income is mainly from social security payments, would not be assisted with the cost of living increases from the scheme. This is unlikely to be acceptable from an equity perspective and is also contrary to the established

practice of increasing many social security payments in line with cost of living increases, as discussed below under 'Equity'. Australia's experience with the carbon pricing mechanism suggests that governments face many calls on permit revenue, including for assistance to households, emissions-intensive trade-exposed industries and other industries. Only a small proportion of the carbon pricing mechanism revenue was used to deliver efficiency-enhancing tax cuts.

TABLE 6 PROJECTIONS OF GROSS NATIONAL INCOME RELATIVE TO CAP AND TRADE (LUMP SUM)

SCENARIO	UNIT	GNI IN 2030	GNI IN 2050	CUMULATIVE DISCOUNTED GNI, 2020-2030	CUMULATIVE DISCOUNTED GNI, 2020-2050
Emissions intensity scheme, absolute change	\$bn	\$3	\$7	\$20	\$45
Emissions intensity scheme, percentage change	%	0.13%	0.18%	0.14%	0.15%
Cap and trade (tax cuts), absolute change	\$bn	\$5	\$13	\$51	\$97
Cap and trade (tax cuts), percentage change	%	0.25%	0.36%	0.35%	0.33%

Note: This table shows projections of GNI for emissions intensity schemes and cap and trade schemes that recycle revenue through tax cuts relative to a reference case of a cap and trade scheme with revenue recycled via lump sum payments. Cumulative discounted GNI is calculated using a seven per cent real discount rate. Dollar figures are in 2014 Australian dollars. For further details see the Special Review electricity research report.

Source: CCA 2016.

Second, modelling of this kind assumes there is certainty about future targets, policy and technologies. Minimising costs over time relies on investors in long-lived assets (such as power stations) forming expectations about future emissions costs that are consistent with targets being met. The cost effectiveness of market mechanisms can be undermined by uncertainty over whether the policy will remain in place and operate according to consistent rules and principles. If investors believe that a policy may be changed or repealed, this could prevent them committing to investments in low-emissions infrastructure that would have made a cost-effective contribution to meeting national targets. This could in turn result in the need to take up higher cost opportunities later on.

This suggests that if one type of market mechanism stands a better chance of gaining wide community acceptance and of operating in a stable way, this will tend to make it more cost effective in practice. The Authority's view is that the smaller price increases resulting from an emissions intensity scheme may be an advantage in this respect.

Equity

The main reason for adopting a market mechanism is that it can reduce costs to the community as a whole below what would occur otherwise. However, all market mechanisms will impose some costs and the distribution of costs can vary by policy. Accordingly, the choice of policy might be influenced by how equitably costs are distributed. There is no objective standard for what would be equitable and so judgments are required.

All market mechanisms would be expected to result in at least some increase in prices for electricity and some other emissions-intensive goods. Unless they were assisted, lower income households would tend to be more strongly affected than others because they tend to spend a higher portion of their income on electricity and have less capacity to pay. Changes in prices will also affect industries differently, depending on how much electricity and other emissions-intensive inputs they use and their ability to pass on costs. In some cases, this could lead to job losses and to the decline of some regions. At the same time, new employment and business opportunities will open up, particularly in low-emissions industries.

As outlined above, emissions intensity schemes result in lower costs for liable firms and lower price increases compared to cap and trade schemes. This means that in the first instance there will be smaller impacts on low-income households and other groups of particular concern from an equity perspective.

For cap and trade schemes, the equity implications depend on how the government revenue raised by the policy is used. Some of the available options are to:

- assist low-income households including through increases to social security payments, noting some payments will increase automatically through indexation to consumer prices (Chapter 14)
- fund cuts to other taxes, so as to generate cost effectiveness gains from revenue recycling
- improve electricity affordability by subsidising energy efficiency improvements for households and businesses
- a combination of the above.

For a cap and trade scheme, there are inevitably trade-offs between equity and cost effectiveness objectives when deciding on the allocation of revenue. As discussed earlier, cost effectiveness is improved by using revenue to cut taxes instead of making lump sum payments. Sometimes both objectives can be met simultaneously, for example, by cutting marginal income tax rates for low-income individuals. However, in many cases equity can only be addressed through making lump sum payments (for example, by increasing social security payments). As shown by the Authority's modelling, this can reduce the cost effectiveness of the scheme.

5.2. THE ELECTRICITY SECTOR SHOULD BE COVERED BY AN EMISSIONS INTENSITY SCHEME

In the Authority's view, the best timing for introducing market mechanisms will vary by sector, and will depend on the policies already in place. The electricity sector is the most suitable to be covered by a market mechanism in the near term. The sector is characterised by measurable emissions, a relatively small number of large emissions sources, and sophisticated profit-seeking investors operating in generally competitive generation markets. Given the importance of the sector for Australia achieving its emissions reduction obligations, it is likely to be more cost effective to create a signal for investment in low-emissions generation as soon as practicable.

The Authority's analysis suggests that the most prospective type of market mechanism for the electricity sector is an emissions intensity scheme. An emissions intensity scheme would increase electricity prices less than a cap and trade scheme, while delivering significant emissions reductions that can be scaled up over time. As outlined above, smaller increases in electricity prices may result in greater community acceptance, making it more stable. Further, the smaller price impacts on low-income households and other groups of particular concern can achieve a balance between cost effectiveness and equity. Although a cap and trade scheme with revenue recycling through tax cuts can be somewhat more cost effective than an emissions intensity scheme, in the Authority's view it is unlikely to be feasible to implement given calls on revenue to address equity concerns.

The Authority notes that a proposal for a scheme using the emissions intensity approach in the electricity sector was made in 2009 (Frontier Economics 2009). The Australian Energy Market Commission (AEMC 2015a) supports such a scheme and the Grattan Institute has advocated its use for electricity as a transitional step towards a cap and trade scheme (Wood et al. 2016).

The Authority's modelling, like other modelling of this kind, assumes investors have certainty about future targets, policy and technologies. In practice, there will be some uncertainty associated with the emissions intensity scheme. Potentially, this uncertainty could be reduced by closing the scheme to international permits and credits, and to domestic offsets, or by introducing additional policies operating alongside the emissions intensity scheme.

The Authority is not seeking to outline a detailed blueprint for the emissions intensity scheme in this report. Recommendations on two important features of the scheme—access to credits and permits, and the decline of the emissions intensity baseline—are discussed in the next two sections. The question of whether additional electricity sector emissions reduction policies should operate alongside an emissions intensity scheme is discussed in Chapter 9.

CONCLUSION

- C.8. An emissions intensity scheme would increase electricity prices less than a cap and trade scheme. It could achieve significant emissions reductions and be scaled up to deliver further emissions reductions over time.

RECOMMENDATION

- R.2. An emissions intensity scheme should be implemented in the electricity generation sector because, as a market mechanism, it will allow Australia to meet its emissions reduction goals and decarbonise the electricity sector at lower cost than would be possible otherwise.

5.2.1. THE EMISSIONS INTENSITY SCHEME SHOULD BE CLOSED TO PERMITS, CREDITS AND MOST OFFSETS

Whether an emissions intensity scheme is ‘open’ or ‘closed’ has implications for the scheme’s cost effectiveness and for investor certainty. Access to international permits and credits and domestic offsets can improve the cost effectiveness of Australia’s climate policy toolkit, while maintaining its environmental effectiveness (if the permits and credits are of high environmental quality) (Chapter 6). However, opening the scheme to international permits and credits means that the price signal to Australian investors is affected by a range of international factors that are inherently hard to forecast, such as global emissions reduction commitments and rates of technological development.

On balance, the Authority considers that closing the scheme to international permits and credits will improve certainty for investors in Australian low-emissions generation assets, and so improve the scheme’s cost effectiveness. This approach will mean that the drivers of investment under the emissions intensity scheme will be primarily determined by domestic factors, such as the rate of decline of the emissions intensity baseline, domestic fuel and new generator costs, and the rate of Australian electricity demand growth. Investors in the Australian electricity generation sector will be able to make reasonably well-informed decisions based on these variables.

Liability facilities under the emissions intensity scheme should be able to use eligible credits from state energy efficiency white certificate schemes and ERF energy efficiency projects to meet their obligations. This approach will ensure that the emissions intensity scheme captures domestically sourced, cost-effective, demand-side abatement. Supply-side emissions reductions under the emissions intensity scheme, such as investment in new low-emissions generators, would compete on a level footing with demand-side emissions reductions available through eligible energy efficiency projects. Standards for white certificates should be set by the Australian Government (Chapter 7).

5.2.2. THE EMISSIONS INTENSITY BASELINE SHOULD DECLINE

Another key design feature of an emissions intensity scheme is the rate at which the emissions intensity baseline declines. The rate of decline should be consistent with Australia’s wider emissions reduction objectives and, for simplicity, the baseline should decline linearly after 2018.

Given the Paris Agreement’s requirement of global net zero emissions between 2050 and 2100, Australia is likely to need to achieve substantial decarbonisation of its electricity sector well before 2050. Further, decarbonising electricity generation offers an important avenue for reducing emissions in other sectors by electrifying light vehicles, for example.

A baseline of zero in an electricity sector emissions intensity scheme implies one of two things. One possibility is that electricity sector emissions are zero. However, such a stringent emissions restriction may not be feasible or cost-effective for the Australian electricity generation sector. The other possibility is that the sector is able to meet its emissions liabilities with permits available to Australia within its net emissions budget, using domestic offsets. Further analytical work would be needed to determine the trajectory for the baseline consistent with Australia’s international obligations, and the appropriate long-term role for offsets in such a scheme.

RECOMMENDATIONS

- R.3. An emissions intensity scheme covering the electricity generation sector should be introduced in 2018. The emissions intensity baseline for electricity should decline linearly over time and reach zero well before 2050, consistent with Australia's Paris Agreement obligations.
- R.4. Facilities with liabilities under the emissions intensity scheme should be able to use credits from eligible energy efficiency projects including from the Emissions Reduction Fund (ERF) and state and territory white certificate schemes to meet their obligations. The Australian Government should set eligibility criteria for the energy efficiency projects. Other than the eligible energy efficiency credits, the emissions intensity scheme should be 'closed' to enhance investor certainty. Liable facilities should not be able to meet their liabilities using international permits or credits, or other domestic offsets.

5.3. ENHANCING THE SAFEGUARD MECHANISM TO PROMOTE POLICY STABILITY

Climate policy has been marked by frequent changes of direction and uncertainty in recent years. To promote policy stability, the Authority recommends building on and enhancing the safeguard mechanism in the direct combustion, industrial processes and fugitive emissions sectors. In the safeguard mechanism, Australia has a broad-based regulatory architecture which can be progressively strengthened and enhanced to achieve emissions reductions that can be scaled up over time. This can provide a stable and pragmatic way of making progress towards Australia's obligations under the Paris Agreement.

The Authority recognises that in theory, applying the safeguard mechanism with these enhancements may not reduce direct combustion, industrial process and fugitive emissions as cost effectively as a well-designed market mechanism. However, allowing liable entities to meet their safeguard obligations using domestic offsets and international permits and credits (with quantitative limits) would reduce costs and secure cheaper abatement opportunities in domestic sectors not covered by a market mechanism or safeguards. These enhancements can allow the safeguard mechanism to occupy a middle ground between more traditional forms of command-and-control regulation and market-based measures.

As currently implemented, the safeguard mechanism is not expected to contribute to material reductions in emissions, but aims to prevent emissions from rising in covered facilities. To enhance the safeguard mechanism to achieve emissions reductions in the direct combustion, industrial processes and fugitive emissions sectors, the Authority recommends:

- Reducing the threshold for covered facilities under the safeguard mechanism from 2018 from 100,000 to 25,000 t CO₂-e. This will increase the coverage of the safeguard mechanism and its capacity to reduce emissions in line with Australia's Paris Agreement obligations. The 25,000 t CO₂-e threshold aligns with reporting required from facilities under the National Greenhouse and Energy Reporting system (NGERs). Building on the NGERs

thresholds and reporting obligations will reduce the impact of transaction costs associated with compliance.

- Declining baselines for all facilities at a uniform linear rate consistent with Australia's INDC commitment to reduce Australia's emissions by 26 to 28 per cent below 2005 levels by 2030, and to position these sectors for the further emissions reductions that are likely to be needed beyond 2030 in line with Australia's obligations under the Paris Agreement.
- Cancelling provisions for facilities to reset their baselines from 2017 onwards. Under the safeguard, baselines can currently be adjusted to allow facilities to emit more in a number of circumstances. Cancelling these provisions would make the emissions outcome of the safeguard policy more predictable.

As currently implemented, covered facilities may not have sufficient flexibility to meet their safeguard obligations cost-effectively once baselines start to decline. To provide flexibility and make the safeguard mechanism more cost-effective, the Authority recommends:

- Allowing liable facilities to surrender international credits and permits, with a quantitative limit to ensure the domestic transition to a lower carbon economy, and with qualitative restrictions to help ensure emissions reductions are genuine. The Australian Government should conduct further work to determine the appropriate restrictions including on the level of the quantitative limit, the types of projects that would be eligible and the commencement date of eligible projects (Chapter 6).
- Providing EITE facilities with access to international permits and credits with no quantitative limits to help guard against international competitiveness issues, but the qualitative restrictions would apply (Chapter 13). The 2022 toolkit review should consider, among other things, whether a declining quantitative limit should apply to access to international permits and credits for EITEs.
- ERF crediting should continue in the land sector and in sectors covered by the enhanced safeguard mechanism, and safeguard facilities could use the resulting credits as offsets if they exceed their baselines. This reduces compliance costs and can secure cheaper domestic emissions reduction opportunities. Rules to prevent double counting of emissions reductions resulting from these ERF contracts should continue to apply.
- ERF auctions should continue to assist safeguard facilities to invest in lower emissions technologies and practices, and support their transition to a lower emissions economy. ERF auctions should continue in the land sector until the enhanced safeguard mechanism is in place and provides a source of demand (Chapter 12). The Government has said it will consider future funding for the ERF in future budgets.

The Authority recommends that liable facilities should not be issued credits for emitting below their safeguard baselines, unless they meet additionality tests under the ERF crediting requirements. Issuing credits to facilities emitting below their safeguard baselines without further additionality requirements would risk rewarding facilities that did not reduce their emissions in the period from 2009–10 to 2013–14. It could also penalise early movers whose baselines are set lower because they emitted less in that period. Further, credits created in such a way could well be non-additional because 'business-as-usual' emissions for a given facility could be below the baseline level as a result of changing production levels rather than efforts to reduce emissions. The Authority notes that using absolute levels of historical emissions to set baselines for facilities may lead to some inequitable outcomes between firms; not crediting emissions below these baselines will avoid some firms receiving windfall gains (Box 4).

The next section discusses assessing the enhanced safeguard arrangements as part of the 2022 review of the policy toolkit.

CONCLUSION

- C.9. The safeguard mechanism has the potential to play a significant role in reducing emissions and helping to meet Australia's Paris commitments.

RECOMMENDATIONS

- R.5. Safeguard baseline coverage should continue in the direct combustion, industrial processes and fugitive emissions sectors and be extended to cover facilities that emit 25,000 tonnes of CO₂-e per year from 2018. Safeguard baselines should not be reset to allow for more emissions after 2017 and baselines should decline linearly to allow fewer emissions over time in line with Australia's obligations in the Paris Agreement.
- R.6. Safeguard facilities should be able to use international credits and permits to meet their safeguard obligations, subject to qualitative and quantitative eligibility restrictions. The Australian Government should conduct further work to determine the appropriate restrictions including on the level of the quantitative limit, the types of projects that would be eligible and the commencement date of eligible projects.
- R.7. Credits for facilities covered by the safeguard mechanism should not be issued unless they meet the ERF method requirements. This is to avoid penalising early movers and crediting non-additional emissions reductions.
- R.8. ERF crediting for the land sector, and projects in sectors covered by the safeguard mechanism, should continue and the resulting credits could be used as offsets for facilities with obligations under the safeguard mechanism.
- R.9. ERF purchasing for sectors covered by the safeguard mechanism should continue to provide transitional assistance to safeguard facilities to invest in lower emissions technologies and practices. ERF purchasing for land based offsets should continue until the enhanced safeguard mechanism is in place and provides a source of demand for these offsets.

5.4. REVIEWING THE ENHANCED SAFEGUARD MECHANISM IN 2022

The Authority has recommended five-yearly reviews of the policy settings within the toolkit, to precede each five-yearly 'global stocktake' under the Paris Agreement (Chapter 4). These reviews would assess the effectiveness of the policy toolkit in meeting Australia's Paris commitments, as well as progress by other key countries towards their Paris commitments.

As part of the first review in 2022, the Authority recommends considering whether to maintain the enhanced safeguard arrangements in the direct combustion, industrial processes and fugitive emissions sectors, or whether to introduce another policy instrument such as a market mechanism. The review should also consider these policy options in relation to the transport

sector (Chapter 10). To inform its findings, the review could consider the environmental and economic outcomes from the enhanced safeguard, including its progress in helping Australia reach its Paris commitments, whether emissions reductions can be scaled up in the future, and the scale and distribution of its economic impacts. It could also consider the level of community acceptance of the enhanced safeguard arrangements, and whether climate policy is sufficiently stable to pursue further reform without creating excessive uncertainty for investors.

This report does not seek to outline a detailed blueprint for the emissions intensity scheme, enhanced safeguard or any possible future market mechanism. Some high level design issues such as coverage and type of scheme were discussed earlier in this chapter. Later chapters consider other issues as follows:

- Chapter 6 examines use of international eligible permits and credits in the enhanced safeguard and in a possible future market mechanism, including the best way to manage the associated risks.
- Chapter 11 considers the use of domestic offsets, including for liable entities under the enhanced safeguard mechanism, with a focus on the land sector. Energy efficiency offsets for the emissions intensity scheme are discussed in Chapter 7.
- Chapter 13 investigates the case for providing assistance to firms whose international competitiveness could be affected by the toolkit.
- Chapter 15 sets out the Authority's recommended transition to the toolkit, which builds on current policy settings.

The detail of policy design should be considered at a later time through processes that involve extensive opportunities for stakeholder input. Policy design should be informed by lessons that can be drawn from international experience (Box 5) and Australia's previous experience with its carbon pricing mechanism (Box 6).

RECOMMENDATION

- R.10. The Government should review the policy toolkit as a whole in 2022 to assess its effectiveness including whether the enhanced safeguards should remain in place or whether another policy instrument such as a market mechanism of some sort be introduced to cover the direct combustion, industrial processes, fugitive emissions and transport sectors.

BOX 5 LESSONS FROM INTERNATIONAL MARKET MECHANISMS

Market mechanisms (ETSs or carbon taxes) have been introduced in about 40 national jurisdictions and over 20 cities, states, and regions (Kossoy et al. 2015). Two of the longest running schemes, the EU ETS and British Columbia's carbon tax, provide a number of lessons in scheme design:

EU ETS

- *Maintaining incentives with free permit allocation:* In the first phase of the EU ETS, allocating electricity permits for free, based on historical absolute emission levels ('grandfathering'), resulted in price increases for households and inequitable windfall gains for some firms. Where it continues to use free allocation, including for competitiveness reasons (Chapter 13), the EU ETS has reformed by (a) using a best-practice emissions benchmark for the product rather than historical facility emission levels, which reinforces incentives for lower emission production, and (b) tying free allocation to actual output rather than historical output, minimising windfall gains.
- *Fraud prevention:* The EU ETS has been subject to some electronic theft of permits and theft of sales taxes. The scheme has reduced the risk of electronic theft over time by tightening security, and from 2018 permit sales will fall under strict rules governing financial markets (EC 2016b).
- *Robust cap setting:* The global financial crisis and other factors resulted in lower-than-expected emissions before the policy impacts of the ETS. The resulting surplus of permits shows the importance of robust cap setting and flexibility to adjust the scheme in response to external factors.
- *Ensuring international offsets are genuine:* Concerns about the environmental integrity of international offsets weakened the perceived credibility of the EU ETS before restrictions were tightened. The use of quality and quantity controls can protect scheme credibility, and ensure some emissions reductions are undertaken domestically.

British Columbia's carbon tax

- *A gradual start:* starting at CA\$10/tonne, the early years of British Columbia's scheme demonstrated to stakeholders that economic impacts were relatively low. As the public support for the measure grew, the rate was incrementally increased.
- *Use of revenue:* British Columbia's carbon tax is 'revenue-neutral,' with revenue recycled through business tax cuts and rebates, and income tax cuts with a focus on lower tax brackets. This demonstrates how revenues from a market mechanism can be used to address both efficiency and equity concerns.

BOX 6 AUSTRALIA'S CARBON PRICING MECHANISM

Following a series of studies that recommended that Australia introduce an emissions trading scheme, the carbon pricing mechanism (CPM) was legislated in 2011 and commenced in July 2012. The CPM was to have a three-year 'fixed charge period' and then transition to a 'flexible charge period'—a cap and trade scheme. The CPM was repealed before the transition, ceasing operation in June 2014.

During the fixed charge period the Government sold permits at a pre-set price—meaning that the CPM operated like a tax. During the flexible charge period, the Government would have issued permits up to the cap. The intention was to set annual caps five years ahead of time.

In 2013–14 the scheme directly covered more than half of Australia's emissions. This included electricity; most direct combustion; industrial processes; most fugitive emissions; and some waste emissions. Firms were covered if they controlled one or more facilities that emitted more than 25,000 t CO₂-e per year. The scheme had about 360 liable entities (CER 2015). During the flexible charge period the scheme was to have a price ceiling and be linked internationally to the Clean Development Mechanism (an international offset scheme discussed in Chapter 6) and the EU ETS (subject to limits), with firms able to use unlimited numbers of domestic offset credits.

There is evidence that the scheme reduced Australia's emissions—for instance O'Gorman and Jotzo's (2014) work on the electricity sector estimated it created reductions of between 11 and 17 Mt CO₂-e over the two years it operated. However, these estimates are uncertain and it may be that fully accounting for factors such as hydroelectricity generators shifting production between periods would lead to lower figures. A Carbon Market Institute survey found that the carbon price had an effect on short-term decisions but not long-term investment (CMI 2013) (as would be expected, given the foreshadowing of repeal).

The scheme increased prices for Australian households and businesses. Assistance measures addressed these price increases for some—but not all—of those affected. While it is difficult to isolate the price effects of the scheme, it would appear that the Consumer Price Index increase was broadly in line with Treasury's expectations of about 0.7 per cent for the fixed price phase.

Lessons from the scheme:

- The scheme showed that Australia can operate an emissions reduction market mechanism with sound administrative systems and excellent compliance—at close to 100 per cent in both years. Australia has the administrative framework for an emissions trading scheme in place (including verified recording of emissions data, a regulator and a register of tradable units).
- While some analysts judged the free allocation provided to emissions-intensive trade-exposed firms to be excessive (Edis & Wood 2011), this assistance reflected political economy considerations and was provided in a way that retained an incentive to reduce emissions.

- A large difference between the fixed price and the price of international permits caused concern and reduced support for the scheme. At \$23 per tonne the fixed price was more than double the EU ETS price in 2012–13. The price difference was even higher in 2013–14.
- Trade-offs between equity and cost effectiveness in the use of scheme revenue are inevitable. Government revenue from the sale of permits was used substantially to assist lower-income households for the cost of living increases caused by the scheme.

CHAPTER 6. INTERNATIONAL PERMITS AND CREDITS

Credible international emissions reductions in the form of tradable units could complement Australia's domestic climate action, particularly in the short term. Units are available in two forms: credits from offsets projects or permits from emissions trading schemes. Using credible international permits and credits could lower the cost of meeting Australia's emissions reduction goals. Trade in international permits and credits may also reduce international competitiveness concerns for Australian businesses by providing access to a wider range of low-cost emissions reductions opportunities.

It will be important to ensure that the use of these permits and credits does not delay Australia's transition to a lower emissions economy. Australia could manage this risk through limiting the volume of international permits and credits that can be used to meet obligations under a market mechanism or other policy instrument.

Using international permits and credits could erode the environmental integrity of Australia's climate policies if they are not genuine reductions. To address this risk, Australia should only link with robust sources of international permits and credits, and set strict eligibility criteria for permits and credits based on their environmental integrity.

The Authority recommends the Government should undertake further work to determine appropriate qualitative and quantitative limits on international credits and permits. In particular, to ensure the environmental effectiveness of Australia's toolkit, restrictions should only allow purchase of credits from new projects and prohibit use of international credits from some emissions reduction projects such as the destruction of some synthetic greenhouse gases, some emissions reductions from fertiliser manufacture and some large-scale hydroelectricity projects.

Australia could use robust and credible international permits and credits to help meet its emissions reduction targets at lower cost than would be the case if they were not used. From an economic perspective, it is sensible to reduce emissions cost-effectively.

There are two main types of international, tradable units that Australia could purchase. Permits represent a tonne of emissions and are issued under emissions trading schemes. Credits are produced by offset schemes—these credits represent a tonne of emissions that has been reduced in comparison to baseline emissions (in other words, in comparison to what emissions would be in the absence of the offset scheme).

The Paris Agreement anticipates international emissions trading (Box 7). Many countries have made use of international emissions trading for decades, for example, the Clean Development Mechanism (CDM) is an offset scheme under the Kyoto Protocol that has been operating since 2005. At the Paris conference, 18 countries including Australia, New Zealand, the United States and Canada declared their continued support for international carbon markets and work to ensure the environmental integrity of these markets (Government of New Zealand 2015).

BOX 7 INTERNATIONAL TRADE IN EMISSIONS UNDER THE PARIS AGREEMENT

The Paris Agreement anticipates that some countries will use international emissions trading to assist in meeting their Paris targets and other emissions reduction commitments. The Agreement allows for direct trading of emissions between countries and also establishes a centralised 'mechanism for sustainable development and mitigation' (UNFCCC 2015a, Art. 6).

The rules for emissions trading under the Paris Agreement are still to be developed and may differ from the arrangements in place for the Kyoto Protocol. The Agreement sets out principles for trade in international emissions reductions, including: voluntary participation; environmental integrity; transparency; avoidance of double-counting, and sustainable development.

The sustainable development mechanism established under the Paris Agreement is expected to operate as a baseline and credit scheme (or schemes), with all countries party to the Agreement eligible to generate credits (UNFCCC 2015a; Marcu 2016). This mechanism will be subject to UNFCCC governance, and the centralised systems developed may allow broad participation including from developing countries (UNFCCC 2015a, Art. 6.4).

Using international permits and credits presents both benefits and risks for Australia. Many of the risks and benefits of other kinds of international trade in commodities and services apply to the use of both permits and credits. Some risks to environmental integrity are specific to credits (Section 6.2).

This chapter considers how a balanced approach to international permits and credits could unlock the benefits while managing the risks. It discusses:

- the benefits of using international permits and credits, including lowering the cost of meeting targets
- the risks of using international permits and credits, and strategies that could be employed to manage these risks
- how international permits and credits could be used as part of Australia's policy toolkit.

6.1. BENEFITS OF USING INTERNATIONAL PERMITS AND CREDITS

Using international permits and credits can provide benefits for Australia and its trading partners, including:

- reduced cost
- an avenue to address competitiveness concerns
- more efficient global transition to a low-emissions economy
- sustainable development and technology transfer in the case of credits from developing countries.

6.1.1. INTERNATIONAL PERMITS AND CREDITS CAN REDUCE THE COST OF MEETING TARGETS

Access to international permits and credits can reduce the cost of meeting a given target. For example, liable entities under the European Union emissions trading scheme (EU ETS) saved €4 to 20 billion through using international credits for compliance between 2008 and 2012 (Stephan et al. 2014). Modelling for the Authority's Targets and Progress Review found that using international permits and credits could halve the GDP impact of a given target (CCA 2014a). Similarly, 2015 modelling for the Department of Foreign Affairs and Trade found that using international permits and credits could reduce the GDP impact of Australia's Intended Nationally Determined Contribution by 42 per cent (McKibbin Software Group 2015b).

Many Australian businesses and organisations support using international emissions trading as part of Australia's policy toolkit. In submissions to Report Two of the Special Review, the Business Council of Australia, the Australian Chamber of Commerce and Industry, the Energy Users Association of Australia, AGL Energy, Origin Energy and WWF Australia expressed support for using international permits or credits to lower the cost of meeting Australia's targets. In its submission on Report Two (p. 2), the International Emissions Trading Association (IETA) suggested that using international permits and credits would allow Australia to meet its targets more cost effectively.

International credits are currently available at very low prices: Certified Emissions Reductions (CERs) from developing countries under the CDM were selling at approximately \$0.59/t CO₂-e in August 2016 (EEX 2016, December 2016 futures price). International credits are likely to become more expensive in the future. Under the Paris Agreement, all countries have committed to reduce their emissions over time, so developing countries may use their lower cost emissions reduction opportunities to meet their own targets, rather than selling credits to developed countries.

There is also uncertainty around the new mechanism that is being negotiated to potentially replace the CDM. At this stage it is unclear when this new mechanism will be implemented, what form it will take and, if it does generate credits that other countries can use to meet their Paris targets, what price they will carry (Box 7).

Prices for permits under emissions trading schemes may also increase after 2020, depending on market conditions. For example, permit prices for the EU ETS may increase due to changes to market operation to reduce the current permit surplus. Different market analysts have different views about the expected rate of price increase, with some predicting a price of €27/t CO₂-e in 2030 and others predicting a price of €50/t CO₂-e (BNEF 2016b; Thomson Reuters Point Carbon 2016). In the California-Quebec ETS, prices are expected to remain at the price floor until 2022 due to easing demand for electricity and the emissions reductions from other Californian climate policies, such as the renewable portfolio standard and transport fuel standards (BNEF 2015b, 2016a). However, permit prices in the California-Quebec scheme will continue to increase, as the price floor increases at 5 per cent per year (ICAP 2016). The price floor is currently US\$13/t CO₂-e and will rise to US\$19/t CO₂-e in 2022 (BNEF 2016a).

Even if international prices increase over time, trade may continue to be cost-effective for Australia. Previous studies have suggested that Australia has relatively high total costs of emissions reductions in comparison to other developed countries (Treasury 2008; McKibbin et al. 2010). This is because Australia has a high share of energy- and emissions-intensive industries, so may face a relatively bigger task to restructure its economy as a whole.

Despite high total costs, studies have shown some sectors of the Australian economy could provide low-cost emissions reductions. Improvements to energy efficiency could be a source of cost-effective emissions reductions and the land sector could provide substantial sequestration (RepuTex 2016). Should these opportunities be realised, Australia could potentially export credits and permits to other countries, with benefits to Australia's economy.

6.1.2. INTERNATIONAL PERMITS AND CREDITS CAN HELP ADDRESS COMPETITIVENESS CONCERNS

International emissions trading can help to address industry competitiveness concerns by equalising carbon prices (or incentives) across countries. This is because carbon prices are more similar across linked schemes and will converge if there are no restrictions on trade. Businesses in Australia with access to international permits and credits would face the international carbon price, rather than the price that would result from a scheme without access to international permits and credits. For example, an Australian company liable under the enhanced safeguard mechanism could pay the same price for its emissions as international competitors that are subject to a mechanism in their country of operation, if they also have access to international permits or credits. This could help reduce potential competitive distortions and may be particularly valuable over the short term when countries' emissions reduction policies and targets remain uneven.

6.1.3. INTERNATIONAL TRADE BRINGS GLOBAL BENEFITS

The benefits of international trade in emissions extend beyond Australia. International trade means that emissions reductions will be more likely to occur where they are cheapest first, promoting an efficient transition path to a low-emissions global economy.

If global action to reduce emissions is shown to be cost-effective, countries may have the confidence to undertake more ambitious climate action, improving the world's chances of limiting global warming to well below 2 degrees.

International trade in emissions may also support sustainable development (CDM Policy Dialogue 2012). As emissions reductions are often cheaper in developing countries, international trade in emissions can promote investment flows from developed to developing countries. Investment in emissions reduction projects in developing countries can build capacity in emissions accounting and governance, and support technology transfer, both of which can promote sustainable development.

6.1.4. PRICE VOLATILITY

If Australia had a market mechanism that was linked to one or more well-governed international schemes, this could theoretically reduce price volatility in the Australian market. Economists generally expect that for well-functioning markets, larger and more liquid markets should experience less price volatility.

Experience with carbon markets to date suggests that this theoretical expectation may not always be realised. The EU ETS is a large and well-governed market that has seen price volatility. An unrestricted link with a volatile market would import price volatility into the Australian market. This could act as a barrier to investment in the low-emissions technologies that will be necessary for Australia to transition to a lower emissions economy.

To access the benefits of linking and manage the risk of volatility, Australia could:

- place quantitative and qualitative limits on trade in permits and credits
- monitor linked schemes and suspend links if serious problems emerge.

While Australia could use price controls, such as price floors and ceilings, to help protect Australia's market from price volatility, this may cause difficulties in linking with other schemes.

6.2. RISKS OF USING INTERNATIONAL PERMITS AND CREDITS

The benefits of using international permits and credits must be balanced against the risks, including risks to the environmental integrity of Australia's action, the efficiency of Australia's transition to a low-emissions economy and carbon market fraud.

In the Authority's view, these risks can be managed by:

- restricting purchases to robust permits and credits
- supporting the development of international carbon market governance and only linking to schemes with strong governance arrangements
- placing quantitative limits on the use of international permits and credits
- using other policies to reduce investor uncertainty and promote strategic, low-emissions investment in the domestic economy.

6.2.1. CARE IN SELECTING INTERNATIONAL PERMITS AND CREDITS IS NEEDED TO SAFEGUARD ENVIRONMENTAL INTEGRITY

The benefits of using international permits and credits only apply if the permits and credits purchased represent genuine emissions reductions. Environmental integrity should therefore be the highest priority when determining which permits and credits can be used to meet Australia's targets.

The Government will need to continue to monitor how international emissions markets develop under the Paris Agreement to assess whether new schemes represent genuine, verifiable emissions reductions and to determine which permit and credit types have sufficient environmental integrity.

Credits and permits are associated with different risks to environmental integrity; these are discussed in turn.

Environmental integrity of international credits

For offset schemes where emissions reductions are calculated against a defined baseline, the central marker of environmental integrity is that credits are 'additional'. To be additional, credits should only be issued for emissions reductions that would not have happened in the absence of the offset scheme. Additionality can never be completely certain, as it is impossible to know what would have happened in the absence of a scheme (CDM Policy Dialogue 2012).

Offset scheme regulators use tests for additionality and balance the costs and benefits of more or less stringent testing. Rigorous additionality tests can provide confidence, but not certainty, that emissions reductions are real. On the other hand, overly stringent additionality rules can significantly increase transaction costs for only small improvements to reduce the risk of non-additionality. The increased transaction costs may deter proponents with projects that are in fact additional.

The environmental integrity of international credits also depends on transparent, robust accounting. Accounting procedures should guard against double-counting of credits, where both the buying and selling countries count the same emissions reduction towards their target. Regulators should set emissions baselines conservatively to avoid over-crediting. For carbon storage credits in the land sector, it is important that carbon storage is permanent, or that the risk of non-permanence is accounted for appropriately.

International processes for measuring emissions reductions and additionality testing have improved over time (Box 8). The Paris Agreement continues this trend, establishing a transparency framework that applies to all countries, including a requirement for all countries to regularly provide greenhouse gas inventories and for these inventories to be reviewed under a uniform process (UNFCCC 2015a Art. 13.7). Decisions arising from Paris also establish a Capacity-building Initiative for Transparency, to assist developing countries in meeting the emissions measurement requirements of the Agreement (UNFCCC 2015a Par. 85).

BOX 8 ADDITIONALITY UNDER THE CLEAN DEVELOPMENT MECHANISM OVER TIME

The Clean Development Mechanism (CDM) is a global offset scheme established under the Kyoto Protocol to credit emissions reductions in developing countries. Projects earn credits by reducing emissions below a defined baseline.

The CDM was the world's first global emissions offset scheme. When the CDM began operating in 2005, global experience with emissions offsets was limited, and CDM operators adopted a 'learning by doing' approach, making continuous improvements to the scheme's governance and environmental integrity (Gillenwater & Seres 2011). Despite governance arrangements to promote additionality, in the early years of the scheme some projects under the CDM were probably not truly additional. For example, some projects that destroyed the greenhouse gas by-products of refrigerant production were so profitable that facilities may have increased refrigerant production solely to generate more credits (Wara 2006; Gillenwater & Seres 2011). The CDM Executive Board responded by excluding new refrigerant gas projects (Grubb et al. 2011).

To reduce the risk that international credits do not represent genuine emissions reductions, Australia could choose to use international credits only from certain project types. This is feasible and would be consistent with policy in other countries. Under the EU ETS, liable entities cannot use CDM credits from industrial gas projects for compliance. In the New Zealand ETS, similar restrictions applied when liable entities were able to use international credits. Australia's previous carbon pricing mechanism would also have prohibited the use of credits from industrial gas projects. The Authority's research paper on international emissions trading provides careful assessment of the environmental integrity of existing types of international credits (CCA 2014c). The Australian Government should conduct further work to determine the environmental integrity of different types of international credits (Chapter 5). The additionality of new types of projects under the Paris Agreement will need to be closely monitored to determine which credits should be allowed in Australia.

Restrictions could also be used to encourage new projects rather than allowing the purchase of emissions reductions that occurred many years ago—for example, by placing an 'age limit' on

eligible offset credits or defining a cut-off date with credits issued before the cut-off ineligible for use to meet domestic obligations. This may be useful if the global carbon market remains oversupplied, providing very weak incentives for new offset project development.

Environmental integrity of international permits

It is also important to consider the environmental integrity of international permits from emissions trading schemes. If an overseas scheme's cap or limit on covered emissions is above business as usual emissions, scheme permits will not represent genuine emissions reductions. Before linking with an overseas mechanism, Australia should be confident that it imposes a binding and genuine constraint on the emissions it covers. As with international credits, measurement, accounting and transparency are essential for the environmental integrity of permits.

RECOMMENDATION

R.11. Australia should strictly exclude international credits and permits assessed as having poor environmental quality to ensure the environmental integrity of the toolkit.

6.2.2. RISKS IN THE TRANSITION TO A LOW-CARBON ECONOMY

If international permits and credits remain abundant and low cost for an extended period, unrestricted access could potentially impede Australia's transition to a low-carbon economy. In these circumstances, Australian companies could be expected to purchase international permits and credits, rather than investing in higher cost technologies and practices to reduce emissions in Australia.

Meeting the global goal of net zero emissions in the second half of the century is likely to require substantial structural changes to the economy. Delays to this process could increase long-term costs, and possibly cause disruptive transitions for firms, regions and communities.

The Authority is of the view that Australia should place limits on the purchase of international permits and credits to promote an efficient transition to a low-carbon economy. Quantitative limits should stipulate that a liable party under the enhanced safeguard can only use international permits and credits to meet a specified percentage of their obligations. This would increase the volume of emissions reductions that take place in Australia. In addition, the use of international permits and credits could be limited to a transitional period, while Australian businesses adjust to the introduction of the enhanced safeguard mechanism. The Authority recommends that, to help provide the investment incentives and certainty required to reduce emissions in the electricity sector, an emissions intensity scheme covering the sector should not allow the use of international permits or credits. Should the 2022 review recommend a market mechanism covering other sectors, liable facilities should be able to use international permits and credits to meet their obligations, subject to quantitative limits (Chapter 5).

6.2.3. FRAUD IS A RISK IN CARBON MARKETS, AS IN ALL MARKETS

Fraud and corruption represent a small but significant risk for carbon markets. This is an issue that confronts all markets. The Australian Stock Exchange, for example, continues to experience and respond to incidences of fraud. There have been some well publicised instances of carbon

market fraud and theft in the EU ETS, prompting governing agencies to improve security. In particular, they aligned the ETS market rules with those of other financial markets. There have been no reports of information technology-mediated fraud or theft since the second phase of the EU scheme, which ran from 2008 to 2012 (European Court of Auditors 2015).

Under the CDM, international bodies were set up to ensure robust measurement and verification. It is expected that similar governance systems will be used by any international offset schemes operating under the Paris Agreement.

Australia can help mitigate the risk of carbon market fraud by contributing to the development of international governance arrangements, and measurement, reporting and verification systems for new trading schemes. The Australian Government has already declared its intention to be involved in this process (Government of New Zealand 2015). Australia could also follow the lead of the European Union in applying broader financial and fraud regulations to any trade in permits or credits in Australia.

6.3. INTERNATIONAL PERMITS AND CREDITS AS PART OF AUSTRALIA'S TOOLKIT

On balance, the Authority recommends Australia allow limited use of robust international permits and credits to complement domestic action to reduce emissions.

As discussed in Chapter 5 the recommended emissions intensity scheme for the electricity sector would be a closed system. However, the Authority recommends that liable entities under an enhanced safeguard mechanism should be able to use international permits and credits to meet their obligations, subject to quantitative and qualitative restrictions (Chapter 5). If Australia subsequently develops a market mechanism for the direct combustion, industrial processes fugitive emissions and transport sectors (Chapter 5), Australia could link this market mechanism with equivalent schemes in other countries. A one-way link would allow liable entities in Australia to purchase permits from the linked country to meet their compliance obligations; a two-way link would also allow liable entities in Australia to sell permits to the linked country. Liable entities could also be allowed to purchase credits from robust international offset schemes to meet their compliance obligations.

In addition, the Government should establish a strategic reserve of international permits and credits to manage the inevitable uncertainty in projecting national emissions growth, and the risk that national emissions reduction targets are not met.

Other countries have taken this approach; for example, Norway uses the Nordic Environment Finance Corporation fund to purchase international credits. Alternatively, the Government could use an intermediary like the World Bank to purchase international permits and credits on its behalf based on specified criteria. The World Bank has extensive experience in purchasing international emissions reduction units on behalf of governments and companies. The Netherlands and Spain have both provided funding to the World Bank to purchase CDM units on their behalf from a particular set of projects including renewable energy, biomass and energy efficiency improvement (World Bank 2016).

The Authority is of the view that all use of international permits and credits should be subject to qualitative restrictions. For example, Australia should consider not allowing the use of credits from the destruction of some synthetic greenhouse gases, some emissions reductions from

fertiliser manufacture and some large-scale hydroelectricity projects under the CDM.² An update of work such as the Authority's 2014 research report on international units could assist in informing views on the environmental integrity of different permits and credits (Chapter 5).

The Authority's proposed use of international credits and permits by emissions-intensive trade-exposed firms is discussed in Chapter 13.

RECOMMENDATION

R.12. The Government should establish a fund to purchase international offset credits and permits and help meet the 2030 emissions reduction goal.

² More specifically, non-eligible projects could include the destruction of trifluoromethane, the destruction of nitrous oxide from adipic acid plants or from large-scale hydroelectricity projects not consistent with criteria adopted by the European Union based on the World Commission on Dams guidelines.

CHAPTER 7. ENERGY EFFICIENCY

Energy efficiency measures are an important part of Australia's climate policy toolkit. Energy efficiency offers significant emissions reduction potential at low cost or net savings across all sectors of the economy, but particularly for buildings, appliances and transport.

Not all opportunities to reduce emissions through energy efficiency respond well to market mechanisms as a range of barriers exist to prevent uptake of energy efficiency improvements. Where these barriers warrant government intervention, effective regulations and information programs can unlock cost-effective emissions reductions.

Australia should continue and expand its energy efficiency programs as part of the policy toolkit. Energy efficiency regulation and information programs should be regularly reviewed and strengthened to ensure continued, cost-effective emissions reductions from buildings, appliances, households and industry.

Work by the Australian Government and state and territory governments to extend and harmonise schemes that encourage energy efficiency projects should continue.

Energy use, including in transport, currently contributes almost three quarters of Australia's emissions (DoEE 2016). This means that energy efficiency—using less energy to achieve the same outcomes—is an important strategy for reducing Australia's emissions.

It is well-established that improving energy efficiency is one of the fastest and most cost-effective ways to reduce emissions (Stern 2007; Garnaut 2008; IEA 2015c). Many energy efficiency opportunities are low cost or negative cost—that is, the energy savings have a higher value than the upfront investment to improve efficiency—but energy users have not taken them up because of non-price barriers to taking action (Australian Government 2010; ClimateWorks 2010).

Improving energy efficiency can have a variety of co-benefits, such as job creation and productivity gains (IEA 2015b). Using energy more efficiently can also improve the affordability of energy. Energy affordability is determined by energy prices, energy use and overall household income and is particularly important for low-income households, which spend a higher proportion of their income on energy (Australian Government 2010). Policies targeting energy use can help to offset any increase in energy prices caused by other policies in the toolkit. For example, the ACT and Californian governments are using energy efficiency initiatives to help offset electricity price rises for consumers while meeting ambitious targets for renewable energy uptake.

The importance of energy efficiency measures in contributing to climate goals is well recognised. The International Energy Agency (IEA) recently considered how the energy sector could contribute to meeting the Paris Agreement by ensuring the sector's global emissions have peaked by 2020 (IEA 2015c). It recommended five proven policies and actions, including improved energy efficiency in the industry, buildings and transport sectors. In submissions to Report Two, many stakeholders including ClimateWorks and RepuTex emphasised the

importance of emissions reductions from energy efficiency improvements in assisting Australia to meet future emissions reduction targets.

There are many low-cost or financially beneficial actions to reduce energy use and improve energy affordability. These are the focus of this chapter which explores:

- the case for energy efficiency policies as part of Australia's policy toolkit
- where energy efficiency policies might be best targeted
- the merits of a range of energy efficiency policies, including market mechanisms, regulation and information standards.

7.1. AUSTRALIA'S ENERGY USE IS ITS LARGEST SOURCE OF EMISSIONS

Australia's per person energy use and energy intensity is high by international standards, which means Australia has many opportunities to improve its energy efficiency (Australian Government 2010; IEA 2011a; G20 2014; IPEEC 2015). Australian business and household energy use produces around 70 per cent of Australia's emissions (DoE 2015e; DIIS 2016b).

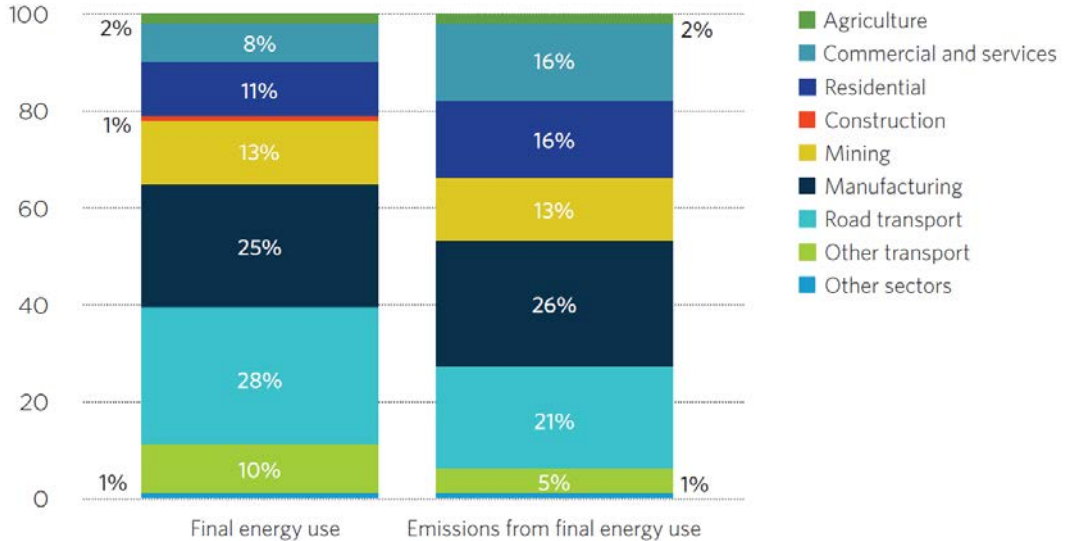
This chapter considers policies to improve the efficiency of final energy use—that is, total energy consumption minus energy consumed or lost in conversion, transmission and distribution. The transport sector uses the largest share of final energy—almost 40 per cent (Figure 9).

Manufacturing makes up about one quarter of final energy use while mining (including LNG), the commercial and services sectors, and households each make up about 10 per cent. Greenhouse gas emissions produced by final energy use are more evenly split between sectors. Transport and manufacturing contribute about a quarter each, residential and commercial emissions 16 per cent each and mining 13 per cent. This means that improving energy efficiency across the economy, even in sectors with lower proportional energy use, can contribute to reducing Australia's emissions. The difference between energy and emissions shares is largely because of the fuel mix: sectors that rely on more emissions-intensive energy sources such as coal have higher emissions than those relying on less emissions-intensive fuels such as gas.

While energy efficiency can be improved in all sectors of the economy, the Australian Government has identified 54 Mt CO₂-e of cost-effective emissions reduction opportunities that can be realised in 2030 under its current and planned policies in three key areas (COAG Energy Council 2015b):

- Transport: cost-effective reductions in light vehicle and other transport emissions could save 16 Mt CO₂-e in 2030
- Buildings and appliances: improving the efficiency of buildings and appliances could save 21 Mt CO₂-e in 2030
- Industry: measures in the manufacturing, mining and agricultural sectors could reduce emissions by 17 Mt CO₂-e in 2030.

FIGURE 9 FINAL ENERGY USE AND FINAL ENERGY USE EMISSIONS BY SECTOR, 2013–14



Note: Emissions by sector are constructed by assigning emissions data (drawn from the Australian Greenhouse Emissions Information System) to the sectoral classifications of the final energy use data. Fugitive emissions are not included. Emissions from electricity transmission and distribution losses are included. Indirect emissions from electricity and gas supply are allocated to the remaining sectors based on their relative proportions of indirect emissions. In this chart, 'agriculture' includes forestry and fisheries. 'Other' sectors in the final energy use column are lubricants, bitumen and solvents. 'Other' sectors in the emissions column include direct 'mobile' emissions and indirect 'water supply, sewerage and drainage' emissions. In both datasets 'other transport' comprises air transport, water transport, rail transport and other transport, services and storage. Construction emissions from final energy use are not shown as they are less than one per cent of total.

Source: Climate Change Authority based on DIIS 2015b and DoEE 2016.

7.2. ENERGY EFFICIENCY MEASURES AS PART OF THE POLICY TOOLKIT

Policies to improve energy efficiency are an important part of the climate policy toolkit for two reasons. First, as discussed above, there are many opportunities to reduce Australia's energy emissions. Second, even though many energy efficiency opportunities have net benefits and are likely to reduce energy bills, barriers such as consumer information gaps make it unlikely that the opportunities will be realised without targeted policies.

Governments can encourage broad take up and use of energy efficiency strategies. A variety of energy efficiency policies are used in Australia (at both national and state and territory levels) and around the world, including market mechanisms, voluntary pricing, regulation and information programs (Table 7).

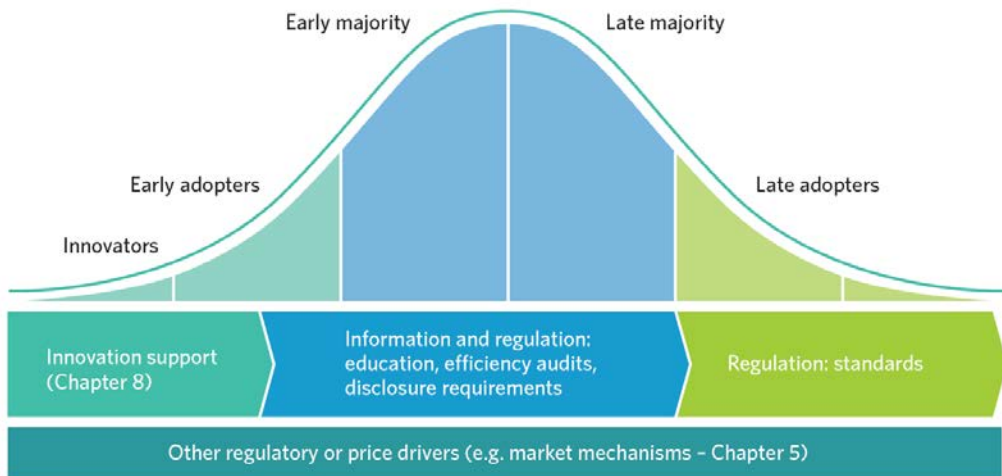
TABLE 7 TYPES OF ENERGY EFFICIENCY POLICIES

POLICY TYPE	EFFECT ON ENERGY EFFICIENCY	EXAMPLES
Market-based mechanisms to reduce emissions	Offer an incentive to reduce the use of emissions-intensive sources of energy	Emissions intensity scheme, cap and trade scheme or carbon tax
Other market-based policies that target particular technologies or activities	Offer an incentive to reduce energy use; some schemes are targeted at emissions-intensive sources of energy	'White certificate schemes' such as the Victorian Energy Efficiency Target
Voluntary pricing	Offer an incentive to undertake projects to reduce emissions through improved energy efficiency	Energy efficiency methods for the Emissions Reduction Fund (ERF)
Regulation	Mandate minimum efficiency standards, require disclosure about the efficiency of a product or service, or other specific action	Minimum energy performance standards Commercial Building Disclosure program Light vehicle CO ₂ emissions standards Government procurement policies
Information programs	Provide information to energy users that helps them to make and implement decisions about their energy use	Energy rating labels on appliances and vehicles Resources assessment grants administered by Sustainability Victoria

Source: Climate Change Authority.

Energy efficiency policies often make use of innovations—improved equipment, technologies or processes that provide the same level of service or comfort with lower energy consumption. Some policies provide incentives to bring new technologies to the market (discussed further in Chapter 8), others provide incentives or assistance to encourage broader take up of commercially viable improvements. Where energy efficiency products and systems are mature and widely implemented, governments may consider mandating their use through standards. Figure 10 shows how different policies can encourage take up of energy efficiency improvements along an innovation diffusion curve.

FIGURE 10 HOW POLICIES ENCOURAGE IMPROVEMENTS IN ENERGY EFFICIENCY OVER TIME



Source: Climate Change Authority.

The Australian Government is investigating new and expanded energy efficiency measures through the National Energy Productivity Plan (NEPP). The NEPP defines energy productivity as economic output (GDP) divided by primary energy use. It sets a 40 per cent improvement target for Australia's energy productivity by 2030—relative to 2015 levels—which is estimated to double the rate of improvement compared to business as usual (COAG Energy Council 2015b).

7.2.1. TARGETED POLICIES ARE NEEDED TO ADDRESS SEVERAL BARRIERS

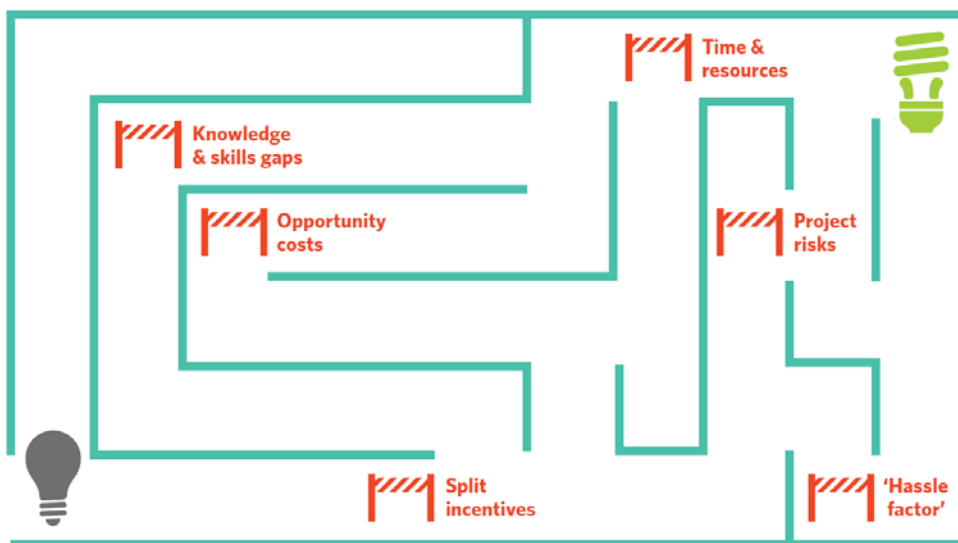
The Authority's recommended emissions intensity scheme for the electricity sector—discussed in Chapter 5—is likely to lead to some improvements in energy efficiency by increasing the existing price incentive to use less energy (CCA 2016). That said, an emissions intensity scheme will increase electricity prices less than other market mechanisms, and, there are a range of other barriers that mean businesses and households may not take up opportunities that are in their interests. As depicted in Figure 11 these barriers include (Australian Government 2010):

- Information gaps: where information about energy efficiency opportunities has the characteristics of a public good, the market may not provide enough information for energy users to take them up.
- Skills gaps: energy users may have skills gaps arising from gaps in education and training that make identifying or adopting energy efficiency opportunities more difficult.
- Split incentives: where one person pays another for a service, but the parties face different incentives. For example, landlords are responsible for the energy efficiency of properties, but tenants pay the energy bills.

- Behavioural, organisational and cultural factors: even when people have good information they do not always make optimal decisions, especially where well-established norms or organisational structures or culture affect decision making.

These barriers mean that there is likely to be a need for energy efficiency measures to capture all low-cost emissions reductions opportunities. The rest of this chapter discusses different types of measures and their merits.

FIGURE 11 BARRIERS TO ENERGY EFFICIENCY



Source: Climate Change Authority.

7.2.2. MARKET MECHANISMS AND PROJECT AGGREGATION

One type of additional energy efficiency measure is to create a market for emissions reductions achieved through energy efficiency activities. This addresses barriers to improving energy efficiency in a targeted way. These schemes are often called white certificate schemes or energy savings schemes, and create an obligation, often on energy retailers, to achieve a target for emissions reductions through energy efficiency activities. In some schemes, the target creates a market for tradable energy efficiency ('white') certificates, which represent energy savings and emissions reductions. A variety of projects can be credited with certificates, and this differs by scheme, but could include projects to install more efficient lighting or shower heads. White certificate schemes can facilitate projects that aggregate many small energy efficiency improvements together. Participants can benefit through decreased energy use, but scheme costs can be passed on by energy retailers to their customers, increasing energy unit costs for both participants and non-participants.

Four states and territories have schemes for energy savings in place: New South Wales (NSW), South Australia (SA), Victoria and the Australian Capital Territory (ACT). The NSW and Victorian schemes are white certificate schemes with tradable credits. Recent reviews of each of these schemes concluded they had reduced emissions (Jacobs 2014). The coverage of these

schemes varies though they all incorporate some mix of residential and commercial sectors. In the ACT, 40 per cent of households have participated in the scheme since its launch in 2013 (ACT Environment and Planning Directorate, Report Two submission, p. 5).

As markets for energy savings operate by imposing an obligation to perform activities that often provide financial rewards to someone because they reduce energy costs, testing for additionality is important. The state and territory schemes offer varying additionality tests that assess regulatory additionality (whether energy efficiency action is beyond legislative requirements); technical additionality (whether improvements are beyond the market average); and financial additionality (whether improvements would have happened without an incentive) (Australian Government 2012). Reviews of these schemes suggest that some schemes are likely to be more successful than others in reducing the risk that scheme credits are non-additional (Pitt & Sherry 2013; Government of South Australia 2013; Jacobs 2014).

Because markets for energy savings can provide cost-effective emissions reductions but impose transaction costs on business, previous reviews have recommended a national, or harmonised state-based white certificate schemes (Australian Government 2010; COAG Energy Council 2015c). Modelling commissioned for the Australian Government on the impacts of a national white certificate scheme concluded that the benefits of a national scheme would exceed its costs over the medium to long term, although costs exceed benefits early in the scheme's life. It estimated net benefits of between \$3 and \$5 billion from 2014 to 2050 (SKM MMA 2011). Expanding existing schemes to more states could capture more opportunities and create new markets for white certificates. Harmonising the schemes where possible to ensure common objectives, approaches and coverage could simplify obligations on energy retailers and reduce complexity for project proponents with national operations (Australian Government 2010). This could reduce the cost of meeting national emissions goals.

States and territories have made some progress in harmonising existing schemes—for example the ACT Energy Efficiency Improvement Scheme was recently amended so that the ACT scheme can adopt other schemes' activities (ACT Environment and Planning Directorate 2016). However, harmonisation is complex and previous efforts through the Council of Australian Governments (COAG) have been unsuccessful. Consolidating state schemes into a single, national scheme may also carry risks for investors if Australia's climate policy is unstable.

To help extend energy efficiency incentives, states and territories that have not done so should consider setting energy efficiency targets and creating a market for white certificates.

The Authority recommends that credits from eligible energy efficiency projects (including ERF crediting and state white certificate schemes) should be eligible for surrender in the proposed electricity sector emissions intensity scheme (Chapter 5). In this way, low-cost emissions reductions from electricity users could reduce the cost of emissions reduction obligations on electricity suppliers. The Australian Government should set standards for the white certificates that may be traded in the emissions intensity scheme to protect the environmental integrity of both schemes. These standards could draw on best practice and lessons learned from the state white certificate schemes, and the energy efficiency methods under the ERF. Energy efficiency projects should remain eligible for ERF crediting, and purchasing should continue until the emissions intensity scheme is sufficiently mature to provide a source of demand for these credits.

RECOMMENDATIONS

- R.13. Standards should establish eligibility for energy efficiency projects including from the Emissions Reduction Fund (ERF) and state and territory white certificate schemes, and the resulting credits could be used to meet liable facilities' obligations under the emissions intensity scheme.
- R.14. ERF crediting of energy efficiency projects should continue. Purchasing of energy efficiency projects should continue until the emissions intensity scheme is in place and provides a source of demand for credits from energy efficiency projects.
- R.15. The Commonwealth and states should pursue harmonisation of white certificate schemes through the COAG Energy Council.
- R.16. States and territories that have not done so should consider setting energy efficiency targets to provide a market for white certificates.

7.2.3. REGULATION AND INFORMATION POLICIES

Regulation and information policies are another way of overcoming non-price barriers to energy efficiency. The most common forms are:

- Standards—requiring products such as appliances, equipment, buildings, fuel or vehicles to achieve energy performance standards addresses the problem that consumers do not always make optimal choices because of information gaps, split incentives, and behavioural and other factors.
- Information disclosure—programs that mandate or support the provision of information to consumers about the energy efficiency of products can help consumers make better choices.
- Energy efficiency audits and implementation—programs that mandate or support energy audits can help households or businesses understand the available energy efficiency opportunities. They may also mandate or support implementation of some of those opportunities. This can address information gaps, skills gaps and other behavioural factors. Depending on how these programs are targeted and funded, they may also address split incentive problems.
- Government procurement programs—governments can mandate or support a range of energy efficiency improvements in their own operations. These include improvements in the fuel efficiency of government fleet cars, and mandated minimum energy efficiency standards for defence housing or leased commercial office areas.

These policies are currently in place in Australia at a national or state and territory level. The most common applications are in buildings, appliances and home energy use—these are explored in turn.

7.3. ENERGY EFFICIENCY POLICIES CAN BE TAILORED TO CAPTURE DIFFERENT LOW-COST EMISSIONS REDUCTIONS

7.3.1. BUILDINGS

New and existing buildings offer significant opportunities to reduce emissions through energy efficiency improvements, such as (Beyond Zero Emissions 2013):

- strengthening the thermal performance of the building, for example through better insulation
- replacing inefficient appliances and systems with high-efficiency alternatives, such as light emitting diode (LED) lighting systems
- improving building management and occupant interactions.

Estimates of the potential building and appliance emissions reduction opportunities range from 21 Mt CO₂-e to 35 Mt CO₂-e in 2030 (Skarbek & Denis 2015; COAG Energy Council 2015c).

Regulation and information policies to capture these opportunities include mandating disclosure of energy efficiency information to prospective tenants or buyers, strengthening minimum standards for new buildings and providing incentives to retrofit the existing building stock to make it more energy efficient.

Australian experience suggests that mandatory disclosure of energy efficiency information for commercial buildings has been effective. For example, the Commercial Building Disclosure (CBD) program mandates disclosure of energy efficiency information when large office buildings are leased or sold. This helps prospective buyers and tenants compare the energy efficiency of buildings, providing an incentive for owners and landlords to make cost-effective energy efficiency improvements. There is evidence to suggest that the CBD program has resulted in building owners, operators and tenants improving commercial building energy efficiency, particularly in less energy efficient buildings (ACIL Allen Consulting 2015). A recent review of the program concluded that actions under the program to 2014 will likely result in cumulative emissions reductions of 2 Mt CO₂-e between 2010 and 2023 (ACIL Allen Consulting 2015b) and estimated that the benefits of avoided energy costs exceeded the administrative and compliance costs of the program by \$15.4 million, excluding benefits from greenhouse gas reductions (ACIL Allen Consulting 2015). The Australian Government recently agreed to strengthen the CBD program, extending the requirements to include smaller buildings. With these new settings, the program is projected to reduce emissions by 4 Mt CO₂-e and deliver around \$65 million in benefits from 2015 to 2019, excluding benefits from greenhouse gas reductions (CBD 2016).

There may also be a case for mandatory disclosure of residential building energy efficiency information and COAG is due to recommend options for implementing a national scheme by the end of 2016 (COAG Energy Council 2015c). The Australian Capital Territory requires residential building owners to obtain a building energy efficiency rating which must be provided to prospective buyers or tenants when the building is being leased or sold. A 2008 assessment of the scheme concluded that home owners who improved the energy performance of their homes by one star level increased market value by approximately three per cent (Berry et al. 2008). Modelling undertaken for the Department of the Prime Minister and Cabinet estimated a national residential mandatory energy efficiency disclosure scheme commencing in 2011–12 would reduce emissions by 14 Mt CO₂-e in its first decade of operation and save \$919 million in present value terms (Allen Consulting Group 2011).

Minimum energy efficiency requirements for new buildings can improve the energy efficiency of the building stock. For example, new building standards have delivered a 32 per cent reduction

in office building emissions over the past decade (ClimateWorks 2013). The upcoming 2019 review of Australia's National Construction Code (NCC) provides an opportunity to consider strengthening the minimum energy efficiency requirements for new buildings. Improvements to the energy efficiency of new building stock could be accelerated through regular updates of the NCC in line with international best practice (IPEEC 2015). Revisions to the code should strengthen over time where that would deliver net benefits.

Retrofitting the existing commercial and residential building stock to improve energy efficiency is likely to be environmentally effective. Retrofits could reduce emissions by up to 100 Mt CO₂-e over 2015 to 2030 (ASBEC 2016), but are more expensive than improving the efficiency of new buildings. Given that this opportunity offers potentially very large emissions reductions, the Australian Government could investigate additional policies that might encourage building retrofits such as minimum standards for rental properties and existing buildings, green depreciation and/or stamp duty concessions for energy efficient properties (ASBEC 2016).

CONCLUSION

- C.10. Evidence suggests that energy efficiency disclosure programs for buildings are environmentally and cost-effective. The Authority supports the current COAG process to examine these issues.

RECOMMENDATION

- R.17. Regular, scheduled updates to the national construction code offer an important opportunity to improve the energy efficiency of Australia's built environment over time, and should continue.

7.3.2. HOUSEHOLDS

Improving household energy efficiency offers a range of cost-effective opportunities to reduce Australia's emissions while improving energy affordability for households. As illustrated in Figure 9, residential emissions account for 16 per cent of emissions from energy or 58 Mt CO₂-e annually. Households, particularly low-income households, face a range of non-price barriers to improving their energy efficiency. These include information gaps, split incentives and difficulties accessing capital to invest in energy efficiency improvements. A range of regulation and information programs can help them better understand their energy use and improve their energy efficiency.

Appliances and home energy use

Australia has a long history of improving the energy efficiency of appliances and home energy use. This looks set to continue over coming decades as efficient appliances are integrated with smart technologies and 'nudge' policy approaches—that is, policies that encourage people to change their behaviour to become more energy efficient.

Appliance standards have proven to be a cost-effective and environmentally effective way of improving the energy efficiency of appliances over time and reducing emissions. For example,

the Equipment Energy Efficiency (E3) program sets minimum energy efficiency standards for appliances and equipment and mandates energy labelling information for consumers. Its benefits have been estimated to far exceed its costs and it is projected to reduce emissions by between 60 and 70 Mt CO₂-e between 2014 and 2020, with a net benefit of between \$3.3 and \$7.3 billion (Databuild 2015). This is a substantial reduction—more than the annual emissions from all the passenger cars in Australia. Appliance standards have been one of the largest contributors to reduced electricity use in Australia over the past decade. For example, the annual rate of improvement for household air conditioners before standards were introduced was around 0.5 per cent, but grew to around four per cent after standards were introduced (Databuild 2015).

The Government has announced it will prioritise the revisions of appliance standards to maximise energy savings. As a result of a recent review, the Government announced six areas for focus: lighting, non-domestic fans, swimming pool pumps, commercial refrigerated storage and display cabinets, air conditioning, and domestic fridges and freezers (E3 2016).

RECOMMENDATION

- R.18. Energy efficiency standards for appliances are an important way to improve energy productivity and reduce emissions. They should continue to be regularly updated and be expanded where it is cost-effective for further improvements to be made.

Targeting information to consumers and businesses can help them to improve energy efficiency. The New Zealand Government provides simple energy efficiency and energy savings tips to households through its EnergySpot television advertisements and website. EnergySpot advertisements have aired since 2009 and reached 2.4 million people with 41 per cent saying they have taken action to reduce energy use as a result (EECA NZ 2016).

Behavioural economics may also offer approaches to encourage behaviours that are in energy users' own interest (Thaler & Sunstein 2008). By 'nudging' consumers to make small changes to their behaviour it is possible to significantly improve household energy efficiency. For example, smart meter infrastructure has the potential to nudge households to reduce their electricity use and emissions.

Smart meter infrastructure creates an interface between the consumer and the electricity network that provides relevant information in a useful form. For example, households with a smart electricity meter and a smart phone can see real-time information about their electricity use and costs. Smart technology trials showed consumers reduced their electricity use by about two to three per cent, when combined with pricing incentives, in the recent Australian Smart Grid, Smart City project (Arup et al. 2014) and up to 12 per cent across other international studies (Ehrhardt-Martinez et al. 2010; Stromback et al. 2011). These studies have also found that for consumers to use smart technology effectively, clear communication of its benefits plays a central role. This might include the disaggregation of household energy use to the appliance level or consumer interactions through mobile phone applications.

Work is already underway by Australian governments to deploy smart technology—in concert with other changes to energy regulation such as moving towards cost-reflective pricing—and

from 1 December 2017 all new meters must be smart meters (AEMC 2015b). Several states permit customers to voluntarily switch to smart meters. Given progress in this area, there does not appear to be a role for climate policy to further encourage smart technology uptake.

Low-income households

Programs targeted at low-income households may be warranted to improve equity and access to cost-effective energy efficiency opportunities. Low-income households spend a higher proportion of their income on energy bills; improving their energy efficiency would help them adjust to increases in electricity costs from the introduction of an emissions intensity scheme. The range of non-price barriers to energy efficiency faced by low-income households highlights the importance of an integrated policy strategy which ensures that measures to target specific barriers work together effectively.

Domestic and international experience shows that including specific targets for low-income households within white certificate schemes assists these households to improve energy efficiency and can improve the cost effectiveness of the schemes (Giraudet et al. 2011). In Australia, white certificate schemes in South Australia and the Australian Capital Territory currently target 19 and 20 per cent of their energy efficiency improvements respectively to low-income households in 2016 (Government of South Australia 2014; ACT Environment and Planning Directorate 2016). Energy retailers must source a proportion of energy savings from low-income households by undertaking energy audits and in some cases, replacing inefficient lighting and appliances. Research into the Victorian Energy Efficiency Target scheme concluded that while it did not target low income households, they were still more likely to participate in the scheme than households in higher income quintiles (ABS 2011). While some organisations in the non-government sector support white certificate schemes because they help some low-income households (ACOSS 2013; Brotherhood of St Lawrence 2014), there is recognition that this support does not reach all low-income households (VCOSS 2015).

Establishing a mandatory energy efficiency disclosure scheme for residential buildings—as discussed in Section 7.3.1—would benefit low-income households. People in the lowest income quintile are twice as likely to rent their homes as those in the highest income quintile and almost three quarters of low-income renters are renting from a private landlord (ACOSS 2013). A mandatory residential energy efficiency scheme would be most beneficial to low-income households if it extended to rental properties and was integrated with targeted energy efficiency information programs, noting that rents may increase to recover the costs of required energy efficiency investments.

Ensuring new residential buildings—particularly public and community housing—are built to high standards of energy efficiency can reduce energy consumption for low-income households and could reduce Australia’s emissions by up to 47 Mt CO₂-e between 2015 and 2030 (ASBEC 2016). The Clean Energy Finance Corporation (CEFC) recently announced a \$250 million financing program to build energy efficient community housing dwellings. The program aims to ensure that tenants will reap the benefits of lower energy costs and improved amenities, while the community housing associations will overcome barriers to financing that have impeded the construction of energy efficient homes in the past (CEFC 2016a).

Programs that retrofit inefficient low-income housing to improve energy efficiency and reduce energy emissions also provide a range of co-benefits for tenants (VCOSS 2015). For example, people on low incomes are twice as likely to suffer heat-related health issues (ACOSS 2013). Weatherproofing and retrofitting homes can improve residents’ health and their attendance rates at work and school (Australian Government 2010). The Netherlands’ Energiesprong program retrofits publicly-owned, low-income housing to net zero energy use at no cost to the tenant. The

program addresses split incentives by requiring tenants to pay the pre-retrofit energy costs directly to the public housing association. Tenants benefit from improved comfort at no additional cost, while the housing associations use the tenants' ongoing energy payments to recoup the costs of the retrofit. The program is intended to refurbish 111,000 houses at a total investment of €6 billion with costs recouped in 30 years. It is also being adopted by other countries including the United Kingdom (Energy post 2014).

RECOMMENDATION

- R.19. The Australian Government should investigate best practice domestic and international approaches to improving the energy efficiency of low-income homes, including innovative models for financing the up-front costs of retrofits.

7.3.3. BUSINESSES AND LARGE ENERGY USERS

Making cost-effective improvements to energy efficiency increases Australia's energy productivity and can have a range of co-benefits. For example, in the industrial sector, ensuring a kiln is used at the optimal temperature can save on energy costs and also improve the overall quality of the final product. Information programs can be combined with energy audits and other government support to help business and industry to realise energy efficiency opportunities and co-benefits. These programs can help address skills gaps, information gaps, and organisational barriers that impede businesses from investing in energy efficiency opportunities. Securing these cost-effective emissions reductions may help reduce the cost of meeting Australia's emissions reduction targets.

Large businesses and industry

There are significant opportunities to improve the energy efficiency of large energy users and reduce emissions. Industry accounts for 38 per cent of Australia's final energy use and emissions (DIIS 2015b; DoEE 2016). Emissions intensity varies widely between industry users as does their technical potential to improve energy efficiency. While pricing policies encourage many cost-effective energy efficiency opportunities to be taken up, information programs can also assist large industrial users to overcome non-price barriers to energy efficiency. For example, the Energy Efficiency Opportunities (EEO) program operated by the Australian Government from 2006 to 2014 built organisational capacity to identify and implement cost-effective energy efficiency improvements for large industrial users (ACIL Tasman 2013).

A 2013 review of the first five year cycle of the EEO program concluded it was a cost- and environmentally effective way to reduce emissions. The review found the EEO program was responsible for around 40 per cent of energy savings among large industrial energy users over this period; reducing emissions by 8 Mt CO₂-e in total and providing net financial benefits of \$808 million per year (ACIL Tasman 2013). The IEA identified the EEO Program as an example of a measure with wide application that encourages investment in energy efficiency, citing the program in its World Energy Outlook (IEA 2012).

Small and medium enterprises

Opportunities exist to improve the energy efficiency of small and medium enterprises (SMEs) through better provision of information, capacity building and access to finance. SMEs consume modest amounts of energy, but collectively their energy demand is considerable. Globally, SMEs account for more than 13 per cent of world energy use, and cost-effective energy efficiency measures could reduce SME energy use by up to 30 per cent (IEA 2015a).

The Commonwealth's Energy Efficiency Information Grants (EEIG) program (2011 to 2015) is cited by the IEA as a successful program for improving the energy efficiency of SMEs (IEA 2015a). The EEIG followed the IEA policy pathway for accelerating energy efficiency in SMEs by developing and implementing the program in four phases: planning, implementation, monitoring and evaluation. The program used merit-based evaluation to provide grants to industry associations and non-profit organisations which could deliver energy efficiency information programs and capacity building to SMEs across a range of sectors. For example, within the agricultural sector, the dairy industry sought to better understand its energy use and improve its energy efficiency. From 2012 to 2015, 21 per cent of Australia's dairy farms underwent on-farm energy assessments through the EEIG program (Dairy Australia 2015b). The assessment concluded that 40 per cent of farms had the capacity to save between \$2,000 and \$10,000 annually, with another five per cent able to save between \$10,000 and \$29,000 per year through efficiency improvements (RMCG 2015). The outcomes of the audits were summarised in a series of case studies and fact sheets on the *Dairying for Tomorrow* website (Dairy Australia 2015a). These allowed other dairy farmers to understand the cost savings and co-benefits available by implementing energy efficiency improvements based on the experience of their peers.

SMEs can also benefit from lower energy bills through participation in white certificate schemes.

CONCLUSION

- C.11. Where they can be provided cost-effectively, programs that help businesses improve their energy productivity may help reduce the cost of meeting Australia's emissions reduction targets.

Local government

Many local governments, including the cities of Melbourne and Sydney, are improving their energy efficiency. One important opportunity is street lighting, which typically accounts for 30 to 60 per cent of council energy use (Ironbark Sustainability 2016b). Councils have available support to upgrade their street lighting through the ERF, the CEFC and some state governments (Ironbark Sustainability 2016a).

7.3.4. TRANSPORT

Energy efficiency policies can substantially reduce emissions from the transport sector, which is a major source of Australia's emissions. Policies that encourage vehicle improvements to reduce fuel use, or logistical improvements to reduce travel distances and optimise load, can reduce emissions from transport. These and other measures that can reduce transport emissions are discussed in Chapter 10.

CHAPTER 8. INNOVATION SUPPORT

Innovation can help Australia reduce emissions cost effectively over the long term, and has other benefits. The Authority is of the view that Government support for low-emissions innovation can help alleviate innovation barriers and address market failures not resolved by an enhanced safeguard mechanism or market mechanisms to reduce emissions.

The early stages of low-emissions innovation—particularly research, development and demonstration—are a priority and support through targeted public funding is needed. Debt and equity funding for deployment of low-emissions projects and technologies should also continue. Other policies in the toolkit will also assist in overcoming difficulties associated with policy and project risks at the deployment and commercialisation stages.

International cooperation can foster efficiency in countries' innovation efforts. Australia should continue collaborating on low-emissions innovation with other countries.

Innovation can include new and improved technologies, products, services and processes, which can help improve the environmental and cost effectiveness of efforts to reduce emissions over the medium to long term. Developing new and improved emissions reduction methods and technologies will expand the range of emissions reduction options and help emissions-intensive industries adapt to the future low-emissions economy. There can also be co-benefits such as job creation and improvements to national competitiveness and energy security, through diversification of a country's exports and energy mix.

In economic terms, innovation can be considered a 'public good'. That is, the benefits of a firm's innovation often extend beyond the innovating firm, to benefit society as a whole and it may be difficult for the firm to capture the entire value of its innovation. For this reason, these 'spillovers' are likely to result in less innovation investment by private firms than is optimal for society (Global Commission on the Economy and Climate 2014). There is a case for government intervention to support greater innovation, particularly for research, development and demonstration.

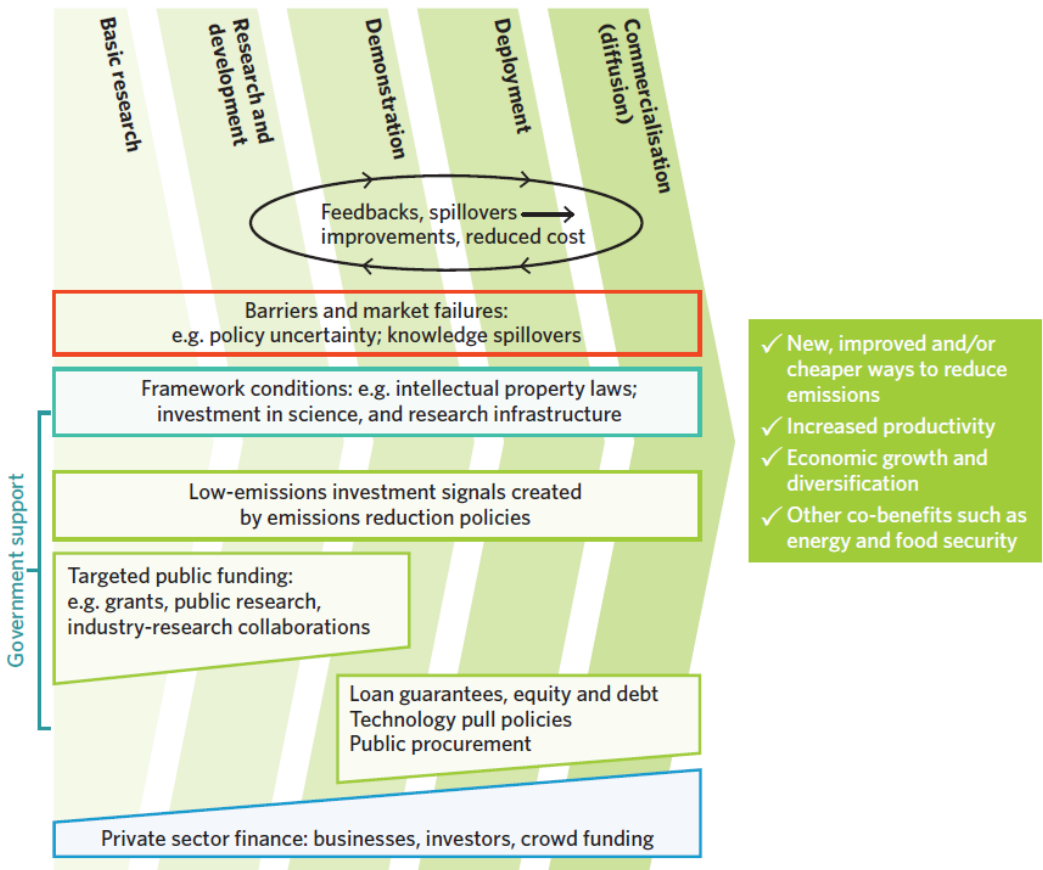
Innovation is an Australian Government priority. The Government committed \$9.7 billion towards science, research and innovation in the 2015–16 Budget (DIIS 2015c). The Government has announced a package of measures under a National Science and Innovation Agenda that builds on those already in place to support innovation, costing about \$1.1 billion between 2015–16 and 2018-19 (PM&C 2015). A new, independent body, Innovation and Science Australia, will provide strategic whole-of-government advice on science, research and innovation (DIIS 2016c). The Government has committed to increase its support for clean energy research and development from \$104 million in 2015 to \$208 million by 2020 (Mission Innovation Secretariat 2016).

This chapter identifies the barriers to innovation and what governments can do to help overcome them at different stages of the innovation process, or ‘chain’. It also discusses the areas where it may be useful to target Australian Government support for low-emissions innovation as part of the climate policy toolkit.

8.1. INNOVATION SUPPORT IS AN IMPORTANT PART OF THE CLIMATE POLICY TOOLKIT

Innovation takes place in phases, which together form what is often referred to as the ‘innovation chain’. The phases of innovation are: basic research, research and development, demonstration, deployment and commercialisation (Figure 12). There are feedback loops throughout the chain, where learning-by-doing leads to further improvements.

FIGURE 12 THE ROLE OF GOVERNMENT SUPPORT ACROSS THE INNOVATION CHAIN



Source: Climate Change Authority.

Governments support innovation by investing in enablers such as education and infrastructure; encouraging business investment; facilitating access to data; and removing regulatory obstacles (PM&C 2015). Governments can help deliver the human and financial capital needed for innovation to take place. Business innovation is also affected by framework conditions such as corporate tax rates, competition regulation and intellectual property laws (Daley et al. 2013).

Policy measures can help drive low-emissions innovation throughout the innovation chain. Policies such as enhanced safeguards, market mechanisms to reduce emissions or energy efficiency standards can give firms an incentive to innovate to find new and improved ways to comply at least cost. They create a market for low-emissions technologies and services and allow them to compete with more emissions-intensive technologies and services.

Several stakeholders noted in their Report Two submissions that government support for low-emissions innovation plays an important complementary role to emissions reduction market mechanisms. These included AGL Energy, Alan Pears, the Australian Petroleum Production and Exploration Association, Gas Energy Australia, Investor Group on Climate Change, U3A Climate Conversation Group and University of New South Wales.

Government support is often needed to help alleviate innovation barriers. Addressing the multiple barriers at different points in the innovation chain is likely to require a range of interventions suited to each stage (Global Commission on the Economy and Climate 2014). Public funding is often needed for research, development and demonstration to take place. Debt and equity funding assists deployment and commercialisation of low-emissions projects and technologies. Other measures can help overcome policy and project risks, including regulatory and market mechanisms to reduce emissions and energy efficiency standards. Effectively implementing such a range of policy interventions requires a coherent innovation strategy with priorities, and stable funding (Global Commission on the Economy and Climate 2014).

The Australian Government supports the different stages of low-emissions innovation in a range of ways, some of which are outlined in Table 8.

8.1.1. RESEARCH AREAS OF PARTICULAR INTEREST TO AUSTRALIA

Australia is part of the global economy and can adopt ideas and technologies developed elsewhere—this is something that has been done well in Australia in the past. According to the Grattan Institute, 98 per cent of the productivity uplift in Australia from innovation is likely to be the result of applying ideas that were first invented overseas (Daley et al. 2013). This means that it will often be preferable for Australia to be a technology taker rather than duplicating research efforts in other countries. Technologies with broad application and commercial potential are likely to be developed outside Australia (Garnaut 2008), so it may be most appropriate to prioritise Australia's public financial support for low-emissions innovation where:

- there is potential to substantially reduce Australia's emissions
- Australia has particular challenges, strengths or opportunities
- the private sector and other countries are unlikely to prioritise their efforts.

TABLE 8 INNOVATION SUPPORT MECHANISMS USED BY THE AUSTRALIAN GOVERNMENT

	TYPE OF SUPPORT	EFFECT ON INNOVATION CHAIN	AUSTRALIAN EXAMPLES
research, development and demonstration (RD&D)	Tax incentives	Give businesses a financial incentive to innovate	Research and Development Tax Incentive Early Stage Venture Capital Limited Partnerships and Venture Capital Limited Partnerships
	Publicly funded research, development and demonstration	Research grants Support RD&D undertaken by universities and businesses by reducing the upfront costs Help leverage private finance	Australian Research Council's National Competitive Grants Australian Renewable Energy Agency (ARENA) Carbon Capture and Storage Research Development and Demonstration Fund
		Public research institutions Undertake RD&D in the public interest Foster collaboration	Commonwealth Scientific and Industrial Research Organisation (CSIRO) International Agricultural Research Centre Rural Industries Research and Development Corporation
		University funding Supports RD&D undertaken by universities and builds human capital and research infrastructure	University block funding
		Industry-research collaborations Foster collaboration Provide financial support	Cooperative Research Centres (CRCs) Industry Growth Centres Entrepreneurs Programme
deployment and commercialisation	Debt and equity co-investment Loan guarantees Risk insurance	Address perceived policy risk Catalyse private sector financing	Clean Energy Finance Corporation (CEFC)
	Market-based mechanisms Voluntary carbon pricing Technology pull policies Regulation Public procurement	Shift market towards low-emissions technologies and practices	Emissions and efficiency targets Renewable Energy Target Emissions Reduction Fund Safeguard mechanism Energy efficiency standards

Source: Climate Change Authority.

The International Energy Agency (IEA) and Intergovernmental Panel on Climate Change have identified carbon capture and storage (CCS) as an essential technology to meet the global 2 degree goal (IPCC 2014; IEA 2014). While the individual aspects of the CCS chain have been proven to be technologically feasible, there are few demonstration projects around the world and it has yet to be proven commercially. In the future, using CCS in conjunction with bio-energy (BECCS) could enable the drawdown and storage of emissions already in the atmosphere (a 'negative emissions technology'), which could support efforts to limit warming to 1.5 degrees. CCS could also help reduce emissions from industrial processes, such as in the production of cement, iron and steel. The IEA has estimated that the commercialisation of CCS could reduce the cost of electricity sector decarbonisation by around US\$1 trillion between 2012 and 2035 (IEA 2013). Developing expertise in CCS could position Australia as a future exporter of this technology, to assist mitigation efforts in other countries and allow Australia to utilise its own resources of coal and gas.

Agriculture is a key export sector for Australia and accounted for 14 per cent of Australia's emissions in 2013–14 (DoEE 2016). Australia is regarded as a leader in agricultural innovation and developing effective emissions reduction methods may offer benefits in a low-emissions global economy. The challenge is to work out how to feed the world's growing population and continue to meet the demand for Australian food without producing more emissions (particularly methane emissions from livestock and nitrous emissions from fertiliser application). Once there are established and proven methods for reducing agriculture emissions, farmers can sell credits in offset schemes (Chapter 11). Technologies and methods in this sector are highly specific to local factors and innovative emissions reduction methods are still emerging—for example, genetic improvements, improved nutrition and supplements, improved fertilisers, and better management of manure and herds. The New South Wales Farmers' Association noted this in its Report Two submission, and the National Farmers Federation said:

...many emissions reduction technologies are still in the embryonic phase of research and development and are not yet "method ready". To fully unlock the potential for abatement in agriculture, further investment in R&D is required (Report Two submission, p. 5).

Beyond CCS and agriculture, there may be other areas where it would be strategically useful to focus Australia's public innovation support, such as large-scale solar, geothermal, and nuclear energy.

It would be useful for Innovation and Science Australia to consider which areas of low-emissions innovation may provide strategic benefits for Australia, and reflect this in its long-term plan for Australia's innovation and science system, which is due in late 2017 (DIIS 2016c).

8.2. EARLY RESEARCH, DEVELOPMENT AND DEMONSTRATION

8.2.1. BARRIERS AND MARKET FAILURES

There can be barriers at the early stages of innovation that make it difficult for businesses to access the finance needed to pursue research, development and demonstration. Private sector funding for early stage research and development can be difficult to secure due to the uncertainties involved. The new technology or practice being pursued may not deliver the promised results, and may not be cost-competitive with existing technologies or practices for a long time (or ever). Private sector funding can be even more difficult to secure when policy settings are perceived as unstable, as investors are not sufficiently confident about the future returns they might see on their investment.

Knowledge ‘spillovers’ can also cause suboptimal private sector investment in research, development and demonstration. Businesses may be reluctant to be a pioneer because competitors could replicate or improve an innovation without the returns accruing to the original investor. Intellectual property rights go some way to protecting investments in innovation and addressing this market failure, but the market is still likely to produce less innovation than is socially optimal. For this reason, there is often a case for government intervention to support greater innovation, particularly in technologies or processes with strong social and environmental benefits. With support, more innovation and more spillovers can trigger innovation cycles that can lead to new and more affordable emissions reduction methods and technologies becoming available (Garnaut 2008; Global Commission on the Economy and Climate 2014).

8.2.2. TARGETED PUBLIC FUNDING FOR RESEARCH, DEVELOPMENT AND DEMONSTRATION

Long-term benefits can arise from publicly funded early research, development and demonstration of new or improved emissions reduction methods and technologies, particularly when funding is targeted at areas where innovation would be in Australia’s strategic national interest (Section 8.1.1). As the example in Box 9 shows, targeted public funding for early research and development of low-emissions technologies can trigger innovation cycles, which bring economic and environmental benefits.

BOX 9 AUSTRALIAN GOVERNMENT SUPPORT FOR SOLAR RESEARCH WAS AN IMPORTANT INPUT TO THE DEVELOPMENT OF AFFORDABLE SOLAR PHOTOVOLTAIC TECHNOLOGY

The University of New South Wales (UNSW) is a world leader in solar photovoltaic (PV) technology development. It has set several world records in sunlight-to-electricity conversion efficiency over the past three decades (Green 2015; da Silva 2016). Analysts estimate that by 2018 around 60 per cent of the solar cells manufactured worldwide will use technology pioneered by UNSW, and 85 per cent by 2025 (Wang 2015; Green 2016a). The university’s work has been supported by Australian Government grants (da Silva 2016). Solar PV has become more affordable and widespread due to the combined effect of low-cost Chinese manufacturing, strong German policy support through feed-in-tariffs, and the availability of capital from the United States. In turn, Australians are able to import affordable solar PV, which has helped to bring down Australia’s electricity emissions. UNSW is now working on new techniques to reduce manufacturing complexity and create cheaper cells (Green 2016b).



Public funding can help alleviate barriers and address market failures affecting the early stages of innovation. Government support and incentives for early research and development can be provided in different ways. For example, the Australian Government provides tax incentives and grants, funding for research institutions and universities, and engages in industry-research collaborations. All of these can be useful in supporting the early stages of low-emissions innovation.

- Tax incentives—The Research and Development Tax Incentive encourages businesses to invest in research and development by offering them favourable tax treatment in the form of a refundable offset (DIIS 2016a). It is an indirect form of support designed to let the market determine what research to pursue.
- Grants programs—Grants help address funding barriers at the early stages of innovation, and can help catalyse private sector funding. Local Government New South Wales and Sydney Water noted the important role of grants in their Report Two submissions, as did several university researchers and renewable energy businesses during stakeholder consultations. Australia provides non-sector-specific competitive grants through the Australian Research Council and other government agencies, as well as targeted grants, for example through the Australian Renewable Energy Agency (ARENA). ARENA has committed at least \$1.1 billion so far to support over 230 projects, which has helped catalyse \$1.6 billion in funding from the private sector (ARENA 2015). Grants programs must be carefully designed and administered to achieve value for money and ensure public funding stimulates additional research and development rather than displaces what the private sector would have otherwise funded on its own (PC 2008).
- Public research institutions—Scientists and engineers at publicly funded research institutions such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) often undertake longer term, higher risk research, including at the very early stages of the innovation chain (OECD et al. 2015). The CSIRO has delivered many inventions, innovations and knowledge breakthroughs, often in collaboration with businesses. It is developing technologies such as solar thermal and photovoltaics, more efficient and sustainable fossil fuel technologies, energy storage, energy efficiency systems and management tools (CSIRO 2016a).
- University block funding—Universities provide the research infrastructure for grant recipients to undertake their research. They help develop human capital and research that can lead to innovative new and improved technologies and processes. For example, UNSW's research on solar PV technology was made possible by block funding and grants.
- Industry-research collaborations—Increased collaboration is a key pillar of the Government's National Innovation and Science Agenda (PM&C 2015). Bringing together experts from universities and research institutions with end users from business and industry can facilitate research that responds to the needs of business, industry and the community. In Australia, Cooperative Research Centres (CRCs) are helping to develop CCS technology (CO2CRC 2016), products and services to reduce emissions in the built environment (Low Carbon Living CRC 2016), and improvements to pastures and cattle (Dairy Futures CRC 2016). The Government also fosters collaboration through Industry Growth Centres, such as National Energy Resources Australia (DIIS 2016d). The Entrepreneurs' Programme, including an Incubator Support Programme, supports businesses with co-funded grants, practical advice and collaboration opportunities (PM&C 2015; DIIS 2016a).

More important than the form of support for the early stages of innovation is that there is evidence of adequate, stable and predictable funding that is consistent with the Government's overall innovation strategy and priorities (Chiavari & Tam 2011). UNSW noted in its Report Two submission that 'on-off' research and development funding is less cost effective (p. 14). The Grantham Research Institute and Global Green Growth Institute recommend slow and sustained increases in low-emissions research and development investment, including long-term public research and development targets (Dechezleprêtre et al. 2016). Australia has set itself a target to increase its support for clean energy research and development from \$104 million in 2015 to \$208 million by 2020. Funding will support projects with the private sector, activities at national laboratories, university grants and collaborative research centres, for energy efficiency, renewable energy, nuclear energy, electric grid technologies, CCS, and advanced transportation systems and fuels (Mission Innovation Secretariat 2016).

The Authority is of the view that early stage research, development and demonstration is a priority for government support. Targeted public funding is useful to ensure nationally significant research and development takes place (OECD et al. 2015). Governments can target funding in different ways. For example, targeted grants programs specifically earmark funding for particular projects and sectors. Governments can also issue policy directions that agencies must consider when making innovation funding decisions. Australia's Chief Scientist has set science and research priorities, one of which is energy (DIIS 2016e). The Government could consider whether this type of guidance could be used and framed as key performance indicators, or other accountability criteria for evaluation and to inform future funding decisions. Regular review of priorities is important to ensure public funding is not being targeted at areas where technologies and processes have become self-sustaining, or where technologies have failed to develop as hoped (Chiavari & Tam 2011; Global Commission on the Economy and Climate 2014; OECD et al. 2015).

8.3. DEPLOYMENT AND COMMERCIALISATION

Financial support from governments is less necessary at the later stages of low-emissions innovation, because measures such as emissions reduction market mechanisms and energy efficiency standards give businesses and consumers an incentive to invest in low-emissions technologies, products, services and practices.

Technology pull policies like mandatory renewable energy targets, auctions for contracts for difference and public procurement are often used to strengthen investment signals where policies are not sufficient to promote the desired changes to investment decisions. They can help reduce up-front costs that can deter businesses and consumers from investing in low-emissions technologies (Chapter 9).

Even with enhanced safeguards or market mechanisms in place, uncertainty about emissions reduction targets and the stability of long-term climate policies can make private sector financiers reluctant to invest in or expect higher returns from low-emissions investments. Governments can help reduce the risk profile of low-emissions innovation projects by providing risk insurance, loan guarantees, and debt or equity funding as a co-investor. Government participation can help boost investor confidence and catalyse private sector co-financing. Many countries are using green investment banks as an institution to provide this kind of financial support. They have been introduced in the United States, the United Kingdom, Europe, Asia and Australia (OECD 2015).

BOX 10 OUTLOOK FOR ELECTRICITY STORAGE

Improved energy storage has the potential to transform the way electricity is currently used by addressing the intermittency of renewable generation and reducing the need for additional generation and network capacity at times of peak electricity demand (Brinsmead et al. 2015). Increased use of energy storage could reduce costs for network operators, electricity consumers and off-grid energy users. Large and small scale storage options are at varying stages on the innovation chain. Pumped hydroelectricity storage is widely used globally; new fresh-water storage in Australia seems unlikely due to issues such as site availability; salt-water storage may be feasible but more research is needed (Hearps et al. 2014; AECOM 2015). Compressed air energy storage faces similar site limitations due in part to its need for large underground caverns (AECOM 2015). Several other storage technologies are at the deployment and diffusion stages, including some thermal (molten salt), mechanical (flywheels) and electro-chemical (batteries) types. Large- and small-scale batteries are the most versatile and have many relevant applications, including augmenting distributed renewable electricity generation (AECOM 2015).

The largest barrier to wider deployment of battery storage—both small and large scale—is cost. However, studies project that by 2020, the cost of some battery technologies will almost halve compared to their costs in 2014 or 2015 (IRENA 2015; Brinsmead et al. 2015; AECOM 2015). In some states, projections indicate grid-scale energy storage could compete with gas peaking plants to help manage load in 20 years. Battery storage could be viable for households by 2022 under current tariff structures (Brinsmead et al. 2015). The decrease in battery storage prices is being driven by technology improvements and increases in production, including from the US\$5 billion Tesla Gigafactory in the United States that produces batteries for cars, home and commercial storage (AECOM 2015; Hull 2016).

Countries such as China, Germany, Japan and the United States are leading the development of battery storage technology, in part due to subsidies for research and development and subsidies for technology deployment (IRENA 2015; AECOM 2015). There have also been some significant contributions by Australia, including work on zinc bromide flow batteries (Redflow Limited 2015, 2016) and the CSIRO's development of the advanced lead-acid battery (IRENA 2015).

The Australian market for battery storage is in its infancy (AEMO 2015), but Australia provides a good test case for widespread deployment due to its high penetration of rooftop PV, high solar radiation and a sophisticated electricity network. The Australian Energy Market Operator estimates residential battery capacity will rise from less than 0.1 GWh in 2016 to a useable capacity of 6 GWh in 2035–36, which could reduce maximum electricity demand for all regions together by around 1.5 per cent (AEMO 2016b). Large-scale battery storage capacity in Australia is less than 5 MW, with about 8 MW in planning or construction (AECOM 2015; CEC 2015).

Given the rapid cost reductions of battery technologies and numerous battery trials in Australia, it is important that policies in the electricity sector to reduce emissions are technology neutral so they do not deter the deployment and commercialisation of battery storage technology.

In its Report Two submission, the Investor Group on Climate Change noted the importance of an independent financing institution like Australia's Clean Energy Finance Corporation (CEFC) (p. 6). The CEFC is an investment bank that provides debt and equity funding for low-emissions projects and technologies, typically as a co-financier with a private sector investor. It has specialist expertise to assess the particular project risks that can accompany low-emissions technologies and practices. CEFC finance is provided as close to commercial terms as possible, in line with investment mandates set by the Government and consistent with its enabling legislation. The CEFC's core portfolio focuses on projects at the later stages of development, which have a positive expected rate of return. A \$1 billion Clean Energy Innovation Fund was recently set up within the CEFC to support projects with a higher level of risk—that is, projects at an earlier innovation stage (Australian Government 2016a). The CEFC has invested around \$2.3 billion since its inception in 2013, contributing to projects with a total value of \$5.7 billion (CEFC 2016b). Once constructed and operational, projects supported by the CEFC in its portfolio as at 30 June 2015 are estimated to reduce 4.2 Mt CO₂-e annually (CEFC 2015a).

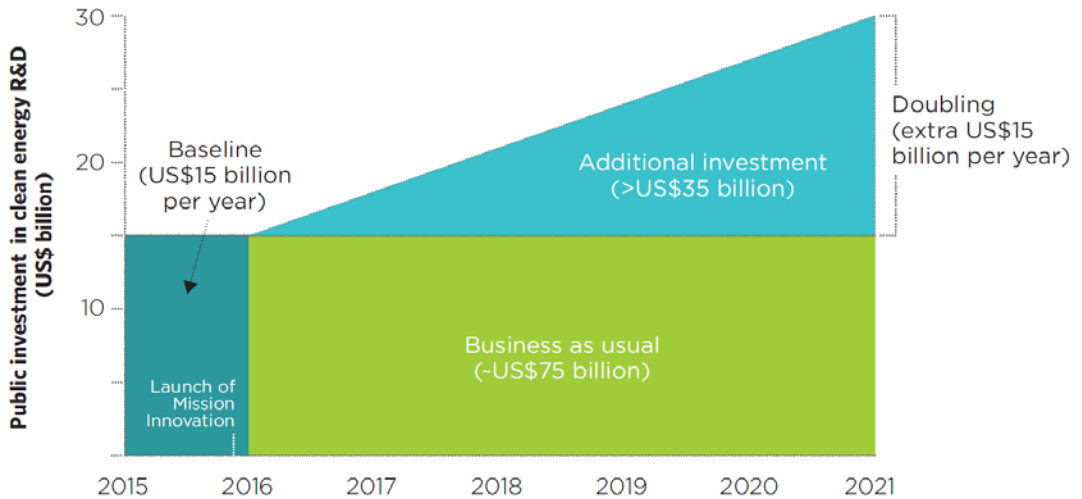
The role for governments to help address financing challenges at the deployment and commercialisation phases is likely to diminish as other climate change policies become more established. In the United Kingdom, for example, the Government has launched a process to move its Green Investment Bank into the private sector (UK Green Investment Bank 2016). This follows nearly a decade of emissions pricing and ambitious emissions reduction targets.

In some cases there may be a need to test overseas experience with emerging technologies against the unique features of Australia's market, typography or other domestic circumstances. Large-scale electricity storage could meet this test. The outlook for energy storage technologies is discussed in Box 10.

8.4. INTERNATIONAL COOPERATION

International cooperation can enable more efficient innovation (PC 2008). At its best, international cooperation can reduce duplication of research efforts, pool partners' comparative strengths and set in motion a global 'green imitation machine' in developing countries, which will bring down the costs of mitigation technologies (Aghion et al. 2014). Cooperation could facilitate the uptake of Australian technology and services in other countries and allow Australia to take advantage of developments elsewhere. Research and development efforts in developed countries and technology transfer to developing countries will allow developing countries to reduce emissions.

Australia is cooperating with other countries to support low-emissions innovation through a range of partnerships. At the Paris Climate Conference, Australia and 19 other countries joined 'Mission Innovation', committing to work together and with the private sector to accelerate global clean energy innovation. Participating countries pledged to double spending on clean energy research and development over the next five years (Mission Innovation 2016) (Figure 13). The Breakthrough Energy Coalition is the private sector counterpart to Mission Innovation. Its members are influential investors that plan to take the investment risks needed to help bring clean energy to the marketplace (Breakthrough Energy Coalition 2016).

FIGURE 13 PLEDGES BY THE 20 MISSION INNOVATION COUNTRIES


Source: Mission Innovation Secretariat 2016.

Australia also supports and participates in other initiatives such as the Global Carbon Capture and Storage Institute, Carbon Sequestration Leadership Forum and Global Research Alliance on Agricultural Greenhouse Gases. Australia collaborates bilaterally with countries including the United States, China, India, Japan and the Republic of Korea.

RECOMMENDATIONS

- R.20. Australia should continue to support low-emissions innovation through targeted public funding for research, development and demonstration as a priority and through debt and equity funding for the deployment of low-emissions projects and technologies.
- R.21. Australia should continue to cooperate with other countries to support low-emissions innovation, focusing in particular on areas where innovation is in Australia's strategic interest.

CHAPTER 9. POSSIBLE ADDITIONAL POLICIES FOR THE ELECTRICITY SECTOR

Chapter 5 outlined the Authority's recommendation that an emissions intensity scheme should be introduced in 2018 to drive cost-effective emissions reductions in the electricity supply sector. This chapter considers whether other policies should also be applied to further reduce emissions in that sector and, if so, which ones.

The Authority considered the case for adding other policies to an emissions intensity scheme in the electricity generation sector. Such policies could include technology pull policies that target the entry of low-emissions generation, or policies that regulate the entry or exit of high-emissions generators.

Decision making here is finely balanced. In principle, additional regulatory or technology pull policies can reduce the costs of new low emissions technologies through targeted support and provide additional investor confidence. On the other hand, adding policies to the emissions intensity scheme could increase costs and the complexity of the regulatory environment. The prospect of new policies being implemented can also add to uncertainty as investors may delay new investment until the measures are designed and in place.

On balance, however, the Authority has reached the view that adding further policies in the electricity generation sector could risk adding to uncertainty rather than helping secure low emissions investment decisions.

As outlined in Chapter 5 and the electricity research report (CCA 2016), the Authority recommends that the Government implement an emissions intensity scheme in the electricity sector in 2018 because:

- the sector is Australia's largest single source of emissions and is well suited to a market mechanism to reduce emissions
- it will achieve cost-effective emissions reductions in the sector that can be scaled up over time
- the price impacts on Australian households and businesses will be lower than under other types of market mechanisms.

The Authority recommends that, to improve investor certainty, the emissions intensity scheme should be closed to international permits and credits and most sources of domestic offsets except for eligible energy efficiency credits (Chapter 5).

Nevertheless there may be a need to further improve investor certainty and support cost-effective emissions reductions through policies additional to the emissions intensity scheme.

This chapter considers:

- whether there is a need for policies in addition to an emission intensity scheme in the sector
- which additional policies are likely to best support the emissions intensity scheme
- the potential role for these policies if the emissions intensity scheme is not implemented in the sector.

The focus of this chapter is on policies that can affect investment decisions for large-scale generation on the supply side of the electricity sector, rather than policies that affect the demand side. Measures targeting the demand side, such as white certificate schemes for energy efficiency, are discussed in Chapter 7. Small-scale generation is currently supported by the Small-scale Renewable Energy Scheme (SRES), which will begin to phase out from 2017. Small-scale low-emissions technologies (including storage) have drivers other than climate policy, such as the structure of electricity tariffs, and their uptake is likely to continue to grow strongly in the absence of additional supporting policies (Jacobs 2016; AEMO 2016b).

Before proceeding it is useful to emphasise that emissions reduction policy is required to decarbonise the Australian electricity supply sector—that is, falling technology costs will not achieve this outcome automatically (Box 11).

9.1. THE COSTS AND RISKS OF ADDITIONAL POLICIES ARE LIKELY TO OUTWEIGH THEIR BENEFITS

The emissions intensity scheme should be the primary emissions reduction policy in the electricity supply sector, as it will provide an incentive that benefits low-emissions generators over higher-emissions generators. The Authority considered whether there is a case for policies in addition to an emission intensity scheme to help reduce policy risk and deliver additional emissions reductions in the sector. Possible additional policies include:

- standards that regulate the emissions intensity of new generators ('new generator emissions standards')
- policies that directly support the entry of new low-emissions generators ('technology pull' policies)
- regulations that require the retirement of existing high-emissions generators ('regulated closure' policies).

While a closed emissions intensity scheme may promote investment certainty, it may still be affected by policy risk. This could delay investments, increase their cost of financing, or both. Given the history of climate policy in Australia it may take some time to build investor confidence in the longevity of the emissions intensity scheme. For example, if investors do not believe the scheme will endure, they may be less likely to take long-lived investment decisions in the 2020s consistent with a least cost route to decarbonising the supply sector over the period to 2050.

BOX 11 LOW-EMISSIONS INVESTMENT IN AUSTRALIA REQUIRES POLICY SUPPORT

New low-emissions investments in Australia need to out-compete and displace the incumbent coal fleet that provided over 60 per cent of Australia's electricity in 2013–14 (DIS 2015). The ongoing running costs of the existing coal fleet are typically low; a large number of coal generators in the National Electricity Market have remained viable over extended periods while earning average (inflation adjusted) market prices of around \$40 per megawatt hour (AEMO 2016a).

While the cost of building new renewable generation in Australia has fallen substantially in recent years, these generators are likely to remain uncompetitive with existing coal plant for the foreseeable future. The 2015 Australian Power Generation Technology (APGT) report indicated that the average cost of generating electricity from a new wind farm in Australia was around \$93 to \$114 per megawatt hour, while utility-scale solar photovoltaic (PV) generation was higher again at \$125 to \$161 per megawatt hour depending on the technology used (EPRI 2015).

Recent Australian projects suggest that, with concessional finance or secure government contracts to reduce risk, project costs can be lower than these levels. The low cost of these projects is likely to reflect, in part, that government-backed contracts or grants, lower commercial risks and therefore project financing costs.

While renewable costs vary between projects and are likely to continue to fall over time, in general they are likely to remain substantially higher than the ongoing cost of incumbent coal plant for the foreseeable future. This means that climate policy is required to drive substantial investment in low-emissions generation in Australia.

In principle, residual policy uncertainty could be mitigated through implementing supporting policies alongside the emissions intensity scheme. Supporting policies may help reduce policy risk and improve investor confidence by directly targeting long-lived entry and exit decisions such as retiring existing high-emissions generators or building new low- or zero-emissions generators. These decisions are most likely to be affected by policy uncertainty associated with market mechanisms (TCI 2016). Several modelling studies have indicated that these actions are likely to be more important for substantial emissions reductions over the longer term than other actions such as fuel-switching across existing plants (see for example: CCA 2014a; ClimateWorks et al. 2014a; Jacobs 2016). Supporting policies can also deliver reductions additional to those that would be delivered by a market mechanism. For example, a technology pull policy would typically result in more investment in new low-emissions plant than would happen under a market mechanism alone, and therefore greater emissions reductions (CCA 2012).

Many Report Two submissions argued for additional electricity sector policies alongside a market mechanism. This included submissions by both energy industry stakeholders and environmental organisations. AGL Energy stated that 'a range of policies are likely to be needed', while Origin Energy expressed support for the Authority's 'toolbox' approach, and supported regulation to complement a market mechanism (Report Two submissions, p. 3, pp. 1, 3–4). The Australian Energy Council said that the main policy instrument should be

market-based because such policies discover and exploit the lowest cost abatement, but that there 'may still be a role for complementary policies that entail modest regulation', noting that such policies would 'require careful consideration' (Report Two submission, p. 1). Meanwhile, WWF Australia stated that supporting policies such as the Renewable Energy Target (RET) provide 'investor confidence and help to support the emergence of affordable clean technology', and The Climate Institute noted that 'unless backed by other measures, such as a coal closure regulatory measure, weak carbon signals would defer the necessary transformation to a later date' (Report Two submissions, p. 1).

The Authority notes that adding policies to the emissions intensity scheme could reduce the cost effectiveness of the policy toolkit. The Authority's modelling indicates that implementing additional policies in combination with a market mechanism will tend to increase costs compared with a market mechanism operating on its own.

While the main benefit of additional policies is to reduce policy uncertainty, implementing these policies could introduce new uncertainties and further increase costs. If investors anticipate that additional policies will be implemented they may delay investment decisions, with the result that some emissions reductions may not occur and the overall costs of emissions reductions could rise.

On balance the Authority considers that the increased cost and additional sources of uncertainty arising from additional policies are likely to outweigh their potential benefits. While additional policies can directly target important emissions reduction decisions such as investment in low-emissions generation or retirement of high-emissions generation, an emissions intensity scheme should provide a broader and more cost-effective signal to these decisions. This is particularly the case where policy uncertainty is reduced through clear policy directions agreed by national, state and territory governments.

9.2. TECHNOLOGY PULL POLICIES

Decarbonising the electricity sector will require substantial investment in low-emissions generation over the coming decades. An emissions intensity scheme will provide a strong incentive to invest in low-emissions generation. However, as discussed above, it is possible that uncertainty over the future of such a policy could affect investor confidence, potentially increasing costs or delaying construction of these assets.

In that environment, there may be a case for expanding the role of technology pull policies in Australia to complement the Authority's proposed emissions intensity scheme. Technology pull policies directly encourage the deployment of additional renewable and/or low-emissions generation. The main national technology pull policy currently in operation is the Australian Government's RET. In addition, there are various implemented or planned technology pull policies at the state and territory level, such as the ACT Government's renewable energy auctions, the Victorian Government's planned auctions for new renewable projects and the Queensland Government's 'Solar 120' initiative to support new large-scale solar.

The existing national RET and existing and some of the planned state and territory technology pull policies will assist Australia to achieve its emissions reduction goals. To promote policy stability and investor certainty the Authority is of the view that the current RET target should not be modified.³ As the target rises to its ultimate level of 33,000 GWh in 2020 (which it maintains until the scheme ends in 2030) it will play an important role in driving new investment prior to

³ Support for small-scale generation under the SRES, will begin to phase out from 2017 and end in 2030 and should also remain unmodified.

2020. The Authority's analysis indicates that the RET and other technology pull policies can operate alongside an emissions intensity scheme to encourage investment in low-emissions generation and reduce emissions in the sector (CCA 2016). The impact of any additional policies or changes to the current RET should be considered carefully and care taken to avoid policy-induced changes to the value of investments made under the current scheme.

In consultation on Report Two several stakeholders, including environmental organisations, argued for a continued or enlarged RET; electricity generators argued for continuing incentives for deploying renewables but generally did not suggest particular policy mechanisms. The Australian Chamber of Commerce and Industry noted that the RET had been successful in encouraging wind and solar investment, but with relatively high costs of abatement (Report Two submission, p. 12). The Energy Networks Association cited preliminary results from modelling commissioned from Jacobs which found that a policy package that included a low emissions target could lower overall costs of reducing emissions in the stationary energy sector.

The Authority has assessed the effects of technology pull policies in its electricity research report. This analysis assessed the performance of technology pull policies both in isolation and in combination with a market mechanism. Electricity sector modelling indicated that while technology pull policies are likely to be less cost effective than an emissions intensity scheme in isolation, they tend to be more cost effective than regulatory policy options (CCA 2016).

States and territories such as Queensland and Victoria propose substantial increases in renewable energy uptake in coming years, and are likely to need technology pull policies to achieve these targets. While these policies will assist Australia to meet its emissions reduction objectives, they could also result in uneven investment incentives across jurisdictions, increasing the overall cost of meeting those objectives.

Increasing use of technology pull policies could also complicate the operation of the electricity system and increase concerns about impact of intermittent generation on electricity market reliability. This places greater importance on the integration of climate and energy policy, a point recognised by many stakeholders. Given policies are being developed at both the state and national level, the COAG Energy Council will play an important role in managing the transition to a low-emissions electricity sector. This was noted by the Council late last year:

[Australian energy Ministers have] agreed to a national, cooperative effort to better integrate energy and climate policy, with a clear focus on ensuring that consumers and industry have access to low-cost, reliable energy as Australia moves towards a lower-emissions economy.

The successful integration of carbon and energy policies will be critical to meeting Australia's emissions reduction target of 26 to 28 per cent below 2005 levels by 2030. Ministers will develop a national approach to connect environmental outcomes and energy policy in the interests of consumers. (COAG Energy Council 2015a).

The importance of these interactions was further recognised by the COAG Energy Council in its August 2016 meeting, where it requested officials to consider the economic and operational impacts of existing state and territory emissions reduction policies (COAG Energy Council 2016).

Given the interactions between state and national climate policies, and between climate policies and the energy market, the Authority considers these interactions should be coordinated through the COAG Energy Council to ensure that substantial and scalable emissions reductions can be achieved cost-effectively on a national basis.

RECOMMENDATION

- R.22. To promote policy stability and investor certainty the existing Large-scale Renewable Energy Target (LRET) should be unchanged to 2020 and remain in place until 2030. Support for small scale technologies through the Small-scale Renewable Energy Scheme (SRES) should also continue and phase out as planned.

9.3. NEW GENERATOR EMISSIONS STANDARDS

Another important lever for reducing emissions is through preventing investment in new high-emissions generators. This could be achieved through emissions standards that restrict entry of high-emissions generators into the market. These standards are typically technology-neutral and set the maximum permissible emissions intensity for new plants.

New generator standards could improve the cost effectiveness of the policy toolkit alongside an emissions intensity scheme. Standards would give investors in new low-emissions generators confidence that they would not have to compete with new, low-cost but high-emissions generators. This in turn would reduce risk and potentially reduce capital costs. While they would have some administrative costs, standards would be likely to create a relatively low extra regulatory burden.

The electricity research report notes that standards can be difficult to set and adjust as technologies change (CCA 2016). Even if a standard were technology-neutral (by for example referring to a given level of emissions intensity), setting it requires consideration of the costs and benefits of setting it at different levels. For example, a standard should avoid restricting investment in gas peaking generation as this would have undesirable impacts on the electricity market. Peaking gas plants are used infrequently, and therefore produce relatively small volumes of emissions, but are valuable to the reliability of the electricity system as a whole.

Several stakeholders, including AGL Energy, noted their support for an emissions intensity standard for new generators in their submissions to Report Two of the Special Review (Report Two submission, p. 3).

The Authority's view is that there is not a strong case for implementing new generator emissions standards alongside the emissions intensity scheme to provide additional certainty for investors. Agreeing on and administering standards would have administrative costs, and new high-emissions plants are not currently expected to be built. Therefore the Authority does not recommend such a measure.

9.4. REGULATED CLOSURE

Decarbonising the sector will require withdrawal of high-emissions generators over the coming decades. An emissions intensity scheme will encourage existing low-emissions generators to increase output and new low-emissions generators to enter the market. This in turn will reduce generation and profits of high-emissions generators, and over time some are likely to close. There may be a case to drive this closure directly through regulation.

All electricity generators which made Report Two submissions supported consideration of explicit mechanisms for the exit of older, high-emissions power stations. Several cited barriers to exit for high-emissions generators. For example, EnergyAustralia stated that:

Barriers to the closure of excess capacity....conspire to keep the most emissions intensive generators operating in the market for longer than necessary for security of supply, effectively 'crowding out' new investment in low and renewable energy generation... The pros and cons of different options for Government facilitation of the orderly exit of high emission electricity generation ought to be evaluated as part of the carbon policy development process. (Report Two submission, p. 3)

The Climate Institute (TCI) also recently investigated the role of a regulated closure policy in addition to a market mechanism. TCI argues that:

Measures that directly target an orderly phase out of high-carbon generation over the next 15-20 years and de-risk clean energy investment would smooth the sector's emission reduction pathway and reduce the risks of disruptive adjustment in the future. (TCI 2016, p. 1)

The Authority has considered the performance of regulated closure in detail—both in isolation and in combination with a market mechanism (CCA 2016). This analysis indicates that regulated closure of generators represents a high cost policy when implemented in isolation. It has also identified a number of practical issues that may affect the cost effectiveness and equity of this approach:

- A 'closure sequence' would have to be fixed and announced well in advance to provide clarity for generators and investors, but this decreases the flexibility of the policy toolkit (for example, to changes in demand) and could increase the risk of high prices and reliability issues.
- Given the largely private ownership of generators in Australia, it may be difficult to implement a closure policy without some form of payment or compensation. Paying for closure could create perverse incentives and encourage generators to ignore economic reasons to exit.
- There would be significant equity and precedent issues associated with policies that require taxpayers or consumers paying to meet the remediation obligations that properly belong to generators.

While the Authority recognises the views of many stakeholders that there is a role for a regulated closure policy, it is not convinced that the risks associated with the policy can be readily overcome.

CHAPTER 10. TRANSPORT

Transport is an important and growing source of Australia's emissions, and the sector has many opportunities for emissions reductions. Australia's climate policy toolkit should include measures to harness cost-effective opportunities in the sector, including supporting and encouraging more efficient vehicles, less emissions-intensive fuels and modes of transport, and reducing the need for transport while maintaining or enhancing living standards.

In the short-term Australia should introduce a mandatory CO₂ emissions standard for light vehicles. This could deliver substantial, low-cost emissions reductions, with net economic benefits. The sector as a whole should continue to be covered by the Emissions Reduction Fund crediting and purchasing mechanisms until light vehicle standards are in place. There also appears to be a case to pursue heavy vehicle standards.

In the longer term, covering transport under an enhanced safeguard mechanism or market mechanism would help to reduce Australia's transport emissions cost-effectively and the first toolkit review in 2022 should consider transport coverage.

Further work would be useful to consider what else governments can do to encourage the use of less emissions-intensive fuels. One example is the appropriate roles of public and private providers in delivering electric vehicle recharging infrastructure.

Infrastructure investment and effective city planning can help reduce travel distances and the need for transport, and encourage greater use of low-emissions options. Continuing collaboration between all levels of government, the private sector and communities will be required over the coming decades to plan and build more sustainable cities.

Transport is a major source of Australia's emissions and emissions from the sector continue to grow. Transport emissions include emissions from light and heavy vehicles, trains, and domestic aviation and shipping. Transport emissions have increased by 25 per cent since 2000, and contributed about 18 per cent of Australia's emissions in 2014 (DoEE 2016). Australia's transport emissions are projected to continue to increase at a similar rate to 2030 (DoE 2015d).

There are four broad ways to reduce transport emissions without diminishing living standards:

- Improve efficiency: improving the efficiency of vehicles, and improving logistics to help avoid congestion, reduce travel distances and optimise loads.
- Switch fuels: switching to less emissions-intensive fuels, such as renewable electricity, hydrogen and sustainable biofuels.
- Switch modes: switching to low-emissions or active methods of transport, for example, travelling by public transport, cycling or walking instead of driving, or moving freight by rail or water instead of road.

- Reduce use: using information and communications technology to reduce the need to travel, and planning cities to reduce travel distances, while maintaining access and connection.

This chapter identifies measures that governments can implement to reduce transport emissions in the short to medium term.

Greenhouse gas emissions from international aviation and shipping are not included in countries' emissions inventories and are addressed through the International Civil Aviation Organization (ICAO) and International Maritime Organization (IMO) (Box 12).

BOX 12 REDUCING EMISSIONS FROM INTERNATIONAL AVIATION AND SHIPPING

International aviation and shipping contributes approximately two per cent of global emissions, with international aviation producing about 1.2 per cent—similar to the emissions of the whole Australian economy (1.4 per cent) (ICAO 2013; WRI 2015). Global aviation emissions are forecast to grow by around 49 per cent above 2012 levels by 2030 (ICAO 2013). On average over 2007 to 2012, shipping as a whole accounted for approximately 2.8 per cent of annual global emissions, with international shipping producing 2.4 per cent (IMO 2014). Shipping emissions are projected to increase by 50 to 250 per cent by 2050 (IMO 2014).

Countries are working through the ICAO and IMO to reduce these emissions at the global level:

- The 191 member states of ICAO (including Australia) have set a collective goal of two per cent global annual fuel efficiency improvement and carbon neutral growth in net aviation emissions from 2020 (ICAO 2010). A CO₂ emissions standard has been developed to apply to new aircraft and is expected to be formally adopted in October 2016 (ICAO 2016b). ICAO members are also working on a global market-based mechanism for adoption at its October 2016 General Assembly (ICAO 2016a). Offset credits generated in countries including Australia may well be able to be used in this market (ICAO 2013).
- The IMO's efforts to date have focused on energy efficiency and establishing a data collection system for fuel consumption to inform further measures (IMO 2016a). In October 2016 the IMO will continue its discussions on reducing emissions from shipping, including on a possible global emissions reduction target for international shipping (IMO 2016b).

10.1. EXISTING POLICIES CAN HELP TO REDUCE TRANSPORT EMISSIONS

Australia's existing emissions reduction policies include the Emissions Reduction Fund (ERF) crediting and purchasing mechanisms (Chapter 3), which can encourage emissions reductions from the transport sector. Transport projects that reduce emissions can receive offset credits through the ERF, which can be sold to the Government or other buyers. By July 2016, the Government had contracted to buy 1.2 Mt CO₂-e of transport emissions reductions under ERF purchasing.

The Authority recommends that the transport sector continue to be eligible for ERF crediting and purchasing until the light vehicle standards recommended in Section 10.2 are in place.

In Chapter 5, the Authority recommended the sector not be covered under the recommended enhanced safeguard mechanism, but that the 2022 review of the toolkit consider covering transport under the enhanced safeguard or a market mechanism. Covering transport under one of these mechanisms would encourage energy efficiency, fuel switching, mode switching and reducing travel time.

The Authority's judgement is that while covering transport is technically feasible, community sensitivities about fuel prices are likely to preclude coverage of transport emissions by the enhanced safeguard or another market mechanism in the short to medium term. Partial coverage (say, excluding light vehicles) might be more feasible, but would result in competitive distortions between different modes of transport. The pragmatic approach is to therefore to defer coverage for the time being, but to make progress in cutting transport emissions using other effective policy options.

RECOMMENDATIONS

- R.23. ERF crediting and purchasing for the transport sector should continue until light vehicle standards are put in place.
- R.24. The Government should consider covering transport under either the enhanced safeguard mechanism or with another policy instrument such as a market mechanism as part of the 2022 review.

10.2. VEHICLE EMISSIONS STANDARDS COULD HELP IMPROVE EFFICIENCY

Energy efficiency policies could substantially reduce transport emissions for cars, vans and other light vehicles. Energy efficiency improvements that could be encouraged by policy include vehicle improvements to reduce fuel use, and logistical improvements to avoid congestion and optimise load.

10.2.1. LIGHT VEHICLE EMISSIONS STANDARDS

One particular energy efficiency policy—light vehicle CO₂ emissions standards—offers potentially very large emissions reductions in Australia over time. In a previous report, the Authority investigated emissions reductions from light vehicles—that is, all passenger cars, sports utility vehicles (SUVs) and light commercial vehicles. It found that if Australia adopted a CO₂ standard that matched the United States' by 2025, it could avoid 59 Mt CO₂-e between 2018 and 2030 (CCA 2014b). The Australian Government is currently investigating CO₂ emissions standards among other measures to reduce the environmental and health impacts of vehicle emissions (Australian Government 2016c).

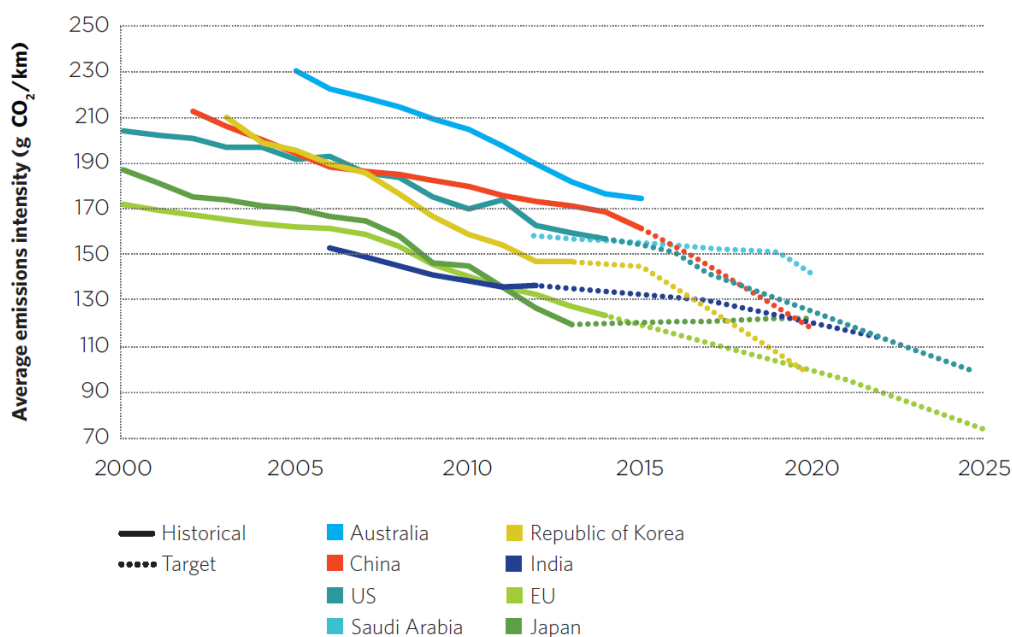
Policies to improve light vehicle efficiency are a priority because light vehicles are a major source of emissions. Light vehicles create over 10 per cent of Australia's emissions and contribute almost two thirds of emissions from the transport sector (DoEE 2016).

Improving the fuel efficiency of light vehicles reduces emissions and brings substantial co-benefits. If Australia's light vehicles were more fuel efficient, motorists could save hundreds of dollars each year in fuel bills (CCA 2014b). The Authority's previous analysis found that a CO₂ emissions standard closely aligned to that of the US would save Australia \$580 for each tonne of CO₂ avoided (CCA 2014b). It may also help to reduce Australia's reliance on imported fuel.

In the medium term, improving the efficiency of light vehicles using existing technologies is one of the lowest-cost emissions reduction opportunities in the Australian economy (CCA 2014b). Fleet improvements can be achieved cost-effectively over time by improving the design of new vehicles (CCA 2014b). There are many proven, cost-effective and currently available technologies to improve light vehicle efficiency, including reducing vehicle weight, and implementing more efficient engines and drive trains (CCA 2014b).

There are several policies that can reduce light vehicle emissions, and the Authority found that mandatory CO₂ standards are a good option (CCA 2014b). Evidence demonstrates that standards achieve major emissions reductions while providing financial benefits to consumers (Kodjak 2015). Australia is unusual in not having a standard and our fuel efficiency lags other countries' (Figure 14). Stakeholders including the Investor Group on Climate Change support a light vehicle emissions standard as part of the climate policy toolkit (Report Two submission, p. 6).

FIGURE 14 PASSENGER VEHICLE CO₂ EMISSIONS INTENSITY, SELECTED COUNTRIES, 2000–2025



Note: CO₂ emissions and fuel economy for all standards normalised to European test cycle (NEDC). The coverage of 'passenger vehicles' differs by country; SUVs are included in the EU, Japan, Republic of Korea, China and India, and covered under 'light trucks' in the United States. The EU met its 2015 target in 2013, so the EU trajectory to its next target year (2020) is a straight line from actual 2014 data; Japan, which met its 2015 target in 2011, has a similar approach. EU 2025 target is a mid-point between proposed targets of 68 and 78 g CO₂/km.

Source: Climate Change Authority based on ICCT 2015 and National Transport Commission 2016.

A light vehicle CO₂ emissions standard would set a national average target for new vehicles sold in Australia. Over time, more vehicles in the fleet become more efficient. The standard could be designed to meet a fleet target that strengthens over time, to minimise regulatory burden on manufacturers and to preserve consumer choice. In the approach the Authority recommended (CCA 2014b), the Government would set a national average target in each year. The target would relate to the average emissions intensity of the new light vehicle fleet—not individual vehicles. Each supplier would determine the mix of vehicles it supplies to the market. A supplier could improve the efficiency of all its vehicles or sell more highly efficient vehicles to offset its less efficient vehicles. This imposes a more equitable burden across suppliers that specialise in different market segments.

RECOMMENDATION

R.25. Australia should introduce a light vehicle CO₂ emissions standard as part of its policy toolkit.

10.2.2. HEAVY VEHICLE EMISSIONS STANDARDS

Improving the efficiency of heavy vehicles would reduce emissions and likely result in cost savings for freight businesses. As with light vehicles, while more efficient vehicles are more expensive upfront, lower fuel use means that more efficient models are likely to provide net financial savings as well as emissions benefits.

Mandatory CO₂ emissions standards could be applied to heavy vehicles in a similar way to light vehicles. These standards would require manufacturers to meet minimum efficiency standards in the vehicles and engines they offer to the market. As with light vehicles, there are currently available options for improving heavy vehicle efficiency such as using low rolling resistance tyres or improving aerodynamics. Several new technologies may allow greater efficiency gains in the near future. For example, retrofitting a heavy vehicle to run partially as an electric vehicle, with batteries charged by an on-board generator, would reduce fuel use (CARB 2015).

Internationally, there has been less focus on heavy vehicle standards than light vehicle standards. This is because truck engines and trailers can be used in a variety of configurations, making efficiency testing more complex for heavy vehicles. Despite this, the United States, Canada, China and Japan have all implemented emissions standards for heavy vehicles (Kodjak 2015). The European Union is also considering heavy vehicle standards, with an initial focus on measuring, certifying and reporting emissions from heavy vehicles (EC 2014). The International Energy Agency has recommended that governments implement and periodically strengthen mandatory fuel efficiency standards for heavy vehicles (IEA 2011a).

Heavy vehicle standards in the United States are projected to reduce emissions while delivering savings to vehicle owners. A proposed second phase of the standards would cover vehicles sold in 2021 to 2027, and is expected to reduce emissions by 103 Mt CO₂-e annually by 2040 (reducing the United States' transport emissions by six per cent). These Phase 2 standards are projected to save vehicle owners about US\$170 billion in fuel costs over the life of the vehicles (US EPA 2015; US EIA 2016). The proportionate net benefits may be smaller in Australia. Australia is a small market with unique vehicle design regulations, for example for very large

vehicles such as road trains that are not used elsewhere. This means the costs of design and testing are spread across a smaller number of vehicles. A cost-benefit analysis would help determine if such standards would be appropriate for Australia.

The Australian Government has committed to investigate policies to improve the efficiency of Australia's heavy vehicle fleet as part of the G20 International Partnership for Energy Efficiency Cooperation Transport Energy Efficiency Task Group (Australian Government 2016c).

RECOMMENDATION

R.26. The Government should carry out a cost-benefit analysis of heavy vehicle CO₂ standards for Australia with a view to determining if these should be added to the toolkit.

10.3. FURTHER WORK IS NEEDED ON LESS EMISSIONS-INTENSIVE FUELS

Powering transport with electricity, hydrogen and sustainable biofuels could help reduce emissions.

10.3.1. ELECTRIC VEHICLES

Using electric vehicles (EVs) in place of conventional internal combustion engine vehicles can reduce Australia's total emissions. There are two types of EVs: hybrid vehicles, which also have a conventional engine; and fully electric vehicles, which require charging. Even today, an EV charged from the National Electricity Market (NEM) will have lower overall emissions than a similarly sized conventional vehicle (CCA 2014b; ClimateWorks 2016). Greater reductions will be possible in the future if Australia decarbonises its electricity sector. Increasing use of EVs alongside decarbonisation of the electricity grid could reduce Australia's emissions by 9 Mt CO₂-e by 2030, and 27 Mt CO₂-e by 2050 (ClimateWorks 2016) (Figure 15). Previous modelling commissioned by the Authority from the CSIRO shows that light vehicle emissions standards would support the uptake of EVs (Reedman & Graham 2013).

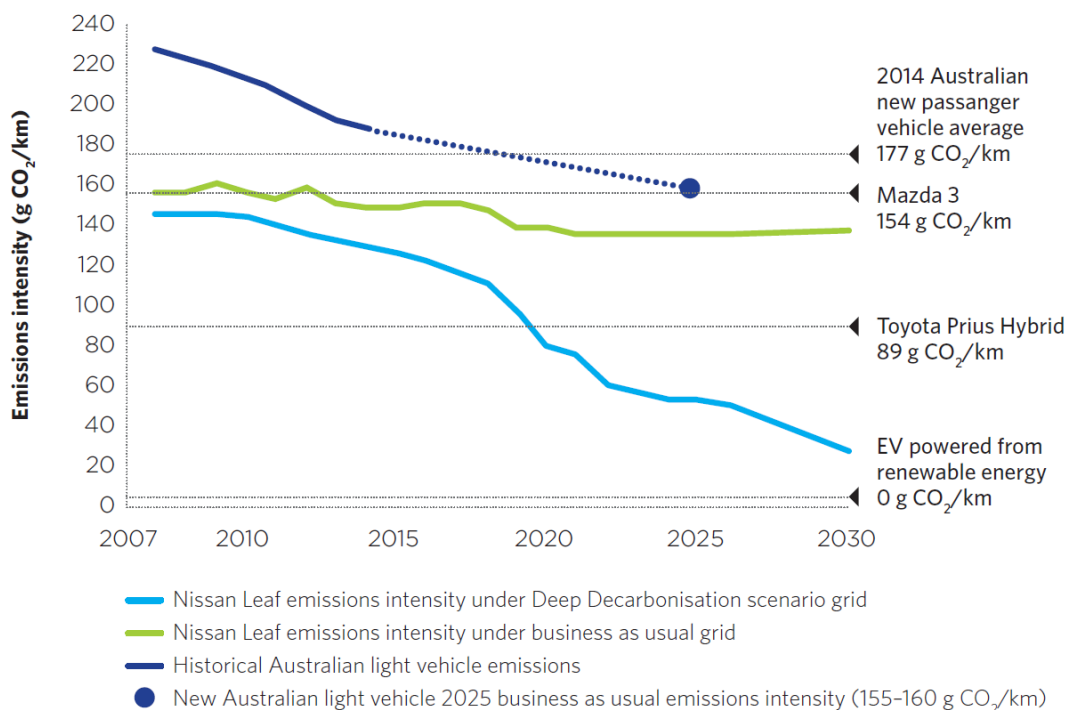
EVs make up less than 0.1 per cent of cars globally, but the use of EVs is rising (ESAA 2013; IEA 2016a). EVs are emerging at a slower rate in Australia than other developed countries. In April 2015, there were about 2,000 EVs (including some classes of hybrids) on Australian roads in NEM jurisdictions (that is, all states and territories except Western Australia and the Northern Territory). This is equivalent to around 0.01 per cent of the current light vehicle fleet (Climate Change Authority based on ABS 2015b; AEMO 2015).

The Australian Energy Council identified the main barriers to EV uptake in Australia as: the cost of EVs compared to conventional vehicles; the limited driving range of EVs; and the time and facilities needed for recharging. Cost is a major barrier, particularly for batteries, which can comprise up to 50 per cent of the total cost of an EV (ESAA 2013). However, studies show that the cost of lithium-ion batteries—which EVs use—may more than halve by 2020 compared to 2014 (Brinsmead et al. 2015; IRENA 2015) and EVs may become cost-competitive with conventional vehicles over the next 20 years (Brinsmead et al. 2015; AEMO 2016b). This will

require EVs to be manufactured on a large scale. Other countries subsidise EV manufacturing and Australia will benefit by importing lower cost EVs as a result.

According to the IEA, increasing the uptake of EVs will require substantive policy support. Countries with higher levels of EV penetration than Australia have offered incentives and supporting infrastructure policy. The IEA notes that a range of policy interventions may be useful, including increasingly stringent noxious and greenhouse gas emissions standards, and support for purchasing EVs, using EVs and deploying charging infrastructure (IEA 2016a).

FIGURE 15 EMISSIONS INTENSITY OF CONVENTIONAL AND ELECTRIC LIGHT VEHICLES IN THE NATIONAL ELECTRICITY MARKET



Note: EV emissions intensity determined using NEM grid emissions and NEM grid emissions projections. The business as usual grid is based on analysis in the Climate Change Authority 2014 Renewable Energy Target Review. The deep decarbonisation scenario grid is based on CSIRO modelling of a scenario in which Australia achieves net zero emissions by 2050.

Source: ClimateWorks 2016.

Australia has had vehicle standards to reduce noxious emissions since the early 1970s, and these are being strengthened (CCA 2014b). The Authority also recommends a light vehicle CO₂ emissions standard. Direct government subsidies for purchasing EVs would likely be a relatively expensive form of emissions reductions.

It is possible that the lack of charging facilities is a barrier to the adoption of EVs. The most common mechanisms to increase the number of charging locations are direct investment or fiscal incentives (such as through the tax system) from governments and the private sector. The

IEA found that to encourage further EV adoption, governments must support the deployment of charging infrastructure (IEA 2016a).

Many countries with higher EV penetration provide financial incentives at the national level to install private charging outlets and/or provide financial incentives for the deployment of public charging infrastructure (IEA 2016a). For example, in Japan the government has partnered with the private sector to install 500 fast chargers and 650 standard chargers, providing about two thirds of the funding (IEA 2016a).

The private sector has already installed charging stations in Australia, such as Tesla Motors (2015), and the RAC has done so in Western Australia in partnership with local governments (RAC 2015). Other Australian governments and businesses offer or plan to offer policies and programs such as charging discounts and deployment of public charging infrastructure (ACT Government 2015; AGL Energy 2016).

The Australian Government should consider what policies may be appropriate to cost-effectively encourage greater use of EVs as a way to reduce Australia's emissions. One policy that warrants further investigation is whether planning and infrastructure rules act as a barrier to EV charging, particularly in areas of high density housing. Further adjustments to the concessional luxury car tax for fuel-efficient vehicles could also be considered. The Productivity Commission has recommended the Government consider removing the tax entirely (PC 2014). States and territories could consider moving from existing registration fees and duties to differential charges based on emissions intensity, which would provide a technology-neutral way of encouraging uptake, noting that any equity implications should be considered.

RECOMMENDATION

R.27. There should be further research into the best roles of public and private providers in delivering electric vehicle recharging infrastructure.

10.3.2. HYDROGEN-POWERED VEHICLES

Fuel-cell electric vehicles (FCEVs) generate electrical power by combining hydrogen and oxygen in a fuel cell stack, which causes a chemical reaction. This process emits water vapour and heat, but no greenhouse gas emissions (US Department of Energy 2016). The driving performance of FCEVs is comparable to conventional cars and refuelling time is about the same. The potential of FCEVs is promising; however their costs are currently high. Many aspects are still in development including the production, distribution and storage of hydrogen, and fuel cell technology. These challenges will need to be solved before FCEVs are commercially deployed. Development and trials are being undertaken in Europe, Japan, Republic of Korea and the United States. As the technology nears commercial deployment, governments should consider the appropriate roles of the public and private sectors in hydrogen re-fuelling infrastructure (IEA 2016b).

10.3.3. BIOFUELS

Biofuels may help to reduce emissions from aviation, long-haul rail, shipping and heavy vehicles over the long term. These modes of transport are less amenable to electrification. Biofuels are produced from organic material, including plant materials and waste, and can be used as cleaner substitutes for fossil fuels such as aviation fuel, diesel and petrol. In theory, the growth of biomass to make biofuels balances out the emissions released when they are combusted. A range of research identifies sustainable biofuels as important potential contributors to making substantial emissions reductions in the transport sector if barriers can be overcome. The IEA has estimated that by 2050, biofuels could provide 27 per cent of total transport fuel, avoiding around 2.1 Gt CO₂-e emissions per year when produced sustainably (IEA 2011b). In a scenario of deep and rapid national emissions reductions, the CSIRO sees rapid biofuel uptake by the aviation sector between 2029 and 2040. Largely due to aviation's increased use of biofuels, non-road domestic transport emissions would increase by only five per cent between 2014 and 2050, despite the significant projected growth in activity (ClimateWorks et al. 2014a).

There are many concerns about 'first generation' biofuels, which are produced from food crops such as corn, wheat and sugar cane. When their entire life cycle is considered—including land use change, pesticides and fertilisers—they may actually generate more emissions than fossil fuels. Biodiesel made from palm oil can have serious consequences for emissions and biodiversity if palm plantations displace rainforest. Using agricultural crops to make biofuels also raises food security concerns (FAO 2008; IAASTD 2008).

There are fewer concerns about 'advanced' ('second' and 'third' generation) biofuels, but they are not yet available at scale for transport uses in Australia. Second generation feedstocks include grasses and seed crops, agriculture and forestry residues, and wastes such as vegetable oil, human waste and landfill gas. Third generation biofuels are derived from algae. Further, substantial research into production methods is required, for example to reduce the amounts of water and fertilizer that algae need to grow before it is a viable feedstock (IEA 2011b). The Australian Government is supporting biofuel research through the CSIRO, ARENA and CEFC (CEFC 2015b; CSIRO 2016b; ARENA 2016). Over the longer term, a market mechanism would encourage the use of advanced biofuels in Australia.

10.4. INFRASTRUCTURE AND CITIES PLANNING CAN ENABLE MODE SHIFTING AND HELP REDUCE TRANSPORT USE

Infrastructure investment and effective city planning can help reduce Australia's transport emissions by reducing travel distances and the need for transport, and encouraging greater use of low-emissions options like public transport, walking and cycling (Infrastructure Australia 2016).

Shifting commuters from cars to public and active transport can reduce traffic congestion and emissions. This mode shift could reduce up to 7 Mt CO₂-e per year by 2050 (Cosgrove et al. 2012). To achieve this mode shift, Australian cities need public transport that is frequent, reliable, affordable, safe and comfortable. Building safe and convenient bicycle tracks and pedestrian-friendly neighbourhoods can encourage more active transport, with emissions reductions and co-benefits for public health. Policies such as road congestion charges can help incentivise the use of public and active transport, generating emissions benefits that are material, if relatively small.

Economic, social and environmental benefits can derive from compact cities, with higher density buildings, localised production and consumption, and well-connected infrastructure. They can help reduce emissions by minimising travel distances and the need to travel (UNEP 2011; Gouldson et al. 2015). Australia's cities are less densely populated than most cities of the world

(DIT 2013). People living in outer suburbs are spending more time travelling. The Government's Smart Cities Plan seeks to respond to cities' connectivity needs through the concept of '30 minute cities', where residents can access employment, schools, shopping, services and recreational facilities within 30 minutes of home (PM&C 2016).

Reduced transport demand may also be achieved through investment in information and communications technology (ICT) infrastructure. ICT enables videoconferencing and telecommuting (working remotely) to be an alternative to air and other transport. ICT technologies can also be applied to optimise travel and freight patterns, including traffic and shipping logistics, and public transport management.

Continuing collaboration between all levels of government, the private sector and communities will be required over the coming decades to address Australia's infrastructure investment requirements and plan cities for the future. A clear, coordinated strategy is needed. The Australian Government is seeking public comment on its Smart Cities Plan (PM&C 2016). In it, the Government proposes to implement the successful UK model of 'city deals'. The Commonwealth, state and local governments would agree to deliver major infrastructure projects, while setting targets for policy outcomes like job creation, housing construction and emissions reductions. State and local governments are also developing strategies, such as Future Melbourne 2026 which has a prominent focus on sustainability and climate change (City of Melbourne 2016).

CHAPTER 11. THE LAND SECTOR AND OFFSETS UNDER THE EMISSIONS REDUCTION FUND

Australia has substantial opportunities for emissions reduction activities in agriculture and land use.

An offsets scheme is a good way to reduce emissions from the land sector, but other policies may also be useful. Offset schemes can complement market mechanisms or regulatory arrangements and reduce the cost of meeting Australia's targets. Risks to environmental integrity can be managed through robust methods and governance.

The offsets crediting and purchasing arrangements under the Emissions Reduction Fund (ERF) have created emissions reductions in the land sector. ERF offset crediting should continue to cover the land sector, and ERF purchasing arrangements should continue until the enhanced safeguard mechanism provides a source of demand.

Regulation can be an effective way to reduce emissions for some land use activities.

The interaction between land sector emissions reduction policies and natural resource management arrangements offers opportunities for synergies and efficiencies. The Australian Government should lead a review with state and territory governments of how natural resource management policies could better encourage carbon storage and reduce emissions in the land sector.

Emissions from the land sector are normally considered in two closely connected categories: those from agriculture; and those from land use, land use changes and forestry (collectively referred to as land use in this report).

Agricultural emissions are predominantly methane from livestock and nitrous oxides released after applying fertilisers and manure.⁴ In 2014 these emissions accounted for around 14 per cent of Australia's national emissions, the fourth largest source (DoEE 2016). About 80 per cent of these emissions—more than 11 per cent of Australia's national total—are from livestock, mostly emitted directly by grazing cattle and sheep, or from manure (DoEE 2016). Emissions from agriculture have declined since 2000, and Government projections suggest that by 2020 emissions will decline further (DoE 2015e). Longer term Government projections suggest emissions in the sector may increase by 2030 (DoE 2015d).

⁴ Farm activities that affect carbon emissions or storage are accounted for under land use, land use change and forestry. This now includes emissions from savanna burning (Australian Government 2016b).

Land use activities can be a source of emissions, or can store carbon in forests, other vegetation and the soil. Emissions occur when trees are harvested in forestry operations or land is cleared (for example, to extend grazing land). Changing land management practices and planting or allowing the regeneration of vegetation can increase the amount of stored carbon.

In 1990 land use was the sector with the highest emissions, mainly due to land clearing (DoEE 2016). By 2014 land use emissions had reduced to less than one per cent of the national total (DoEE 2016). Emissions are expected to increase to 2020 compared to 2014 (DoE 2015e). In the longer term the sector could be a net sink of carbon because Australia has substantial storage potential (Box 14).

Chapter 5 recommended that the current safeguard mechanism be enhanced to reduce emissions in the direct combustion, industrial processes and fugitives sectors, and that liable facilities could use offsets from the Emissions Reduction Fund (ERF) for compliance under the mechanism. This chapter provides further detail on this and other policies that the Authority considers should be implemented in the land sector.

11.1. THE LAND SECTOR IS SUITED TO OFFSET SCHEMES

The land sector is suited to offset schemes. Australia's ERF and its forerunner the Carbon Farming Initiative (CFI) have reduced emissions in the land sector by creating incentives for emissions reduction projects (Chapter 3, Box 1).

Offset schemes issue credits for project-based emissions reductions against a baseline. The baseline reflects what would have happened without the offset scheme. In order to demonstrate that a project has created genuine emissions reductions, the government sets rules and standards for different types of projects. These rules, or 'methods', set out the eligible project types, and how to determine and verify the quantity of offset credits to be issued. Each offset credit represents a net reduction—through fewer emissions or increased carbon storage—of one tonne of carbon dioxide or equivalent (CO₂-e).

Offset schemes can extend the benefits of a market-based approach into sectors that are not suited to an emission intensity scheme, cap and trade scheme or carbon tax. This is an advantage compared to some traditional forms of command and control regulation. Firms identify eligible projects and bring forward those that they expect will cost less than the revenue from selling offset credits. Firms will only choose to participate if they think it will benefit them, which can help to keep costs low.

There are three potential sources of demand for offset credits:

1. Firms with an obligation to reduce emissions as the result of an emissions reduction policy (for example under the ERF safeguard mechanism) would buy offset credits when they find it cheaper than:
 - reducing emissions from within their own operations or
 - paying for emissions under the policy that imposes the obligation (for example paying a regulatory penalty under the safeguard mechanism or buying permits under a cap and trade scheme).
2. Individuals and businesses can voluntarily buy offset credits to reduce their emissions (Box 13). For example, passengers may choose to offset their emissions from a flight.
3. A government may purchase offsets to help meet its emissions reduction targets, as the Australian Government does through the ERF purchasing arrangements.

In each case, purchasers would generally buy the lowest cost offset credits, creating competition among potential providers.

Australia has first-hand experience of voluntary pricing policies through the crediting and purchasing mechanisms of the ERF, its predecessor the CFI and earlier schemes.

Under the ERF, projects are credited for emissions reductions from designated activities. Land sector activities currently eligible for ERF crediting include (but are not limited to): livestock and manure management; changes to fertiliser application; changes to grazing and cropland management to increase soil carbon; savanna fire management; improved forest management, tree planting and revegetation.

Several stakeholders, in their submissions to Report Two of the Special Review, supported the view that offset schemes are a good fit for the land sector. For example, the National Farmers' Federation (NFF) said 'it is critical that Government continues efforts to enable the agriculture sector to actively participate in voluntary carbon markets' (Report Two submission, p. 5). The Kimberley Land Council commented that a 'voluntary offset mechanism, which enables sectors uncovered by a mandatory pricing mechanism, to participate in the carbon market, should be included as part of a suite of climate policies' (Report Two submission, p. 2). WWF Australia said '[d]omestic and international experience has shown that voluntary carbon pricing can play an important supporting role to other climate policies' (Report Two submission, p. 12). However, Greenpeace Australia does not support the use of offsets because it considers that this would allow Australia to 'avoid cutting fossil fuel emissions' (Report Two submission, p. 7).

BOX 13 OFFSET CREDITS CAN BE USED IN VOLUNTARY ACTION

Firms and individuals can choose to purchase credits from the ERF or similar schemes to offset their carbon emissions as 'voluntary action'. For example, some individuals choose to offset the carbon emissions from their flights, and some businesses ensure their operations or a product or service are carbon neutral. The use of voluntary credits has increased—globally retirement of credits has increased each year since 2009 (Hamrick & Goldstein 2016).

The Government established the National Carbon Offset Standard (NCOS) to give customers and businesses confidence in the environmental integrity of the carbon neutral label. The Government determines which offsets can be used under NCOS—ERF credits meet the 'offset integrity principles' and so do several types of international credits. The Government also runs the Carbon Neutral Program which certifies that organisations, products, services or events have met NCOS requirements (DoE 2015a).

The Australian Government has ensured that voluntary action is additional to national targets to date. That means emissions reductions from voluntary action strengthen Australia's action. This holds even when the voluntary action occurs within sectors covered by regulatory or market mechanisms.

11.2. OFFSET SCHEMES CAN HELP MEET TARGETS AT REDUCED COST

Provided an offset scheme functions well, low-cost emissions reductions from the offset scheme replace higher-cost emissions reductions. This reduces the overall costs of meeting Australia's emissions reduction targets. The ability to purchase offset credits will tend to reduce costs for liable firms, which also reduces competitiveness impacts.

When an offset scheme is working as intended, it generally leaves overall emissions unchanged. The offset scheme causes emissions to decline, but the use of credits causes emissions in covered sectors to increase by the same amount. This suggests that the main role of an offset scheme is to reduce costs rather than to bring about extra emissions reductions. However, any substantial reduction in costs can make it more feasible to adopt more ambitious emissions reduction targets.

Many countries operate offset schemes that sell credits domestically or internationally. Nearly all emissions trading schemes are linked to offset schemes, including those in the European Union, California-Quebec and regional Chinese schemes (ICAP 2016). The Clean Development Mechanism, established under the UNFCCC, is the most prominent example of an international offset scheme (Chapter 6).

Australia has substantial opportunities for offset projects in the land sector. Research by CSIRO indicates that in the longer term Australia has considerable technical potential for carbon storage through new plantings under certain circumstances, although there are likely to be practical limitations on achieving this potential (Box 14). Work by Bain & Company for the Business Council of Australia (BCA) highlights better land management as one of three areas in which Australia could make the most progress to reduce emissions (BCA Report Two submission, p. 5).

A complexity with offset schemes is the risk that they credit emissions reductions that would have happened without the scheme. If the credits do not represent genuine and additional emissions reductions then Australia's national emissions will be higher than they would be otherwise. The Authority considers this risk can be managed through careful scheme design (Section 11.3.2).

11.2.1. OTHER POLICIES ARE LESS SUITED TO THE LAND SECTOR

Other policies can be used to reduce emissions in the land sector, but are likely to be less suitable than an offset scheme like the ERF. The characteristics of this sector mean that some kinds of policies can be expected to be less effective or more costly in reducing emissions here than in other sectors.

A market mechanism like an emissions intensity scheme or a cap and trade scheme is not well suited to the land sector because it would carry high transaction costs. Emissions in the land sector arise from many small sources, even when aggregated at the level of the farm or forestry business. For instance, there are around 123,000 farm businesses in Australia (ABS 2016b), but few have emissions over 25,000 t CO₂-e per year (Prime Ministerial Task Group on Emissions Trading 2007). Estimation techniques to verify emissions reductions can also be complex in some cases. This means land holders tend to have relatively high transaction costs to reduce emissions, which makes mandatory coverage by a market mechanism problematic. In contrast, when the land sector is covered by an offset scheme only those businesses that have prospective emissions reduction opportunities and wish to participate—presumably to sell their

emissions reductions at a profit—will incur transaction costs. An offset scheme would support farmers to take up those cost-effective emissions reductions as they become available.

In most cases regulation would not be expected to work well in the land sector because farm and forestry businesses are very diverse in the activities they undertake, the natural conditions within which they operate and in their scale. This diversity makes it very difficult to design cost-effective regulations. For example, fertiliser use creates emissions of around 6 Mt CO₂-e each year (DoEE 2016). Best practice in fertiliser use is very sensitive to changes in soil type, temperature, rainfall patterns and type of land use—both in terms of emissions reductions and productivity. There may be opportunities to improve fertiliser use and reduce emissions, but it is difficult to envisage regulation that could be cost effective or equitable in a range of cases.

BOX 14 CARBON STORAGE IN THE LAND SECTOR IN AUSTRALIA

The CSIRO has modelled the potential for carbon storage in the land sector (Bryan et al. 2015, 2015). The research suggests that Australia's technical potential for carbon storage through new plantings and regeneration could be substantial—up to 513 Mt CO₂-e average annual emissions reductions over the period 2031 to 2050 (Bryan et al. 2015). This would, however, require an unprecedented level of revegetation of agricultural land.

The extent to which this potential is likely to be realised depends on a range of factors. In the modelling, the quantity of emissions reductions depends strongly on the price for domestic offsets and international demand. Also, the CSIRO research does not consider all impacts on regional communities; amenity and recreational values; or all the environmental impacts at the local level on soil and water. There may be other practical limitations. For instance, some land holders may not be willing to tie up land to meet permanence rules under an offset scheme, and the Australian community may be reluctant to accept an intensification of agriculture—such as a shift to cattle raised in feed lots rather than on open ranges—which could result from increased carbon storage.

11.3. OFFSETS UNDER THE EMISSIONS REDUCTION FUND

11.3.1. THE EMISSIONS REDUCTION FUND HAS REDUCED EMISSIONS IN THE LAND SECTOR

Projects under the CFI and the ERF have already reduced land sector emissions and are expected to reduce more over the next ten years.

There were 630 offset projects registered under the ERF crediting mechanism on 29 July 2016 (CER 2016a). Of those, 448 were from the land sector—352 projects for the planting or conservation of vegetation to store carbon, 71 to manage emissions from burning savanna vegetation, and 33 to reduce emissions from agriculture (CER 2016d).

Between December 2012 and June 2016, 26 Mt CO₂-e of reductions were credited against CFI and ERF projects (CER 2016a). Of that, 15 Mt CO₂-e were emissions reductions credited to land sector projects—mostly for increased carbon storage in vegetation (CER 2016a).

Under the ERF purchasing arrangements, the Government has contracted to purchase credits through three auctions. A large portion of the emissions reductions the Government has purchased will come from the land sector. The Government has entered into 309 contracts to buy emissions reductions from 348 projects to deliver offsets equivalent to 143 Mt CO₂-e. Of those emissions reductions, 115 Mt CO₂-e are to come from the land sector (CER 2016b).

One area of the land sector where offset credits have been less forthcoming is agriculture. This may be because there are relatively fewer approved methods and of those the ones for management of beef herds have only been available since spring 2015. By July 2016 16 agricultural projects were registered. Some of the opportunities to reduce emissions in agriculture can provide co-benefits, including for farm productivity. For instance, improvements to feed management for livestock can increase weight gain and reduce emissions per unit of product (Bray et al. 2012; Harrison et al. 2015), although costs of production may increase.

The Australian Government should improve the reach of the ERF into the land sector by developing new methods for land sector activities. The Government should also support research into new and improved opportunities to reduce emissions from the land sector, which could be developed into methods in the future (Chapter 8).

Innovation to develop new low-emissions technologies and practices is important, given the scarcity of commercially proven opportunities for reducing emissions from some agricultural activities. The NFF has emphasised the importance of further research and development (Report Two submission, p. 4). Chapter 8 discusses how government support for innovation could help to bring this about. Policies encouraging innovation and energy efficiency in businesses, as discussed in Chapter 7, will also be relevant to reducing energy use in agriculture, because the sector's energy use is significant (DoEE 2016).

11.3.2. OFFSET SCHEME DESIGN IS IMPORTANT FOR ENVIRONMENTAL INTEGRITY AND COST EFFECTIVENESS

The rules and procedures for an offset scheme need to ensure that the emissions reductions are measurable, additional, do not create leakage and are permanent. These rules and procedures need to strike a balance. They must ensure a reasonable level of environmental integrity without creating excessive transaction costs or excluding too many projects that would have been additional. The ERF was designed to ensure that the methods addressed the following issues:

- **Measurability**—methods should set out clearly how emissions reductions from each eligible activity should be measured and verified, and the number of credits an activity will earn.
- **Additionality**—the regulator must be able to show with reasonable confidence that the emissions reductions would not have occurred without the scheme. In particular, schemes should test, as appropriate, for regulatory additionality (only crediting action beyond legislative requirements) and technical additionality (improvements beyond common practice in the market).
- **Avoiding carbon leakage**—an emissions reduction by an offset project should not lead to increasing emissions in response. For example, if one farmer reduced emissions by decreasing herd size and another farmer increased herd size to meet unchanged demand for meat or milk. Methods address this risk by not crediting emissions reductions resulting from decreased production.
- **Permanence**—carbon storage projects should result in permanent storage. If a tree-planting project is later cleared, the stored carbon could be released as carbon dioxide. Offset schemes should require vegetation to be maintained for a set period, and should only credit

activity after the carbon has been stored, for example, once trees have grown to a certain size.

- Robust compliance—scheme regulators should enforce transparent rules with clear penalties, including how firms will make good if permanency arrangements are not met.

In a previous review, the Authority found that the CFI had a reasonably high level of environmental integrity and that the additionality of the emissions reductions credited under the scheme was likely to have been reasonably high. That means that the number of credits issued is likely to be a reasonable indication of the emissions reductions the CFI achieved (CCA 2014d). The Authority also observed that the changes to introduce the ERF incorporated some important improvements that could increase participation and reduce transaction costs (CCA 2014d). Specifically, ERF methods have been developed by the Government under a more systematic and transparent approach, allowing for better prioritisation and the development of more broadly applicable methods.

11.3.3. THE AUTHORITY'S VIEW

The land sector is well suited to an offsets scheme and the Authority recommends that crediting under the ERF should continue.

Facilities covered by the enhanced safeguard mechanism (or a future market mechanism) would be a source of demand for offset credits from the land sector. Over time, as declining baselines under the enhanced safeguard increase the incentives for covered facilities to reduce emissions, it is likely these facilities will demand more offsets. Where covered facilities can purchase land sector offsets at lower cost than reducing emissions within their facilities they are likely to do so. In this way, low-cost emissions reductions from the land sector could lower the cost of meeting Australia's targets.

The Authority recommends that government purchase of ERF land sector offset credits should continue until the enhanced safeguard mechanism provides a source of demand.

RECOMMENDATIONS

- R.28. The land sector (land use and agriculture) should be covered by the Emissions Reduction Fund crediting mechanism. Credits could be used as offsets for facilities with obligations under the safeguard mechanism and the sector should be covered by the ERF purchasing mechanism until the safeguard mechanism provides a source of demand.
- R.29. The Australian Government should support new ERF method development and associated research to reduce emissions in the land sector.

11.4. LAND USE REGULATIONS CAN BE ENVIRONMENTALLY EFFECTIVE

Regulations have been a major reason for the substantial reduction in Australian land use emissions—namely state restrictions on land clearing (CCA 2014a). New South Wales, Queensland and Western Australia introduced stronger land clearing regulations from the early 1990s; since then land use emissions have reduced to less than one per cent of the national total (DoEE 2016). These states relaxed their land clearing regulations in 2013 (CCA 2014a). This may contribute to future increases in emissions in the sector, but to date the impact on national emissions is projected to be less than earlier estimates indicated.

Regulations to restrict land clearing are not focused on reducing emissions, despite their success in doing so. Their main aim is to conserve native vegetation and address natural resource management problems like dryland salinity, erosion and water quality.

Land clearing restrictions do not however receive universal support. The NFF and NSW Farmers' Association emphasised that the restriction of land clearing since 1990 has reduced farm profitability (Report Two submissions pp. 3).

An alternative approach might involve further support for conservation initiatives such as Australia's Native Vegetation Framework (COAG 2012), which could be adapted to play a greater role in reducing emissions. Its first two goals are aimed at increasing the extent of native vegetation and improving its condition—both potentially complementary to emissions reductions, depending on design and implementation. Goal three of the Framework—on ecosystem services—highlights the role of market-based instruments to increase services provided by native vegetation management. Governments have used a variety of market-based instruments in this area (DoE 2016c). The Council of Australian Governments (COAG) discussions on the Framework could be a useful vehicle to consider how carbon reductions could fit within this goal.

The Australian and state governments could also usefully explore the opportunities to increase carbon storage on public land, as it comprises nearly a quarter of Australia (SoE 2011). The majority of agricultural land is privately owned and managed (ABS 2012). Forests, however, have extensive public ownership—around 30 per cent of total forest area (DAWR 2015). This suggests that state governments have opportunities to increase carbon storage on these lands. This need not preclude the use of public land for grazing, forestry and logging, but could influence how it is managed. An exploration of how governments can increase carbon storage through the management of public land could be integrated within discussions on the National Vegetation Framework.

Stakeholders, including the NFF, have for many years called for a more integrated approach to climate policy and broader natural resource management goals at the farm level, including by improving soil conservation, biodiversity management, water and salinity. The Authority is of the view that this is an important area for further work, and recommends the Australian Government lead a review involving states and territories and other key stakeholders.

RECOMMENDATION

- R.30. The Australian Government should lead a review involving states and territories and other key stakeholders to provide guidance on how natural resource management policies at both the national and farm levels could encourage carbon storage and reduce emissions from the land sector, and deliver increased productivity as well as enhanced natural resource management outcomes like improved biodiversity, water quality and soil conservation.

CHAPTER 12. WASTE AND SYNTHETIC GREENHOUSE GASES

Governments should build on current regulations to reduce emissions from waste and synthetic greenhouse gases (SGGs).

In the waste sector, most states and territories already regulate landfill emissions to reduce odour, reduce the risk of explosions and limit greenhouse gas emissions. Strengthening and harmonising this regulation in line with Australia's emissions reduction targets would enable greater emissions reductions from the sector. Regulations should offer flexibility for landfill operators to meet set emissions levels rather than adopt a particular technology.

A phase down in Australian emissions from SGGs is already regulated in accordance with the Montreal Protocol under the United Nations Environment Program. In 2016, the Australian Government announced an ambitious commitment, to also phase down hydrofluorocarbons and ban specific types of equipment.

This chapter outlines the opportunities to reduce emissions from waste and SGGs and explains why the Authority recommends regulation as the most appropriate policy approach to realise those opportunities.

12.1. WASTE

The waste sector presents opportunities for emissions reductions, despite its small contribution to Australia's total emissions. Emissions from the sector are already regulated for odour and safety. Strengthening and harmonising regulations to align with Australia's emissions reduction targets could promote further efficient emissions reductions in the sector.

The waste sector makes up two per cent of Australia's total emissions. The majority of waste emissions (around 74 per cent) come from landfill, when organic material decomposes in the absence of oxygen, producing methane (DoEE 2016). The remaining emissions come from waste water, composting and incineration (DoE 2015e). Landfills present the main opportunity for emissions reductions in the sector. Landfill emissions have fallen around 27 per cent since 2000 due to increases in methane capture and the diversion of organic waste out of landfill and into alternative waste treatment facilities (DoE 2015e; DoEE 2016).

12.1.1. REGULATION IS THE BEST WAY TO REDUCE LANDFILL EMISSIONS IN AUSTRALIA

Strengthening regulation may be an effective way to further reduce emissions from landfill. Technologies and engineering practices to reduce landfill emissions are well known, so there is limited risk that regulation will overlook innovative emissions reduction opportunities (Box 15). Regulations can specify emissions levels, rather than prescribing the use of a particular emissions reduction technology. This means that any new technologies discovered can also be

used to meet regulations. In their submission to Report Two, the Australian Landfill Owners Association expressed support for the harmonisation and strengthening of regulation to reduce emissions from the sector.

Most states and territories already regulate emissions from landfill to some extent, specifying that landfill gas must be managed, but there is variation in the level of emissions allowed (Table 9).

TABLE 9 AUSTRALIAN LANDFILL EMISSIONS REGULATIONS

STATE/ TERRITORY	ALLOWABLE SURFACE METHANE CONCENTRATION (PARTS PER MILLION)	APPROXIMATE REQUIRED METHANE CAPTURE RATE (%)	AVERAGE METHANE CAPTURE RATE 2014 (%)
NSW	500	0%	42%
Victoria	100	72%	65%
Queensland	500	0%	33%
WA	N/A	N/A	31%
SA	N/A	N/A	26%
Tasmania	500	0%	36%
ACT	100	60%	Confidential (included with NSW)
NT	N/A	N/A	41%

Note: Calculations of approximate required methane capture rate are based on a large landfill operating in a particular state or territory, and are not applicable to all landfill sites. While the allowable methane concentration for some states implies that no methane capture is required, for most states landfill gas management is still mandatory, which implies some level of methane capture. State based environmental regulators may also apply specific conditions to individual landfills and this is not captured in the table. The ACT has adopted the same regulation of landfill gas capture as Victoria.

Source: Allowable methane concentration: EPA NSW (2016), EPA Vic (2015), DEHP Qld (2013a), DEHP Qld (2013b), DoE, EPA SA (2007), DPIWE Tas (2004), DIICCSRTE (2013), NT EPA (2013). Approximate required methane capture rate: DoE Average methane capture rate: DoE.

Most states and territories list a number of aims in their landfill gas regulation, including amenity, safety, and limiting greenhouse gas emissions.

Coverage of landfill gas regulation also varies and a number of small landfills are not covered by regulation at all or only to a limited extent.

It is important to note that regulations only create emissions reductions to the extent that landfill operators meet their obligations. Adequate monitoring and enforcement by state and territory regulatory bodies will be needed to ensure that regulations deliver the potential emissions reductions.

The Authority is of the view that Australian governments should commence work to harmonise regulation of emissions from landfill waste facilities. If enhanced, these regulations could be an environmentally effective and straightforward way to reduce emissions in this sector. Consideration should be given as to how best to deal with smaller regional landfills given they tend to emit lower volumes of greenhouse gases and some abatement options may not be feasible. It will also be important to avoid creating perverse outcomes like waste being transported from one region to another to avoid the impact of regulation. Given their coverage by these measures, landfill waste projects should not be eligible for ERF purchasing and crediting once the new regulation is in place.

BOX 15 OPPORTUNITIES TO REDUCE EMISSIONS FROM LANDFILL

Regulations may promote emissions reductions from landfill through encouraging methane capture and combustion, and alternative waste treatment.

Landfill operators can capture methane emissions by installing a cap on landfill cells, and can either flare the methane or combust it to generate electricity. Flaring or combusting converts methane into carbon dioxide, reducing its global warming potential. Efficient methane capture is now common practice for large landfills, and broadening this practice could further reduce emissions in the future. In 2012, the overall rate of methane capture for Australian landfills was about 40 per cent (Hyder Consulting 2014). With current technology, an efficient landfill gas collection system can capture about 90 per cent of the methane produced at the site, indicating that there is substantial room for improvement (Bogner et al. 2007). However, it is important to note that gas collection becomes more expensive at small landfills (MMA 2010).

Alternative waste treatment involves diverting waste away from landfill and processing it in a way that reduces emissions. This can include composting, anaerobic digestion and process engineered fuel manufacture (DoE 2015b). These processes may have other benefits in producing fertiliser, generating electricity, and reducing odour and safety concerns for landfills (Sustainability Victoria 2015). Alternative waste treatment is a higher-cost emissions reduction option than methane capture (Bogner et al. 2007, p. 600) and is not well established in most Australian states and territories (Blue Environment & Randell Environmental Consulting 2014).

12.1.2. WASTE WATER EMISSIONS SHOULD BE REGULATED

Emissions from waste water make up 25 per cent of emissions from waste, and 0.6 per cent of Australia's total emissions (DoEE 2016). The Authority is of the view that emissions from waste water should be regulated. All Australian states and territories regulate waste water treatment facilities above a given size through licencing systems (e.g. Government of the ACT 1997; Government of Victoria 2007). These licences impose conditions on waste water treatment facilities to protect the environment, protect human health, and prevent odour, but are generally not designed to reduce climate impacts of waste water treatment. Emissions reduction opportunities for the waste water sector are well-known and becoming cheaper (Hyder Consulting 2014). Expanding current waste water regulations to cover greenhouse gas emissions could be an effective way to reduce waste water emissions.

12.1.3. ADDITIONAL ELECTRICITY SECTOR POLICIES CAN COMPLEMENT REGULATION IN THE WASTE SECTOR

Some landfill and waste water treatment operators use captured methane to produce electricity and sell it into the grid. Many of these facilities receive large-scale generation certificates under the Large-scale Renewable Energy Target (Chapter 3); each certificate represents one megawatt hour of renewable energy. This may supplement regulation and incentivise further emissions reductions in the sector (Chapter 9).

RECOMMENDATION

R.31. Regulations that set limits on methane emissions from landfill waste should be harmonised across Australia. Consideration should be given as to how best to cover small and regional landfills and avoid creating distortions.

12.2. SYNTHETIC GREENHOUSE GASES

Reducing emissions from SGGs is best achieved through existing international agreements given effect through domestic regulation. This approach is straightforward and enjoys strong support from affected industries. The Government's plan for phasing down SGGs is faster than proposed for international standards.

SGGs contributed about 11 Mt CO₂-e or two per cent of Australia's emissions in 2014 (DoEE 2016). Common SGGs used in Australia include hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF₆). SGGs are mostly manufactured as substitutes for ozone depleting substances. Most SGG emissions—97 per cent—leak from refrigerators and air conditioning units (DoEE 2016). Other sources include fire extinguishers, aerosols, and foams. Under current policy, SGG emissions are projected to increase by around 2 Mt CO₂-e to 2020, primarily due to increasing take up of equipment using HFCs, which gradually leak gases over their lifetime (DoE 2015e).

Ozone depleting substances are controlled under the *Montreal Protocol on Substances that Deplete the Ozone Layer* (UNEP 1989). The Montreal Protocol sets binding, progressive phase outs for gases covered under the treaty. The most harmful ozone depleting substances have already been phased out and replaced largely by SGGs, however many SGGs have very high global warming potentials and are powerful contributors to global warming even though the volume of emissions is very low relative to methane and carbon dioxide. International negotiations to include the phase down of HFCs under the Montreal Protocol are expected to conclude by the end of 2016.

Australia has implemented the Montreal Protocol by progressively phasing out the import and manufacture of gases covered by the treaty. Australia has also implemented regulations on the acquisition, storage, use and disposal of ozone depleting substances and SGGs beyond those required under the Montreal Protocol (DoE 2016b). Australia has met or exceeded its commitments under the Montreal Protocol. From 2003 to 2013 Australian regulations reduced SGG emissions by 25 Mt CO₂-e (DoE 2015c, p. 19).

The Government has announced it will reduce HFC emissions by up to 80 Mt CO₂-e in the period to 2030. This represents additional effort beyond Australia's existing regulations. This will be achieved through a statutory phase down of HFC imports commencing in 2018, an awareness program to improve equipment maintenance and provision for bans on specified equipment (DoE 2016e). The statutory phase down will reduce HFC emissions by 85 per cent by 2036, a more ambitious phase down than proposals under the Montreal Protocol. The announcement follows a 2015-16 review of Australia's ozone protection and SGG program to identify further opportunities for emissions reductions and improve the program's efficiency and effectiveness.

While SGGs were previously covered under Australia's carbon pricing mechanism, industry submissions to the Authority expressed a preference for SGGs being managed via regulated supply measures rather than cost measures. In their submission to Report Two, Refrigerants Australia noted that coverage of SGGs under the repealed carbon price had resulted in delayed upgrades to equipment, which led to higher power consumption and an increase in indirect emissions. These perverse outcomes for SGGs under the carbon price—coupled with the industry preference for regulation—suggest a phase out approach would be the most environmentally effective means of reducing emissions in this sector. Given their coverage by regulation, SGG projects should not be eligible for ERF purchasing and crediting once the new measures are in place.

RECOMMENDATIONS

- R.32. Australia should continue to phase down synthetic greenhouse gases and adopt an accelerated phase down of hydrofluorocarbons.
- R.33. Emissions reduction projects from landfill waste and synthetic greenhouse gases should be eligible for ERF purchasing and crediting until enhanced regulation is put in place for these sectors.

CHAPTER 13. INTERNATIONAL COMPETITIVENESS

For the Australian economy as a whole, the competitiveness effects of reducing emissions are likely to be modest when they are achieved through cost-effective policies. Australia can continue to grow strongly and compete in international markets while meeting its emissions reduction objectives.

While economy-wide effects are likely to be modest, differences between Australia's policies and those of other countries can affect businesses and industries in ways that cause two related problems:

- carbon leakage, where Australia's emissions reduction efforts are eroded when Australian policy leads to emissions increases overseas
- competitiveness distortions between Australian and overseas businesses, where changes in production and investment are driven by policy differences between countries rather than differences in cost and emissions.

The Authority is of the view that Australia's policy toolkit could include specific competitiveness measures that try to reduce the risk of carbon leakage and the extent of competitive distortions. Competitiveness measures should be targeted to industries that are particularly emissions-intensive and trade-exposed (EITE) as competitive distortions are likely to affect these industries most.

To address competitiveness concerns, the Authority recommends that businesses in EITE industries be allowed to surrender international permits and credits that are subject to strict eligibility rules for any emissions above their safeguard mechanism baselines without quantitative restrictions. The strict qualitative restrictions would apply to ensure that only credible international permits or credits are used by EITE businesses to meet safeguard mechanism obligations. The 2022 toolkit review should assess the use of international permits and credits, and consider whether a quantitative limit that declines over time should apply.

Further competitiveness measures could be considered if a market mechanism were implemented in response to the Authority's proposed 2022 review of the policy toolkit. Any further assistance should be output based to maintain incentives to reduce emissions. It should also be subject to review, time limited and withdrawn according to a predictable timeframe to reflect its transitional nature.

The Authority's principal evaluation criteria for assessing emissions reduction policy options are environmental effectiveness, cost effectiveness and equity. Alongside these criteria, the terms of reference for the Special Review require the Authority to consider the effect of policies on the cross-cutting issue of international competitiveness. Competitiveness effects, and measures to address them, could affect how policies perform against each of the evaluation criteria.

Competitiveness effects can occur at the level of the nation, an industry or an individual business. National competitiveness effects can be seen through changes in a country's growth and productivity (see for example Schwab 2015) or its ability to sell products in international markets (see for example OECD 2014a). Competitiveness effects on an industrial sector in Australia could be seen through changes in its global market share. Individual businesses could experience changes in profitability or output, some of which will be driven by international competition.

The national competitiveness effects of reducing emissions are likely to be modest when they are achieved through cost-effective policies. By moving to more cost-effective policies over time Australia may even gain a competitive advantage relative to its major trading partners. As is outlined in Chapter 14 it is a consistent finding of previous high quality modelling exercises that Australia can continue to grow strongly and compete in international markets while meeting its emissions reduction objectives.

While economy-wide effects are likely to be modest, undesirable competitiveness effects can arise for particular businesses and industries due to differences between Australia's policies and those of other countries. Section 13.1 describes two potential undesirable effects: carbon leakage, which undermines the environmental effectiveness of Australia's policies, and competitive distortions, which could affect the cost effectiveness of emissions reduction policies. Section 13.2 considers the case for including measures to address competitiveness impacts ('competitiveness measures') within Australia's policy toolkit.

Section 13.3 identifies that undesirable effects of policy differences between countries are most likely to arise in businesses and industries that are both emissions-intensive and trade-exposed (EITE), and that competitiveness measures should be targeted to businesses in EITE industries. Sections 13.4 and 13.5 consider options for implementing these measures within the Authority's proposed policy toolkit.

13.1. POLICY DIFFERENCES WITH OTHER COUNTRIES CAN HAVE UNDESIRABLE EFFECTS

There are three kinds of changes to competitiveness that businesses and industries may experience due to emissions reduction policies:

- Some changes are a necessary part of emissions reduction efforts. Australia's emissions reduction policies should improve the competitive position of low-emissions producers over higher-emissions competitors over time. This will cause some businesses and industries to grow faster than they would have without a market mechanism or other policies to reduce emissions, while others will grow slower or decline.
- Separately, the emissions reduction policies of other countries may reduce the competitiveness of some Australian businesses and industries, independently of Australia's own emissions reduction policies. For example, Australia's fossil fuel exporters will be affected as other countries strengthen their emissions reduction efforts (Treasury 2011).
- Finally, some competitiveness effects may be both undesirable and able to be ameliorated by Australian policy. These happen when investment and production decisions are driven by differences between Australia's and competitor countries' climate policies, rather than differences in other costs or productivity.

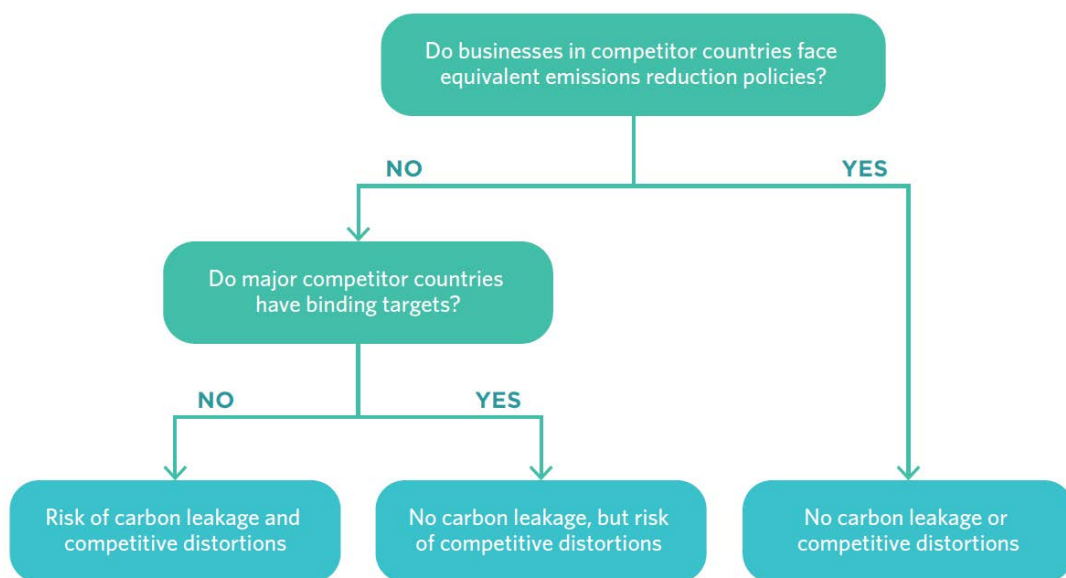
Any competitiveness measures included in Australia's policy toolkit should only target the third type of competitiveness changes. Differences between Australia's emissions reduction policies and those of other countries can cause two related problems:

- 'Carbon leakage', which is where emissions reductions achieved in Australia are partially or even fully offset by emissions increases in other countries. This would occur because production, investment and emissions move out of Australia due to uneven emissions reduction policies.
- Competitive distortions, where production and investment shifts to another country not because it is genuinely the lowest cost producer, but because that country is not placing equivalent costs on businesses that emit greenhouse gases.

The relationship between leakage and competitive distortions at the business or industry level is outlined in a stylised way in Figure 16. It shows that the risks of leakage and distortions depend on the nature of policies and targets in competitor countries. Overall:

- Carbon leakage does not make it harder for Australia to reach its own emissions reduction targets, but it can undermine the international effort to reduce global emissions. If Australian activities and associated emissions move to a competitor country, Australia's emissions will not change. However, emissions in the competitor countries will increase if they do not have 'binding' emissions targets, that is, targets that reduce emissions relative to what they would have been otherwise. This is true irrespective of whether the leaking activity is more or less emissions-intensive in Australia than in the competitor countries.
- Global emissions are unlikely to change when activity moves from Australia to a competitor country with a binding target. While this shift would cause emissions in one industry in the competitor country to increase, overall, emissions in that country would need to reduce in other industries to meet that country's target.
- In practice national targets may or may not be fully binding, depending on how they are structured. An economy-wide target that limits cumulative emissions over an extended period of time (an 'emissions budget') will be most effective in ensuring that movement of activities to that country do not result in carbon leakage. Economy-wide targets that limit emissions in a particular year reduce the risk of carbon leakage, but leave some residual risk as they do not directly limit cumulative emissions. Targets that do not cover all sectors similarly leave a residual risk of carbon leakage.
- The risk of carbon leakage reduces as the number of countries with binding national targets increases, particularly when these are important trading competitors for Australia. This remains true even if competitor countries' targets are less ambitious than those of Australia.
- Competitive distortions can arise even when Australia's competitors have binding targets. This might occur because competitor countries' emissions reduction policies are not 'equivalent'—specifically, when they place lower costs on a given industry than do Australia's policies. In that case shifts in output are not necessarily consistent with reducing global emissions in an efficient manner, as they are driven by policy differences rather than fundamental differences in cost or efficiency across countries.

FIGURE 16 STYLISED RELATIONSHIP BETWEEN CARBON LEAKAGE AND COMPETITIVE DISTORTIONS FOR BUSINESSES OR INDUSTRIES



Note: In this diagram a binding target can be thought of as an economy-wide target that limits cumulative emissions over a period of time (an 'emissions budget'). Where countries do not have a target of this form, a residual risk of carbon leakage will remain though it will be reduced relative to a country with no target.

Source: Climate Change Authority.

13.2. PERSISTENT POLICY DIFFERENCES BETWEEN COUNTRIES JUSTIFY COMPETITIVENESS MEASURES

Australia's policy toolkit should uphold the environmental effectiveness of Australia's emissions reduction efforts by including competitiveness measures to reduce the risk of carbon leakage.

While the case for using competitiveness measures to prevent carbon leakage is strong in principle, the risk of carbon leakage is modest and likely to decline over time. Countries responsible for around 95 per cent of global emissions submitted Intended Nationally Determined Contributions (INDCs) as part of the Paris Agreement (CAT 2015) and around 90 per cent of global emissions occur in countries that have quantifiable and unconditional emissions reduction targets (DFAT 2016). The evidence to date is that a large majority of countries take their targets seriously and take action to achieve them (CCA 2015b). This view was reflected in Westpac's submission to Report Two of the Special Review:

There is now [following the Paris Agreement] greater commitment globally to reducing emissions; this leads Westpac to believe that the risk of carbon leakage (a reduction in emissions in Australia leading to an increase in emissions offshore as the market moves to a less regulated economy) is reduced. (Report Two submission, p. 5)

For carbon leakage to not be considered a problem, countries must not just have binding targets, but also put in place effective policies to achieve these targets. A range of stakeholders

submitted that further steps are required to reinforce countries' commitments. For example, the Australian Industry Greenhouse Network stated:

Whilst the Paris Agreement removed past differentiations between developed and developing economies over responsibilities for reducing emissions, it cannot be adjudged an outright success until measures to ensure the integrity of INDCs are developed, implemented and followed, in such areas as measuring commitments, reporting arrangements and approaches to scaling up ambition. (Report Two submission, p. 7).

The Energy Users Association of Australia made a similar point, emphasising that 'there is little detail on how [Paris] commitments will be delivered and therefore the impact that those commitments will have on domestic business and industry' (Report Two submission, p. 7). The Authority considers these concerns to be valid. While the Paris Agreement has substantially reduced the risk of carbon leakage, some risk remains and competitiveness measures can help to reduce it.

While the risk of carbon leakage is relatively low, the risk of competitive distortions appears likely to persist for the foreseeable future. Most of Australia's major trading partners have emissions reduction targets but the policies they have in place to meet them vary greatly. Similarly, these countries are likely to use a diverse range of new policies in future to meet these targets. This means that both the level and distribution of costs are likely to vary greatly by country and by industry.

The difference in the costs placed on businesses between Australia and competitor countries is also affected by assistance measures that other countries put in place to help firms or other liable parties deal with the impacts of emissions reduction policies (Box 16). Together, these factors mean that it appears unlikely that similar businesses in different countries will face equivalent carbon costs for the foreseeable future.

Several stakeholders commented on the 'uneven' nature of global action, including the Business Council of Australia and the Minerals Council Australia. In a similar vein, the Australian Aluminium Council stated that:

While the Paris climate conference has prompted significant progress at a global and national level – particularly the number of countries making pledges – there will still be material differences in carbon costs for many years (decades). (Report Two submission, p. 3)

The Australian Petroleum Production and Exploration Association expanded on this point:

The Paris Agreement is an important step in the world moving together on climate change. However, it still shows significant differences between countries in their targets and, importantly, the resultant impact on businesses. Until our major competitors are imposing comparable costs, issues around trade competitiveness remain valid in any future policy development in Australia, and must be addressed to minimise differences in the cost of carbon. (Report Two submission, p. 13)

Given that the costs of international climate change policies are likely to remain uneven, competitiveness measures can improve the cost effectiveness of Australian policy.

BOX 16 ASSISTANCE MEASURES UNDER INTERNATIONAL EMISSIONS REDUCTION POLICIES

The European Union Emissions Trading Scheme (EU ETS) provides assistance to a range of emissions-intensive and/or trade-exposed industries through allocations of free permits. The level of permits received is based on best practice benchmarks for emissions so most businesses will face a policy cost even when assistance is provided. The EU has committed to continue assistance measures during the period from 2020 to 2030 (EC 2016a).

The ETS covering California, Quebec and Ontario also allocates free permits to address carbon leakage and provide transitional assistance. Assistance is based on either best practice benchmarks or benchmarks set below industry average emissions, and so here too most businesses will face some policy cost. The assistance factor is also adjusted to reflect the leakage risk of the industry, and will decline for some industries prior to 2020. Assistance rates after 2020 are uncertain.

A high proportion of permits under the Republic of Korea's ETS and the Chinese ETS pilots are allocated for free, greatly reducing the policy cost companies face under these schemes. These schemes use a mix of 'grandfathering' (allocations based on historical emissions) and allocations based on sectoral benchmarks.

The Regional Greenhouse Gas Initiative (RGGI) covering nine states in the north-eastern United States is unusual in that the vast majority of permits are auctioned rather than allocated for free. However, this scheme only covers electricity emissions and costs on electricity-intensive industries as a result of the policy have, to date, been modest due to low permit prices.

The main channel for improved cost effectiveness is when competitiveness measures can reduce the risk of unexpected closures of existing businesses due to sudden changes in climate change policy. In practice, large business closures usually see employees remaining unemployed for a period of time. This has a direct cost in the form of lost wages and taxes, and is likely to be particularly high in regional communities with a narrow employment base. Further, closures can have flow on effects to other regional businesses (PC 2001). However, Australian experience indicates that the cost of closures will largely be transitional as a substantial proportion of employees find new employment relatively quickly, though a portion of workers will remain unemployed for an extended time or withdraw from the workforce (PC 2001). This means that assistance measures will primarily have a benefit when they give employees and communities time to plan for and adjust to potential closures.

Competitiveness measures are unlikely to improve the cost effectiveness of Australian policy or address carbon leakage in other cases. For example, if measures do not change production and investment decisions (including a decision to keep a business in operation), they cannot reduce carbon leakage and the assistance will have had no effect on employment or investment. That said, the absence of measures to address competitiveness can raise equity concerns for Australian businesses if firms in similar circumstances in other countries are not facing equivalent costs.

On balance, however, the combination of cost effectiveness and environmental effectiveness highlight the need for carefully targeted competitiveness measures. The targeting of assistance is discussed further in Section 13.3, while the form of assistance is discussed in Sections 13.4 and 13.5. The case for assisting regions and communities affected by business closures is considered in Chapter 14.

RECOMMENDATION

- R.34. Australia should use carefully targeted competitiveness measures to improve the cost effectiveness of Australia's emissions reduction policy and to reduce residual risks of carbon leakage.

13.3. SOME ASSISTANCE FOR BUSINESSES IN EMISSIONS-INTENSIVE AND TRADE-EXPOSED INDUSTRIES IS WARRANTED

Differences between countries' emissions reduction policies are most likely to have significant impacts on businesses that are both emissions-intensive and trade-exposed (EITE). Businesses that are trade-exposed but not emissions-intensive will be affected by policy differences between countries, but these effects are unlikely to be significant relative to a firm's overall costs of production. Electricity and gas costs comprise around 1.3 per cent of total business input costs on average across all energy end-use sectors of the Australian economy (Climate Change Authority analysis based on ABS 2015a).⁵ This indicates that cost increases resulting from emissions reduction policies for such businesses will be small relative to their revenue, other production costs and profits.

As only EITE industries will face significant impacts from international differences in climate policies, assistance should be targeted to these industries. Assistance should be provided to EITE businesses irrespective of their size, unless their emissions fall below coverage thresholds under the enhanced safeguard mechanism or market mechanism if one is implemented after 2022.

Identifying and targeting assistance to a focused group of EITE industries is feasible. Both emissions intensity and trade exposure can be readily measured using available data and methods. The Authority's analysis indicates that EITE activities are a relatively small share of the Australian economy (Table 10). While it is difficult to make precise judgements about the thresholds of emissions intensity and trade exposure where competitiveness effects become significant, the Authority's analysis and similar analysis undertaken as part of Australia's former carbon pricing mechanism indicate that it is feasible for the Government to identify a focused set of industries and activities that could face significant impacts, and target competitiveness measures to these industries.

⁵ Energy end-use sectors are all sectors of the economy, except three energy supply sectors: electricity generation; electricity transmission, distribution, on-selling and electricity market operation; and gas supply.

TABLE 10 EMISSIONS INTENSITY AND TRADE EXPOSURE OF AUSTRALIAN INDUSTRIES, 2012–13

INDUSTRY	MORE EMISSIONS-INTENSIVE AND TRADE-EXPOSED ACTIVITIES	EMISSIONS INTENSITY (T CO ₂ -E / \$M GVA)	TRADE EXPOSURE	SHARE OF NATIONAL EMISSIONS	SHARE OF NATIONAL ECONOMIC OUTPUT	SHARE OF NATIONAL EXPORTS
Metals manufacturing	Aluminium, alumina, steel, copper, nickel, lead, zinc, silicon, manganese	3,691	54%	11.5%	1.2%	12.1%
Agriculture, fisheries and forestry	Beef cattle, dairy cattle, sheep (see note*)	2,605*	22%	17.3%	2.4%	5.3%
Non-metallic minerals manufacturing	Cement (clinker), lime, bulk glass, glass products	2,305	15%	2.6%	0.4%	0.1%
Coal mining	None	2,009	77%	7.2%	1.3%	12.1%
Petroleum and coal products	Refined petroleum products, coke	1,850	57%	1.4%	0.3%	1.2%
Chemicals and rubber	Ammonia, ammonium nitrate, ethene	1,239	56%	3.2%	0.9%	2.8%
Oil and gas	Liquefied natural gas	786	68%	4.3%	2.0%	7.9%
Wood, paper and printing	Pulp, paper products	575	22%	1.1%	0.7%	0.6%
Other mining	None	361	54%	4.8%	4.9%	22.0%
Other manufacturing	None	236	59%	2.3%	3.7%	11.0%
All other economic sectors	None	200	6%	44.4%	82.2%	24.9%
Australia (total)		370	19%	100%	100%	100%

Note: *While parts of agriculture, such as beef cattle, are emissions intensive, these activities would only require assistance if they were covered by the enhanced safeguard mechanism or a market mechanism. The emissions intensity calculated in the table includes all agricultural emissions including those from livestock production. Shares may not sum due to rounding. Shares of national economic output are based on the gross value added (GVA) of each industry group. Employment shares were not reported as they are generally similar to shares of economic output. Emissions calculations include all direct emissions, except for the electricity supply industry. 'All other economic sectors' includes electricity supply. Direct emissions from electricity supply are allocated to the electricity-using industry. Emissions attributable to own consumption of electricity by electricity generators, and to electricity losses in transmission and distribution of electricity, are allocated to the electricity supply industry. Electricity supply is included with the rest of the economy. Trade exposure is the sum of imports and exports, divided by the sum of Australian output and imports.

Source: Climate Change Authority based on ABS 2015a, DoEE 2016 and DIIS 2015a.

While EITE businesses and industries face greater than average impacts from international differences in climate policies, many other factors affect their production and investment decisions and climate change policy appears not to have been a significant factor in the large majority of recent Australian closures. Appendix C provides an overview of the reasons for recent closures of EITE businesses. It shows that many factors affect firm closure. Important drivers include exchange rates, commodity prices, labour and other input costs (including energy costs) and insufficient scale and many of these factors are likely to continue to be important into the future.

Competitiveness measures should not attempt to solve broader impacts of structural change in the Australian economy but rather seek to assist businesses, employees and communities affected by emissions reduction policies to adjust at a more measured pace. The potential impacts of climate policies on regions and communities, and the case for providing regional assistance, are discussed further in Chapter 14.

13.4. ACCESS TO INTERNATIONAL PERMITS AND CREDITS CAN REDUCE COMPETITIVENESS CONCERNS

Competitiveness issues are most likely to arise in relation to the market mechanisms and the enhanced safeguard mechanism in the Authority's recommended policy toolkit. In the short-term these measures are:

- an emissions intensity scheme in the electricity sector (see Chapter 5)
- an enhanced safeguards mechanism covering direct combustion, industrial process and fugitive emissions.

In relation to the electricity sector, the design of an emissions intensity scheme means that competitiveness impacts for electricity-using businesses are likely to be moderate and the need for further competitiveness measures is not strong. Under an emissions intensity scheme, electricity generators receive emissions intensity baselines which reduce the scheme's effect on electricity prices compared to other mechanisms like cap and trade or a carbon tax. This means that the impact on competitiveness on electricity-using EITE businesses from an emissions intensity scheme, and the need for competitiveness measures, is likely to be less pronounced. In consequence, the policy case for further assistance to EITE businesses in relation to electricity costs is not strong.

The competitiveness implications of the enhanced safeguard mechanism for EITE industries would also need to be considered in detail by the Australian Government during the implementation phase. Competitiveness concerns under this policy should be able to be satisfactorily addressed by allowing EITE industries in these sectors to use eligible international permits or credits to comply fully with their safeguard baselines (without quantitative restrictions). However, international permits or credits would be subject to strict qualitative restrictions to ensure that the units are genuine. As outlined in Chapter 6 the use of genuine international permits and credits will not reduce the environmental effectiveness of Australia's policy toolkit, and can improve its cost effectiveness. Where these permits and credits are lower cost than abatement in Australia, this would mean that EITE businesses that exceed their baselines would be able to reduce their emissions to baseline levels at relatively low cost.

It is appropriate to review EITE industries' unrestricted access to these permits and credits over time. The use of international permits and credits will, in general, be subject to quantitative limits (Chapter 6) and so businesses in EITE industries will have more access to international units than other Australian businesses.

The policy toolkit review in 2022 should consider these matters, including whether a quantitative limit that declines over time should apply.

RECOMMENDATION

- R.35. Competitiveness assistance to emissions-intensive, trade-exposed (EITE) industry businesses with obligations under the safeguard mechanism should be provided by allowing unlimited access to international permits and credits with strict qualitative restrictions. The toolkit review in 2022 should assess EITE access to international permits and credits and consider whether a quantitative limit that declines over time should apply.

13.5. FURTHER COMPETITIVENESS MEASURES MAY BE REQUIRED UNDER A FUTURE MARKET MECHANISM

As outlined in Chapter 4 the Authority recommends that the Government review the climate policy toolkit in 2022 to assess its effectiveness. One thing this review would consider is whether the enhanced safeguard mechanism covering direct combustion, industrial process and fugitive emissions should remain in place or be replaced by a market mechanism of some sort. In the event that a market mechanism was introduced at that point, further competitiveness measures may be required. The sections below consider:

- the design of further competitiveness measures under a market mechanism
- the level and rate of withdrawal of this assistance.

13.5.1. DESIGN OF FURTHER COMPETITIVENESS MEASURES

As under the enhanced safeguard mechanism, competitiveness concerns that result from the implementation of a market mechanism could be addressed by allowing EITE businesses to continue to use eligible international permits or credits to comply with their obligations under the market mechanism. This would be subject to the outcome of the 2022 review, which should examine whether there is a need to apply a quantitative limit on permits and credits and whether that limit should decline over time.

In addition to the ability to use international permits and credits, further competitiveness support may be justified under a market mechanism. This assistance can be provided under either a cap and trade scheme, an emissions intensity scheme or a carbon tax.

Competitive distortions can be reduced through providing 'output-based assistance' through free allocations of permits to EITE businesses under a cap and trade scheme. This approach provides all eligible firms a specified free allocation of permits per unit of output, meaning that firms receive more assistance if they produce more, and vice versa. This output-based assistance reduces the net cost each business faces per unit of output, and therefore reduces the potential effect of competitive distortion on their production and investment decisions. Importantly, the amount of assistance will be the same for each unit of a given product, ensuring that competing businesses that produce the same product are treated equitably. The number of

permits provided per unit of output typically reflects the emissions associated with a unit of that product and so are sometimes referred to as emissions intensity based allocations. This approach was adopted under the carbon pricing mechanism that operated in Australia between 2012 and 2014. It is also used elsewhere, such as the ETS in place in California, Quebec and Ontario.

Output-based assistance can also be effectively provided under a carbon tax. This approach would involve providing businesses with tradable tax exemptions that are linked to output in the same way as the free allocations of permits under a cap and trade scheme, or through output-linked cash rebates.

An output-based approach to EITE assistance is inherently part of an emissions intensity scheme because of the way its baselines are set. Each business will only face a cost where its emissions per unit of output are higher than the relevant emissions intensity baseline. This means that an emissions intensity scheme covering direct combustion, industrial process and fugitive emissions would have almost exactly the same effect on EITE businesses as a cap and trade scheme with emissions intensity allocations. The output-based approach has three main benefits:

- **Efficiency incentives.** As each business' allocation is fixed for a given level of production, the business will face a lower effective carbon cost if it can reduce its emissions without reducing production. This means that lower emitting firms will gain an advantage relative to higher emitting firms, promoting a shift over time to cleaner producers within Australia.
- **Reduced competitive distortions.** As the allocation increases or decreases with production it is effectively a production subsidy. This lowers costs for liable entities as a result of the given market mechanism and reduces the effect of any competitive distortions between Australian businesses and competitors in other countries.
- **Administrative feasibility.** EITE industries are major emissions sources and so their emissions data is generally well understood. Further, the number of products EITEs make is relatively small and so the required production data is generally sufficiently well understood to allow this approach to be reliably implemented and audited.

Given these advantages, if the 2022 policy review results in a cap and trade scheme or carbon tax covering transport, direct combustion, industrial processes and fugitive emissions, and if further competitiveness assistance is required (in addition to access to international permits and credits), this should be implemented through output-based allocations under a cap and trade scheme or equivalent exemptions under a carbon tax. If that review results in an emissions intensity scheme being implemented, the nature of emissions intensity baselines and the resulting lower policy cost on businesses means that further, direct assistance to EITEs may not be needed.

One industry stakeholder advocated an alternative approach to industry assistance in its submission to Report Two. The Cement Industry Federation considers that, ‘a global sectoral approach applying the same rules across countries and regions... would target reduced emissions while avoiding competitiveness concerns’ (Report Two submission, p. 4). The idea has merit, however, ‘international sectoral agreements’ of this kind have not been widely adopted to date. The greatest progress has been in the areas of international aviation and shipping, which sit outside countries national emissions inventories and targets.⁶ Australia should support the future development of international sectoral agreements across a broader range of sectors. However, it seems unlikely that agreements outside of international shipping and aviation will emerge in the near future, and other approaches to deal with competitiveness are likely to be needed.

RECOMMENDATION

R.36. Further competitiveness measures could be considered if another policy instrument such as a market mechanism is implemented after the recommended 2022 review. Any further assistance should be output-based to ensure that businesses receiving assistance are rewarded for reducing emissions and those that take early action to reduce emissions will gain a competitive advantage over those that do not.

13.5.2. LEVEL AND WITHDRAWAL OF ASSISTANCE

Setting the level of any further assistance provided under a market mechanism and changing this level over time requires striking a balance between the needs of the industries being assisted and the interests of the wider community. While assistance can improve the overall cost effectiveness of Australia’s climate policy toolkit in some circumstances, this is not always the case. Further, assistance provided to one group will tend to impose costs on other groups. The level of assistance should reflect these considerations.

Similarly, assistance should be time-limited, reflecting the transitional nature of the assistance. Providing assistance indefinitely would tend to reward businesses that do little to reduce their emissions, and slow Australia’s transition to a low-emissions economy. The withdrawal of assistance should give some predictability and certainty to both EITE industries and the Government. A reasonable balance between predictability and flexibility may be to set with a pre-determined phase out rate, subject to periodic independent reviews. These reviews would consider factors such as changing industry circumstances and composition in Australia, changes in international policies and changes to carbon leakage risks. These decisions would require further deliberation by the Australian Government during policy implementation.

⁶ The international nature of these industries is reflected by the important governance role played by specialised United Nations agencies, the International Civil Aviation Organization and the International Maritime Organization. In turn, these organisations have played an important role in coordinating efforts to establish sectoral agreements in these areas (see also Box 9 in Chapter 10).

There are two broad approaches to setting and changing the level of assistance:

- Seeking to eliminate all competitive distortions. This would involve detailed comparisons of policy costs in competitor countries and in Australia, and a contingent withdrawal of assistance as differences in policy costs reduced over time.
- Setting assistance in a simpler way that is less precisely calibrated to differences in policy costs, and withdraws this assistance in a more transparent and predictable way over time.

Stakeholders' submissions to Report Two generally favour the first approach. For example, the Australian Industry Greenhouse Network considers that:

If Australian industry is not to be put at a competitive disadvantage through the imposition of costs that do not apply to our international competitors, policies should be introduced that offset the differences in carbon costs between trade-exposed Australian entities and their major competitors. Comparisons should be at the facility level in both Australia and competing jurisdictions. (Report Two submission, p. 10).

Similarly the Cement Industry Federation stated that assistance measures should 'take into consideration the actual carbon costs borne by key comparable facilities in competing countries and/or regions' (Report Two submission, p. 6).

If assistance is to closely reflect the differences in policy costs between countries, the level of this assistance will need to be adjusted over time in response to policy changes. This relationship was captured by Rio Tinto's submission, which said:

assessing the impacts on competitiveness requires... a detailed understanding of the scale and timing of policy implementation and the actual costs borne by industry in jurisdictions where our competitors are located. (Report Two submission, p. 1)

The Authority prefers a simpler approach to setting assistance because precisely eliminating all competitive distortions is unlikely to be cost effective or administratively feasible. Competitiveness measures impose a cost on the broader community and so a balance needs to be struck when determining the appropriate level of assistance. Excessive levels of assistance are also not likely to promote a cost-effective transition of Australian industry to a carbon-constrained future, a point raised by the Investor Group on Climate Change in their Report Two submission:

For emissions-intensive, trade exposed companies, failure to adequately position Australian business for the global low carbon economy of the future by being over-protective is just as likely to result in diminished economic competitiveness as an excessively onerous policy response. (Report Two submission, pp. 7–8)

Seeking to eliminate all competitive distortions also has real practical challenges. The Productivity Commission highlighted these difficulties in its 2011 comparison of emissions policies across different countries, noting that assessing competitiveness impacts on individual firms:

... would require detailed information for particular firms and industries, including knowledge of the cost functions for the comparable industries in the competing countries, relative energy intensities, the net impacts of other policy measures affecting the cost of production, and the ability to pass on costs. Moreover, Australian firms may compete with firms in a wide range of countries... and the position would change as market conditions and exchange rates change. (PC 2011)

The Authority considers that such a complex process would be difficult to implement in a transparent way that maintains the confidence of both recipients of assistance and broader stakeholder groups.

Given these difficulties, the Authority recommends that the level of assistance be set in a simple and transparent way that strikes a balance between the benefits of assisting EITE industries and the costs to the wider community. This should avoid excessive assistance to EITE industries, noting that the risk of carbon leakage is probably low.

RECOMMENDATIONS

- R.37. The level of competitiveness assistance should be set in a simple and transparent way that strikes a balance between the benefits of assisting EITE industries and the alternative uses of this assistance.
- R.38. EITE-focused competitiveness measures should be subject to review, time limited, and withdrawn according to a predictable timeframe.

CHAPTER 14. IMPACTS ON AUSTRALIA'S ECONOMY

The primary benefit from reducing Australia's emissions is to contribute to global action to limit the long-term economic, social and environmental consequences of climate change. The Authority has sought to increase the net benefit to Australia by recommending a toolkit of climate policies that targets many cost-effective emissions reduction opportunities across the economy, while also seeking to provide policy stability.

This chapter discusses the likely impacts of the Authority's recommended toolkit on the economy as a whole, and considers the distribution of impacts across regions, households and individuals.

Relevant modelling and analytical exercises suggest that the policy toolkit can help Australia meet its emissions reduction goals at modest overall cost, and while living standards continue to rise.

The costs of transitioning to a low-emissions economy may fall more heavily on particular industries, regions, households and individuals. These impacts can be managed.

Decision makers should consider transitional assistance for regions and communities where it can be demonstrated that impacts are the result of emissions reduction policies. Additional assistance could be considered for low-income households, noting that welfare recipients will receive assistance through normal cost of living increases to welfare payments, and most still receive the additional assistance provided under the 2012 carbon pricing mechanism.

Studies by Stern (2007), Garnaut (2008) and many others have found that over the long term, the benefits of limiting the economic, social and environmental costs of climate change are considerably greater than the cost of taking action to reduce emissions.

Australia is expected to be affected by climate change more than many other developed countries. It therefore stands to benefit strongly from global action to reduce greenhouse gas emissions and limit dangerous climate change. The costs of reducing Australia's emissions, and the net benefits of reducing emissions over the long term, will depend on the climate policies Australia uses to meet its goal. In recommending its policy toolkit, the Authority has sought to increase the net benefits of reducing Australia's emissions by limiting the economic impacts.

This chapter discusses the likely economic impacts of the Authority's recommended policy toolkit. It:

- provides an overview of the cost effectiveness of the main elements of the policy toolkit
- considers the likely overall economic impacts of the toolkit
- considers the distribution of the costs across the economy and how equity concerns can be managed.

14.1. DESIGNING A COST-EFFECTIVE POLICY TOOLKIT

The Authority has recommended a toolkit of climate policies that targets many cost-effective emissions reduction opportunities across the economy, while also providing policy stability. The Authority has chosen policies capable of meeting Australia's climate goals to 2030 and beyond by focusing on measures that:

- can be scaled up over time, for example by adjusting emissions baselines, increasing the ambition of energy efficiency standards, and so on
- have some 'built in' flexibility to respond to changing circumstances—such as changes in technology costs or economic conditions—without requiring extensive redesign
- provide a predictable pathway to a durable toolkit of policies to limit costs associated with policy uncertainty, including by building on and/or retaining existing measures such as the Renewable Energy Target.

These features of the toolkit will help to manage the costs of reducing emissions over time. The main elements of the toolkit are:

- *An emissions intensity scheme for the electricity sector from 2018.* Economic theory indicates that well-designed market mechanisms are the most cost-effective emissions reduction policies for key economic sectors (Chapter 5). The Authority's electricity sector modelling supports the view that a market mechanism would reduce electricity sector emissions at a lower cost than would be possible without such a policy in the toolkit (Jacobs 2016).
- *Enhanced safeguards in the direct combustion, industrial processes and fugitive emissions sectors, with access to domestic offsets and international permits and credits.* While enhanced safeguards may not deliver emissions reductions with the same degree of cost effectiveness as a market mechanism, they offer a stable and pragmatic way of reducing emissions. Costs can be lowered by providing liable facilities with access to domestic offsets and genuine emissions reductions from other countries, with restrictions (Chapters 6, 11 and 15).
- *Energy efficiency and vehicle standards.* These measures can provide net savings for businesses, households and individuals while reducing the cost of meeting Australia's emissions commitments in the Paris Agreement (Chapters 7 and 10). Australian governments have identified substantial emissions reduction opportunities to 2030 in buildings, appliances and industry (COAG Energy Council 2015b). The Authority has previously estimated that light vehicle standards could reduce emissions by 59 Mt CO₂-e to 2030, while providing a net economic benefit due to fuel savings (2014b).
- *A domestic offset scheme to access low-cost opportunities in the land sector.* Such a scheme would extend the market for emissions reductions to a broader range of cost-effective abatement opportunities (Chapters 11 and 15).
- *Ongoing support for innovation.* Policies targeting barriers to innovation, particularly in its early stages, can expand the range and reduce the future cost of technologies and practices to reduce emissions over the medium to longer term (Chapter 8).
- *Targeted emissions reduction regulations where this would be cost-effective.* Regulation is likely to be preferable to market mechanisms in the landfill waste and synthetic greenhouse gas sectors because an effective regulatory base is already in place. Regulation is also

suitable for covering these sectors because of the large number of small emitters, and because information required for effective regulation is readily available (Chapter 12).

Many of the policies in the toolkit also have co-benefits—that is, they provide further value to society beyond the climate-related benefits of reducing emissions. Several submissions to Report Two emphasised the importance of co-benefits, especially the benefit to public health from reducing fossil fuel combustion to improve air quality (Climate and Health Alliance, Public Health Association of Australia, Doctors for the Environment, WWF Australia). Co-benefits are not assessed here, but they further strengthen the case for climate action in both the short and long term.

14.2. OVERALL ECONOMIC IMPACTS ARE EXPECTED TO BE MODEST

Modelling exercises by Australian governments, business associations, academic institutions and non-government organisations have shown that emissions can be reduced while maintaining strong economic growth.

For the Special Review, the Authority commissioned modelling that compares the cost of various emissions reduction policies in the electricity sector, including an emissions intensity scheme (CCA 2016). The results showed that market mechanisms reduce emissions at the lowest costs. The discussion in this chapter is informed by this work, as well as previous modelling and analytical studies of climate policy in Australia.

A recent study that illustrates the potential economic impacts of the Authority's recommended toolkit is the 2015 McKibbin Software Group modelling, commissioned by the Department of Foreign Affairs and Trade (2015a; 2015b). This modelling estimated the economic impacts of reaching a range of 2030 emissions reduction targets using a generic 'mix of energy efficiency and energy sector policies'. Such a policy mix has features in common with the Authority's recommended policy toolkit, including a focus on electricity sector and energy efficiency measures.⁷

The McKibbin modelling found that the cost of reaching emissions reduction targets of up to 45 per cent below 2005 levels by 2030 is likely to be modest. The estimated economic impact of meeting Australia's INDC commitment of 26 to 28 per cent below 2005 levels by 2030 was to slow growth in Gross National Income (GNI) by around 0.07 per cent per year compared to a 'no additional action' scenario, in which other countries reach their commitments under the Paris Agreement. This is small compared with Australia's long-term historical growth rate of around 3.5 per cent. The measure of GNI is used here because it provides a more complete measure of Australians' living standards than GDP. While GDP measures the total output of the Australian economy, GNI measures consumption possibilities by reflecting output and international income transfers.

Many other modelling exercises in Australia have examined the economic impacts of broad-based market mechanisms to reduce emissions. The expected economic impact of the recommended toolkit will differ from the results of such exercises, because the enhanced safeguard mechanism may not deliver emissions reductions in the direct combustion, industrial processes and fugitive emissions sectors as cost-effectively as a market mechanism. That said,

⁷ Although individual policies are not directly modelled, the McKibbin Software Group modelling is broadly consistent with implementing key Government emissions reduction policies in the energy sector including the Emissions Reduction Fund, National Energy Productivity Plan and renewable energy targets.

allowing liable facilities to meet safeguard obligations with domestic offsets and international permits and credits (with some restrictions) is expected to keep costs relatively low (Chapters 6, 11 and 15).

The Authority's view is that building on existing policies in these sectors can help limit costs associated with policy uncertainty, which can be considerable. Policy uncertainty can lead to higher perceived risks for long-term investment in low-emissions projects, reducing investment in long-lived assets and ultimately leading to higher prices and increased input costs for businesses. For example, the modest economic impacts estimated by the McKibbin modelling arise from a scenario in which climate policy is assumed, and believed to be, stable. The McKibbin (2015a) report estimates that policy uncertainty could have an impact on GNI approaching that of climate policy itself.⁸

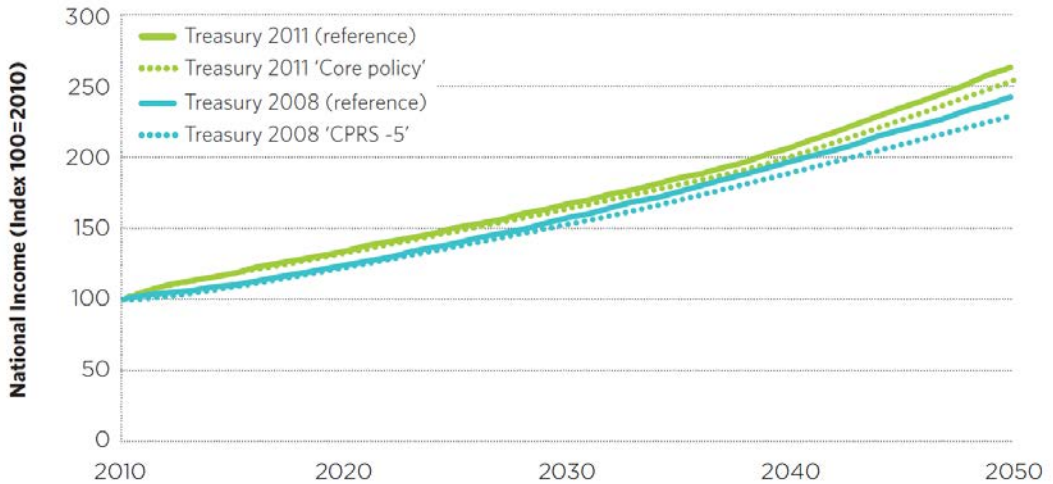
Given the recent history of climate policy in Australia, Australia's best interests are served by avoiding further policy uncertainty. There would be considerable costs associated with further delay of Australia's transition to a low-emissions economy, while awaiting the political will to implement more comprehensive policy reform.

If a broader market mechanism were to be implemented following the 2022 review, the expected economic impact would be indicated by the many previous high quality studies of the impact of broad-based market mechanisms. The common finding of these studies, including comprehensive exercises by the Commonwealth Treasury, is that market mechanisms can achieve emissions reductions consistent with Australia's Paris Agreement commitments at modest overall cost (Figure 17) (Treasury 2008, 2011; Treasury and DIICSRTE 2013).

Recent modelling exercises by ClimateWorks Australia et al. (2014a) and by CSIRO (Hatfield-Dodds et al. 2015) also highlight that Australia can achieve more ambitious emissions reduction scenarios over the long term while maintaining economic prosperity. These studies provide additional insights into impacts in specific sectors (Box 17).

⁸ The McKibbin Software Group exercise (2015) estimated the cost of uncertainty associated with Australia not committing to any post-2020 target, and found it could reduce GNI by around 0.4 per cent in 2030. The estimate was based on an increase in the risk premium on investment in the Australian energy sector (where the risk premium is the additional return required by investors to be compensated for policy uncertainty). This risk premium was assumed to be four per cent, based on recent changes in the cost of debt for investments in renewable energy in the US. Any estimate of the costs of policy uncertainty will depend heavily on modelling assumptions. For comparison, the modelling estimated that reducing emissions by 26 per cent below 2005 levels in 2030 would reduce GNI by 0.6 per cent in 2030.

FIGURE 17 LONG-TERM ECONOMIC IMPACT OF CLIMATE POLICY: PROJECTED NATIONAL INCOME UNDER 'NO ACTION' AND CENTRAL POLICY SCENARIOS



Note: The Treasury 2008 scenario shown is 'CPRS -5'; the Treasury 2011 scenario shown is 'Core policy'. These scenarios are somewhat more ambitious than Australia's INDC commitment of 26 to 28 per cent below 2005 levels by 2030—in the 'CPRS -5' scenario, emissions are 34 per cent below 2005 levels in 2030; in the 'Core policy' scenario emissions are 36 per cent below 2005 levels in 2030. Treasury 2008 reported economic impacts in terms of Gross National Product (GNP); this measure is now identical to GNI following changes to ABS definitions.

Source: Climate Change Authority based on Treasury (2008; 2011).

CONCLUSION

C.12. The cost of the recommended policy toolkit to the Australian economy will be relatively modest, and far lower than the long-term cost of unmitigated global climate change.

BOX 17 STUDIES OF DECARBONISATION BY CLIMATEWORKS AND CSIRO

Recent studies of decarbonising the Australian economy by ClimateWorks Australia *et. al.* (2014b) and the CSIRO (Hatfield-Dodds *et al.* 2015) have found that Australia can achieve ambitious emissions reductions while maintaining economic prosperity. These studies identify cost-effective emissions reduction opportunities across the economy that could be achieved by a range of efficient climate policies.

ClimateWorks' study *Pathways to Deep Decarbonisation in 2050* provides an illustrative pathway for Australia to achieve deep emissions reductions consistent with the global 2 degree goal, using known technologies and without fundamental changes to the economy. CSIRO's *Australian National Outlook 2015* examines a range of future global scenarios based on various demographic, technological and social drivers to provide insights into securing sustainable prosperity for Australia.

Some of the long-term emissions reduction opportunities that these studies identify are:

- transitioning to low-emissions electricity, including though large scale and rooftop solar, wind, and other technologies including carbon capture and storage.
- electrifying transport, industry and buildings over time, with low-emissions electricity replacing transport fuels and on-site fuel combustion.
- greater energy efficiency in residential and commercial buildings, and more efficient vehicles.

In addition, both studies use detailed land sector modelling to conclude that large-scale opportunities for carbon storage in Australia's land sector can help Australia achieve ambitious emissions reductions with modest economic impacts:

- The ClimateWorks illustrative emissions reduction pathway includes large-scale sequestration of carbon in the land sector through payments to landholders. This enables Australia to reach net zero emissions in 2050 without importing emissions reductions under a global emissions trading scheme.
- The CSIRO *Australian National Outlook 2015* finds that participating in stronger global action could provide a net economic benefit to Australia when compared to current climate policy trends. This could include exporting emissions reduction credits in scenarios with large-scale carbon sequestration in the land sector.

The Authority notes that realising some of these opportunities may require significant changes with potential impacts on agricultural communities, and natural resources including water and food production (Chapter 11). These abatement estimates and modelled costs should therefore be considered indications of technical potential as there may be significant barriers to their realisation in practice.

14.3. DISTRIBUTION OF ECONOMIC IMPACTS

While the impact of the policy toolkit on the economy as a whole is expected to be relatively modest, the distribution is likely to be uneven. The costs of transitioning the economy may fall more heavily on particular industries, regions, households and individuals. Where emissions reduction policies result in inequitable outcomes, decision makers may wish to consider targeted assistance.

This section finds that the policy toolkit:

- may contribute to the closure of some emissions-intensive facilities in regional areas
 - where it can be shown that economic impacts result from emissions reduction policies, the Government should consider targeted transitional assistance to regions and communities
- is expected to increase the price of electricity and emissions-intensive consumer goods and services
 - options for managing the equity implications for households will depend on the type of policy instrument, but in all cases the energy efficiency measures in the toolkit will assist with overall electricity costs.

14.3.1. POTENTIAL IMPACTS ON REGIONS AND COMMUNITIES

The policy toolkit is expected to have varying impacts on different industries and businesses; some will grow faster as a result of new opportunities, many will not be substantially affected or will find ways to adapt to the new policy environment, and a small number are expected to contract.

Under some circumstances, climate policy may contribute to a firm's decision to close an emissions-intensive industrial facility. The loss of a major industrial facility to a regional area, whatever the main cause, could create a relatively large number of job seekers with fewer alternative opportunities than they would have in major job centres. It is also likely to have flow-on effects on other local businesses and community services. Individuals in such communities could face reduced job prospects, housing values and access to services.

Chapter 13 sets out the Authority's recommendations on assisting emissions-intensive and trade-exposed facilities. These facilities may face higher costs compared to international facilities, depending on the strength and scope of climate policies in competitor countries. Emissions-intensive industries which are not exposed to international competition may also face higher costs from climate policy compared to lower-emissions domestic competition. Coal-fired electricity generation is a key example; areas that rely heavily on such generators for employment are expected to experience more significant impacts.

Several organisations highlighted the potential impacts of climate policy on regions and communities in their submissions to Report Two, including Energy Australia, the Australian Aluminium Council and the Australian Energy Council; some also specified the need for targeted government assistance to support equitable outcomes for these communities, including the Construction, Forestry, Mining and Energy Union (CFMEU), the Australian Council of Trade Unions, the Minerals Council of Australia, and the Kimberley Land Council.

The Government should assess impacts on regions and communities, and consider additional assistance where it can be demonstrated that adverse economic impacts are due to emissions reduction policies. A basic level of assistance is available to affected workers through longstanding and ongoing assistance programs, such as social security payments, job search

assistance and training subsidies. Additional assistance packages have been adopted in Australia in the past for a range of industries and regions undergoing structural change, including steelworks, forestry, the textiles and clothing sector, car manufacturing and aluminium smelting. These packages have included additional assistance for affected workers, seed funding for new businesses, investment funds for existing businesses or public investment in infrastructure (PC 2001, 2014).

In some cases, there is not only an equity argument for assistance to regional communities and individuals, but also an efficiency argument to overcome any barriers to the market-based transition of regional economies following the closure of uneconomic high emissions facilities (Beer 2014). As noted in the CFMEU submission to Report Two, government assistance programs for regions affected by structural economic changes have had mixed results in the past. It will be important that Australian governments at all levels co-ordinate future programs to deliver assistance efficiently to affected regions.

14.3.2. IMPACTS ON LOW-INCOME HOUSEHOLDS

Using climate policy to achieve Australia's long-term emissions reduction goals can increase the price of electricity and other emissions-intensive goods and services. To the extent that prices rise (and before any assistance is provided), this tends to affect lower income households more than other households. This is because they tend to spend a higher proportion of their income on emissions-intensive goods and have less capacity to pay for increases in costs.

A range of government benefits adjust automatically with changes in consumer prices, which will ameliorate the equity impacts of price rises for emissions-intensive goods and services without additional assistance. Furthermore, the Clean Energy Future package contained significant compensation to households through welfare payment increases and tax cuts for low and middle income earners, which remained after the repeal of the carbon pricing mechanism.⁹

The Government could consider the case for further assistance to low-income households, while noting that the Authority's recommended toolkit is designed to have a relatively small impact on households. This is because:

- The Authority is recommending an emissions intensity scheme for the electricity sector, which will not increase electricity prices as much as a cap and trade scheme. In effect, an emissions intensity scheme assists all electricity users, including both households and businesses. In the short term, this will reduce the need to address equity outcomes through direct assistance.
- The Authority's electricity sector modelling projects that to achieve electricity sector emissions consistent with the 2 degree global goal (requiring deeper emissions reductions than Australia's INDC commitment for 2030), an emissions intensity scheme would increase residential spending on electricity by around eight per cent on average over the period to 2050 compared to the reference case (CCA 2016). Electricity spending as a share of household income is projected to remain around 2.2 per cent for the modelled reference case and 2.4 per cent for an emissions intensity scheme over the period to 2050. This should be viewed in context however: household disposable income is projected to grow almost 40 per cent over the same period.

³ The 2016-17 Budget measures removes the compensation measures introduced under the Clean Energy Future package (the 'Energy Supplement') for new entrants to the welfare system; existing recipients will continue to receive the supplement.

- The Authority's toolkit includes continuation and strengthening of energy efficiency policies, which can improve energy affordability for low-income households by reducing their electricity and fuel consumption (Chapter 7). In particular, the Authority recommends the Government investigate best-practice domestic and international approaches to improving the energy efficiency of low-income homes. To the extent that low-income households spend a greater proportion of their income on energy than high-income households, the net savings from such policies can benefit them more.
- The Authority is recommending strengthening the safeguard mechanism in the direct combustion, industrial processes and fugitive emissions sectors. Because this measure may target some higher cost emissions reductions, it may result in higher cost-pass through to households for some emissions-intensive goods. However, providing liable entities with access to domestic offsets and access to international permits and credits (with quantitative limits) will help contain any price increases.

The Authority notes that if a market mechanism was introduced to cover direct combustion, industrial processes, fugitives and transport following the 2022 review, and a cap and trade scheme were chosen, a proportion of revenue could be redistributed to address equity outcomes. In particular, this could be used to provide assistance to low-income households (Chapter 5).

CONCLUSION

- C.13. The costs of meeting Australia's emissions reduction goals may fall more heavily on particular industries, regions, households and individuals. Impacts on households in particular will depend to some extent on policy choice and design.

RECOMMENDATIONS

- R.39. Impacts on regions should be assessed and, where it can be demonstrated that adverse economic impacts are due to emissions reduction policies, transitional assistance to support affected regions should be considered. This would be in addition to the income support payments, job search assistance and training subsidies that are generally available.
- R.40. The Government could consider additional support for low-income households for the impacts of emissions reduction policies, noting that for recipients, assistance will occur through the normal cost of living increases to government social security payments and that most households assisted under the carbon price mechanism in 2012 still receive this assistance.
- R.41. If the 2022 or a subsequent review resulted in a market mechanism that raises government revenue being implemented outside the electricity sector a proportion of this revenue could be used to assist low-income households. If a broad-based emissions intensity scheme is introduced, further assistance to households may not be necessary.

CHAPTER 15. MOVING TO THE RECOMMENDED POLICY TOOLKIT

The Authority has recommended a toolkit of policies to meet Australia's emissions reduction obligations in the Paris Agreement. The toolkit is durable and capable of being scaled up in response to the Authority's recommended ongoing reviews. Five-yearly reviews of toolkit policy settings would examine Australia's progress in reducing emissions and emissions reduction actions in other countries.

The pathway from current policies to the Authority's recommended toolkit needs to be well-designed. To implement the toolkit, some new policies will need to be introduced and some existing policies will need to be expanded. Given Australia's recent history of significant climate policy uncertainty, it is particularly important that the transition is predictable and provides confidence that the toolkit will endure.

This chapter discusses the principles that can guide a policy transition: predictability, cost effectiveness, environmental effectiveness and equity. These align broadly with the Authority's principles for assessing policies in this review. In designing the toolkit, the Authority has considered the need for scalability, as it is important that the toolkit is capable of being scaled up to meet future emissions reduction goals. For the transition, the Authority has proposed an additional principle of 'predictability', which aligns to the need for the toolkit to be in the public interest. The chapter also provides a summary of the Authority's recommended policy toolkit and outlines how a transition to the toolkit can meet the guiding principles. The review of the toolkit in 2022 is an opportunity to assess progress, and look closely at the enhanced safeguard mechanism, measures to reduce transport emissions and assistance for emissions-intensive trade-exposed businesses.

As a result of the Paris Agreement Australia will need to accelerate its emissions reduction efforts over time, to contribute to the global goal of net zero emissions by the second half of the century. This report sets out the Authority's recommended toolkit, which is capable of reducing Australia's emissions in line with its INDC, and is scalable in response to regular reviews of Australia's progress and that of other countries.

Australia's climate policy has changed frequently in the last ten years. While policy change is sometimes necessary, policy stability is important—it reduces uncertainty and helps businesses and households make sensible decisions and investments. Many stakeholders expressed a desire for greater stability in submissions to Report Two of the Special Review on Australia's climate policy options. For example, the Australian Chamber of Commerce and Industry (ACCI) said:

A clear issue voiced by Australian business is the need for a stable and predictable policy framework, allowing businesses to adapt and invest in alternative technologies that are long-term focussed (Report Two submission, p. 12).

The Authority has addressed stability concerns in its recommended toolkit in several ways. First, it has recommended a toolkit that can be scaled up over time. Australia will be able to increase its emissions reduction efforts without major changes to the policy architecture. Second, when recommending the toolkit, the Authority has selected many policies that can respond flexibly to unexpected changes. This improves the likelihood that the policies will continue to be cost- and environmentally effective as technologies and economic conditions change over the decades to come, which improves the likelihood that policies will remain stable. Third, the Authority recommends continuing and building on existing measures, such as the safeguard mechanism, offsets, energy efficiency and innovation support measures.

To move to the Authority's recommended toolkit, some changes will be necessary. As there are several ways to reach the Authority's recommended toolkit, this chapter proposes a number of key principles to guide decisions about the policy transition. It then examines the Authority's recommended transition to the policy toolkit and considers the implications for households, communities and businesses.

15.1. PRINCIPLES FOR TRANSITION

There are several possible pathways to build on existing policies and reach the Authority's recommended toolkit. Decisions about the pathway must be informed by a detailed understanding of both current policies and the new or revised policies, as well as the intended speed of transition. The Authority recommends that the transition from current policies to the enhanced or new measures in the toolkit should be guided by the principles laid out in its legislation, in particular with respect to the public interest, cost effectiveness, environmental effectiveness and equity. Predictability is also important for a stable transition to the toolkit. These principles can help ensure that the transition is in the best interests of households, businesses, workers and communities.

The Authority recognises that some transition proposals have been put forward by stakeholders. This is a positive development and demonstrates the broad and strong interest in a stable and effective climate policy environment. A detailed discussion with all stakeholders is an important part of developing a good transition pathway.

15.1.1. PREDICTABILITY

Predictable policy transition means that, to the extent possible, businesses, households and other affected entities have a clear understanding of future policy arrangements and can form well-founded expectations about the future.

Predictability does not mean that policy settings cannot evolve over time. Indeed, some policies will need to be able to scale up in response to the reviews in the Paris Agreement and to help meet the global long-term emissions reduction goals.

Climate policy also needs to adapt to changes in the global and domestic economy, new scientific information about climate change, and technological developments.

Predictability is important both during policy transition and after the toolkit is put in place. During the process of policy transition, predictability ensures that necessary change happens in a managed and transparent way. In the longer term, predictability helps businesses and

households to understand how policy will evolve, helping them to make informed and cost-effective decisions.

In a policy transition process, predictability requires that:

- once settled, the future toolkit of policies and the pathway for getting there are clearly communicated to all stakeholders, including the Australian public
- there are clear boundaries from the outset about which parts of the transition arrangements could change (for example, to account for minor implementation issues) and which are unlikely to change
- areas for future review and the timing of reviews are set out early.

15.1.2. COST EFFECTIVENESS

Cost effectiveness is important not only in the final toolkit, but also in the pathway to the toolkit. The Government should ensure that the transition pathway imposes costs that are as low as possible.

Governments can work towards a cost-effective policy transition by:

- using or adapting existing systems, for example the National Greenhouse and Energy Reporting scheme and the Australian National Registry of Emissions Units, where they are suitable
- avoiding unnecessary administrative complexity as participants transition to new arrangements, for example, retaining the Clean Energy Regulator as the scheme administrator
- ensuring that the transition pathway is clearly communicated so participants can make cost-effective decisions for the future (this is part of predictability, discussed above).

15.1.3. ENVIRONMENTAL EFFECTIVENESS

Different pathways to the policy toolkit can have different effects on Australia's emissions reductions—that is, they can differ in their environmental effectiveness. For example, the speed of transition can affect emissions reductions. Long lead times give participants more time to plan for changes and can help build support for a measure. However, long lead times could mean missing early opportunities for emissions reductions and potentially 'locking in' emissions-intensive, long-lived plants that might not have been built under revised arrangements. A slower transition could make it necessary for Australia to achieve substantially more emissions reductions in the future in order to meet its target.

An environmentally effective policy transition means:

- striking a balance between early transition and providing lead times for participants
- ensuring the current policy mix continues to achieve emissions reductions during the transition.

15.1.4. EQUITY

In Report Two of the Special Review, the Authority discussed the importance of achieving an equitable distribution of impacts and risks across households, businesses and communities. Policy transition should be equitable in its impacts on households, businesses, workers and communities. When designing the policy transition, the two dimensions of equity discussed in

Report Two should be considered: horizontal equity (treating individuals or firms in similar situations the same) and vertical equity (not allowing costs to fall disproportionately on groups that are less able to bear them—for example, low-income households). Consultation is an important step in designing an equitable policy transition.

Equitable arrangements for transition would ensure that:

- both current and new participants are consulted on how policy should evolve and how the toolkit is put in place
- differences in timing of implementation (say between new entrants and existing firms) are justified
- potential impacts on groups such as low-income households are recognised during the transition as well as in the final toolkit.

15.2. THE AUTHORITY'S RECOMMENDED TOOLKIT

This section summarises the Authority's recommended toolkit and sets out a transition pathway to the toolkit that builds on current policy settings.

The transition begins from Australia's current climate policy framework. Building on existing mechanisms is likely to make the transition more feasible and durable, particularly given the recent history of climate policy instability in Australia. The transition is depicted in Figure 18. Section 15.2.3 explains how the pathway meets the transition principles.

15.2.1. THE RECOMMENDED TOOLKIT

An emissions intensity scheme should be introduced for electricity generators in 2018 (Chapters 5 and 9). Generators should be able to use credits from eligible energy efficiency projects (including ERF crediting and state white certificate schemes, subject to eligibility criteria set by the Government), but the scheme should be closed to other domestic offsets and international permits and credits. The emissions intensity baseline should decline linearly over the period and reach zero well before 2050, consistent with Australia's Paris Agreement obligations.

An intensity scheme can be readily implemented in the electricity sector because electricity is a homogeneous product that is well suited to a single baseline for emissions intensity. The nature of an emissions intensity scheme means that the price impacts on Australian households and businesses will be lower than with a cap and trade scheme (Chapter 5). The Authority considers that closing the scheme to international permits and credits will improve certainty for investors in Australian low-emissions generation assets, and so improve the scheme's cost effectiveness.

The existing safeguard mechanism should be enhanced to promote policy stability (Chapter 5). The safeguard mechanism should be continued and strengthened in the direct combustion, industrial processes and fugitive emissions sectors. Continuing the safeguard mechanism, and making the necessary developments so it can become part of the policy toolkit, means the transition is phased and predictable, building carefully on existing policies. The following changes should be made to the safeguard mechanism to enhance its environmental and cost effectiveness:

- *Lower thresholds.* The safeguard currently sets a limit on direct emissions from facilities that emit 100,000 t CO₂-e or more (this limit is expressed as a 'baseline') (DoE 2016d). In 2018, the coverage of the safeguard should extend to facilities that emit 25,000 t CO₂-e or more, because broader coverage increases the cost effectiveness and environmental effectiveness of the scheme. The 25,000 tonne threshold also aligns with reporting required

from facilities under the National Greenhouse and Energy Reporting scheme, which reduces transaction costs.

- *No further baseline revisions.* Under the safeguard, baselines can currently be adjusted in a number of circumstances (DoE 2016d). To make the emissions outcome of the safeguard policy more predictable and to bring it in line with Australia's targets, from 2017 baselines should not be able to be reset to allow for more emissions, and baselines should decline linearly to provide a binding constraint on emissions, which should be set consistent with meeting Australia's INDC.
- *Access to international units.* Safeguard facilities should be able to use international credits and permits to meet their baselines with a quantitative limit to ensure that the transition to a lower carbon economy is not delayed, and qualitative limits to help ensure units are genuine (Chapter 6). Access to international units will likely mean relatively lower compliance costs for safeguard facilities.
 - To help guard against international competitiveness issues (Chapter 13), emissions-intensive trade-exposed facilities should not have quantitative limits on access to international units, but the qualitative restrictions would apply. The 2022 toolkit review will consider, among other things, whether a quantitative limit that declines over time should apply to EITs.
- *Access to domestic offsets.* Facilities should also have unlimited access to ERF credits from the land sector and sectors covered by the safeguard mechanism to reduce emissions if they exceed their baselines. Offsets help reduce compliance costs. They also extend the benefit of a market for emissions reductions to uncovered sectors.
- *No credits for emissions below baselines.* Because of additionality concerns and to avoid penalising early movers, credits should not be issued to facilities for emissions below their baselines. As noted above, however, facilities should continue to be able to earn credits as a result of ERF projects (which have stringent additionality tests).

ERF crediting for the land sector and sectors covered by the safeguard mechanism should continue, and these credits could be used as offsets for safeguard facilities. ERF auctions should continue for the land sector until the enhanced safeguard mechanism provides a source of demand (Chapter 11); and for projects in the safeguard sectors to provide transitional assistance to safeguard facilities. This promotes policy stability by providing a continuing incentive for these projects. Additionality rules for ERF crediting would need to reflect declining safeguard mechanism and emissions intensity baselines to ensure that ERF projects remain additional.

In the electricity supply sector, the Authority recommends that the existing national Renewable Energy Target (RET) should remain in its current form to 2030 to promote policy stability and investor certainty.

Given the importance of investor confidence to making the transition to a low-emissions electricity sector and the policy uncertainty that has characterised emissions reduction policy in the last decade or so, the Authority considered whether additional electricity sector policies (beyond the RET) might be warranted to support the emissions intensity scheme. The Authority reached the view that investor confidence is best met by introducing a scalable, cost-effective policy which remains stable and adding further policies in the electricity generation sector risks policy interactions that could undermine this key objective of policy stability.

Carbon dioxide emissions standards should be introduced for light vehicles (Chapter 10). The transport sector as a whole should continue to be covered by the Emissions Reduction Fund

crediting and by purchasing until light vehicle standards are put in place. There also appears to be a case to pursue heavy vehicle standards in line with developments in the US, Canada, China and Japan, and these should be considered following a cost-benefit analysis.

Existing energy efficiency standards and programs for appliances and buildings should be regularly strengthened and expanded (Chapter 7). Australian governments should again seek to harmonise white certificate schemes to promote a more uniform approach to energy efficiency incentives across the country. Eligible energy efficiency credits could be surrendered for compliance in the emissions intensity scheme, with the Australian Government setting eligibility criteria. Government purchase for energy efficiency credits should continue until the emissions intensity scheme provides a source of demand.

Innovation support for low-emissions technologies and practices should continue through targeted public funding for research, development and demonstration, and Government support for deployment through debt and equity funding (Chapter 8).

Synthetic greenhouse gases should continue to be phased down under domestic and international law. Australian governments should commence work to harmonise regulations that set limits on emissions from landfill waste facilities (Chapter 12). These are environmentally effective and straightforward ways to reduce emissions in these sectors. ERF crediting and purchasing should continue for landfill and synthetic greenhouse gas projects until enhanced regulation is put in place.

As the toolkit is implemented, its impacts on regions should be assessed and addressed (Chapter 14). Where it can be demonstrated that adverse economic impacts are due to emissions reduction policies, transitional assistance to support strongly affected regions should be considered. The Government could consider additional support for low-income households for the impacts of emissions reduction policies, noting that, for recipients, assistance will occur through the normal cost of living increases to government social security payments and that most households assisted under the carbon price mechanism in 2012 still receive this assistance.

15.2.2. REVIEW IN 2022

The Authority has recommended five-yearly reviews of the policy settings within the toolkit before each five-yearly 'global stocktake' under the Paris Agreement (Chapter 4). The Authority recommends that there is a substantive review of the toolkit as a whole in 2022. This should consider the effectiveness of the enhanced safeguard arrangements (Section 5.4). In particular, the review would consider whether to maintain the enhanced safeguard arrangements or introduce another policy instrument such as a market mechanism in the direct combustion, industrial processes and fugitive emissions sectors.

The 2022 toolkit review should also assess:

- whether the transport sector should be covered by the enhanced safeguard or another policy such as a market mechanism
- access to international permits and credits by emissions-intensive trade-exposed facilities, and would consider whether a quantitative limit that scales down linearly over time should apply.

FIGURE 18 TRANSITION TO THE POLICY TOOLKIT

	Current policies	Toolkit
Electricity supply		Emissions intensity scheme from 2018 <i>Intensity baseline declines linearly over time, reaching zero well before 2050</i> <i>Eligible energy efficiency credits can be used to meet obligations</i> Chapter 5
		Renewable Energy Target Chapter 9 <i>Ends 2030</i>
Direct combustion	Emissions Reduction Fund (ERF) - crediting and purchasing Safeguard mechanism	Enhanced safeguard mechanism <i>Baselines decline consistent with Australia's commitments</i> <i>ERF credits from agriculture, land use and safeguard sectors can be used to meet obligations</i> Chapter 5
Industrial processes		Enhanced safeguard or market mechanism Chapter 5
Fugitive emissions	<i>ERF auctions in safeguard sectors and transport</i>	
Transport		Carbon dioxide standards for light vehicles Chapter 10 Standards continue; 2022 review to consider transport coverage under enhanced safeguard or market mechanism Chapter 5
		Cost-benefit analysis of carbon dioxide standards for heavy vehicles
Agriculture		<i>ERF auctions for agriculture and land use</i> ERF crediting Chapter 11
Land use	Regulation and standards Safeguard mechanism	ERF auctions; Regulation to further reduce emissions Chapter 12
Waste		
Synthetic greenhouse gases		
Cross-cutting policies	State-based white certificate schemes Energy efficiency measures for buildings, industry, households Innovation support	Efforts to harmonise white certificate schemes for use as offsets under emissions intensity scheme Chapter 7
		ERF crediting and auctions for energy efficiency Chapter 7 New or enhanced energy efficiency measures for buildings, industry, households Chapter 7 Innovation support focussed on R&D for low-emissions technologies Chapter 8
Reviews		First toolkit review in 2022 Five-yearly reviews thereafter <i>Reviews to assess Australia's progress and that of key countries</i>

Note to Figure 18: Dotted boxes indicate areas where there appears to be a case for including a policy in the toolkit but further investigation is required. This diagram focuses on Commonwealth and nation-wide policies; some state-based policies that reduce emissions are not included here for simplicity. ERF auctions continue: in sectors covered by the enhanced safeguard mechanism to provide transitional assistance; in the land sector until the enhanced safeguard mechanism provides a source of demand; for ERF energy efficiency projects until the emissions intensity scheme provides a source of demand; for transport projects until light vehicle standards are in place; and for waste and synthetic greenhouse gas projects until enhanced regulation is in place.

Source: Climate Change Authority.

15.2.3. THE TRANSITION CAN MEET THE PRINCIPLES

The transition to the toolkit is predictable. Continuing the safeguard in the shorter term makes for a smooth policy transition and helps bed down the predictability of the policy toolkit. Modifying an existing mechanism is likely to be viewed as more stable and predictable by stakeholders than immediately replacing it with a new policy, and allows for future policy settings to be well-planned and thoroughly consulted on before implementation.

In general, the predictability of the transition can be secured with good communication strategies explaining transition plans far enough into the future to enable businesses and individuals to make informed investment decisions. It is important to note that the predictability of the transition would be reduced if the steps were changed, delayed or not carried out.

The transition can be implemented in a cost-effective way, drawing on existing systems used by the Clean Energy Regulator. Participants would incur some costs as they adjust to new rules. However, safeguard participants would be familiar with the arrangements already in place, which may reduce their costs.

Any delays to introducing the emissions intensity scheme could reduce the cost effectiveness of the transition, because some low cost emissions reduction opportunities could be missed or delayed.

The transition will be environmentally effective, provided transition settings work towards achieving Australia's emissions reduction targets. For example, emissions intensity benchmarks for electricity generators and safeguard baselines would need to decline over time, and not stay constant or increase. Delays in transition to the toolkit would delay emissions reductions and extreme delays could risk not meeting Australia's targets. Environmental effectiveness would also be eroded if elements of the toolkit were abandoned because changes were made before gaining public acceptance or resolving stakeholder concerns.

The transition provides for equity in a number of ways. It assists emissions-intensive trade-exposed firms to address potential competitiveness impacts by providing full access to international credits and permits (as long as they represent genuine emissions reductions). It assists households and other electricity users to adjust because an emissions intensity scheme will not increase electricity prices as much as other market mechanisms, and so would have a smaller short-term impact on equity. In general the toolkit provides horizontal equity by treating like businesses alike where they are in the same sector. Thorough consultation of detailed transition settings will be important to ensure equity issues are fully identified and addressed.

In the Authority's view, there is a close relationship between the policy toolkit's durability and the degree of public acceptance it receives. The proposed pathway will also meet a key test of public acceptability if it is communicated effectively. While some may take the view that elements of the policy toolkit and the transition pathway fall short of first-best policy, the Authority considers that as a whole the transition and the toolkit itself represent a pragmatic and durable solution to reducing Australia's emissions. This has in turn met the need for the toolkit to be in the public interest. Furthermore Australia cannot make an effective contribution to the global response to climate change, if its policies to reduce emissions lack durability.

The Authority considers that the policy toolkit and the recommended transition to its toolkit meet the principles in the Authority's legislation. In its work the Authority has been guided by the terms of reference for the Special Review. Appendix A provides detail on how the Authority has met the terms of reference for the review.

CHAPTER 16. FURTHER WORK

In this report the Authority has recommended a toolkit of climate change policies that Australia can use to build a durable architecture for meeting its emissions reduction commitments under the Paris Agreement. The Authority hopes that this toolkit might be adopted by the Government. If it were, several matters would require further consideration or research work. These are outlined in this chapter. They include matters of governance and implementation, matters on which the Authority has not come to a firm view in the course of the Special Review, and a small number of matters not considered as part of the Review.

16.1. GOVERNANCE AND IMPLEMENTATION

This report outlines the Authority's recommended climate policy toolkit for Australia, but does not give a complete blueprint for implementing each of the policies. The detailed policy design and implementation arrangements will need further work by Government. This would include governance arrangements and an appropriate legislative framework.

Further investigation would also be needed to determine the appropriate rate of decline of baselines in the enhanced safeguard mechanism and electricity sector emissions intensity scheme.

Implementation of the toolkit would include the Authority's recommended five-yearly reviews to assess Australia's progress in reducing emissions and emissions reduction actions that other countries, particularly major trading partners, are taking to meet their Paris commitments. The first of these, in 2022, should assess whether the enhanced safeguard mechanism would continue or whether another policy instrument such as a market mechanism should be implemented to cover emissions from direct combustion, industrial processes and fugitives, and whether emissions from transport should be covered.

The Authority notes the importance of emissions reduction policies being designed with the operation of electricity markets in mind. This imperative has influenced the Authority's recommendations for an emissions intensity scheme to reduce emissions in the electricity sector. Ongoing work by expert bodies including the Australian Energy Market Commission and Australian Energy Market Operator will be needed to support Australia's transition to an efficient, decarbonised electricity supply.

16.2. POLICIES THAT REQUIRE FURTHER CONSIDERATION

In this report the Authority has identified several areas where further design work or investigation is needed. There is cause to further consider:

- introducing heavy vehicle CO₂ emissions standards following a cost benefit analysis (Chapter 10)

- delivering electric vehicle recharging infrastructure and the best roles of public and private providers in this delivery (Chapter 10)
- pursuing harmonised white certificate schemes across all states and territories (Chapter 7)
- setting a standard for white certificates to be surrendered for compliance under the electricity sector emissions intensity scheme (Chapters 5 and 7)
- establishing a new scheme for the disclosure of residential building energy efficiency information—further consideration is underway through a COAG process (Chapter 7)
- strengthening energy efficiency requirements for new buildings in the 2019 review of the National Construction Code (Chapter 7)
- introducing additional policies that might encourage building energy efficiency retrofits, such as minimum standards for rental properties and existing buildings, green depreciation and/or stamp duty concessions for energy efficient properties (Chapter 7)
- harmonising state and territory landfill regulations and ensuring that maximum allowable levels of methane emissions reflect Australia’s long-term emissions reduction goals (Chapter 12)
- establishing a strategic fund of international credits and permits to help meet the 2030 target (Chapter 6).

As recommended in Chapter 6, the Authority is of the view that the use of international permits and credits, whether for a strategic fund or when surrendered for compliance under the enhanced safeguard mechanism, should be subject to strict qualitative restrictions. An update of work such as the Authority’s 2014 research report on international units (CCA 2014c) could assist in informing views on the environmental integrity of different permits and credits.

As recommended in Chapter 11, the Australian Government should lead a review involving states and territories and other key stakeholders to provide guidance on how natural resource management policies at both the national and farm levels could encourage carbon storage and reduce emissions in the land sector while pursuing broader natural resource management outcomes.

16.3. MATTERS OUTSIDE THE SCOPE OF THE SPECIAL REVIEW

There are some matters which affect the delivery and outcomes of climate policy but are outside the scope of this Review. These matters also warrant further consideration:

- Planning permissions for large-scale, low-emissions development (plant or infrastructure), in particular whether these create unnecessary barriers to approval.
- Consistency of existing policies with the policies recommended in the Authority’s toolkit. Consideration could involve a review of state and territory climate-related policies for consistency with the toolkit.

APPENDIX A. TERMS OF REFERENCE



15 DEC 2014

COMMONWEALTH OF AUSTRALIA

SPECIAL REVIEW BY THE CLIMATE CHANGE AUTHORITY

By this written instrument I, Greg Hunt, Minister for the Environment, request that the Climate Change Authority conduct a review under section 59 of the *Climate Change Authority Act 2011*, as below:

- Assess whether Australia should have an Emission Trading Scheme in the future and what conditions should trigger the introduction of such a scheme.
- This review must consider:
 - whether the USA, China, Japan, Republic of Korea and the EU have established ETSS or equivalent schemes that have similar effect;
 - Australia's international commitments and undertakings under the United Nation's Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to which Australia is a party;
 - whether Australia should introduce an ETS that does not harm Australian businesses international competitiveness; and
 - what future emissions reduction targets Australia should commit to as part of an effective and equitable global effort to achieve the objective of the UNFCCC (Article 2) or subsequent agreement to which Australia is a party.

Timing

- The Authority should issue a draft report on what future emissions reduction targets Australia should agree to for public consultation by 30 June 2015.
- The Authority should issue a draft report on an Emissions Trading scheme for public consultation by 30 November 2015.
- The Authority should issue a final report by 30 June 2016 recommending what action Australia should take to implement outcomes flowing from the Paris conference.

Dated *10 December* 2014

A blue ink signature of Greg Hunt, written in a cursive style.

Greg Hunt

Minister for the Environment

Table 11 indicates how the Authority has met the terms of reference for the Special Review.

TABLE 11 ANALYSIS OF CLIMATE CHANGE AUTHORITY SPECIAL REVIEW TERMS OF REFERENCE

TERMS OF REFERENCE ELEMENT	SEE
<i>Climate Change Authority to conduct a review...</i>	
...Assess whether Australia should have an emissions trading scheme in the future...	<ul style="list-style-type: none"> • Preliminary analysis on various forms of emissions trading schemes, stakeholder submissions sought in Report Two of the Special Review • Special Review electricity research report – modelling and analysis on emissions intensity scheme and cap and trade/carbon tax • Special Review Report Three – Summary, Chapters 5 and 15
...and what conditions should trigger the introduction of such a scheme	<ul style="list-style-type: none"> • Emissions intensity scheme for the electricity sector to commence in 2018 • 2022 review to consider other policies such as market mechanisms for direct combustion, industrial processes, fugitives and transport
<i>The review must consider:</i>	
Whether the USA, China, Japan, Republic of Korea and the EU have established ETSs or equivalent schemes that have similar effect	<ul style="list-style-type: none"> • Special Review Report Two, Table 1 • Special Review Report Three – Section 2.1; Table 2; Chapter 5
Australia's international commitments and undertakings under the UNFCCC and the Kyoto Protocol	<ul style="list-style-type: none"> • Draft and final report on targets • Special Review Report Three – Chapter 1, Section 1.3; Chapter 3
Whether Australia should introduce an ETS that does not harm Australian businesses international competitiveness	<ul style="list-style-type: none"> • Special Review Report Three – Summary, Chapter 13
What future emissions reduction targets Australia should commit to as part of an effective and equitable global effort to achieve the objective of the UNFCCC (Article 2) or subsequent agreement to which Australia is a party	<ul style="list-style-type: none"> • Draft and final reports on targets • Special Review Report Three – Chapter 1, Section 1.3; Chapter 3
<i>Timing</i>	
The Authority should issue a draft report on what future emissions targets Australia should agree to for public consultation by 30 June 2015	<ul style="list-style-type: none"> • Draft report on targets April 2015 • Final report on targets July 2015

TERMS OF REFERENCE ELEMENT	SEE
The Authority should issue a draft report on an Emissions Trading scheme for public consultation by 30 November 2015	<ul style="list-style-type: none">• Special Review Report Two November 2015
The Authority should issue a final report by 30 June 2016 recommending what action Australia should take to implement outcomes flowing from the Paris conference	<ul style="list-style-type: none">• Special Review Report Three (delayed until after federal election)

Source: Climate Change Authority.

APPENDIX B. PUBLIC CONSULTATION

The Authority is required to conduct public consultation for all of its reviews.

Throughout this review, the Authority has consulted with a wide range of interested parties, including business, industry, and government and non-government organisations.

The Authority released Report Two of the Special Review on 30 November 2015. 70 submissions were received from a wide range of stakeholders; 66 of these were non-confidential. Table 12 lists the individuals and organisations that provided public submissions to Report Two.

Throughout the Special Review and the development of the electricity modelling and consultation paper, the Authority has conducted stakeholder meetings. Meetings spanned a wide range of stakeholders and groups, including business and industry, non-government organisations and interest groups, and state, territory and Commonwealth government agencies. In particular, the Authority's electricity modelling work and research report (released alongside this report) benefited from ongoing input and expert advice from technical and industry reference groups, and a range of government departments and regulatory agencies. 14 stakeholders made submissions to the Authority's May 2015 consultation on its proposed approach to its electricity modelling (eight of which were non-confidential)—these contributed to the direction of the modelling work.

The Authority also received 28 submissions on its March 2015 consultation on Australia's future emissions reduction targets. These submissions informed the Authority's Special Review *Final report on Australia's future emissions reduction targets*, released 2 July 2015.

The Authority's previous reports and consultation papers, as well as stakeholder submissions, are available on the Authority's website at: www.climatechangeauthority.gov.au.

TABLE 12 SUBMISSIONS RECEIVED: REPORT TWO OF THE SPECIAL REVIEW

ACT Government – Environment and Planning	Greenpeace Australia Pacific
Australian Council of Trade Unions (ACTU)	Harley Wright
AGL Energy	Hydro Tasmania
Australian Petroleum Production & Exploration Association (APPEA)	Ian Wallis
Alan Pears	International Emissions Trading Association
Alex Nicolson	Investor Group on Climate Change
Angus Atkinson	John C.V. Pezzey and Frank Jotzo
Australian Aluminium Council	John Chapman

Australian Automotive Aftermarket Association	John Gare
Australian Chamber of Commerce and Industry	Kimberley Land Council
Australian Energy Council	Local Government Association of South Australia
Australian Financial Markets Association	Local Government NSW
Australian Forest Products Association	Master Electricians Australia
Australian Gas Networks	Meta Economics Consulting Group
Australian Industry Greenhouse Network	Minerals Council of Australia
Australian Landfill Owners Association	Murray Scott
Australian Pipeline and Gas Association	N2O Avoidance Methodology
Barbara J. Fraser	NSW Farmers' Association
Business Council of Australia	National Farmers Federation
Carbon Market Institute	Origin
Cement Industry Foundation	ProductWise
Centre for Energy and Environmental Markets, UNSW	Public Health Association of Australia
Centre for Resources, Energy and Environmental Law, University of Melbourne	Refrigerants Australia
Citizens' Climate Lobby Australia	RepuTex
Climate and Health Alliance	Rio Tinto
ClimateWorks Australia	Stephen Miller
Climates	Stephen Pollard et al.
Construction, Forestry, Mining and Energy Union	Sydney Water
Doctors for the Environment Australia	The Climate Institute
EnergyAustralia	The Wilderness Society

Energy Networks Association

U3A Climate Conversation Group

Energy Users Association of Australia

WWF Australia

Future Business Council

Westpac

Gas Energy Australia

APPENDIX C. RECENT CLOSURES OF EMISSIONS-INTENSIVE AND TRADE-EXPOSED FACILITIES

TABLE 13 RECENT EITE FACILITY CLOSURES IN AUSTRALIA

FACILITY	CLOSURE ANNOUNCED	CLOSURE	REASONS FOR CLOSURE AND RELATIONSHIP TO CLIMATE CHANGE POLICY
Metals manufacturing			
Bluescope Steel (NSW and Victoria)	August 2011	October 2011	In August 2011 Bluescope Steel announced the closure of blast furnace no.6 at Port Kembla, NSW, and the Western Port hot strip mill in Victoria. The company cited the high Australian dollar, low steel prices and high raw material costs for this decision. It emphasised that its decision 'is not related to the Federal Government's proposed carbon tax' (Bluescope Steel 2011).
Kurri Kurri aluminium smelter (NSW)	June 2012	September 2012	Hydro cited weak macroeconomic conditions, low metal prices, and strong Australian dollar for meaning that Kurri Kurri would not be profitable in the short-term. It also noted that the plant's long-term viability was negatively affected by 'a number of factors including increasing energy costs and the carbon tax' (Hydro 2012a, 2012b). The smelter stopped producing metal in September 2012 and its permanent closure was confirmed in May 2014 (Hydro 2016).
Gove alumina refinery (NT)	November 2013	May 2014	Rio Tinto suspended production at Gove in response to challenging market conditions, including low alumina prices and a high exchange rate, which resulted in substantial after-tax losses for the refinery (Rio Tinto 2013). The refinery has been placed under care and maintenance (Rio Tinto 2016) rather than permanently closed. The Gove bauxite mine remains in operation.
Point Henry aluminium smelter and rolling mill (Victoria)	February 2014	August 2014	Alcoa's February 2012 review of Point Henry was prompted by 'low metal prices, a high Australian dollar and input costs'. It stated that 'the future price on carbon would be an additional cost, however Point Henry smelter is already losing money' (Alcoa 2012). In February 2014 Alcoa announced that the review had shown no prospect of the plant returning to financial viability (Alcoa 2014). The smelter closed in August 2014 and the rolling mill in December 2014 (Alcoa 2016), after the repeal of Australia's carbon price.

FACILITY	CLOSURE ANNOUNCED	CLOSURE	REASONS FOR CLOSURE AND RELATIONSHIP TO CLIMATE CHANGE POLICY
Petroleum refineries			
Clyde petroleum refinery (NSW)	July 2011	September 2012	Shell considered that Clyde was not competitive against large-scale Asian 'mega-refineries'. It emphasised that its decision was 'not reached as a result of any government policy – including any proposed price on carbon' (Shell 2011).
Kurnell petroleum refinery (NSW)	July 2012	October 2014	Caltex cited scale, competition from larger Asian refineries, the strength of the Australian dollar and increased operating costs for Kurnell's closure. It said that Australia's then carbon pricing policy had 'no material impact' on the closure decision (Caltex 2012), which took place after its repeal.
Bulwer Island petroleum refinery (Queensland)	April 2014	May 2015	BP emphasised competition from low cost, newer refineries in the Asia Pacific as causing Bulwer Island's closure (BP 2014). The closure took place after the repeal of Australia's carbon price.
Cement and clinker plants			
Kandos cement plant (NSW)	July 2011	September 2011	When announcing the Kandos closure, Cement Australia cited dated technology, high fixed costs, skills shortages and the high Australian dollar as reasons (Cement Australia 2011). Separately Cement Australia's CEO was quoted as saying that the decision 'was not directly related to the carbon tax, however current regulation and government imposts are an increasing burden on manufacturing in Australia... [and] the carbon tax will exacerbate this'. He also noted that 'it has been a challenge for some years to operate the Kandos plant viably' (Manufacturers' Monthly 2011).
Waurm Ponds cement plant (Victoria)	December 2012	April 2013	Boral cited the high Australian dollar, low shipping costs and high energy and other manufacturing costs as contributing to high domestic production costs relative to imports (Boral 2012).
Maldon cement plant (NSW)	June 2014	December 2014	Boral cited the Maldon kiln's high cost and sub-scale output as primary reasons for its closure, in the face of low demand and cheap competing imports (Boral 2014). The closure took place after the repeal of Australia's carbon price.

FACILITY	CLOSURE ANNOUNCED	CLOSURE	REASONS FOR CLOSURE AND RELATIONSHIP TO CLIMATE CHANGE POLICY
Munster clinker plant (WA)	February 2014	End 2015	In February 2014 Cockburn Cement announced the progressive phase out of clinker production at Munster, and its replacement with imported clinker by 2016. The primary reasons cited were increased energy costs and the plant's low energy efficiency. Lime production and cement milling continues at the site (Cockburn Cement 2014). The clinker plant closure was completed after the repeal of Australia's carbon price.
Other emissions-intensive trade-exposed facilities			
Penrice soda ash and sodium bicarbonate plant (South Australia)	January 2013	June 2014	In January 2013 Penrice's CEO was quoted as saying that the impending cessation of soda ash manufacturing was due to lower shipping costs leading to cheap imports, and increasing costs and taxes. He said that the carbon tax was not the reason for the closure as 'there are a lot of factors at play here, but the carbon tax, on top of all these other factors, is very difficult to manage' (ABC 2013). Penrice ceased manufacturing soda ash in 2013 and moved to imported soda ash to produce sodium bicarbonate (The Advertiser 2014). The entire plant closed in June 2014 (The Advertiser 2014).
Shoalhaven paper mill (NSW)	February 2015	July 2015	Australian Paper attributed to closure to declining demand for specialty security paper products (Australian Paper 2015). The closure took place after the repeal of Australia's carbon price.

Source: Climate Change Authority based on the sources cited.

GLOSSARY OF TERMS

abatement	The act or process of limiting or restricting greenhouse gas emissions. See also 'emissions reduction'.
additionality	A test of the environmental integrity of policy, particularly offset credits. An additionality test assesses whether a project or activity creates 'additional' emissions reductions that would not have occurred in the absence of the policy.
agricultural emissions	Emissions resulting from livestock digestive processes (enteric fermentation), manure management, nitrous oxide emissions from cropping and pastureland soils, and burning of agricultural residues.
auctions for contracts for difference	A type of 'technology pull' policy. The government sets a required quantity of new low- (or zero-) emissions generation. Low emission generators bid for long-term 'contracts for difference' with the government which partially or fully specify the price per MWh received by generators. This bidding takes place through a reverse auction ('auctions for contracts for difference').
baseline emissions	A reference level of emissions for a facility or industry used to set policy and/or measure progress in reducing emissions. Under the safeguard mechanism, the baseline for a covered facility sets a limit on its direct emissions. In a baseline and credit scheme, covered entities are credited for emissions below the baseline and must surrender purchased credits for emissions above the baseline. In an offset scheme, projects are credited for emissions below a project baseline that reflects what emissions would have been in the absence of the offset scheme. See also 'emissions intensity baseline'.
business as usual emissions (BAU)	Emissions that would occur without any additional policy intervention.
cap	A year-by-year limit on emissions from sources covered by a cap and trade scheme.
carbon capture and storage (CCS)	Technologies that capture carbon dioxide emissions from energy production or industrial processes, and inject it below the land or the sea into underground geological formations.
carbon dioxide equivalent (CO ₂ -e)	A measure that quantifies different greenhouse gases in terms of the amount of carbon dioxide that would deliver the same global warming.
carbon leakage	The shift of production of goods or services and their associated greenhouse gas emissions as a result of emissions reduction policies. This can erode the environmental effectiveness of policy. For example, production may shift from a country that does have emissions reduction policies to one that does not have a binding constraint on emissions.
carbon neutral	Describes a process, product or service with net zero emissions.

carbon price	The price of one tonne of greenhouse gas emissions (CO ₂ -e) in a market mechanism.
carbon storage	In this report 'carbon storage' refers to practices that increase the capture and long-term storage of atmospheric carbon dioxide in the land sector, such as tree planting, revegetation or increasing soil carbon.
Clean Development Mechanism (CDM)	An international offset scheme under the Kyoto Protocol that credits projects in developing countries for reducing emissions. These credits can be traded, and developed countries can use them to help meet their emissions reduction targets under the Protocol.
Climate Change Authority (The Authority)	Established on 1 July 2012, the Climate Change Authority provides independent, expert advice on Australian Government climate change mitigation initiatives.
co-benefits	Benefits that arise from the introduction of a policy in addition to its main purpose. An example is health benefits from emissions standards for power plants.
competitive distortions	Competitive distortions arise when production and investment shifts between firms, economic sectors or countries due to differences in the emissions reduction policies those entities face.
competitiveness	A measure of a country's, industry's or business' relative advantage in selling its products in domestic or international markets.
competitiveness measures	Policy measures designed to reduce competitive distortions and carbon leakage.
contracts for difference	A type of technology pull policy for encouraging new zero- or low-emissions generation. The government sets a required quantity of new low- or zero-emissions generation. Low-emission generators bid for long-term 'contracts for difference' with the government which partially or fully specify the price per MWh received by generators.
cost effectiveness	The effectiveness with which a policy achieves its objectives. For climate policy, this is often indicated by dollars per tonne of emissions reduced.
credit	A tradable instrument generated under an offset scheme, representing one tonne of greenhouse gas emissions (CO ₂ -e) reduced relative to baseline emissions.
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.
direct costs	The additional costs in a sector above those that would have occurred in the absence of the policy, such as the added cost of investing in a low-emissions electricity generation plant rather than a high-emissions one.

direct emissions	Greenhouse gas emissions arising directly from an activity rather than associated activities such as the production of inputs. For example, the direct emissions from electricity generation are those from the generation itself rather than (say) the transport of fuel to power stations.
discount rate	The rate at which future costs and benefits are discounted. For example, an annual discount rate of seven per cent means that a cost or benefit in one year will be valued seven per cent higher than the same cost or benefit incurred a year later.
domestic emissions	Emissions produced within a country. Also referred to as 'national emissions'.
electricity emissions	Emissions released when fuels, such as coal and natural gas, are combusted to generate electricity.
emissions intensity	A measure of the amount of emissions associated with a unit of output; for example, emissions per unit of gross domestic product or electricity production.
emissions intensity baseline	In an emissions intensity scheme, a baseline level of freely allocated permits that a business receives per unit of production. As the allocation is provided for each unit of output, the level of the allocation generally reflects the broad emissions intensity of producing a given good, and hence the allocations are known as emissions intensity baselines.
emissions reduction	The act or process of limiting or restricting greenhouse gas emissions. See also 'abatement'.
Emissions Reduction Fund (ERF)	An Australian Government climate policy consisting of three elements: <ul style="list-style-type: none"> • crediting of emissions reductions from voluntary projects that reduce emissions in comparison to baseline emissions • government purchase of credits through a reverse auction process • a safeguard mechanism that requires covered facilities to stay below specified baseline emissions levels.
emissions-intensive trade-exposed (EITE) businesses or industries	Businesses or industries that are involved in activities that produce with a high level of emissions intensity (for example cement production) and are either focused on the export market or subject to import competition.
energy efficiency	The ratio of energy inputs to outputs. Processes are more energy efficient if they require less energy to generate the same amount of value or comfort.
energy productivity	The ratio of outputs to energy inputs. Processes that produce more value from a given energy input improve energy productivity.
environmental effectiveness	In this report, a policy's ability to help close the gap between business as usual emissions and national targets and help achieve the global climate goals.

environmental integrity	In this report, refers to whether a credit or permit issued under a market mechanism represents a genuine emissions reduction. Sometimes assessed using tests such as accurate emissions measurement, additionality, permanence or carbon leakage.
equity	In this report, the distribution of the costs and benefits of a policy.
feed-in tariffs (FiTs)	A type of technology pull policy. The government pays low-emissions generators a long-term fixed price for their electricity generation, with the price set administratively.
fugitive emissions	Greenhouse gases emitted during the extraction, production, processing, storage, transmission and distribution of fossil fuels such as coal, oil and gas.
generation	The amount of electrical energy produced or used over a period of time, typically measured in gigawatt hours (GWh) or megawatt hours (MWh).
global temperature goal	A goal set by the countries party to the UNFCCC to limit global warming with the aim of avoiding dangerous climate change. Under the Paris Agreement, the global temperature goal is to keep warming to 'well below' 2 degrees Celsius compared to pre-industrial levels, and to 'pursue efforts to limit the temperature rise to 1.5 degrees'.
global warming	A warming of global average temperatures caused by increased atmospheric concentrations of greenhouse gases. This warming results in changes to the climate system.
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 carbon dioxide, water vapour, nitrous oxide, methane and ozone.
gross domestic product (GDP)	A measure of total activity in an economy, such as a country or region. It reflects the total market value of all final goods and services produced in that economy.
gross national income (GNI) (see also 'terms of trade')	An economic measure of total income earned by residents of an economy that reflects gross domestic product, the terms of trade and international income transfers.
heavy vehicle	In this report, all motor vehicles with gross vehicle mass greater than or equal to 3.5 tonnes, including trucks and buses.
indirect costs (see also 'tax interaction effect')	In addition to their direct costs, emissions reduction policies often involve indirect costs, including those due to interactions with the tax system ('tax interaction effects'). In some cases indirect costs can be reduced through recycling revenue raised by emissions reduction policies in ways that improve economic efficiency.

indirect emissions	Greenhouse gas emissions arising from associated activities rather than the activity itself. For example, in the electricity sector indirect emissions from electricity supply would include those from transporting fuel to a power station.
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.
Innovation and Science Australia	An independent statutory body that will be responsible for strategic whole of government advice on all science, research and innovation matters.
Intended Nationally Determined Contribution (INDC) (see also 'Paris targets')	A pledge to make emissions reduction efforts, made by a country or region in advance of the 2015 United Nations Framework Convention on Climate Change conference in Paris. When countries ratify the Paris Agreement, they can choose to keep their INDC or strengthen it. At this point the INDC becomes a nationally determined contribution (NDC).
Intergovernmental Panel on Climate Change (IPCC)	Scientific intergovernmental body that produces reports that support the United Nations Framework Convention on Climate Change, which is the main international treaty on climate change.
Kyoto Protocol	An international agreement adopted under the United Nations Framework Convention on Climate Change in 1997. It includes binding national targets for developed countries and flexible mechanisms including the Clean Development Mechanism (CDM).
land sector	The land use and agriculture sectors.
land use (land use, land-use change and forestry) emissions and removals	Emissions and emissions removals associated with human-induced changes in land use, such as deforestation and afforestation, and those arising from management of forests, crop lands and rangelands and savanna burning.
Large-scale Renewable Energy Target	Commonwealth policy that creates a financial incentive for the establishment or expansion of renewable energy power stations, such as wind and solar farms or hydroelectric power stations.
light vehicle	All motor vehicles under 3.5 tonnes gross vehicle mass, including passenger vehicles, sports utility vehicles (SUVs) and light commercial vehicles, but excluding motorbikes.
low emissions target	A type of technology pull policy that creates a market for additional zero- or low-emissions electricity that supports investment in new zero- or low-emissions capacity. Eligible generators get certificates to sell (scaled in line with their emissions intensity), which electricity retailers buy to meet their target obligations. Trade in certificates determines their price, which subsidises new low-emissions generation.

lump sum	Lump sum payments are government payments such as pensions. While they return government revenue to households, resulting in an increase in consumption, they have a minimal effect on economic efficiency.
market mechanism	In this report, 'market mechanism' refers to policies which use markets to change the relative price of goods and services in proportion to their emissions intensity. Examples include cap and trade schemes, emissions intensity schemes and carbon taxes.
national emissions	Emissions produced within a country. Also referred to as 'domestic emissions'.
negative emissions technology	A process that removes greenhouse gases from the atmosphere. For example, reforestation, soil enhancement to increase soil carbon, or biomass energy with carbon capture and storage (where biomass is burned to generate energy and the carbon dioxide emissions are captured and stored underground).
net zero emissions	When greenhouse gas emissions released are balanced by an equivalent quantity removed from the atmosphere or offset.
non-price barriers	Barriers other than cost that make it less likely that individuals and businesses will take up emissions reduction opportunities. Examples of non-price barriers include a lack of relevant skills or information, and split incentives (where the person who bears the cost is not the person who benefits from the change).
offset (see also 'credit')	A verified emissions reduction in comparison to a baseline. That reduction could be used to balance ('offset') other emissions.
offset scheme	A scheme, typically voluntary, that measures emissions against an emissions baseline and credits verified emissions reductions. Those verified reductions can then be used by liable entities to comply with obligations under other policies or by individuals and businesses taking voluntary action.
output-based assistance	Assistance provided under a market mechanism, where the level of assistance a business receives increases directly in line with its output.
Paris Agreement	An international agreement adopted under the United Nations Framework Convention on Climate Change in 2015.
Paris targets	In this report, 'Paris targets' refers to countries' plans to make emissions reduction efforts, submitted in advance of the 2015 United Nations Framework Convention on Climate Change conference in Paris. These plans are also referred to as Intended Nationally Determined Contributions (INDCs).
peaking generator	An electricity generator whose marginal or opportunity costs are higher than baseload generators and is therefore dispatched infrequently. In Australia, open-cycle gas turbines and limited-storage hydro generators typically operate in a peaking role.

permanence	A test of the environmental integrity of offsets representing carbon stored in vegetation and soils. These offsets represent 'permanent' emissions reductions only if the stored carbon is not released back into the atmosphere by human-induced or natural events. Scheme operators specify criteria for determining permanence. For example, under the Emissions Reduction Fund carbon storage must be maintained for at least 25 years.
permit	A tradable instrument that represents one tonne of greenhouse gas emissions (measured in carbon dioxide equivalent) issued under a market mechanism that includes a trading component, such as a cap and trade scheme or emissions intensity scheme.
present value	Present value is a standard method for using the time value of money, or 'discounting', to estimate future costs or future benefits. It adjusts the value of a cost or benefit in the future to a 'present value' that reflects how far into the future that cost or benefit will occur.
renewable energy target	A type of technology pull policy that creates a market for additional renewable electricity that supports investment in new renewable capacity. Eligible generators get certificates to sell, which electricity retailers buy to meet their target obligations. Trade in certificates determines their price, which subsidises new renewable generation. The current Commonwealth RET is a specific example of this general policy type. It operates in two parts—the Small-scale Renewable Energy Scheme and the Large-scale Renewable Energy Target.
safeguard mechanism	An Australian Government policy requiring each facility with annual greenhouse gas emissions greater than 100 kt CO ₂ -e to keep its net emissions below its baseline level.
Small-scale Renewable Energy Scheme (SRES)	Commonwealth policy that supports the installation of small-scale systems, including solar photovoltaic systems, solar water heaters, and small generation units.
solar photovoltaic (PV)	A method of generating electricity by converting the sun's energy into electricity.
split incentive	Broadly speaking, where one person pays another for a service, but the parties face different incentives. For example, landlords are responsible for the energy efficiency of properties, but tenants pay the energy bills.
synthetic greenhouse gases (SGGs)	Human-produced gases that absorb infrared radiation in the atmosphere. Examples are hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulfur hexafluoride (SF ₆).
tax interaction effect	The magnification of lost economic value due to emissions reduction policies being imposed as well as existing taxes.
technology pull policies	General name for policies such as renewable energy targets, low emissions targets and contracts for difference that encourage the deployment of additional renewable and/or low-emissions generation.

terms of trade	The ratio of the price of a country's exports to the price of its imports. It is typically expressed as an index.
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 national inventory.
United Nations Framework Convention on Climate Change (UNFCCC)	An international treaty that commits signatory countries (known as Parties) to stabilise greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous human-induced interference with the climate system.
voluntary pricing	Policies that pay the firms that elect to participate for reducing emissions below what they would otherwise be.
waste emissions	Emissions, mainly methane and nitrous oxide, that arise as organic waste decomposes in the absence of oxygen.
white certificate	A tradable instrument issued to certify a reduction of energy use against a baseline.
white certificate scheme	A mechanism that creates an obligation, usually on energy retailers, to achieve a target for energy efficiency gains. White certificates can be generated when businesses or consumers implement eligible energy efficiency measures, and may be surrendered to a regulatory body by a liable party to meet its obligations.

ABBREVIATIONS AND ACRONYMS

ACT Australian Capital Territory

ARENA Australian Renewable Energy Agency

BAU business as usual

CCA Climate Change Authority

CCS carbon capture and storage

CDM Clean Development Mechanism of the Kyoto Protocol

CEFC Clean Energy Finance Corporation

CFI Carbon Farming Initiative

CO₂ carbon dioxide, a greenhouse gas

CO₂-e carbon dioxide equivalent

COAG Council of Australian Governments

CSIRO Commonwealth Scientific Industrial and Research Organisation

EEO Energy Efficiencies Opportunities program

EITE emissions-intensive trade-exposed

ERF Emissions Reduction Fund

ETS emissions trading scheme

EU European Union

GDP gross domestic product

GNI gross national income

GVA	gross value added
HFC	hydrofluorocarbon
IEA	International Energy Agency
INDC	Intended Nationally Determined Contribution under the UNFCCC
IPCC	Intergovernmental Panel on Climate Change
NSW	New South Wales
NT	Northern Territory
OECD	Organisation for Economic Co-operation and Development
PV	photovoltaic
RET	Renewable Energy Target
SA	South Australia
SGG	synthetic greenhouse gas
SME	small and medium enterprise
SRES	Small-scale Renewable Energy Scheme
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
WA	Western Australia

REFERENCES

- The Advertiser 2014**, Adelaide manufacturer Penrice Soda placed in administration; jobs at Osborne, Angaston mine on the line, 11 April 2014.
- The Advertiser 2014**, Adelaide Brighton buys Penrice Soda's limestone quarry, secures supply and 40 jobs, Changarathil V, 23 July 2014.
- ACIL Allen Consulting 2014**, *RET Review modelling—Market modelling of various RET policy options*, Report to the RET Review Expert Panel, Melbourne.
- ACIL Allen Consulting 2015**, *Commercial Building Disclosure program review final report*.
- ACIL Tasman 2013**, *Energy Efficiency Opportunities program end of first full five year cycle evaluation- Final report: Prepared for the Department of Resources Energy and Tourism*.
- ACT Government 2015**, *New website will raise awareness of electric vehicles*, ACT Government, Canberra.
- ACT Environment and Planning Directorate 2016**, *Frequently asked questions about the Energy Efficiency Improvement Scheme*, viewed 03 Aug. 2016, http://www.environment.act.gov.au/energy/smarter-use-of-energy/energy_efficiency_improvement_scheme_eeis/frequently_asked_questions_about_the_energy_efficiency_improvement_scheme.
- AECOM 2015**, *Energy storage study: funding and knowledge sharing priorities*.
- Aghion P, Hepburn C, Teytelboym A & Zenghelis D 2014**, *Path dependence, innovation and the economics of climate change: New Climate Economy Contributing Paper*, Grantham Research Institute on Climate Change and the Environment.
- AGL Energy 2016**, *AGL Electric Vehicle (EV) website: AGL EV service and plan*, viewed 05 Aug. 2016, <https://aglsolar.com.au/evadvantage/>.
- Alberta Government 2016**, *Carbon levy and rebates*, viewed 20 Jun. 2016, <http://www.alberta.ca/climate-carbon-pricing.cfm>.
- Alcoa 2012**, *Alcoa to review future of Point Henry smelter in Geelong, Victoria: Media release*.
- Alcoa 2014**, *Alcoa to close Point Henry aluminium smelter and rolling mills in Australia: Media Release*.
- Alcoa 2016**, *Point Henry*, viewed 23 May. 2016, http://www.alcoa.com/australia/en/info_page/point_henry.asp.
- Allen Consulting Group 2011**, *Mandatory disclosure of residential building energy, greenhouse and water performance: Consultation Regulation Impact Statement*, Fourth draft report to the National Framework for Energy Efficiency Building Implementation Committee.
- Arup Energeia Frontier Economics & Institute of Sustainable Futures (University of Technology Sydney) 2014**, *Smart Grid, Smart City: shaping Australia's energy future: National cost benefit assessment*, July 2014.
- Australian Broadcasting Corporation (ABC) 2013**, *Penrice to pull the pin on soda ash production*, viewed 27 May. 2016, <http://www.abc.net.au/news/2013-01-18/penrice-soda-pulls-pin-on-soda-ash-production/4471004>.
- Australian Bureau of Statistics (ABS) 2011**, *Analysis of Victorian Energy Efficiency Target administrative dataset*.
- ABS 2012**, *Year Book Australia 2012: cat. no. 1301.0*. Year Book Australia: 92, ISSN 0312-4746, Canberra.
- ABS 2015a**, *Australian National Accounts: input-output tables, 2012-13: cat. no. 5209.0.55.001*, Canberra.
- ABS 2015b**, *Motor Vehicle Census, Australia, 31 Jan 2015: cat. no. 9309.0*, Australian Bureau of Statistics (ABS), Canberra.
- ABS 2016a**, *Australian Demographic Statistics: cat. no. 3101.0*, Canberra.

- ABS 2016b**, *Land management and farming in Australia: 2014-15 cat. no. 4627.0*, Australian Bureau of Statistics (ABS), Canberra.
- Australian Council of Social Service (ACOSS) 2013**, *Energy Efficiency & People on Low Incomes: Improving Affordability*, Australian Council of Social Service (ACOSS), Strawberry Hills, NSW.
- Australian Energy Market Commission (AEMC) 2015a**, *Submission to the ERF Safeguard Mechanism consultation*.
- AEMC 2015b**, *Expanding competition in metering and related services, Rule Determination*, Sydney.
- Australian Energy Market Operator (AEMO) 2015**, *Emerging technologies information paper: National electricity forecasting report*, June 2015, Australian Energy Market Operator (AEMO).
- AEMO 2016a**, *Data Dashboard: Average Prices - Historical*, viewed 03 Aug. 2016, <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Data-dashboard#average-price-table>.
- AEMO 2016b**, *National electricity forecasting report: for the National Electricity Market*.
- Australian Government 2010**, *Report of the Prime Minister's Task Group on Energy Efficiency*, Australian Government, Department of Climate Change and Energy Efficiency, Canberra.
- Australian Government 2012**, *Progress Report: National Energy Savings Initiative*, Canberra.
- Australian Government 2016a**, *Clean Energy Finance Corporation Investment Mandate Direction 2016*, Australian Government.
- Australian Government 2016b**, *National Inventory Report 2014 and Revised Kyoto Protocol National Inventory Report 2013 Volume 1*, Canberra.
- Australian Government 2016c**, *Vehicle Emissions Discussion Paper*, Department of Infrastructure and Regional Development (DIRD), Canberra.
- Australian Renewable Energy Agency (ARENA) 2015**, *Australian Renewable Energy Agency Annual Report 2014-15*.
- ARENA 2016**, *ARENA Bioenergy projects website*, viewed 25/07/16, <http://arena.gov.au/projects/bioenergy/>.
- Australian Sustainable Built Environment Council (ASBEC) 2016**, *Low carbon, high performance: How buildings can make a major contribution to Australia's emissions and productivity goals*.
- Australian Paper 2015**, *Australian Paper announces closure of Shoalhaven plant*.
- Beer A 2014**, Structural adjustment programmes and regional development in Australia *Local Economy* 30, pp.21–40.
- Berry S, Chevalier T & Marker T 2008**, *Modelling the Relationship between Energy Efficiency Attributes and House Price: The Case of Detached Houses Sold in the Australian Capital Territory in 2005 and 2006*, 2008 ACEEE Summer Study on Energy Efficiency in Buildings 2 pp 52-56, American Council for an Energy-Efficient Economy.
- Beyond Zero Emissions 2013**, *Zero Carbon Australia Buildings Plan*, Melbourne Energy Institute, The University of Melbourne, Melbourne.
- Bloomberg New Energy Finance (BNEF) 2015a**, *Country profiles*, viewed 15 Jun. 2016, <https://www.bnef.com/core/country-profiles>.
- BNEF 2015b**, *H1 2015 CA-QC Carbon Deep Dive: Under the cap, against all odds*.
- BNEF 2016a**, *2016 WCI Deep dive: Introducing Ontario*.
- BNEF 2016b**, *EU ETS Deep Dive Q1 2016: Black January*.
- Blue Environment & Randell Environmental Consulting 2014**, *Waste generation and resource recovery in Australia: Final Report*, Department of Sustainability, Environment, Water, Population and Communities.

- Bluescope Steel 2011**, *Bluescope announces major restructure to Australian operations and reinforces commitment to steel production in Australia*, viewed 12 May. 2016, <http://www.asx.com.au/asxpdf/20110822/pdf/420j7kfy3vbyx6.pdf>.
- Bogner J, Abdelrafie A & Diaz C et al. 2007**, Waste Management. In: Metz B, Davidson OR, Bosch PR, Dave R, Meyer LA, eds. *Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press, pp. 585–618.
- Boral 2012**, *Boral plans suspension of clinker production at its Waurin Ponds cement plant in Victoria: ASX Release*.
- Boral 2014**, *Boral to cease clinker manufacturing at Maldon cement works: Media release*.
- BP 2014**, *BP Bulwer Island refinery: processing to halt: Media Release*.
- Bray S, English B, Sullivan M, Eady S & Holmes B 2012**, *Evaluation of wet season phosphorus supplementation to improve production and greenhouse gas emissions in northern Australia*, Department of Agriculture, Fisheries and Forestry (DAFF).
- Breakthrough Energy Coalition 2016**, *Breakthrough Energy Coalition website*, viewed 01 Apr. 2016, <http://www.breakthroughenergycoalition.com/en/index.html>.
- Brinsmead TS, Graham P, Hayward J, Ratnam EL & Reedman L 2015**, *Future Energy Storage Trends: An Assessment of the Economic Viability, Potential Uptake and Impacts of Electrical Energy Storage on the NEM 2015-2035*, Commonwealth Scientific and Industrial Research Organisation (CSIRO).
- Brotherhood of St Lawrence 2014**, *VEET energy saving scheme helps those on low incomes and should continue: Media release*, Brotherhood of St Lawrence.
- Bryan BA, Hatfield-Dodds S, Nolan M, McKellar L, Grundy MJ & McCallum R 2015**, *Potential for Australian land-sector carbon sequestration and implications for land use, food, water, and biodiversity: Report for the Australian National Outlook 2015*, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.
- California Air Resources Board (CARB) 2015**, *Draft Heavy-duty Technology and Fuels Assessment: Overview*, California.
- Caltex 2012**, *Caltex announces supply chain restructuring: ASX Release*.
- Carbon Market Institute (CMI) 2013**, *The first year of Australia's Carbon Pricing Mechanism: Lessons learnt: A survey of liable entities - 2013*, Melbourne.
- CDP 2015**, *Putting a price on risk: carbon pricing in the corporate world*, New York.
- Cement Australia 2011**, *Cement Australia remains focused on supporting their people at Kandos: Media Release*.
- Chiavari J & Tam C 2011**, *Good Practice Policy Framework for Energy Technology RD&D: IEA Accelerating Energy Innovation Series*, Information paper, International Energy Agency (IEA), Paris.
- City of Melbourne 2016**, *Future Melbourne 2026 website*, viewed 05 Jun. 2016, <http://www.melbourne.vic.gov.au/building-and-development/urban-planning/city-wide-strategies-research/Pages/future-melbourne.aspx>.
- Clean Energy Council (CEC) 2015**, *Australian energy storage roadmap*, Melbourne.
- Clean Energy Finance Corporation (CEFC) 2015a**, *Clean Energy Finance Corporation Annual report 2014-15*, Sydney.
- CEFC 2015b**, *The Australian bioenergy and energy from waste market: A market report by the Clean Energy Finance Corporation*, Sydney.
- CEFC 2016a**, *Financing energy efficient community housing: A market report by the Clean Energy Finance Corporation*, Sydney.
- CEFC 2016b**, *CEFC continues to lead transformation of investment in Australian clean energy: Media Release*, Clean Energy Finance Corporation (CEFC), Sydney.

- Clean Energy Regulator (CER) 2015**, *LEPID for the 2013-14 financial year*, viewed 28 Jun. 2016, <http://www.cleanenergyregulator.gov.au/Infohub/CPM/Liable-Entities-Public-Information-Database/LEPID-for-the-2013-14-financial-year>.
- CER 2016a**, *Emissions Reduction Fund Register*, viewed 01 Aug. 2016, Canberra, <http://www.cleanenergyregulator.gov.au/ERF/project-and-contracts-registers/project-register>.
- CER 2016b**, *Combined results for auctions 1, 2 and 3: Emissions Reduction Fund*, Clean Energy Regulator (CER), Canberra.
- CER 2016c**, *The safeguard mechanism comes into effect: Media release*.
- CER 2016d**, *Emissions Position as at June 2016: Emissions Reduction Fund cumulative projects across Australia*, Media resource, Clean Energy Regulator (CER), Canberra.
- Cleugh H, Stafford Smith M, Battaglia M, Graham P 2011**, *Climate change: Science and solutions for Australia*, Commonwealth Scientific and Industrial Research Organisation (CSIRO), CSIRO publishing, Australia.
- Climate Action Tracker (CAT) 2015**, *Tracking INDCs: Assessment of mitigation contributions to the Paris Agreement*, viewed 02 May. 2016, <http://climateactiontracker.org/indcs.html>.
- Climate Change Authority (CCA) 2012**, *Renewable Energy Target Review*, Melbourne.
- CCA 2014a**, *Reducing Australia's greenhouse gas emissions: Targets and progress review*, Melbourne.
- CCA 2014b**, *Light vehicle emissions standards for Australia: Research report*, Melbourne.
- CCA 2014c**, *Using International Units to Help Meet Australia's Emissions Reduction Targets: Research paper*, Melbourne.
- CCA 2014d**, *Carbon Farming Initiative Review*, Melbourne.
- CCA 2015a**, *Comparing countries' emissions targets: A practical guide*, Melbourne.
- CCA 2015b**, *Special Review draft report: Australia's future emissions reduction targets*, Climate Change Authority (CCA), Melbourne.
- CCA 2015c**, *Special Review second draft report: Australia's climate policy options*, Melbourne.
- CCA 2016**, *Policy options for Australia's electricity supply sector: Special Review research report*, Melbourne.
- ClimateWorks Australia (ClimateWorks) 2010**, *Low carbon growth plan for Australia*, Melbourne.
- ClimateWorks 2013**, *Tracking Progress Towards a Low Carbon Economy: National Progress Report*, Melbourne.
- ClimateWorks 2016**, *The path forward for electric vehicles in Australia: Stakeholder recommendations*, Melbourne.
- ClimateWorks Australia (ClimateWorks), Australian National University (ANU), Commonwealth Scientific and Industrial Research Organisation (CSIRO) & Centre of Policy Studies 2014a**, *Pathways to deep decarbonisation in 2050: How Australia can prosper in a low carbon world:*, Technical report, ClimateWorks Australia, Melbourne.
- ClimateWorks, ANU, CSIRO & Centre of Policy Studies 2014b**, *Pathways to deep decarbonisation in 2050: How Australia can prosper in a low carbon world: Initial project report*, Melbourne.
- CO2CRC 2016**, *CO2CRC website*, <http://www.co2crc.com.au/about-us/>.
- Cockburn Cement 2014**, *Rationalisation of domestic clinker production at Munster: Media release*.
- Commercial Building Disclosure (CBD) 2016**, *CBD program review final report*.
- Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2016a**, *Commonwealth Scientific and Industrial Research Organisation website*, viewed 31 Mar. 2016, <http://www.csiro.au/>.
- CSIRO 2016b**, *CSIRO website: Producing biofuels from algae*, viewed 25/07/16, <http://www.csiro.au/en/Research/Collections/ANACC/Algae-bioproductions/algae-biofuels>.

- Cosgrove D, Gargett D, Evans C, Graham P & Ritzinger A 2012**, *Greenhouse gas abatement potential of the Australian transport sector: Technical report from the Australian Low Carbon Transport Forum*, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.
- Council of Australian Governments Energy Council (COAG Energy Council) 2015a**, *Fourth meeting communique*.
- COAG Energy Council 2015b**, *National energy productivity plan 2015–2030: Boosting competitiveness, managing costs and reducing emissions*.
- COAG Energy Council 2015c**, *National Energy Productivity Plan: Work Plan*.
- COAG Energy Council 2016**, *Fifth meeting communique*.
- Council of Australian Governments (COAG) 2012**, *Australia's Native Vegetation Framework*, Council of Australian Governments (COAG).
- da Silva W 2016**, *Milestone in solar cell efficiency by UNSW engineers*, University of New South Wales (UNSW), Sydney.
- Dairy Australia 2015a**, *Dairying for Tomorrow: Smarter energy use on Australian dairy farms*, viewed 03 Aug. 2016, <http://www.dairyingfortomorrow.com.au/tackling-specific-issues/energy-2/>.
- Dairy Australia 2015b**, *Smarter energy use on Australian dairy farms - Project summary*, viewed 02 Aug. 2016, <http://frds.dairyaustralia.com.au/events/smarter-energy-use/>.
- Dairy Futures CRC 2016**, *Diary Futures CRC website*, <http://dairyfuturescrc.com.au/about/>.
- Daley J, Reichl J & Ginnivan L 2013**, *Australian Government Spending on Innovation*, Grattan Institute, Melbourne.
- Databuild 2015**, *Greenhouse and Energy Minimum Standards (GEMS) Review 2015 Report*, Report to the Department of Industry and Science, Sydney.
- Dechezleprêtre A, Martin R & Bassi S 2016**, *Climate change policy, innovation and growth*, Grantham Research Institute on Climate Change and the Environment; Global Green Growth Institute.
- Department of Agriculture and Water Resources (DAWR) 2015**, *Australia's forests webpage*, viewed 01 Aug. 2016, 2015, <http://www.agriculture.gov.au/forestry/australias-forests>.
- Department of Environment and Heritage Protection of Queensland (DEHP Qld) 2013a**, *Model operating conditions: ERA 60 Waste disposal*.
- DEHP Qld 2013b**, *Guideline - Landfill siting, design, operation and rehabilitation*.
- Department of Foreign Affairs and Trade (DFAT) 2016**, *Map of post-2020 Intended Nationally Determined Contributions*, 'pers. comm.'. 23 June 2016.
- Department of Industry and Science (DIS) 2015**, *2015 Australian energy update*, Canberra.
- Department of Industry, Innovation and Science (DIIS) 2015a**, *Australian energy statistics: Table F*, Canberra.
- DIIS 2015b**, *Australian energy statistics: Table H*, Canberra.
- DIIS 2015c**, *The Australian Government's 2015-16 Science, Research and Innovation Budget Tables: Minister for Industry and Science's foreword*, Canberra.
- DIIS 2016a**, *business.gov.au website*, viewed 27 Apr. 2016, <http://www.business.gov.au/Pages/default.aspx>.
- DIIS 2016b**, *Energy in Australia 2015*, Canberra.
- DIIS 2016c**, *Innovation and Science Australia website*, viewed 01 Aug. 2016, <http://www.industry.gov.au/Innovation-and-Science-Australia/Pages/default.aspx>.
- DIIS 2016d**, *National Energy Resources Australia website*, viewed 01 Aug. 2016, <http://www.nera.org.au/content/about-us>.
- DIIS 2016e**, *Science.gov.au website: Science and Research Priorities*, viewed 01 Aug. 2016, <http://www.science.gov.au/scienceGov/ScienceAndResearchPriorities/Pages/default.aspx>.

- Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (DIICCSRTE) 2013**, *Carbon Farming Initiative: Guidelines for calculating regulatory baselines for legacy waste landfill methane projects*.
- Department of Infrastructure and Transport (DIT) 2013**, *State of Australian Cities 2013*, Canberra.
- Department of Primary Industries, Water and Environment of Tasmania (DPIWE Tas) 2004**, *Landfill Sustainability Guide*, Hobart.
- Department of Prime Minister and Cabinet (PM&C) 2015**, *National Innovation and Science Agenda*.
- PM&C 2016**, *Smart Cities Plan*, Canberra.
- Department of State Development, Business and Innovation (DSDBI Vic) 2014**, *Business Impact Assessment: Victorian Energy Efficiency Target*, Melbourne.
- Department of the Environment and Energy (DoEE) 2016**, *Australian Greenhouse Emissions Information System: Kyoto Protocol classifications*, viewed 15 Aug. 2016, <http://ageis.climatechange.gov.au/NGGI.aspx>.
- Department of the Environment (DoE) 2015a**, *Carbon Neutral Program Guidelines, National Carbon Offset Standard*, Canberra.
- DoE 2015b**, *Emissions Reduction Fund method: Alternative waste treatment*, viewed 10 Mar. 2016, Canberra, <http://www.environment.gov.au/system/files/resources/051ec043-e770-4037-ae60-b1729914c5df/files/erf-fs-alternative-waste-treatment.pdf>.
- DoE 2015c**, *The Safeguard Mechanism: carbon offsets and avoiding double counting of emissions reductions*, Canberra.
- DoE 2015d**, *Australia's emissions projections 2014-15*, Canberra.
- DoE 2015e**, *Tracking to 2020: An interim update of Australia's greenhouse gas emissions projections*, Canberra.
- DoE 2016a**, *Emissions Reduction Fund methods*, viewed 24 Jul. 2016, <https://www.environment.gov.au/climate-change/emissions-reduction-fund/methods>.
- DoE 2016b**, *Ozone Depleting Substances and Synthetic Greenhouse Gases*, viewed 01 Aug. 2016, <https://www.environment.gov.au/protection/ozone/legislation>.
- DoE 2016c**, *Productivity Commission Inquiry - Regulation of Australian agriculture: Submission*, Department of the Environment (DoE), Canberra.
- DoE 2016d**, *The Safeguard Mechanism - Overview*.
- DoE 2016e**, *Outcomes of the Review of the Ozone Protection and Synthetic Greenhouse Gas Management Programme*, Canberra.
- DoE 2016f**, *Estimation of landfill methane capture rates required by regulation*, 'pers. comm.'. 10 June 2016.
- DoE 2016g**, *Western Australia landfill gas policy*, 'pers. comm.'. 28 June 2016.
- DoE 2016h**, *Average methane capture rates for states and territories*, 'pers. comm.'. 18 August 2016.
- E3 2016**, *E3 Prioritisation plan*.
- Edis T & Wood T 2011**, *New protectionism under carbon pricing: Case studies of LNG, coal mining and steel sectors*, Grattan Institute, Melbourne.
- Ehrhardt-Martinez K, Donnelly KA & Laitner S 2010**, *Advanced metering initiatives and residential feedback programs: a meta-review for household electricity-saving opportunities*, American Council for an Energy-Efficient Economy, Washington DC.
- Electric Power Research Institute (EPRI) 2015**, *Australian Power Generation Technology Report*.
- Energy Efficiency and Conservation Authority (NZ) (EECA NZ) 2016**, *Our programmes*, viewed 15 Aug. 2016, <https://www.eeca.govt.nz/about-eeeca/our-programmes/>.
- Energy post 2014**, *Zero energy at zero cost: industrialising the building sector*, van Renssen S, 12/09/2014.

- Energy Supply Association of Australia (ESAA) 2013**, *Sparking an Electric Vehicle Debate in Australia: Discussion Paper November 2013*, Melbourne.
- Environment Protection Authority New South Wales (EPA NSW) 2016**, *Environmental guidelines - solid waste landfills*, Sydney.
- Environment Protection Authority South Australia (EPA SA) 2007**, *EPA Guidelines - Environmental management of landfills*, Adelaide.
- Environment Protection Authority Victoria (EPA Vic) 2015**, *Siting, design, operation and rehabilitation of landfills*. Best practice environmental management Publication 788.3.
- European Commission (EC) 2014**, *Communication from the Commission to the Council and the European Parliament: Strategy for reducing heavy-duty vehicles' fuel consumption and CO₂ emissions*, COM(2014) 285 final, Brussels.
- EC 2016a**, *Carbon leakage*, viewed 29 Jun. 2016, http://ec.europa.eu/clima/policies/ets/allowances/leakage/index_en.htm.
- EC 2016b**, *Ensuring the integrity of the European carbon market*, viewed 19 Aug. 2016, http://ec.europa.eu/clima/policies/ets/oversight/index_en.htm.
- European Court of Auditors 2015**, *The integrity and implementation of the EU ETS*, Special Report, Luxembourg.
- European Energy Exchange (EEX) 2016**, *Certified Emissions Reduction Futures*, viewed 23 Aug. 2016, <https://www.eex.com/en/market-data/emission-allowances/derivatives-market/certified-emission-reductions-futures#!/2016/08/22>.
- Food and Agriculture Organization of the United Nations (FAO) 2008**, *The State of Food and Agriculture: Biofuels: prospects, risks and opportunities*, Food and Agriculture Organization of the United Nations (FAO), Rome.
- Frankfurt School United Nations Environment Program Collaborating Centre (FS-UNEP Collaborating Centre) 2016**, *Global trends in renewable energy investment 2016*, Frankfurt.
- Frontier Economics 2009**, *The economic impact of the CPRS and modifications to the CPRS: Report for the Coalition and Senator Xenophon*, Frontier Economics, Melbourne.
- G20 2014**, *G20 Energy Efficiency Action Plan: Voluntary collaboration on energy efficiency*, Australia.
- Garnaut R 2008**, *The Garnaut climate change review: Final Report*, Commonwealth of Australia, Cambridge University Press, Port Melbourne.
- Gillenwater M & Seres S 2011**, *The Clean Development Mechanism: a review of the first international offset program*, Pew Center on Global Climate Change, Arlington, Virginia.
- Giraudet L, Bodineau L & Finon D 2011**, *The costs and benefits of white certificate schemes*. CIRED Working Papers 29-2011, Centre International de Recherches sur l'Environnement et le Développement (CIRED), Paris.
- Global Commission on the Economy and Climate 2014**, *The New Climate Economy: Better Growth, Better Climate*, New Climate Economy, Washington DC.
- Goulder LH 2013**, Climate change policy's interactions with the tax system *Energy Economics* 40, pp.S3-S11.
- Gouldson A, Colenbrander S & Sudmant A et al. 2015**, *Accelerating Low-Carbon Development in the World's Cities: Contributing paper for Seizing the Global Opportunity: Partnerships for Better Growth and a Better Climate*, New Climate Economy, London, Washington DC.
- Government of New Zealand 2015**, *Ministerial Declaration on Carbon Markets*, Paris.
- Government of South Australia 2013**, *Review report of the Residential Energy Efficiency Scheme (REES), Part 4 of the Electricity (General) Regulations 2012, under the Electricity Act 1996, and Part 4 of the Gas Regulations 2012, under the Gas Act 1997: A403035*, Adelaide.

- Government of South Australia 2014**, *Retailer Energy Efficiency Scheme: Final decisions on Thresholds and Targets: A567716*, Adelaide.
- Government of the Australian Capital Territory (Government of the ACT) 1997**, *Environment Protection Act*, Government of the Australian Capital Territory (Government of the ACT).
- Government of Victoria 2007**, *Environmental Protection (Scheduled Premises and Exemptions) Regulations*, Government of Victoria.
- Green M 2015**, Forty Years of Photovoltaic Research at UNSW *Journal and Proceedings of the Royal Society of New South Wales* 148, pp.2–14.
- Green, M 2016a**, *Estimate of the Likely Minimal Benefits from ACAP Solar Silicon Research: MAG/ACAP1604*, Australian Centre for Advanced Photovoltaics (ACAP), Sydney.
- Green, M 2016b**, *Estimate of economic benefits to Australia of past Australian photovoltaic research: MAG/UNSW1603*, Sydney.
- Grubb M, Hourcade J & Neuhoﬀ K 2014**, *Planetary Economics: Energy, climate change and the three domains of sustainable development*, Routledge, Oxford.
- Grubb M, Laing T, Counsell T & Willan C 2011**, Global carbon mechanisms: lessons and implications *Climatic Change* 104, pp.539–73.
- Hamrick K & Goldstein A 2016**, *Raising Ambition: State of the Voluntary Carbon Markets 2016*, Ecosystem Marketplace, Washington DC.
- Harrison MT, McSweeney C, Tomkins NW & Eckard R 2015**, Improving greenhouse gas emissions intensities of subtropical and tropical beef farming systems using *Leucaena leucocephala* *Agricultural systems* 136, pp.138–46.
- Harvie A 2015**, *A hard push to the left: Alberta's proposed Carbon Competitiveness Regulation*, Norton Rose Fulbright, Calgary.
- Hatfield-Dodds S, McKellar L & Brinsmead TS et al. 2015**, *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050: Technical Report*, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Canberra.
- Hearps P, Dargaville R, McConnell D, Sandiford M, Forcey T & Seligman P 2014**, *Opportunities for pumped hydro energy storage in Australia*, Arup---MEI Research, Melbourne.
- Hennessy K, Whetton P & Walsh K et al. 2008**, Climate change effects on snow conditions in mainland Australian and adaptation at ski resorts through snowmaking *Climate Research* 35, pp.255–70.
- High-level Panel on the CDM Policy Dialogue (CDM Policy Dialogue) 2012**, *Climate change, carbon markets and the CDM: a call to action*, Luxembourg.
- Hull D 2016**, *Inside the Gigafactory That Will Decide Tesla's Fate*, viewed 22 Jul. 2016, <http://www.bloomberg.com/features/2016-inside-tesla-gigafactory/>.
- Hunt G Hon, MP 2015**, *Boosting incentives for voluntary action to reduce emissions: Media release*, Canberra.
- Hyder Consulting 2014**, *Waste sector modelling and analysis*, North Sydney.
- Norsk Hydro ASA (Hydro) 2012a**, *Hydro is considering full curtailment of the Kurri Kurri aluminium plant in Australia: Media release*, Norsk Hydro ASA (Hydro).
- Hydro 2012b**, *Hydro will close the Kurri Kurri aluminium plant: Media release*, Norsk Hydro ASA (Hydro).
- Hydro 2016**, *Hydro's Kurri Kurri operations was terminated 2012*, viewed 23 May. 2016, <http://www.hydro.com/en/About-Hydro/Hydro-worldwide/Australia/Kurri-Kurri/>.
- Infrastructure Australia 2016**, *Australian Infrastructure Plan: Priorities and reforms for our nation's future*, Canberra.

- Intergovernmental Panel on Climate Change (IPCC) 2014**, *Climate change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessment report of the Intergovernmental Panel on Climate Change*, [Core Writing Team, Pachauri R and Meyer L (eds.)], IPCC, Geneva, Switzerland.
- International Assessment of Agricultural Knowledge, Science and Technology for Development (IAASTD) 2008**, *Bioenergy and Biofuels: Opportunities and Constraints*. Issues in brief.
- International Carbon Action Partnership (ICAP) 2016**, *Emissions Trading Worldwide: Status Report 2016*, International Carbon Action Partnership (ICAP), Berlin.
- International Civil Aviation Organization (ICAO) 2010**, *Resolution A37-19: Consolidated statement of continuing ICAO policies and practices related to environmental protection – Climate change*, International Civil Aviation Organization (ICAO).
- ICAO 2013**, *Destination Green: Environmental Report*, Aviation and Climate Change, Montreal.
- ICAO 2016a**, *ICAO Environment: Market-Based Measures*, viewed 29 Aug. 2016, <http://www.icao.int/environmental-protection/Pages/market-based-measures.aspx>.
- ICAO 2016b**, *New ICAO Aircraft CO2 Standard One Step Closer To Final Adoption*, International Civil Aviation Organization (ICAO), Montreal.
- International Energy Agency (IEA) 2011a**, *25 Energy Efficiency Policy Recommendations*, Paris.
- IEA 2011b**, *Technology Roadmap: Biofuels for Transport*, Paris.
- IEA 2012**, *World Energy Outlook*, International Energy Agency (IEA), Paris.
- IEA 2013**, *World Energy Outlook 2013*, International Energy Agency (IEA), Paris.
- IEA 2014**, *Energy Technology Perspectives 2014: Harnessing Electricity's Potential*, IEA Publications, Paris.
- IEA 2015a**, *Accelerating Energy Efficiency in Small and Medium-sized Enterprises: Powering SMEs to catalyse economic growth*. IEA Policy Pathway series, IEA Publications, Paris.
- IEA 2015b**, *Capturing the Multiple Benefits of Energy Efficiency*, IEA Publications, Paris.
- IEA 2015c**, *Energy and climate change: World energy outlook special report*, International Energy Agency (IEA), Paris.
- IEA 2015d**, *Policies and measures databases*, viewed 15 Jun. 2016, <http://www.iea.org/policiesandmeasures/>.
- IEA 2015e**, *World Energy Outlook 2015*, IEA Publications, Paris.
- IEA 2016a**, *Global EV outlook 2016: beyond one million electric cars*, International Energy Agency (IEA), Paris.
- IEA 2016b**, *Technology roadmap: Hydrogen and fuel cells*, International Energy Agency (IEA), Paris.
- International Maritime Organization (IMO) 2014**, *Third IMO GHG Study 2014*, London.
- IMO 2016a**, *Air Pollution, Energy Efficiency and Greenhouse Gas Emissions*, viewed 24 Aug. 2016, <http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Pages/Default.aspx>.
- IMO 2016b**, *IMO takes further action on climate change: Press Briefing*, viewed 05 Aug. 2016, <http://www.imo.org/en/MediaCentre/PressBriefings/Pages/11-data-collection-.aspx>.
- International Partnership for Energy Efficiency Cooperation (IPEEC) 2015**, *Delivering Energy Savings in Buildings: International Collaboration on Building Energy Code Implementation*, France.
- International Renewable Energy Agency (IRENA) 2015**, *Battery storage for renewables: market status and technology outlook*, Abu Dhabi.
- Ironbark Sustainability 2016a**, *Council funding opportunities*, viewed 01 Aug. 2016, <http://www.ironbarksustainability.com.au/funding/>.
- Ironbark Sustainability 2016b**, *Street lighting emissions*, 'pers. comm.'. 4 August 2016.

- Jacobs 2014**, *Energy Efficiency Improvement Scheme Review: EEIS Review: Final Report*, Report to the ACT Government, Canberra.
- Jacobs 2016**, *Modelling illustrative electricity sector emissions reduction policies*, Report to the Climate Change Authority (CCA).
- Johnson L, Grant J, Ping Low L, Milnes R & Gale G 2015**, *Conscious uncoupling?: Low Carbon Economy Index 2015*, PwC, United Kingdom.
- Kodjak D 2015**, *Policies to reduce fuel consumption, air pollution, and carbon emissions from vehicles in G20 nations*, Briefing paper, The International Council on Clean Transportation (ICCT), Washington DC.
- Kossoy A, Peszko G & Oppermann K et al. 2015**, *State and Trends of Carbon Pricing 2015*, World Bank, World Bank, Washington, DC.
- Low Carbon Living Cooperative Research Centre (Low Carbon Living CRC) 2016**, *Low Carbon Living CRC: About us*, viewed 24 Aug. 2016, <http://www.lowcarbonlivingcrc.com.au/about-us>.
- Manufacturers' Monthly 2011**, Cement Australia blames taxes for Kandos factory closure, Falson S, 15 July 2011.
- Marcu A 2016**, *Carbon market provisions in the Paris Agreement (Article 6)*. CEPS Special Report, Centre for European Policy Studies, Brussels.
- McKibbin W, Morris A & Wilcoxon P 2010**, *Comparing Climate Commitments: A Model-Based Analysis of the Copenhagen Accord*. Discussion Paper, 10-35, Harvard Project on International Climate Agreements, Cambridge, Mass.
- McKibbin Software Group 2015a**, *Report 1: Economic Modelling of International Action Under a New Global Climate Change Agreement*, Canberra.
- McKibbin Software Group 2015b**, *Report 2: Economic Modelling of Australian Action Under a New Global Climate Change Agreement*, Canberra.
- McLennan Magasanik Associates Pty Ltd (MMA) 2010**, *Climate change and the resource recovery and waste sectors*, South Melbourne.
- Meinshausen M & Alexander R 2016a**, *INDC Fact sheet: Iran*, Australian German Climate and Energy College, Melbourne.
- Meinshausen, M & Alexander, R 2016b**, *INDC Fact Sheet: Mexico*, Australian German Climate and Energy College, Melbourne.
- Mission Innovation 2016**, *Mission Innovation: Accelerating the Clean Energy Revolution*, viewed 31 Mar. 2016, <http://mission-innovation.net/>.
- Mission Innovation Secretariat 2016**, *Baseline, Doubling and Narrative Information Submitted by Mission Innovation Countries and the European Union*.
- Nachmany M, Fankhauser S & Davidova J et al. 2015**, *2015 Global Climate Legislation Study*, The London School of Economics and Political Science; Grantham Research Institute on Climate Change and the Environment, London.
- National Transport Commission 2016**, *Carbon dioxide emissions intensity for new Australian light vehicles 2015: Information paper*, Melbourne.
- New South Wales Government (NSW Government) 2015**, *Review of the NSW Energy Savings Scheme: Final statutory review report*, Sydney.
- Northern Territory Environment Protection Authority (NT EPA) 2013**, *Guidelines for the siting, design and management of solid waste disposal sites in the Northern Territory*.
- O'Gorman M & Jotzo F 2014**, *Impact of the carbon price on Australia's electricity demand, supply and emissions*. Centre for Climate Economics and Policy Working Paper 1411, Crawford School of Public Policy, Australian National University, Canberra.
- Organisation for Economic Co-operation and Development (OECD) 2014a**, *Glossary of statistical terms: Competitiveness (in international trade)*, viewed 26 May. 2016, <https://stats.oecd.org/glossary/detail.asp?ID=399>.

- OECD 2014b**, *Economic Outlook No. 95 - Long term baseline projections*, viewed 03 Jul. 2015, <http://stats.oecd.org>.
- OECD 2015**, *Green Investment Banks: Policy Perspectives*. Policy Perspectives, Paris.
- Organisation for Economic Co-operation and Development (OECD) International Energy Agency (IEA) International Transport Forum (ITF) & Nuclear Energy Agency (NEA) 2015**, *Aligning Policies for a Low Carbon Economy*, OECD Publishing, Paris.
- pitt&sherry 2013**, *Evaluation of the South Australian Residential Energy Efficiency Scheme (REES): Final report*, Report to the South Australian Department for Manufacturing, Innovation, Trade, Resources and Energy, Brisbane.
- Prime Ministerial Task Group on Emissions Trading 2007**, *Report of the Task Group on Emissions Trading*, Australian Government, Department of Prime Minister and Cabinet, Canberra.
- Productivity Commission (PC) 2001**, *Structural adjustment - key policy issues: Commission Research Paper*, AusInfo, Canberra.
- PC 2008**, *What role for policies to supplement an emissions trading scheme?: Productivity Commission submission to the Garnaut Climate Change Review*.
- PC 2011**, *Carbon emission policies in key economics: Research report*, Canberra.
- PC 2014**, *Australia's Automotive Manufacturing Industry*. Inquiry Report, 70, Canberra.
- Redflow Limited 2015**, *Annual Financial Report - for the year ended 30 June 2015*, Brisbane.
- Redflow Limited 2016**, *Redflow Advanced Energy Storage*, viewed 25 Aug. 2016, <http://redflow.com/>.
- Reedman L & Graham P 2013**, *Sensitivity analysis of modelling of light vehicle emission standards in Australia: Prepared for the Climate Change Authority Report No. EP1312837*, Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia.
- RepuTex 2016**, *Australia's domestic 'low cost' abatement opportunity*, Melbourne.
- Rio Tinto 2013**, *Rio Tinto to suspend production at Gove alumina refinery*, Melbourne.
- Rio Tinto 2016**, *Gove operations bauxite mine alumina refinery*, viewed 23 May. 2016, <http://www.riotinto.com/aluminium/gove-operations-bauxite-mine-alumina-refinery-9091.aspx>.
- RMCG 2015**, *Data analysis for 'Smarter Energy Use' project*, Penguin, Tasmania.
- Rogelj J, den Elzen M & Hohne N et al. 2016**, Paris Agreement climate proposals need a boost to keep warming well below 2 degrees Celsius *Nature* 354, pp.631–39.
- Schwab K 2015**, *The Global Competitiveness Report 2015-2016*. Insight Report, World Economic Forum, Geneva.
- Science Based Targets 2016**, *Companies taking action*, viewed 15 Jun. 2016, <http://sciencebasedtargets.org/companies-taking-action/>.
- Shell 2011**, *Shell to cease refining at Clyde: Media release*.
- Shislov I, Morel R & Bellassen V 2016**, Compliance of the Parties to the Kyoto Protocol in the first commitment period *Climate Policy* 16, pp.768–82.
- Skarbek A & Denis A 2015**, *New analysis: Australia can halve emissions by 2030*, viewed 03 Aug. 2016, <http://theconversation.com/new-analysis-australia-can-halve-emissions-by-2030-43850>.
- SKM MMA 2011**, *The Energy Savings Initiative and energy markets*.
- State of the Environment 2011 Committee (SoE) 2011**, *Australia state of the environment 2011: Independent report to the Australian Government Minister for Sustainability, Environment, Water, Population and Communities*, Department of Sustainability, Environment, Water, Population and Communities, Canberra.
- Stephan N, Bellassen V & Alberola E 2014**, *Use of Kyoto credits by European industrial installations: from an efficient market to a burst bubble*. Climate Report: research on the economics of climate change 43, CDC Climat, Paris.

- Stern N 2007**, *The Economics of Climate Change: The Stern Review*, Cambridge University Press, Cambridge, UK.
- Stromback J, Dromacque C, Yassin MH & (None) 2011**, *Empower demand: The potential of smart meter enabled programs to increase energy and systems efficiency: a mass pilot comparison*, VaasaETT, Helsinki, Finland.
- Sustainability Victoria 2015**, *Victorian Organics Resource Recovery Strategy*, Melbourne.
- Tesla Motors 2015**, *Tesla Motors Establishes Destination Charging Program across Australia for Model S All-Electric Sedan*, Tesla Motors.
- Thaler R & Sunstein C 2008**, *Nudge: Improving decisions about health, wealth and happiness*, Penguin, Australia.
- The Climate Institute (TCI) 2016**, *A switch in time: Enabling the electricity sector's transition to net zero emissions*, Policy Brief, The Climate Institute (TCI).
- The International Council on Clean Transportation (ICCT) 2015**, *Global passenger vehicle data tables*, viewed 27 Apr. 2016, http://www.theicct.org/sites/default/files/info-tools/pvstds/Global_PV_data_20150803.xlsx.
- Thomson Reuters Point Carbon 2016**, *Tweet - 27 June 2016*, viewed 29 Jun. 2016, https://twitter.com/TRPC_Climate/status/747343801102925830.
- Treasury 2008**, *Australia's Low Pollution Future: The Economics of Climate Change Mitigation*, Treasury, Canberra.
- Treasury 2011**, *Strong Growth, Low Pollution: Modelling a Carbon Price*, Canberra.
- Treasury and the Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education (Treasury and DIICSRTE) 2013**, *Climate change mitigation scenarios: Modelling report provided to the Climate Change Authority in support of its Caps and Targets Review*, Canberra.
- UK Green Investment Bank 2016**, *Bringing private capital into the Green Investment Bank*, <http://www.greeninvestmentbank.com/about-us/privatisation-process/>.
- United Nations Environment Programme (UNEP) 1989**, *Montreal Protocol on Substances that Deplete the Ozone Layer: Montreal Protocol*, United Nations Environment Programme (UNEP).
- UNEP 2011**, *Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication*.
- UNEP 2015**, *Emissions Gap Report 2015*, Nairobi, Kenya.
- United Nations Framework Convention on Climate Change (UNFCCC) 2015a**, *Adoption of the Paris Agreement*, Decision 1/CP.21, United Nations.
- UNFCCC 2015b**, *INDCs as communicated by Parties*, viewed 15 Jun. 2016, <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>.
- UNFCCC 2015c**, *Non-State Actor Zone for Climate Action (NAZCA)*, viewed 01 Apr. 2016, <http://climateaction.unfccc.int>.
- UNFCCC 2016a**, *Greenhouse gas data - new reporting requirements*, viewed 29 Jun. 2016, http://unfccc.int/ghg_data/new_reporting_requirements/time_series/items/9580.php.
- UNFCCC 2016b**, *Paris Agreement - Status of Ratification*, viewed 09 Aug. 2016, http://unfccc.int/paris_agreement/items/9444.php.
- United States Department of Energy Efficiency and Renewable Energy (US Department of Energy) 2016**, *Fuel Cell Vehicles*, viewed 25 Aug. 2016, <https://www.fueleconomy.gov/feg/fuelcell.shtml>.
- United States Energy Information Administration (US EIA) 2016**, *Annual Energy Outlook 2016: Fuel consumption and greenhouse gas emissions Phase 2 standards for medium- and heavy-duty vehicles*, viewed 04 Jul. 2016, http://www.eia.gov/forecasts/aeo/section_issues.cfm#fcghg.
- United States Environmental Protection Agency (US EPA) 2015**, *Cutting carbon pollution, improving fuel efficiency saving money and supporting innovation for trucks*.

- US EPA 2016**, *Inventory of U.S. greenhouse gas emissions and sinks: 1990 - 2014*, Washington DC.
- Victorian Council of Social Services (VCOSS) 2015**, *Energy issues for low-income households*, Lombard, D. (ed.), viewed 26 Aug. 2016, <http://vcoss.org.au/blog/energy-issues-for-low-income-households-september-2015/>.
- Wang X 2015**, *2015 PV Market Outlook*, Bloomberg New Energy Finance (BNEF), Manila.
- Wara M 2006**, *Measuring the Clean Development Mechanism's performance and potential*. Working Paper 56, Program on Energy and Sustainable Development at Stanford University, Stanford.
- Wood T, Blowers D & Moran G 2016**, *Climate phoenix: A sustainable Australian climate policy*, Grattan Institute, Melbourne.
- World Bank 2016**, *Carbon Finance at the World Bank: List of Funds*, viewed 25 Jul. 2016, <https://wbcarbonfinance.org/Router.cfm?Page=Funds&ItemID=24670>.
- World Resources Institute (WRI) 2015**, *CAIT 2.0: Climate Analysis Indicators Tool*, WRI's Climate Data Explorer, viewed 15 Jun. 2016, <http://cait.wri.org>.