

Low Carbon Growth Plan for Australia

Report summary

March 2010



KEY FINDINGS

- ▶ Australia can reduce its GHG emissions to 25% below 2000 levels (a reduction of 249 MtCO₂e) by 2020 at a low cost, using technologies available today.
- ▶ The Low Carbon Growth Plan identifies 54 separate opportunities - across all sectors - that can be implemented over the next ten years to achieve these emissions reductions.
- ▶ Reducing GHG emissions can be profitable for business.
- ▶ A combination of a carbon price and targeted action is required to achieve the full potential of low cost emissions reductions.
- ▶ A portfolio of prompt action is required to implement the 54 opportunities, that takes account of the risk of “locking-in” emissions for the long term and the ease of emissions reductions.
- ▶ Delaying action will mean some low cost opportunities are lost, ensuring greater cost to society and business in the long run.

Australia can reduce its emissions by 25% below 2000 levels, without changing the mix of businesses in the economy, and at a low cost to society.

ClimateWorks Australia (ClimateWorks) was founded in 2009 through a partnership between The Myer Foundation and Monash University, with a mission to substantially reduce Australia's greenhouse gas (GHG) emissions over the next five years.

ClimateWorks believes the practical steps required to achieve these reductions are more likely to be enacted if presented in an easy to understand, overarching and cohesive climate change strategy for Australia.

This strategy, the Low Carbon Growth Plan for Australia, has been built on the following principles:

1. Establish a comprehensive fact base
2. Examine GHG emissions reduction opportunities from both a societal and business perspective
3. Identify the lowest cost means to reduce GHG emissions

4. Understand barriers to reducing GHG emissions and develop measures to overcome them
5. Build momentum for collaborative action

The Low Carbon Growth Plan is the first economy-wide emissions reduction strategy developed for Australia. It clearly identifies that Australia can significantly reduce GHG emissions between now and 2020 at low cost.

Reducing GHG emissions can protect Australia's economy into the future, provide immediate benefits for society, and create profitable opportunities for businesses.

The next step for ClimateWorks is to work with both business and experts to identify the lowest cost emissions reduction opportunities, the barriers to implementation and the means to overcome them.

The opportunity

- ▶ Australia can reduce its GHG emissions to 25% below 2000 levels by 2020 at an average annual cost to society of A\$185 per household (or 0.1% of the projected GDP per household in 2020) using technologies that are available today.
- ▶ 22% of emissions reduction opportunities are already profitable from an investor's perspective.
- ▶ New opportunities will be created for business to supply goods and services as the world moves toward a lower carbon economy.

Example opportunities to reduce emissions through lifestyle and behaviour change			2020 emissions reduction potential	
Categories	% of personal carbon footprint	Example opportunities	Volume MtCO ₂ e	Net savings A\$/tCO ₂ e
Passenger transport	44%	Avoid 25% of business flights on high traffic routes through increased videoconferencing	0.4	200
		Switch 15% of total urban car trips under 3 km to walking or cycling	1.1	6
		Reduce total urban car travel by 5% through increased use of public transport	1.6	6
		Shifting car occupancy rates from 1.4 to 1.6 persons per car	2.8	150
Building and household energy	36%	Reduce required home temperature by 2°C	1.1	56
		Reduce required commercial temperature change by 2°C	1.6	92
		Switch key home appliances from standby to off when not in use	0.2	56
Consumables	20%	Switch 50% of bottled water drunk in Australia to tap water	0.1	200

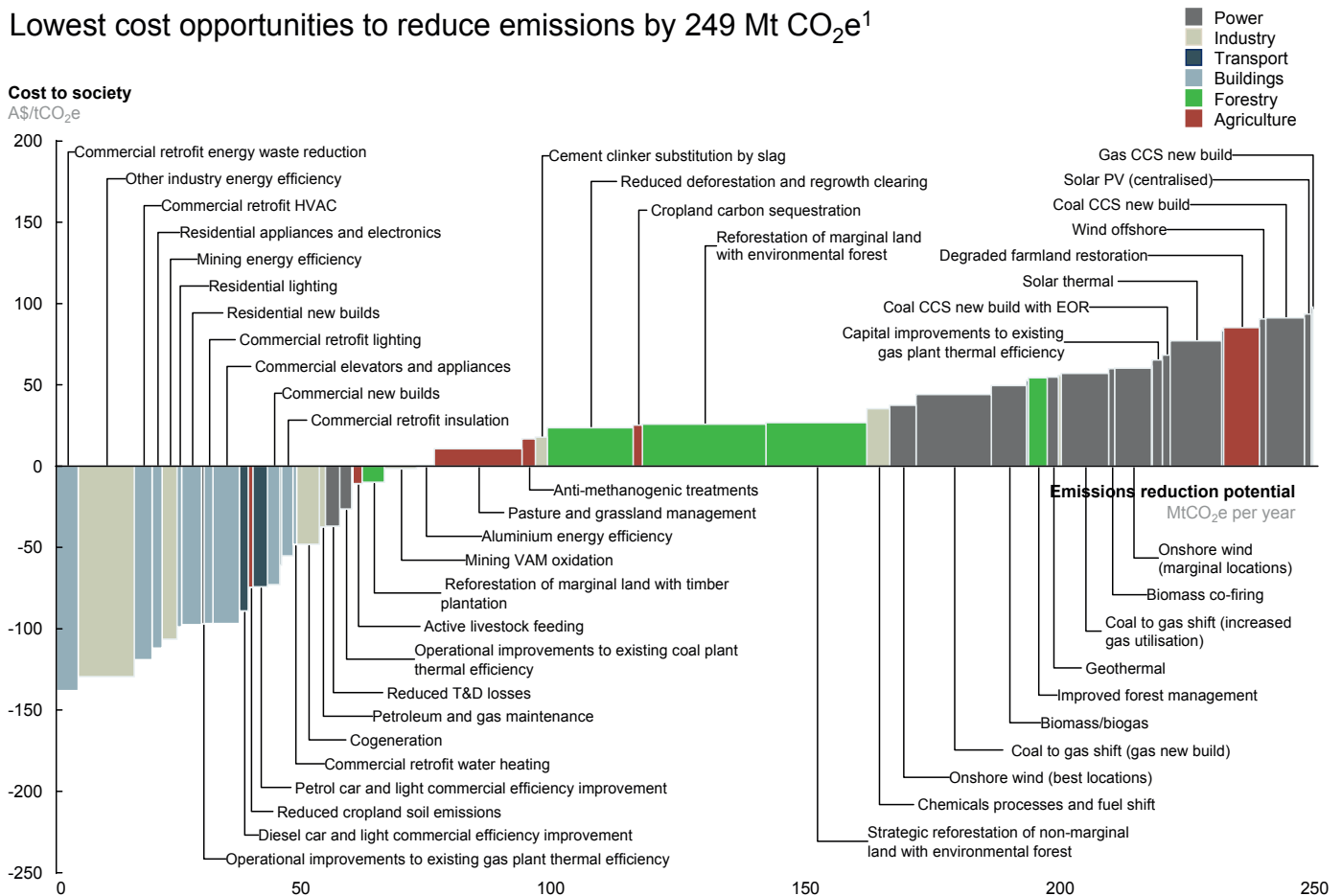
There are a variety of adjustments individuals and businesses can make to their lifestyle and work patterns to reduce carbon emissions, many of which would also save money.

SOURCE: BITRE/CSIRO (2008); Australian Institute of Petroleum (2009); Ovum (2008); ABS (2009 and 2010); DEWHA (2008); Hackett et al (2009); Australasian Bottled Water Institute (2009); Econometrica (2009); ClimateWorks team analysis

There are 54 separate opportunities identified in the cost curve that together can reduce emissions by 249 MtCO₂e by 2020.

2020 GHG emissions reduction societal cost curve

Lowest cost opportunities to reduce emissions by 249 Mt CO₂e¹



¹ Includes only opportunities required to reach emission reduction target of 249 Mtpa (25% reduction on 2000 emissions); excludes opportunities involving a significant lifestyle element or consumption decision, changes in business/activity mix, and opportunities with a high degree of speculation or technological uncertainty

SOURCE: ClimateWorks team analysis (refer to bibliography)

HOW TO READ THE GHG EMISSIONS REDUCTION COST CURVE

The width of each column represents the GHG reduction potential of an opportunity in 2020 compared to the emissions forecast under the business-as-usual (BAU) case. The height of each column represents the average cost for that activity of abating a tonne of CO₂e in 2020. All costs are in 2010 real Australian dollars (A\$), and the graph is ordered left to right from the lowest cost to the highest cost opportunities.

SOCIETAL PERSPECTIVE

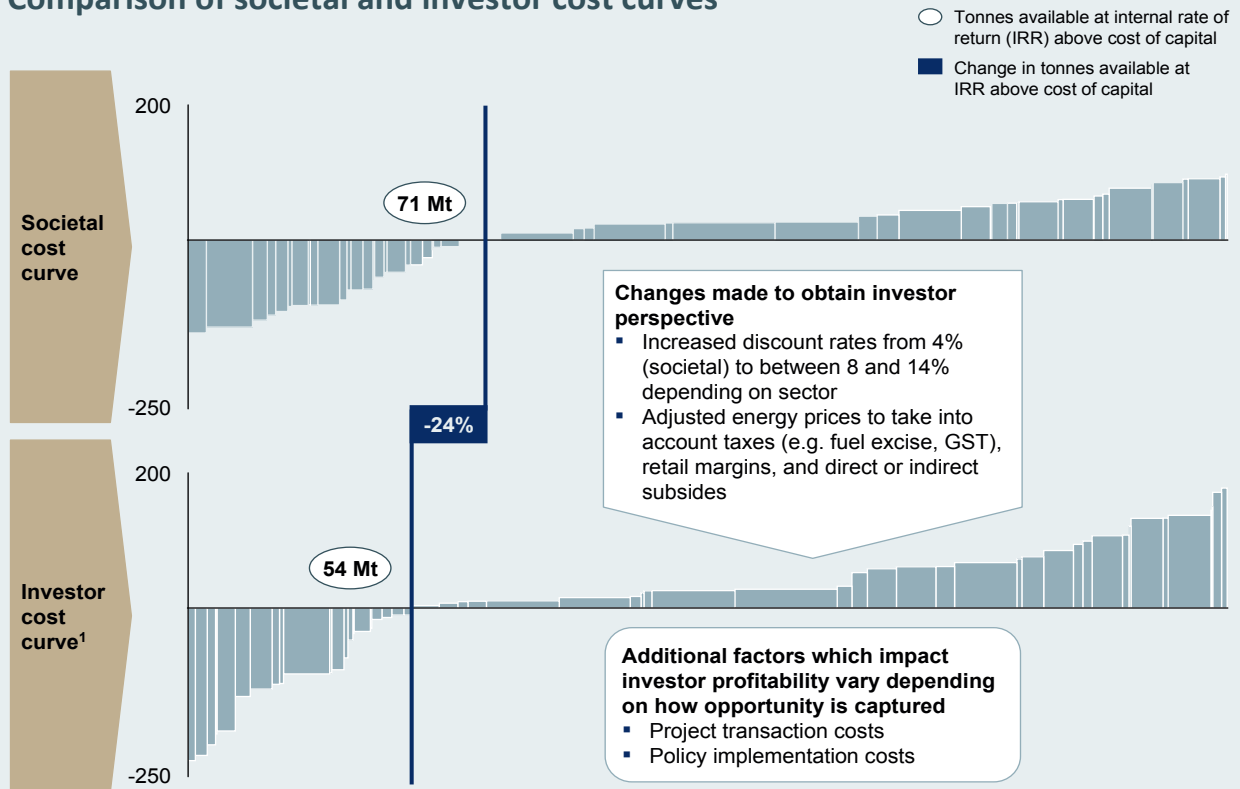
The Societal cost curve above illustrates the cost of emissions reduction from a societal perspective (i.e. excluding taxes and subsidies, and using a cost of capital close to the long term government borrowing rate). This methodology also does not take account of the transaction and program costs associated with implementing these emissions reductions (e.g. administration costs of government programs or management time) as these vary with the precise approach chosen for each opportunity.

INVESTOR PERSPECTIVE

The investor perspective differs from the societal cost curve in that it includes the net direct cost faced by a company or consumer to implement an emissions reduction opportunity. This requires adjusting costs calculated from a societal perspective to include the private cost of capital for each sector (8 to 14%), and energy taxes, retail margins and subsidies.

The investor cost curve can be viewed in the Low Carbon Growth Plan report (Exhibit 50). A comparison between the societal and investor perspectives can be viewed on page 3.

Comparison of societal and investor cost curves

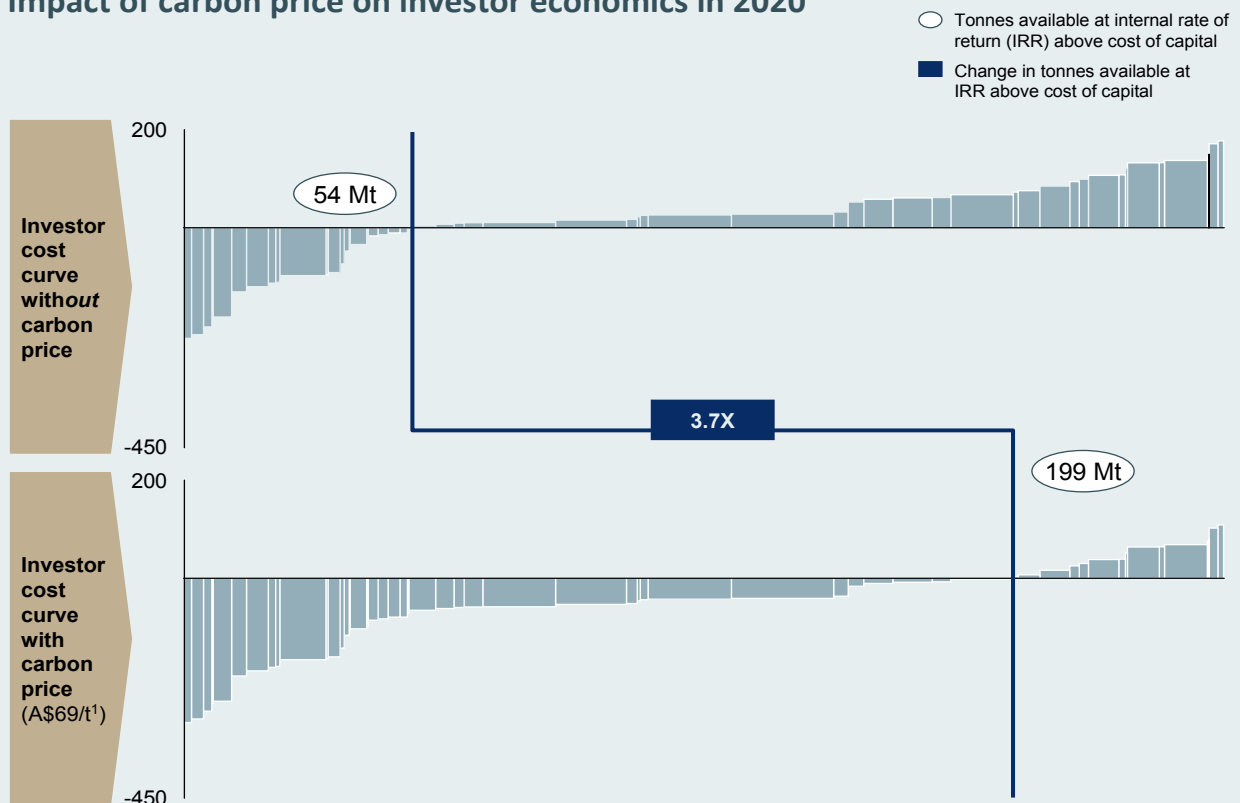


¹ Does not include the impact of a carbon price

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

A carbon price of \$43 per tonne in 2013 rising to \$69 per tonne in 2020 will more than triple the amount of emissions reduction that is profitable for business.

Impact of carbon price on investor economics in 2020

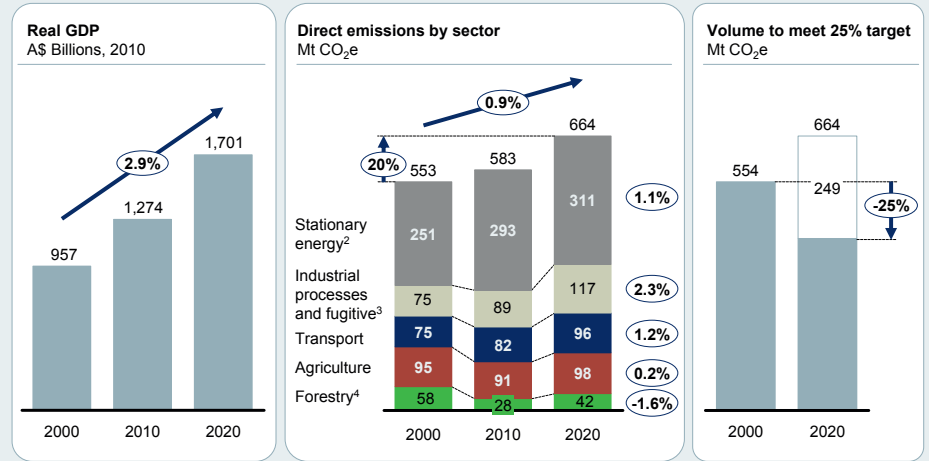


¹ Carbon price in 2020 of A\$69 per tonne based on Treasury Garnaut -25% estimate (*Australia's Low Pollution Future*) converted to 2010 dollars

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Without any additional actions beyond those already underway or legislated, Australia's annual GHG emissions are forecast to increase from 553 MtCO₂e in 2000 to 664 MtCO₂e by 2020—a 20% increase, at a growth rate of 0.9% per year.

Business-as-usual projected economic and emissions growth



1 Compound Annual Growth Rate per annum, 2000–2020
 2 Direct emissions from the power sector can also be regarded as indirect emissions from downstream power-consuming activities (e.g. power use in the building and industry sectors)
 3 Includes fugitive emissions, industrial process emissions and waste emissions
 4 Net emissions after subtracting growth in carbon sinks (e.g. new plantations) from emissions due to land clearing; Kyoto accounting method used
 SOURCE: Australian Department of Climate Change (2009); ClimateWorks team analysis

The challenge

- ▶ In addition to a carbon price, non-price barriers also need to be addressed to ensure maximum realisation of the emissions reduction opportunities identified as being realistically achievable by 2020. These barriers include:
 - **Market structure and supply** (high transaction costs, split incentives, contract structures).
 - **Information gaps and decision process.**
 - **Capital constraints** (access to capital, long payback periods) **and investment priorities.**
- ▶ There is a role for both business and government in creating the market conditions to ensure implementation of the emissions reduction opportunities.

EXAMPLES OF POLICIES AND MEASURES TO OVERCOME BARRIERS

High transaction costs - Some energy service companies (ESCOs) have made a business of aggregating small scale projects on behalf of commercial building owners or city councils, therefore lowering the cost of assessment, planning and implementation of energy efficiency retrofits.

Split incentive - Large commercial property companies have begun to subsidise energy efficiency upgrades of their tenants' equipment even with no immediate financial benefit, as they recognise that demand for energy efficient buildings will increase in the future and are positioning themselves as leaders in the market.

Information gaps – Broad educational campaigns are a relatively simple way to raise awareness and have been successfully conducted by a number of players in the past.

Access to capital - Considerable scope exists for lending institutions, both established and entrepreneurial, to develop innovative financing solutions to capture some of the margin currently lost due to limited access to capital.

Investment priorities - Companies that have identified energy efficiency as a long term priority overcome this barrier by modifying the price of energy used to calculate the internal rate of return for projects.

Power sector summary

- ▶ The power sector has the potential to contribute 31% of the total 2020 lowest cost emissions reduction opportunities for Australia. Fully implementing these would result in emissions reductions of 77 MtCO₂e in 2020, a 39% reduction on the BAU case
- ▶ However, emissions reduction in the power sector is generally higher cost at an average of A\$54 per tonne from a societal perspective and A\$87 per from the investor's perspective
- ▶ As cost is the primary barrier, a carbon price can be particularly effective, increasing the volume of opportunities that are profitable to investors seven-fold (from just over 5 MtCO₂e to over 35 MtCO₂e), under the 25% example price used in the Low Carbon Growth Plan report

Opportunities include:

- ▶ Onshore wind, coal to gas shift, biomass/biogas and solar thermal with storage are among the largest opportunities in the power sector
- ▶ Opportunities that offer net savings in the power sector are improved coal and gas power plant thermal efficiencies and reduced transmission and distribution losses

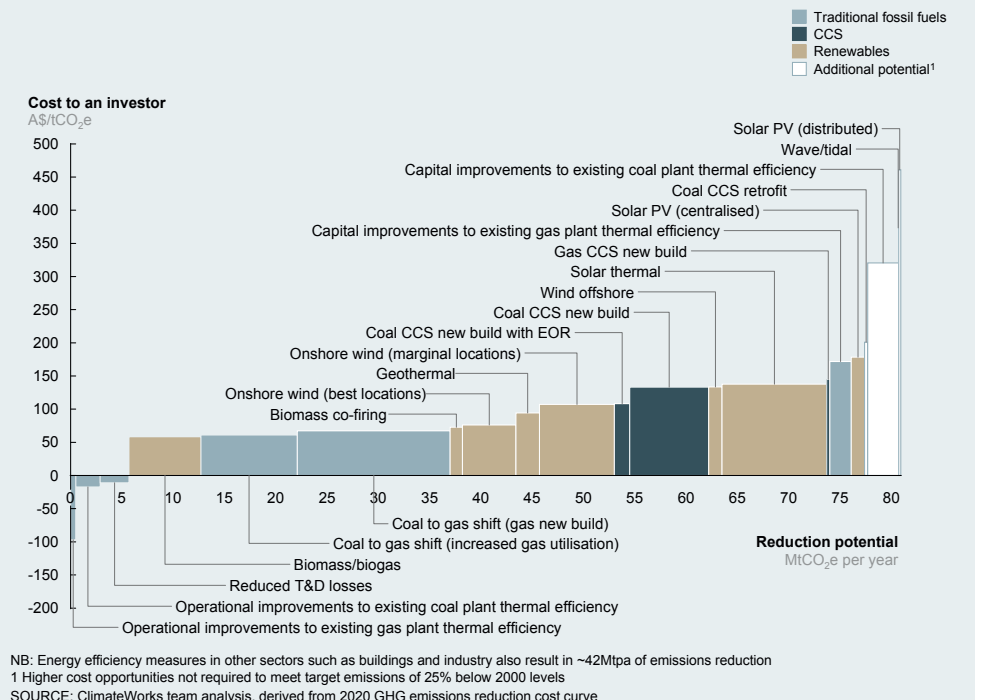
Tools to overcome sector challenges:

- ▶ Improve economics of emissions reduction investments
- ▶ Develop alternative sources of financing (e.g. government guarantees or interest free loans from the public sector, or new financial products or markets that pool 'green funds' together and syndicate risks in the banking industry)
- ▶ Support R&D and pilot programs to accelerate the maturation of new technologies and reduce first-mover disadvantages
- ▶ Provide training and industry support to develop new industries
- ▶ Establish fuel efficiency targets and energy management practices

The power or electricity generation sector is Australia's single largest direct emitter of greenhouse gas emissions, accounting for 35% of Australia's total in 2010.

A carbon price can be particularly effective in the power sector, increasing the volume of opportunities that are profitable to investors seven-fold.

2020 Power GHG emissions reduction investor cost curve

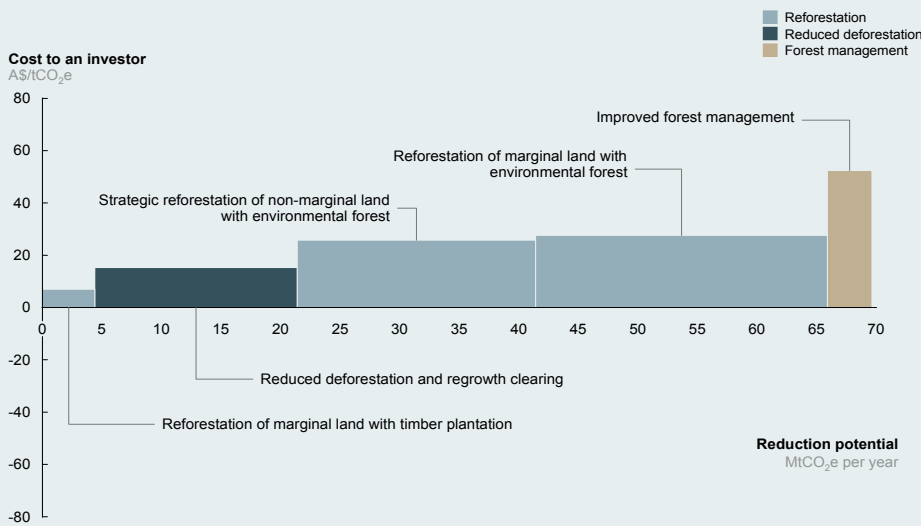


Forestry sector summary

- ▶ The forestry sector has the potential to contribute 28% (70 MtCO₂e) of the total 2020 lowest cost emissions reduction opportunities for Australia
- ▶ These emissions reduction opportunities have an average societal cost of A\$25 per tonne, and a similar cost from the investor's perspective of A\$24 per tonne
- ▶ Information and long term policy certainty are other important barriers to overcome

As cost is the primary barrier in the forestry sector, a carbon price can be particularly effective, making nearly all the volume of opportunities profitable to investors (over 65 MtCO₂e).

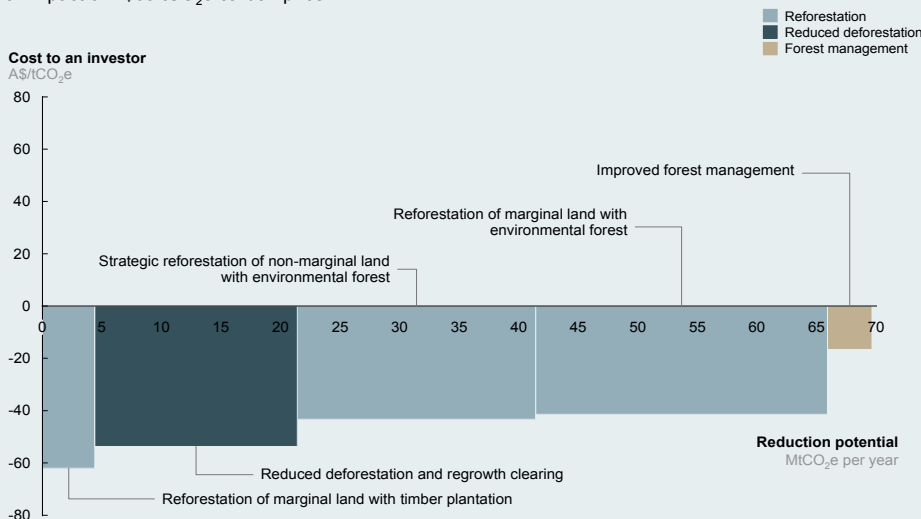
2020 Forestry GHG emissions reduction investor cost curve



SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

2020 Forestry GHG emissions reduction investor cost curve with a price on carbon

With impact of A\$69/tCO₂e carbon price¹



¹ Carbon price in 2020 of A\$69 per tonne based on Treasury Garnaut -25% estimate (Australia's Low Pollution Future) converted to 2010 dollars

SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Opportunities include:

- ▶ 70% of the forestry emissions opportunity is from reforestation
- ▶ Two-thirds of this includes reforestation on marginal land and commercial timber forestry offering revenue from the timber sold.
- ▶ The remaining third is from planting 1–2% of productive farmland with trees in the form of windbreaks, plantings along waterways and as tree islands to shade livestock, in line with best practice
- ▶ Reduced deforestation has delivered almost 90 MtCO₂e p.a. of emissions reduction from 1990 to 2009, and can further reduce emissions by 17 MtCO₂e by 2020, contributing one quarter of the total forestry opportunity

Tools to overcome sector challenges:

- ▶ Improve profitability and create a clear long term position on forestry
- ▶ Provide land owners with good information on the various forestry options available for their type of land

Industry sector summary

- ▶ The industrial sector has the potential to contribute 15% (37 MtCO₂e) of the total 2020 lowest cost emissions reduction opportunities for Australia
- ▶ Without further action, emissions from the industry sector are expected to grow by 40% between 2000 and 2020, driven largely by growth in the mining and gas sub-sectors
- ▶ 70% of the emissions reduction opportunities in the industry sector offer net savings to society. The largest opportunities are from improved energy efficiency (16 MtCO₂e) and from the implementation of new technologies (9 MtCO₂e)

Opportunities include:

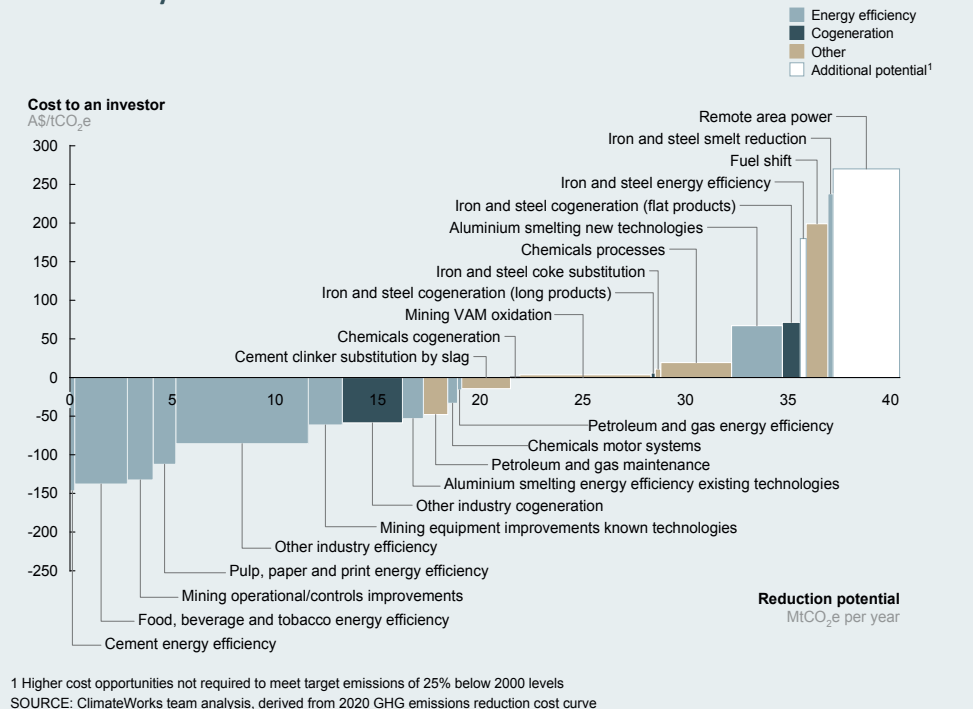
- ▶ Energy efficiency through improved control systems and processes, reduction of duplicated or oversized equipment, upgrade of motor systems, decrease of energy losses in boilers and steam distribution systems, and waste heat recovery
- ▶ New technologies offer potential in aluminum smelting; VAM oxidation which can reduce fugitive methane emissions from gassy underground mines; Carbon Capture and Storage (CCS)
- ▶ Cogeneration (also called combined heat and power)

Tools to overcome sector challenges:

- ▶ Promote energy management practices
- ▶ Provide information to increase awareness and encourage information sharing
- ▶ Set up targets and standards (voluntary agreements - financial, regulatory, brand image, CEO commitment - have been seen to drive significant improvements, and efficiency standards can be effective for most standard equipment)
- ▶ Develop third party financing (e.g. "pay as you save" to reduce capital constraints and cost pressures)
- ▶ Support pilots to accelerate maturation of new technologies
- ▶ Improve the economics of emissions reduction investments (e.g. through a carbon price)
- ▶ Coordination of waste streams between industrial and commercial sites to reduce the supply constraint on alternative energy sources

Energy efficiency can achieve 47% of the total emissions reduction opportunity in the industry sector, offering an average net savings of A\$100 per tCO₂e.

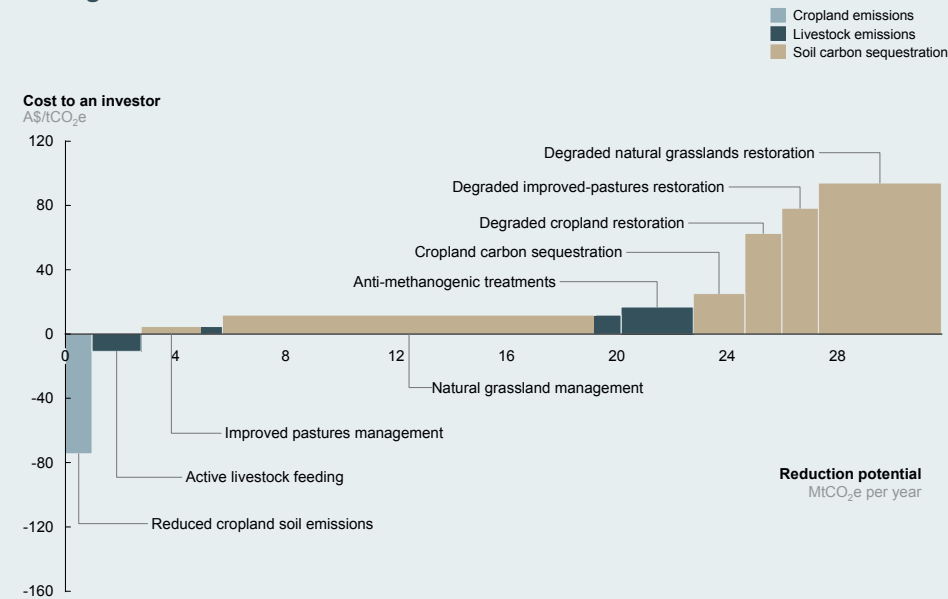
2020 Industry GHG emissions reduction investor cost curve



Agriculture sector summary

- ▶ The agriculture sector has the potential to contribute 13% (32 MtCO₂e) of the total 2020 lowest cost emissions reduction opportunities for Australia
- ▶ These emissions reduction opportunities have an average societal cost of A\$25 per tonne, and the same cost from the investor's perspective
- ▶ 78% of the estimated opportunity (25 MtCO₂e) is through soil carbon sequestration
- ▶ As cost is the primary barrier, economic incentives such as a carbon price can be particularly effective, making nearly all the volume of opportunities profitable to investors (over 25 MtCO₂e) under the 25% example price used in the Low Carbon Growth Plan report
- ▶ Information and long term policy uncertainty are other important barriers to overcome

2020 Agriculture GHG emissions reduction investor cost curve

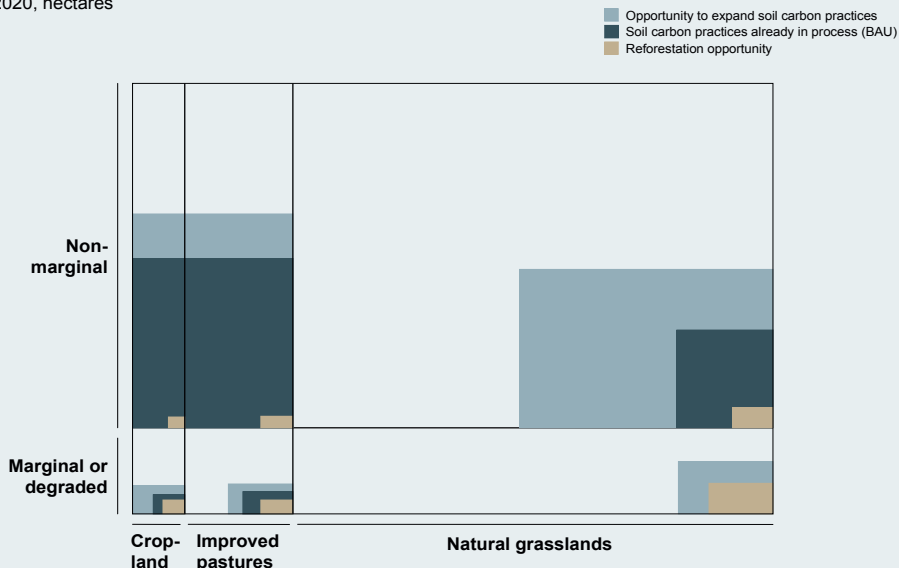


SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

The entire rectangle in the chart below represents all Australian agricultural land (~400 Mha) and demonstrates that a large volume of emissions reduction can be achieved through reforestation of just 1.5% of the total. Soil carbon practices are already being implemented, but further emissions reductions can be achieved with a modest extension of these practices, which also benefits soil health and productivity.

Potential farmland penetration of carbon sequestration practices

2020, hectares



SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

Opportunities include:

- ▶ Soil carbon sequestration through:
 - increasing the prevalence of deep rooted perennial grass species
 - optimising grazing intensity and timing to maximise productivity and carbon sequestration
 - restoration of degraded farmland by reducing salinity, acidification and erosion through revegetation, application of nutrients and other measures to restore the health of land
- ▶ Active livestock feeding
- ▶ Reducing tillage

Tools to overcome sector challenges:

- ▶ Create a clear system of agricultural carbon accounting and payment
- ▶ Give farmers a range of tools, through extensive R&D into the feasibility of soil carbon programs and how best to pursue them
- ▶ Provide information about emissions reduction science that is relevant to farmers

Buildings sector summary

- ▶ The buildings sector has the potential to contribute 11% (28 MtCO₂e) of the total 2020 lowest cost emissions reduction opportunities for Australia
- ▶ These opportunities offer an average net saving to society of A\$99 per tonne, and offer investors an average profit of A\$90 per tonne
- ▶ 77% of the opportunity is within the commercial sector (including 16 MtCO₂e for existing buildings retrofits and 4 MtCO₂e for new builds)
- ▶ Around three quarters of the emissions reduction opportunities identified are profitable to investors, even without a carbon price, therefore addressing non-price barriers is central to unlocking emissions reductions in this sector

Opportunities include:

Reduce commercial energy waste by:

- ▶ reducing oversized and unnecessary equipment
- ▶ better management of existing controls systems

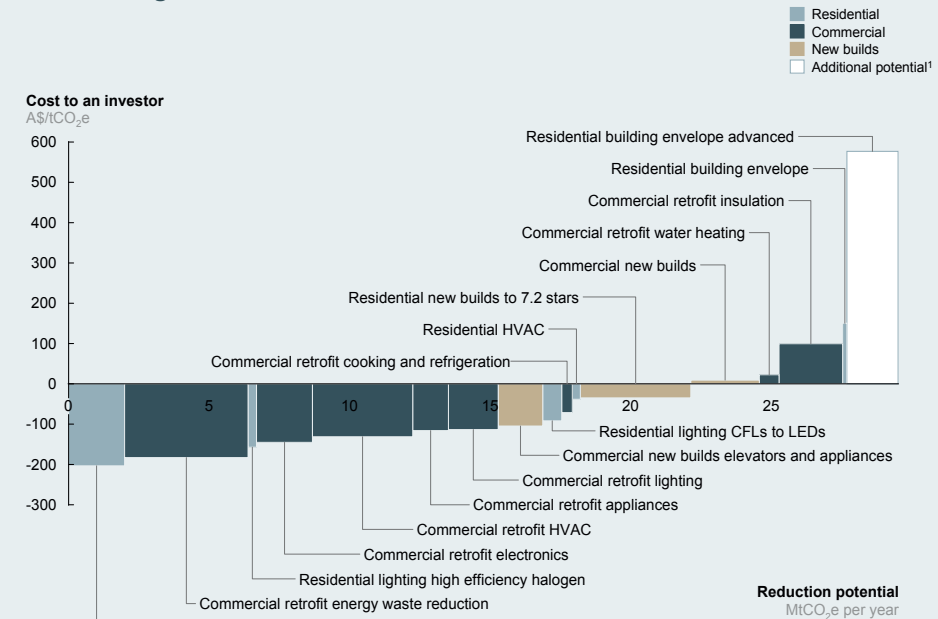
Energy efficient technology, such as:

- ▶ replacing inefficient light bulbs
- ▶ improving the energy efficiency of appliances and equipment
- ▶ decreasing energy losses from open refrigeration, insufficiently insulated ovens or water mains
- ▶ replacing electric heaters with gas and solar-powered water heaters

Tools to overcome sector challenges:

- ▶ Information through awareness campaigns, increased labelling and disclosure of energy efficiency performance to increase demand for energy efficient buildings and spaces
- ▶ Energy price structure through use of smart meters and removal of price distortions
- ▶ Third-party funding to allow loan repayments to be collected through utility meters, leasing contracts and property levies, enabling investors to maintain a positive cash flow and overcome split incentives
- ▶ Increased facilitation services to reduce transaction costs
- ▶ Mandatory standards, rebates and tax incentives
- ▶ Market-based initiatives such as a cap and trade system dedicated to commercial building retrofits
- ▶ Leading by example through role modelling

2020 Buildings GHG emissions reduction investor cost curve

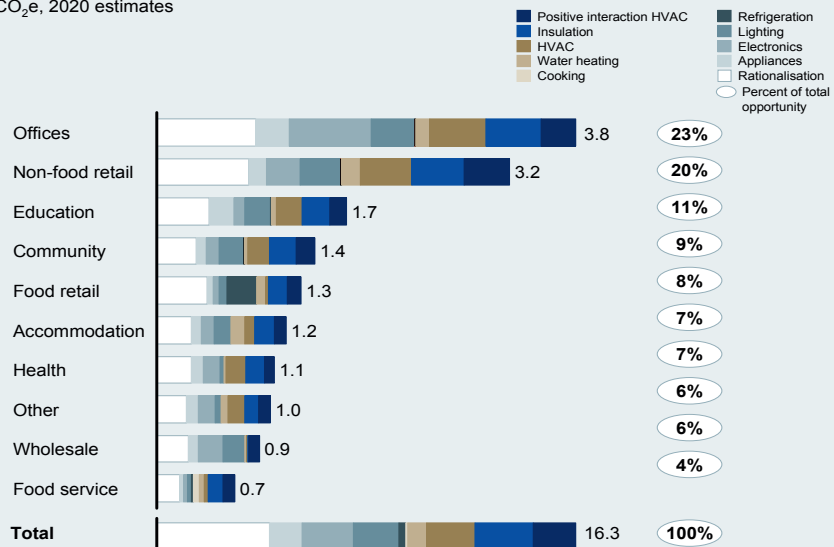


1 Higher cost opportunities not required to meet target emissions of 25% below 2000 levels
SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve

The opportunity in commercial buildings comprises more than just offices. Offices make up just 23% of the total opportunity, with retail comprising a further 28% and education 11%. To date, emissions reduction in the building sector has focused on large public and private spaces—just 13% of the total opportunity

Emissions reduction opportunity in commercial buildings retrofits by technology

MtCO₂e, 2020 estimates

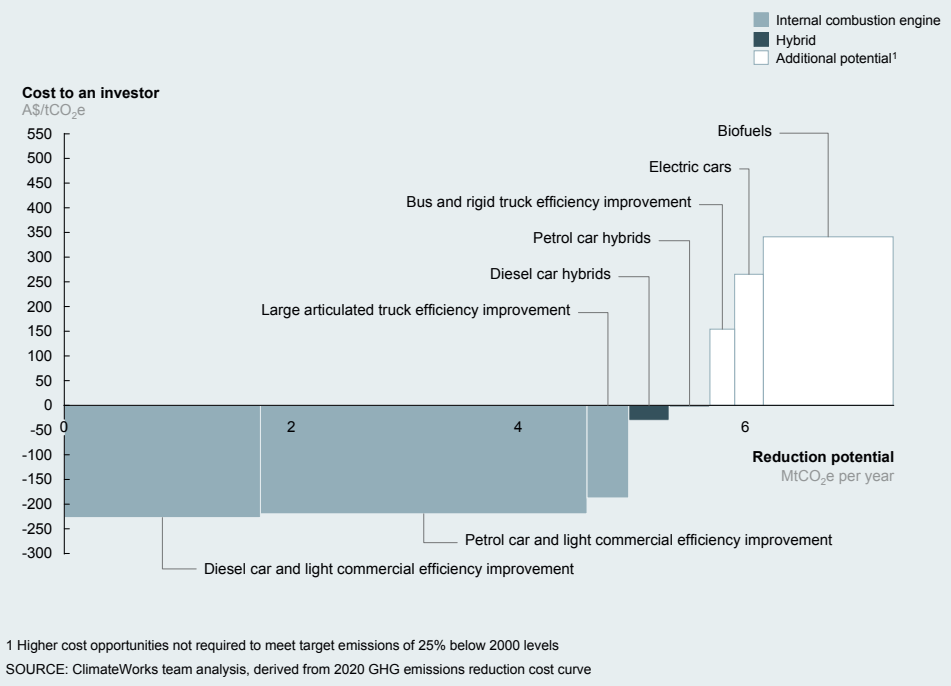


SOURCE: ClimateWorks team analysis, derived from 2020 GHG emissions reduction cost curve (exhibit 4)

Transport sector summary

- ▶ The transport sector has the potential to contribute 6 MtCO₂e of the total 2020 lowest cost emissions reduction opportunities for Australia
- ▶ The largest opportunity in the sector (68% of total) is through improved fuel efficiency of conventional internal combustion engine (ICE) vehicles – which offers net savings to society in 2020 of A\$67 per tonne, and even greater savings to investors with an average profit of A\$192 per tonne
- ▶ As most of the identified emissions reduction opportunities are profitable to investors even without a carbon price, addressing non-price barriers is central to unlocking these emissions reductions

2020 Transport GHG emissions reduction investor cost curve



Opportunities include:

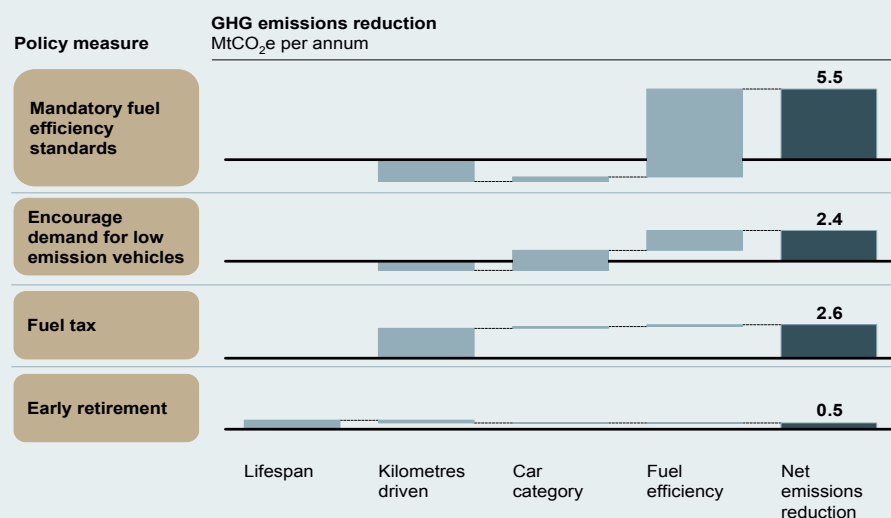
- ▶ Improving the fuel efficiency of petrol- or diesel-fuelled cars and trucks, for example decreasing the accelerating and rolling resistance and weight of vehicles

Tools to overcome sector challenges:

- ▶ Set mandatory vehicle emissions standards for manufacturers
- ▶ Set mandatory or voluntary standards for fleets
- ▶ Financial incentives for low-emissions vehicles
- ▶ Reduce 'network externalities' for low emission vehicles
- ▶ Include the cost of carbon in fuel prices
- ▶ Collaborate to transform local manufacturing, by aligning government and stakeholder priorities for future development
- ▶ Improve traffic flow and public transport use
- ▶ Promote efficiency measures to reduce unnecessary travel
- ▶ Educate consumers through improved vehicle labelling and raising awareness of the risk of lock-in caused by purchasing new inefficient vehicles
- ▶ Direct financial incentives to scrap older vehicles
- ▶ Promote behavioural changes in drivers such as using public transport and car pooling

95% of the projected emissions reduction potential in the road transport sector depends on drivers purchasing more fuel efficient vehicles. Mandatory fuel efficiency standards are an economically attractive policy initiative that provide an emissions reduction opportunity of 5.5 MtCO₂e p.a.

Comparison of policy measures to encourage fuel efficient passenger vehicles



SOURCE: Bureau of Infrastructure, Transport and Regional Economics (2009); ClimateWorks team analysis

The roadmap

The Low Carbon Growth Plan proposes a way to approach the various opportunities that are available in Australia at a low cost, and integrates them into an overarching emissions reduction roadmap—one that can be agreed and understood by business, government and the community.

Implementing each of the 54 opportunities identified in the Low Carbon Growth Plan requires different types of effort, based on the risk of emissions lock-in if actions are delayed and the ease of implementation of each opportunity. The roadmap in this report groups the opportunities into three categories of effort:

- ▶ Implement now (101 MtCO₂e, or 41% of the total opportunities)
- ▶ Act now to remove barriers and motivate action (29 MtCO₂e, or 12% of the total opportunities)
- ▶ Invest now in information and innovation to reduce long-term costs (119 MtCO₂e, or 48% of the opportunities)

Australians want to reduce emissions but also want to look forward to continued prosperity.

The Low Carbon Growth Plan for Australia provides practical details about the lowest cost emissions reduction opportunities that can be undertaken

across Australia's economy in the next ten years to achieve total reductions of 249 MtCO₂e or 25% below 2000. It finds that these actions can be delivered at a cost of just 0.1% of the projected GDP per household in 2020.

While reducing Australia's GHG emissions is indeed a challenge, it is clear that practical opportunities exist for Australia to reduce emissions substantially while both continuing to grow the economy and offering profitable opportunities for business.

ClimateWorks will work with policymakers, business leaders and the community to support this program of practical action.

Roadmap of action

X Abatement potential, Mt CO₂e (total 249 Mtpa)

		Ease of implementation (cost and barriers)			Type of response
		Relatively simple	More challenging	Difficult	
Risk of lock-in	High	<ul style="list-style-type: none"> Residential new builds <p style="text-align: right;">4</p>	<ul style="list-style-type: none"> Coal to gas shift (gas new build) Solar thermal Onshore wind (marginal locations) Onshore wind (best locations) Commercial new builds Solar PV (centralised) <p style="text-align: right;">41</p>	<ul style="list-style-type: none"> Biomass/biogas Geothermal Wind offshore <p style="text-align: right;">11</p>	<ol style="list-style-type: none"> 1 Implement now 2 Act now to remove barriers and motivate action 3 Invest now in information and innovation to reduce long-run cost
	Medium	<ul style="list-style-type: none"> Other industry energy efficiency Commercial elevators & appliances Cogeneration Mining energy efficiency Reduced T&D losses Residential appliances & electronics Commercial retrofit lighting Residential lighting <p style="text-align: right;">31</p>	<ul style="list-style-type: none"> Commercial retrofit HVAC Aluminium energy efficiency Petrol car and LCV efficiency Commercial retrofit insulation Capital improvements to existing gas plant thermal efficiency Diesel car and LCV efficiency Biomass co-firing Commercial retrofit water heating Residential HVAC <p style="text-align: right;">18</p>	<ul style="list-style-type: none"> Reduced deforestation and regrowth clearing Coal CCS new build Coal CCS new build with EOR Diesel car hybrids Petrol car hybrids Gas CCS new build Residential building envelope <p style="text-align: right;">28</p>	
	Low	<ul style="list-style-type: none"> Coal to gas shift (gas utilisation) Comm. retrofit energy waste reduction Improved forest management Improve existing coal plant efficiency Cement clinker substitution by slag Petroleum and gas maintenance Reduced cropland soil emissions Improve existing gas plant efficiency Large articulated truck efficiency improvement <p style="text-align: right;">25</p>	<ul style="list-style-type: none"> Reforestation of marginal land with environmental forest Strategic reforestation of non-marginal land with environmental forest Mining VAM oxidation Chemical processes & fuel shift Reforestation of marginal land with timber plantation Active livestock feeding Iron and steel processes <p style="text-align: right;">62</p>	<ul style="list-style-type: none"> Pasture and grassland management Degraded farmland restoration Anti-methanogenic treatments Cropland carbon sequestration <p style="text-align: right;">29</p>	

SOURCE: ClimateWorks team analysis

For further detail on each of the measures in the roadmap, see Exhibits 46-48 in Chapter 4 of the main report.

The Low Carbon Growth Plan for Australia can be accessed at www.climateworksaustralia.org

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