# Submission: WA Climate Change Issues Paper

The Western Australian (WA) Government has invited public submissions for the *Climate Change in Western Australia - Issues Paper*. The Australia Institute welcomes the opportunity to make a submission highlighting our existing research on climate change and energy issues, including specifically on WA. This submission recommends the WA Government:

- Set interim emission reduction targets to provide policy credibility and investment certainty and develop a detailed strategy to meet it.
- Prevent new fossil fuel projects in WA from increasing greenhouse gas emissions, ideally through a moratorium on new fossil fuel supply. If projects are approved, require offsets for all residual emissions, with preference for offsets providing economic opportunities within WA.
- Develop a comprehensive electric vehicle strategy including consumer incentives, charging infrastructure and Government fleet targets.
- Ensure the electricity sector makes a far greater than pro-rata contribution to Australia's national greenhouse gas emission targets.
- Accelerate renewable projects and secure low prices through mechanisms like reverse auctions for feed in tariffs.
- Develop a regulatory framework to guide the transition to high renewable penetration and incentivise grid management technologies.
- Not rely on carbon capture and storage (CCS) technology to decouple energy use and emissions.
- Ensure the developing Western Australian hydrogen industry is based on renewable hydrogen, not fossil-based hydrogen.
- Support research, development and deployment of renewable hydrogen in long-term power storage, transport and industry, including zero-carbon steel.

The Australia Institute reports referred to in this submission are annexed below.

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**November 2019**

# Introduction

The WA Government is to be commended for pursuing climate mitigation policy, and for its aspirational goal of net-zero emissions by 2050. Action towards such goals can help deliver Australia's emissions commitments and avoid severe climate impacts.

Previously Australian state governments had treated mitigation as a Commonwealth issue. Like other state and territory governments, the WA Government is now responding to the absence of effective national climate and energy policy or an adequate national emissions reduction target.

Such action has broad public support. The vast majority of Australians (84%) agree that state and territory governments should be either taking a leading role in or contributing to action on climate change.[1]

For the WA Government's climate agenda to be credible and ultimately successful, the WA Government must set a comprehensive, informed and ambitious set of policies to address emissions across all major sectors.

It should be set by reference to the global goals of the Paris Agreement, not inadequate federal policy or targets, and should include interim targets. It should integrate with industry policy and seek to take advantage of the opportunities for WA in low cost renewable energy, including in metals processing and energy technology related manufacturing.

[1] Merzian et al. (2019) *Climate of the Nation 2019*, p 6, https://www.tai.org.au/content/climate-nation-2019

# Overarching considerations

## FEDERAL POLICY VACUUM

The need for state policy is clear. Australia's emissions have been trending upwards since the repeal of the carbon price.

Australia makes a vastly disproportionate contribution to global climate change and is one of the lowest ranked countries in the world on climate action. Australia has the highest per capita emissions in the OECD. It has higher emissions than 40 other countries each with bigger populations. In CO2 potential, it is the fifth biggest miner of fossil fuels and the third largest exporter globally, behind only Russia and Saudi Arabia.[2]

The Australian Government's Paris target, of 26-28% reduction on 2005 levels by 2030, is inadequate according to any recognised principle-based approach. The Australia Institute's research shows that given Australia's high historic emissions, high per capita emissions and high income, *all* approaches to assessing nations' contributions to climate action show that Australia's climate targets are nowhere near a 'fair share'.[3]

In setting such low targets, and failing to even approach them, Australia undermines its economic future and its security. WA should have much higher ambition.

## NEED FOR INTERIM TARGETS

Policy credibility requires interim targets out to 2050.

Without interim targets or emission budgets it will not be possible to determine whether the state is on track, for the simple reason that there will be no track on which to assess progress.

Ambiguity or weakness on this matter will have near term ramifications. A clear example is provided by recent proposals regarding conditions of approval for large gas projects, discussed in detail below.

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[2] Swann (2019) *High Carbon from a Land Down Under*, https://www.tai.org.au/content/new-analysis-australia-ranks-third-fossil-fuel-export

[3] Merzian and Campbell (2018) *Advance Australia's fair share,* https://www.tai.org.au/content/advance-australias-fair-share

There are good environmental reasons for interim targets. Greenhouse gases are a stock pollutant: what matters is the total emitted over time. While Australia's international targets are often discussed in terms of reductions by some year, but legally they are expressed as a budget defined by a trajectory over time.

In particular, interim targets should target immediate and sustained reductions. A trajectory that allows emissions to increase is unlikely to be seen as a credible response and will increase WA's cumulative emissions.

WA's interim targets could be expressed either as emissions levels in target years or as emission budgets. They should be legislated with accountability mechanisms. The model here is the UK Government's legislation, which sets five yearly budgets, independent advisory reporting, and annual Parliamentary accountability on progress. Another model is set by the ACT Government's climate policy, with detailed emissions projections and strategies that project 'wedges' of future abatement. The strategy should be revised regularly.

# WA GAS EMISSIONS

WA contributes significantly to Australia's carbon emissions. It is the only state in Australia where emissions are rising. This is primarily due to LNG production. WA is the biggest producer and exporter of LNG in Australia, itself the largest LNG exporter in the world.[4]

Proposed LNG gas projects, using both offshore gas and onshore fracked gas, will further increase WA and the nation's emissions.[5] Allowing such projects to increase WA and national emissions is not consistent with the global goals of the Paris Agreement and undermines the credibility of the WA Government's target.

The matter is far more concerning if we look to the gas that is extracted. For example, plans to exploit the gas resources of the Canning Basin could add millions of tonnes more of greenhouse gases to the atmosphere. Analysis by Climate Analytics shows the global carbon footprint of the Canning basin's unconventional gas resources alone accounts for 2.3%-3.6% of the global carbon budget- around twice as much CO2 than Australia is permitted to emit under the Paris Agreement. [6]

[4] Western Australian Department of Jobs, Tourism, Science and Innovation (2019) Oil and Gas. https://www.jtsi.wa.gov.au/invest-in-wa/sector/resource-services/oil-gas

[5] Climate Analytics (2018) *Western Australia's Gas Gamble: Implications of exploiting Canning Basin and other unconventional gas resources for achieving climate targets*

[6] Ibid, p 5-15.

In 2018, 50 of Australia's most prominent scientists and energy experts wrote an open letter to the WA Government calling for fracking to be permanently banned in WA. The letter noted that "Western Australia is already experiencing severe impacts of global warming, which will become far worse if emissions are not decisively reduced" and that allowing fracking to proceed would be "grossly irresponsible given urgency of the climate situation."[7]

The gas industry claims that LNG exports reduce global emissions by displacing higher emissions alternative fuels, but these claims are not supported by the evidence, including what they themselves provide. The gas industry cites the IEA, who in fact show gas use stagnant in their climate scenario, and who argue against locking in new gas infrastructure, instead urging increased use only of existing infrastructure.[8] Recent studies published in Nature examined the stock of fossil fuel infrastructure globally finding locked in emissions from existing infrastructure exhausts the 1.5C carbon budget and most of the 2C budget.[9] As the Intergovernmental Panel on Climate Change recently showed, trajectories in the peer reviewed literature consistent with the Paris goal of 1.5C require gas consumption not to increase or to fall out to 2030 and then decline dramatically to 2050.[10]

Importantly, the WA-based LNG industry is pursuing an argument in direct contradiction to the NSW and Qld based coal industry. The former wishes governments to give credit for exported impacts on global emissions. The latter is currently attempting to change NSW law to prevent planning decisions from considering exported coal emissions.

The NSW coal industry is right to point out that current accounting ignores overseas impacts, however this merely demonstrates the limits of a purely demand based approach. Both gas and coal are fossil fuels and increasing the supply of fossil fuels tends to increase consumption (all things being equal). This point is made forcefully in a recent report for the UN, which urges governments to consider 'supply side' policy and outlines many governments that are doing so. A regional example is the New Zealand government, which has a moratorium on offshore oil and gas.[11]

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[7] The Australia Institute (2018) *50 experts call for WA fracking ban: open letter*. https://www.tai.org.au/content/50-experts-call-wa-fracking-ban-open-letter

[8] IEA (2019) Role of Gas in Today's Energy Transitions, p42

[9] Tong et al. (2019) *Committed emissions from existing energy infrastructure jeopardize 1.5°C*, Nature 572. https://www.nature.com/articles/s41586-019-1364-3

[10] IPCC (2019) *Special Report: Global Warming of 1.5°C, Mitigation pathways compatible with 1.5°C in the context of sustainable development*, Table 2.7. https://www.ipcc.ch/sr15/chapter/chapter-2/

[11] UNEP (2019) *Production Gap Report 2019* https://www.unenvironment.org/resources/report/production-gap-report-2019

WA's response to climate change should involve a moratorium on all new fossil fuel production. Such a commitment might be revisited at a future time when domestic and international climate policy is consistent with the goals of the Paris Agreement.

Where projects are approved, they should be required offset all direct emissions.

# Responding to the Issues Paper

## 1: TRANSFORMING ENERGY GENERATION

The Issues Paper recognises that decarbonising WA's electricity supply is a necessary step in addressing climate change and providing affordable, reliable and clean energy. Rapid increases in renewable energy present opportunities to cut electricity emissions, electrify other sectors and to attract and expand high energy industry.

CSIRO and BOM find the lowest cost of new generation is now renewable energy with storage.[12] In coming years renewable energy is likely to become competitive with the *marginal* cost of fossil power generation.

However technology costs alone will not ensure the transition works for WA and its climate goals, given incumbent systems and policy uncertainty. The WA can assist through policy to promote rapid installation of renewables. Examples are the guaranteed price contracts set with reverse auctions securing low cost renewable power in Victoria, the ACT and elsewhere. This provides certainty, limits costs to the state, acts as a hedge against high prices, and lowers the cost of capital for projects, which is a crucial determinant of project cost.

Another important consideration is grid stability. WA is unlike the eastern states, in that it is electrically isolated, with no ancillary services from neighbouring markets. The Issues Paper identifies this as a potential challenge, along with transitioning from dispatchable thermal generators to large quantities of solar without jeopardising grid stability. The Australian Energy Market Operator (AEMO) these challenges can be managed with an appropriate regulatory framework, however emphasises the urgency of implementation.[13]

Peer reviewed modelling by ANU academics shows that high renewables penetration scenarios in the South West Interconnector (SWIS) are possible at competitive prices. The study concludes:

> The modelling results demonstrate that 90%-100% penetration by wind and PV electricity is compatible with a balanced grid. With the integration of off-river

[12] Graham et al (2018) *GenCost 2018*, https://www.csiro.au/en/News/News-releases/2018/Annual-update-finds-renewables-are-cheapest-new-build-power.

[13] AEMO (2019) *Integrating Utility-scale Renewables and Distributed Energy Resources in the SWIS* https://www.aemo.com.au/-/media/Files/Electricity/WEM/Security_and_Reliability/2019/Integrating-Utility-scale-Renewables-and-DER-in-the-SWIS.pdf

> PHES, 90% renewables penetration is able to provide low-carbon electricity at competitive prices. Pumped hydro also facilitates a 100% renewables scenario which produces zero greenhouse gas emissions with attractive electricity prices.[14]

New regulations and market rules can support new technologies, such as virtual power plants, demand response, improved inverter standards, microgrids, and battery storage will be central to navigating WA's energy transition. Such technologies can assist with firming as well as with ancillary services. The South Australian 'big battery' has proven remarkably adept at resolving disturbances, even arising as far away as Queensland, and reducing system costs in the process. These new technologies can provide economic opportunities while increasing competition, lowering power prices.

According to the IEA the single most important way to reduce emissions, the 'first fuel', is energy efficiency, otherwise known as less fuel.[15] WA should review all relevant standards, e.g. building standards, to ensure that new purchases are high efficiency, while promoting retro-fits where possible. Property secured loans are an efficient and low-cost way to provide funds for this purpose. The WA Government should consider state standards and advocate nationally for increased standards for appliances and vehicles.

## Should the electricity sector make a pro-rata (or greater) contribution to Australia's national greenhouse gas emission targets?

The electricity sector should make a far greater than pro-rata contribution to Australia's national greenhouse gas emission targets.

The most cost-effective way to achieve the Paris Agreement target is to reduce sector emissions based on how cheaply different sectors are able to reduce emissions, rather than pro-rata sector targets. This would be achieved under an economy wide carbon price. The WA Government could itself introduce a carbon price, in line with accepted economic principle. US states have carbon prices, as do EU members also covered by

[14] Lu, Blakers and Stocks (2017) *90-100% renewable electricity for the South West Interconnected System of Western Australia,* Energy 122, p 1, https://www.sciencedirect.com/science/article/pii/S0360544217300774

[15] IEA (2018) *Energy efficiency is the cornerstone for building a secure and sustainable energy system,* https://www.iea.org/news/energy-efficiency-is-the-cornerstone-for-building-a-secure-and-sustainable-energy-system

the EU ETS. There are however many forms of effective mitigation policy. Taking other approaches requires strategic allocation of effort between sectors.

The electricity sector has cheap, commercially available and technically feasible abatement options. It should be expected to do early and heavy abatement work. Moreover, a complete transition to cleaner and more efficient energy is necessary to achieve the Paris target and WA's target of net-zero emissions by 2050.

Notwithstanding its inadequacy, if Australia is to achieve its *current* Paris target, an equal proportion approach by sectors is inadequate. The Australia Institute's research shows that even on the current Paris target for all sectors, the lowest cost abatement approach would see emissions reductions in the electricity sector of 40%-55% below 2005 levels in 2030, with 66-75% renewable energy.[16] Note this research was based on earlier renewables costs; it is likely now an even higher percentage.

A pro-rata, sector by sector proportional emissions reduction approach would increase policy requirements and transition burdens for other sectors such as agriculture. The agriculture sector would be less able to abate under a 26% pro-rata trajectory; meeting such targets in agriculture, under current available approaches, likely means significant reduction in livestock numbers.[17]

The reduction of electricity sector emissions, as noted in the Issues Paper, can catalyse emissions reductions through electrification of other areas and sectors. The transportation sector may see reduced emissions through the decarbonisation of the electricity sector coupled with a transition to electric vehicles.

agriculture that have fewer readily available lower cost sources of abatement. Complete decarbonisation of the electricity sector is possible and should be a central aim of the WA Climate Change Strategy.

For further information see the attached Australia Institute Reports:

- *Harming Farming: The cost to agriculture from the government's emissions reduction plan.*
- *Meeting out Paris Commitment: Modelling shows 66-75% renewable energy generation required to meet Australia's emissions target and avoid transferring major burden onto other sectors.*

[16] Campbell (2017) *Meeting out Paris Commitment,* p 1, https://www.tai.org.au/content/meeting-our-paris-commitment
[17] Grudnoff (2018) *Harming Farming,* https://www.tai.org.au/content/harming-farming-cost-agriculture-government-s-emissions-reduction-plan

- *Advance Australia's fair share: Assessing the fairness of emissions targets.*

# 2: INDUSTRY INNOVATION

Investing in and supporting new industries and technologies including hydrogen and renewable energy projects is a key focus of the Issues Paper. These new industries present an opportunity to both decarbonise and diversify the WA economy.

The Western Australian renewable hydrogen strategy recognises that WA has a strong advantage in developing truly zero-emissions hydrogen. Western Australia could develop a cost competitive hydrogen industry over the next decade, built on world-class solar and wind resources. This could provide opportunities for export, long-term power storage, or industrial inputs such as for green steel.

In the future WA could use WA iron ore to make zero carbon steel.

WA's transition to renewable industries and technologies should be accompanied by restrictions on new high emitting projects. Without this, WA will not meet its emissions goals.

## What are the barriers to decoupling energy use and emissions in the resources sector?

The main obstacle to decoupling energy use and emissions is the lack of policy or incentives to guide decarbonisation. Without a cost-effective tool to reduce greenhouse emissions such as a carbon price, technology mandate, or planning regulations, WA's resources sector will continue to push WA's emissions up.

On 7 March 2019, the WA Environmental Protection Agency (EPA) published guidelines recommending that high emitting new projects, like large LNG projects, be required to purchase offsets for all direct emissions. Following gas industry backlash, the EPA took the unprecedented move of withdrawing the guidelines pending further consultation. The Government policy for Major Projects rejected this approach, pre-empting the EPA's considerations with a 'Greenhouse Gas Emissions Policy for Major Projects'.

The Issues Paper states:

> The government's Greenhouse Gas Emissions Policy for Major Projects sets out the broad approach that will be taken in consideration of new proposals and project expansions with significant greenhouse gas emissions. The policy aims

> to ensure that new proposals make an appropriate contribution to the State's aspiration of net zero emissions by 2050.

The WA Government's Greenhouse Gas Emissions Policy for Major Projects was released in the middle of consultation over the WA Environmental Protection Agency's (EPA) emissions guidelines, which it directly contradicts.

Recently, as reported in Australian Energy Daily, the EPA appears ready to backdown from their position, revising their greenhouse gas emissions guidelines. A statement, now removed from the EPA website stated:

> The revised guideline requires proponents of major greenhouse gas emitting projects to show how they can reasonably and practicably avoid, reduce and offset emissions to contribute to the State's aspiration of net zero emissions by 2050.[18]

While requiring new projects to offset direct emissions is clear and will ensure the projects do not increase emissions, the new proposals are both unclear and are likely to allow emissions to increase. It is not even clear how such matters could be assessed without interim targets. Even with interim targets, talk of "how they can reasonably and practicably avoid, reduce and offset emissions to contribute" would remain without clear and meaningful content.

If WA climate policy allows the gas companies to build new projects with unabated emissions, this will directly undermine the credibility of the WA emissions target. Other sectors will be required to cut emissions to support the gas companies.

Another barrier to decoupling emissions from energy use in the resources sector is hopeful thinking that is not backed up by policy. A prime example here is carbon capture and storage (CCS). CCS is a costly and problem-plagued technology. Chevron's Gorgon CCS facility has failed to operate for nearly three years, emitting millions of tonnes of CO2. Despite breaching its WA approval, Chevron has faced no penalties, either at the state level or at the federal level, given it set an emissions limit for itself under the safeguard mechanism that assumes CCS fails.[19] Although Chevron's CCS facility is now 'operational', Chevron are yet to demonstrate the rate of sequestration. Getting this project off the ground required the Commonwealth to full indemnify the

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[18] Milne (2019) *Exclusive: WA EPA drops offsets but adopts net zero emissions plan,* Australian Energy Daily (paywalled)

See also, Young (2019) *All eyes on environment watchdog after glimpse of tough new greenhouse gas policy* https://www.watoday.com.au/national/all-eyes-on-environment-watchdog-after-glimpse-of-tough-new-greenhouse-gas-policy-20191206-p53hkw.html

[19] Swann (2018) *Gorgon-tuan Problem,* https://www.tai.org.au/content/gorgon-tuan-problem

state for all storage risk, an offer that will not and should not be available for future projects.

CCS may have a role in some hard-to-abate industrial processes, but CCS should not be relied on to reduce emissions from energy use where there are clear alternatives. Particularly, CCS if successful would be wasteful if used on thermal power generation or used to promote purportedly 'low emissions' fossil fuel hydrogen. Renewable hydrogen is likely to be competitive on timescales commensurate with plausible export demand. Locking in fossil hydrogen on the promise of CCS would lock in emissions for years to come.[20] Hydrogen even with CCS is still a source of emissions; without it the emissions are particularly substantial.

For further information see the attached Australia Institute Reports:

- *Gorgon-tuan Problem.*
- *Hytrojan: Is hydrogen the next 'clean coal'?*

## What exemptions should apply to trade-exposed sectors in reducing our emissions?

Globally, countries are moving to a carbon constrained world. It is in Australia's interest to proceed *with* this movement, not against it. Optimally there would be no or minimal exemptions. Optimally any export adjustment would be combined with adjustments for imports from countries not reducing emissions (if WA does succeed in reducing its emissions). There are also constitutional issues the state would need to consider, given it is the Commonwealth that legislates on international trade.

Arguments for the protection of trade exposed industries should be taken with scepticism. In particular, note that large LNG companies in WA can reduce emissions whilst remaining very profitable. WA's LNG industry can and should reduce emissions in line with the Paris target and the WA target of net-zero emissions by 2050.

The Australia Institute's research shows that large LNG companies including Woodside and Chevron can afford to offset their emissions at a very small share of their profits. Offsets at current prices would cost Woodside 1.1% of 'gross margins' at Pluto and 1.5% of gross margins at North West Shelf. For Chevron's Gorgon and Wheatstone

[20] Kaitsu et al. (2019) *Hytrojan: Is hydrogen the next 'clean coal'?,* https://www.tai.org.au/content/hy-trojan-hydrogen-next-clean-coal

projects, current prices would see offsets cost 2.6% of 'cash margins'. These offset cost estimates have been validated by the WA DWER.[21]

Moreover, gas companies invest using shadow carbon prices. FOI documents show WA Government officials are aware of this fact. Given that these companies are preparing to pay for their externalities, the WA government has little reason not to insist that they do so.

For further information see the attached Australia Institute Submission to the EPA Greenhouse Gas Emissions Consultation, *Offset Upset*.

## How can the Government of Western Australia foster clean industries and technologies?

Hydrogen could play a major role in decarbonising Australia's and the world's energy systems and presents a substantial zero-carbon economic opportunity for Australia, particularly for WA.

WA's strong advantage lies in the development of zero-emissions hydrogen based on its solar and wind resources. A cost competitive WA's hydrogen industry could be developed within the next decade. To foster a clean industry and technology, truly zero hydrogen (from electrolysis and renewables) should be the sole focus of the WA hydrogen strategy, rather than hydrogen produced from coal or gas.

While from the Issues Paper it seems WA Government is focusing on renewable hydrogen, it is concerning that it has not supported efforts via COAG to prevent government support to fossil hydrogen, or even to promote a clear definition of 'clean' hydrogen with at least 90% CCS.[22] Support of such efforts would establish WA's intent to develop only zero-emission hydrogen.

The Government should make strategic RD&D investments and plans to exploit the links between low cost renewable energy and high quality metal ores. Western Australia's cheap wind and solar resources could be used to increase processing and manufacturing industries. WA holds a competitive advantage in battery manufacturing due to its access to lithium and other critical battery metals. Exporting refined critical

[21] Young (2019) *Going carbon neutral would barely touch Woodside's huge Pilbara profits: Thinktank,* Sydney Morning Herald, https://www.smh.com.au/national/going-carbon-neutral-would-barely-touch-woodside-s-huge-pilbara-profits-thinktank-20190321-p51697.html

[22] Seccombe (2019) *Hydrogen strategy backs dirty coal*, The Saturday Paper, https://www.thesaturdaypaper.com.au/news/politics/2019/11/30/hydrogen-strategy-backs-dirty-coal/15750324009156

battery metals, powered by renewables is another substantial clean technology opportunity for WA.

The WA Government could set itself a mission to develop a zero-carbon steel industry, based on renewable hydrogen and WA iron ore. While this is not a near term opportunity, advantages to the state and the climate effort would be large.

Making the most of these opportunities requires strategic long-term industry policy. This may include incentives for factory or facility investment, public co-investment, industrial clustering, public RD&D funding and royalties incentives. Such industry policy should integrated with energy policy. Efforts to capture more of the value in the battery and electric vehicle supply chain can only be supported by efforts to promote uptake of batteries and electric vehicles.

# 3: FUTURE MOBILITY

Increased uptake of electric vehicles in WA could play a significant role in decreasing greenhouse gas emissions, improve air quality and health, and create industry opportunities in battery manufacturing.

Moving from fossil vehicles to EVs would also benefit WA's security interests by reducing reliance on imported oil. The Interim Report on Liquid Fuel Security shows Australia is ill-equipped to deal with a liquid fuel security crisis, due to scarce domestic oil reserves and declining refining capacity.[23] Australia imports nearly all oil it consumes, even while it exports nearly all petroleum extracted. This creates energy security risks. There are also security risks at more local levels, as WA has recently experienced.

In May 2014, issues with imported diesel led to a shortage across the Perth Metropolitan area. BP confirmed an acute supply shortage, diesel was unavailable at more than 100 service stations across Perth and regions, and the WA Department of Mines Industry Regulation and Safety advised drivers not to drive without checking ahead of a trip to see if fuel was available.[24]

[23] Swann (2019) *Submission: Interim Report on the Liquid Fuel Security Review,* https://www.thesaturdaypaper.com.au/news/politics/2019/11/30/hydrogen-strategy-backs-dirty-coal/15750324009156

[24] BP (2014) *BP confirms WA diesel supply*, https://www.bp.com/en_au/australia/media/media-releases/bpconfirms-wa-diesel-supply.html, WA Department of Mines Industry Regulation and Safety (2014) *Diesel buying advice for WA drivers*, https://www.commerce.wa.gov.au/announcements/diesel-buying-advice-wa-drivers

WA has much to gain reduce its reliance on imported fuel and shift towards locally generated and decentralised renewable power and higher uptake of electric vehicles. This requires government policies with specific electric vehicle targets and fuel efficiency standards, and government incentives for low and zero emissions vehicles.

## What can be done to facilitate the uptake of electric and other low-emission vehicles in Western Australia?

Nordic policies serve as a useful roadmap for OECD members suffering from low uptake of EVs.  Australia, and the WA government could look to Nordic policy solutions to facilitate the uptake of electric and low emissions vehicles.

Norway is a prominent leader in electric vehicle (EV) policy amongst the Nordic countries and the world. In Norway, the number of new car registrations that are EVs is now over 50%.[25] By contrast, in Australian EV sales last year were only about 0.2% cent of the total compared with just under 2% globally.[26]

Norway's success has been driven by government leadership, creating a policy environment to drive a large-scale and sustainable shift to EV use.

Policy levers implemented by the Norwegian government include registration tax rebates and exemptions, GST exemption, circulation tax rebates, waivers on toll, parking and ferry fees, discounted parking for EVs and access to bus lanes. These incentives have been accompanied by investment in publicly accessible charging infrastructure.

For further information see the attached Australia Institute report, *Driving Norse*.

## How can we ensure that Western Australia isn't left behind in the transition to cleaner transportation?

WA, like the rest of Australia, is already being left behind in the transition to cleaner transport compared to other OECD countries. WA should not wait for the Federal Government to develop a comprehensive electric vehicle strategy.

The Federal Government's main climate policy, the Climate Solutions Package is predicated on establishing a national EV strategy in mid-2020 that is expected to

[25] Norsk Ebilforening (2019) *Norway reaches historical electric car market share* https://elbil.no/norwayreaches-historic-electric-car-market-share/

[26] Bloomberg New Energy Finance (2018) *Cumulative Global EV Sales Hit 4 Million* https://about.bnef.com/blog/cumulative-global-ev-sales-hit-4-million/

reduce emissions by up to 10 million tonnes by 2030. The purportedly forthcoming EV Strategy will "coordinate action across governments", industries and communities to manage the transition to EVs.[27]

In addition, Government emissions modelling revealed in Senate Estimates shows the Coalition's climate policy assumes an electric vehicle uptake of 25-50% of new car sales by 2030.

However, without a tangible strategy to guide the transition to electric vehicles, Australia is being left behind other comparable nations in terms of EV market investment. WA should develop a comprehensive, state-wide strategy to guide the EV transition and demonstrate certainty to car manufactures and consumers, rather than wait for action from the Federal Government.

A priority of the WA EV strategy should be the procurement of a government EV fleet. Fleets make up over half of new vehicle sales. Specifying EV targets for fleets increases EV demand, helps bring new models to Australia and boosts the 2nd hand (more affordable) market.

For further information see the attached Australia Institute Report:

- *Driving Norse: Electric vehicle policies in Norway*
- *Submission: Interim Report on the Liquid Fuel Security Review,*

# APPENDIX

- *Advance Australia's fair share: Assessing the fairness of emissions targets.*
- *Driving Norse: Electric vehicle policies in Norway*
- *Gorgontuan Problem: Problems with Chevron's CCS project*
- *Harming Farming: The cost to agriculture from the government's emissions reduction plan.*
- *Hytrojan: Is hydrogen the next 'clean coal'?*
- *Meeting out Paris Commitment: Modelling shows 66-75% renewable energy generation required to meet Australia's emissions target and avoid transferring major burden onto other sectors.*
- *Submission to WA EPA re Emissions Guidelines: Offset Upset*
- *Submission: Interim Report on the Liquid Fuel Security Review,*

[27] Department of Environment and Energy (2019) *A National Strategy for Electric Vehicles,* https://www.environment.gov.au/climate-change/publications/national-strategy-electric-vehicles

# Meeting our Paris Commitment

## Modelling shows 66-75% renewable energy generation required to meet Australia's emissions target and avoid transferring major burden onto other sectors.

*If Australia is to achieve the Abbott Government's climate targets new energy policies will be required. Existing government modelling shows that renewable energy generation of 75% in 2030 could be required if an abatement cost or long-term incentive approach guides climate policy.*

Discussion paper

**Rod Campbell**
**September 2017**

# ABOUT THE AUSTRALIA INSTITUTE

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# Summary

Under the Abbott Government, Australia signed the Paris climate agreement, committing to reduce carbon emissions by 26-28% below 2005 levels by 2030. The electricity sector will play a significant role in meeting these targets, as it accounts for 35% of the country's total emissions.

A central question concerning the electricity sector's role in meeting Australia's mitigation targets is whether it should reduce its emissions by 26-28%, consistent with the national target, or whether it should shoulder a larger part of the abatement task.

While an equal proportion approach has the benefit of simplicity, it is inefficient because it will push the abatement task onto other industries, where the costs of abatement are higher. The electricity sector can turn to renewable energy which is already commercially available, while other sectors such as agriculture, construction and manufacturing do not have similarly available and cost-effective options. Because of this it has long been assumed that the electricity sector would reduce emissions by more than other parts of the economy.

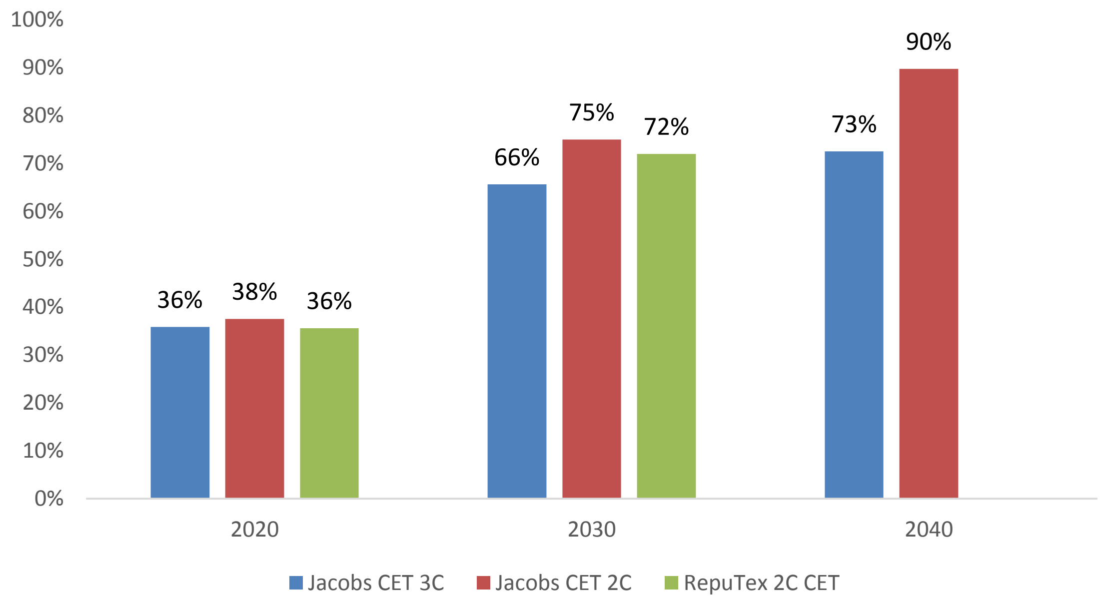
Alternatives to a proportional approach include setting policy with reference to costs of abatement, or to incentives for long term investment.

Government agencies have conducted modelling exercises that consider the size of the task of the electricity sector, what policies could help achieve this and what level of renewable energy generation would result from these policies. This report collates and compares the results of these modelling exercises, showing the likely outcomes from current policy options.

A key result is that under the more efficient abatement cost and long-term investment signal approaches, the electricity sector will need to reduce emissions by between 40%-55% below 2005 levels in 2030.

The level of renewable energy penetration required to achieve emissions reductions of this magnitude under a CET-like policy have been estimated in separate assessments by well-known consultants Jacobs Group and RepuTex, with results summarised in the chart below:

**Renewable penetration, with 40%-55% CET**




Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) *It's the economics, stupid*

These studies show that if an abatement cost approach is used to set the 2030 electricity sector target, and a CET-like policy is used to achieve it, renewable penetration is likely to be in the order of 66-75% by 2030.

# 1. Introduction

Under the Paris Climate Change Agreement, all parties are required to submit and maintain nationally determined contributions (NDCs) that they intend to achieve and 'pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions'. Collectively, the successive NDCs are intended to realise the agreement's objective of 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels'.[1] Australia's first NDC, which was officially submitted in November 2016, commits it to an economy-wide emission reduction target of between 26-28% below 2005 levels by 2030. Although expressed as a single year target, the Australian Government intends to develop it into an emissions budget covering 2021-2030, meaning there will be a target level of cumulative emissions over this period.[2]

The Australian Government currently has a number of policies that are intended to reduce greenhouse gas emissions, including the Emission Reduction Fund (ERF), Large-scale Renewable Energy Target (LRET) and the minimum energy efficiency standards set under the *Greenhouse and Energy Minimum Standards Act 2012* (Cth). There are also a number of state, territory and local government policies that aim to abate emissions like the Victorian and Australian Capital Territory (ACT) renewable energy target schemes, and the energy efficiency schemes that operate in Victoria, South Australia, New South Wales and the ACT. Despite the existence of these policies, additional measures are likely to be required to meet the 2030 targets. The Australian Government's latest projections suggest emissions will have to be reduced by a further 842-1202 million tonnes (Mt) of carbon dioxide equivalent ($CO_2$-e) to meet the NDC commitments.[3]

In addition to the need for measures to reduce emissions, the Australian Government has faced pressure to respond to the escalating crisis in the electricity sector. In recent years, the National Electricity Market (NEM) has been beset by rapidly increasing prices, which have adversely affected residential, commercial and industrial electricity

[1] *Paris Agreement,* p 2, http://unfccc.int/files/home/application/pdf/paris_agreement.pdf

[2] See for e.g. Department of Foreign Affairs and Trade (2015) *Australia's intended Nationally Determined Contribution to a new climate change agreement,* http://dfat.gov.au/international-relations/themes/climate-change/submissions/Pages/australias-intended-nationally-determined-contribution-to-a-new-climate-change-agreement-august-2015.aspx

[3] Department of the Environment and Energy (2016) *Australia's emissions projections 2016,* p 8, https://www.environment.gov.au/system/files/resources/9437fe27-64f4-4d16-b3f1-4e03c2f7b0d7/files/aust-emissions-projections-2016.pdf

consumers. The escalating prices are attributable to a combination of factors, particularly high gas prices, increased retail margins, the closure of aging coal-fired generators and a lack of investment in new generation capacity beyond that supported by the LRET. One of the major reasons for the generation investment drought is the absence of stable long-term climate policy signals. Fluctuations in climate policy over the past decade have created uncertainty, undermining the ability of investors to judge the economic viability of alternative energy investments. Those considering investments in fossil fuel generators have been concerned about potential increases in the stringency of climate policy constraints. Similarly, those considering investments in low emissions generators have been stymied by the absence of short-term incentives outside of the LRET and uncertainty about the longer-term trajectory of climate policy.

To address the challenges facing the electricity sector, the Australian Government commissioned the Independent Review into the Future Security of the National Electricity Market, led by the Chief Scientist, Dr Alan Finkel (Finkel Review).[4] The Review highlighted the adverse impacts of ongoing policy uncertainty and called for long-term policy stability and clarity.

> Uncertainty related to emissions reduction policy and how the electricity sector will be expected to contribute to future emissions reduction efforts has created a challenging investment environment in the NEM. Ageing generators are retiring from the NEM, but are not being replaced by comparable dispatchable capacity. Policy stability is required to give the electricity sector confidence to invest in the NEM.
>
> Reliability in the NEM will be strengthened by establishing a framework for an orderly transition to a low emissions future. This must include a long-term emissions reduction target for the electricity sector, a credible and enduring mechanism for the sector to achieve the emissions reduction trajectory and better management of generator closures.[5]

To address concerns about policy uncertainty, and drive emissions reductions, the Finkel Review made a number of recommendations, the most relevant of which were:

- the Australian and State and Territory governments agree to an emissions reduction trajectory for the NEM; and

[4] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, http://www.environment.gov.au/system/files/resources/1d6b0464-6162-4223-ac08-3395a6b1c7fa/files/electricity-market-review-final-report.pdf

[5] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 33

- the Australian Government introduce a Clean Energy Target (CET) to help meet Australia's Paris Agreement commitments and improve security and reliability in the electricity sector.[6]

A CET is a type of tradeable permit scheme in which new electricity generators (or existing generators who generate above a historic baseline) receive certificates for electricity they generate as long as their emissions are below a threshold per unit of electricity (emissions intensity). Depending on the emissions intensity of their generation, they are awarded more or less of these certificates. The emissions intensity threshold mooted in the Finkel Review was 0.6 tonnes of carbon dioxide equivalent ($CO_2$-e) per MWh, meaning a generator with an emissions intensity of 0 $tCO_2$-e/MWh would receive 1 certificate per MWh, a generator with an emissions intensity of 0.3 $tCO_2$-e/MWh would receive 0.5 of a certificate per MWh, and a generator with an emissions intensity of ≥0.6 $tCO_2$-e/MWh would receive no certificates. Generators who receive CET certificates would sell them to electricity retailers, who would be required by law to purchase a prescribed number each year. The cost of purchasing these certificates would be passed onto electricity consumers through their electricity bills.

This process is similar to the LRET, under which eligible generators are awarded one 'large-scale generation certificate' (LGC) for each MWh of generation. Retailers are required to buy a set number of LGCs each year from eligible generators. The two main differences between the LRET and a CET are:

- a CET awards certificates in proportion to the extent to which their emissions intensity is below the prescribed threshold (under the LRET, eligible generators receive 1 LGC for each MWh of generation); and
- under a CET, the generation target, which determines the number of certificates retailers are required to purchase, is calibrated to achieve an emissions target for the electricity sector (under the LRET, the target is set to achieve a prescribed amount of eligible generation).

To give effect to the Finkel Review's recommendations and implement the CET, the Australian Government must set an emissions reduction trajectory for the electricity sector. The Review only considered the trajectory briefly, commenting:

> At a minimum, the electricity sector should have a trajectory consistent with a direct application of the national target of 26 to 28 per cent reduction on 2005

[6] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 21 onwards

levels by 2030, as per Australia's international obligations under the Paris Agreement.[7]

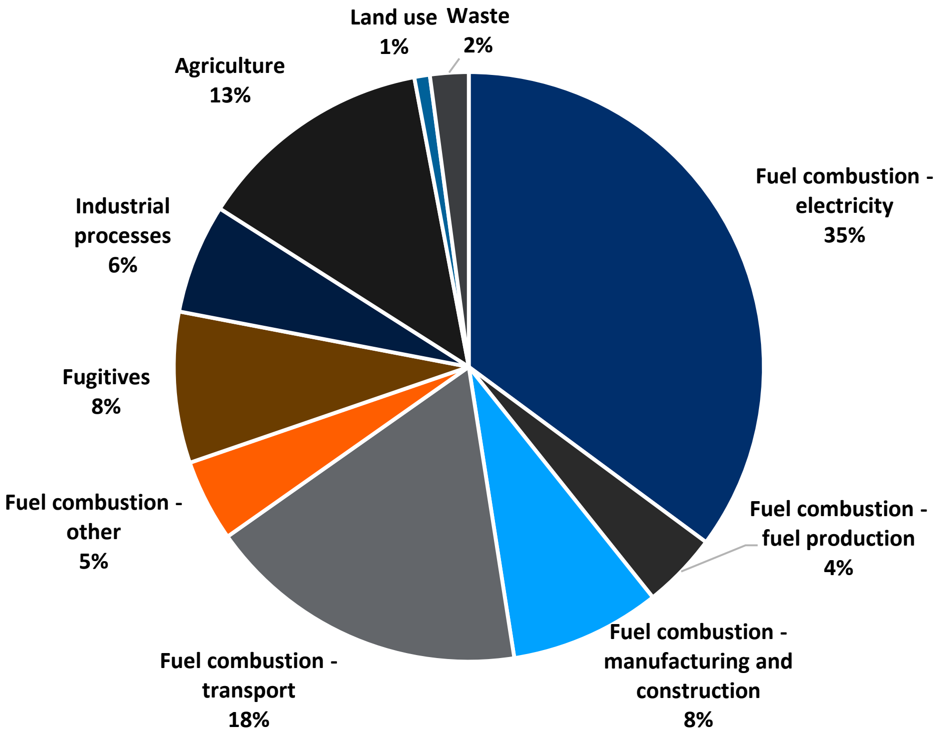
This report considers what emission reduction targets should be adopted for the electricity sector and what amount of renewable energy generation is likely to be required to meet them. Both issues are of high current policy interest. The Australian Government is currently considering whether to implement the proposed CET and what targets it might set for the electricity sector as part of its 2017 Climate Policy Review. The Opposition has signalled 'in principle' support for a CET and has committed to a 50% renewable energy target by 2030, which has been ridiculed by the Government and conservative commenters. The remainder of the report is set out as follows. Section 2 provides background information on Australia's greenhouse gas emissions and the current generation mix in Australia's electricity sector. Section 3 analyses what emission reduction targets should be adopted for the electricity sector. The analysis draws on the major climate change modelling exercises undertaken by and for the Australian Government and Australian Government agencies over the past decade, and recent modelling by RepuTex. Section 4 looks at the required level of renewable energy penetration under a CET to achieve alternative electricity sector targets and section 5 concludes.

[7] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 86

# 2. Australia's emissions and electricity generation

Approximately 70% of Australia's emissions come from the combustion of fuels for energy, with the remainder coming from a combination of agriculture (mainly methane from animals' digestion and methane and nitrous oxide emissions associated with manure and soils), fugitive emissions from mining and oil and gas production, industrial processes like metal, cement and chemical production, waste and the net emissions from land use (e.g. net carbon dioxide emissions and sequestration associated with deforestation and native forest harvesting, and agricultural soils) (Fig. 1). Fuel combustion associated with electricity generation is the largest single source of emissions. In 2015, it constituted 35% of Australia's emissions, or 189 $MtCO_2$-e.

**Figure 1. Australia's emissions, by sector, 2015 (total 538 $MtCO_2$-e)**



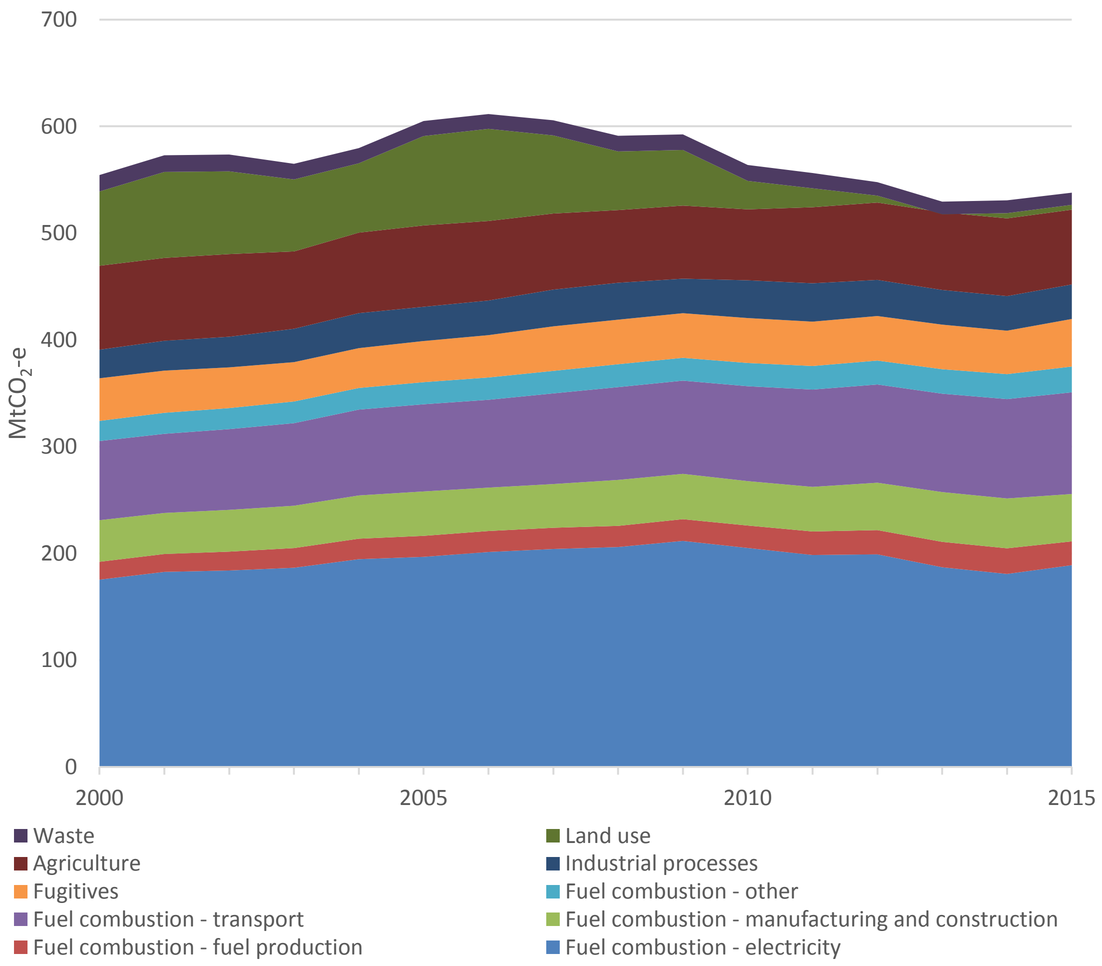

Source: Department of the Environment and Energy (2017)[8]

As Figure 2 shows, over the period 2000-2009, there was steady growth in emissions across the energy sector, including from electricity generation. After 2009, the rate of

[8] Department of Environment and Energy (2017) *Australian Greenhouse Emissions Information System* (AGEIS). http://ageis.climatechange.gov.au/.

growth in these sectors slowed and, in the case of the electricity sector, they declined, falling from 211 $MtCO_2$-e to a low of 181 $MtCO_2$-e in 2014. After the repeal of the carbon pricing mechanism in 2014, electricity sector emissions increased in 2015, mainly as a consequence of a decline in hydroelectric generation. Since then, electricity sector emissions have remained relatively stable.

**Figure 2. Australia's emissions, by sector, 2000-2015, $MtCO_2$-e**



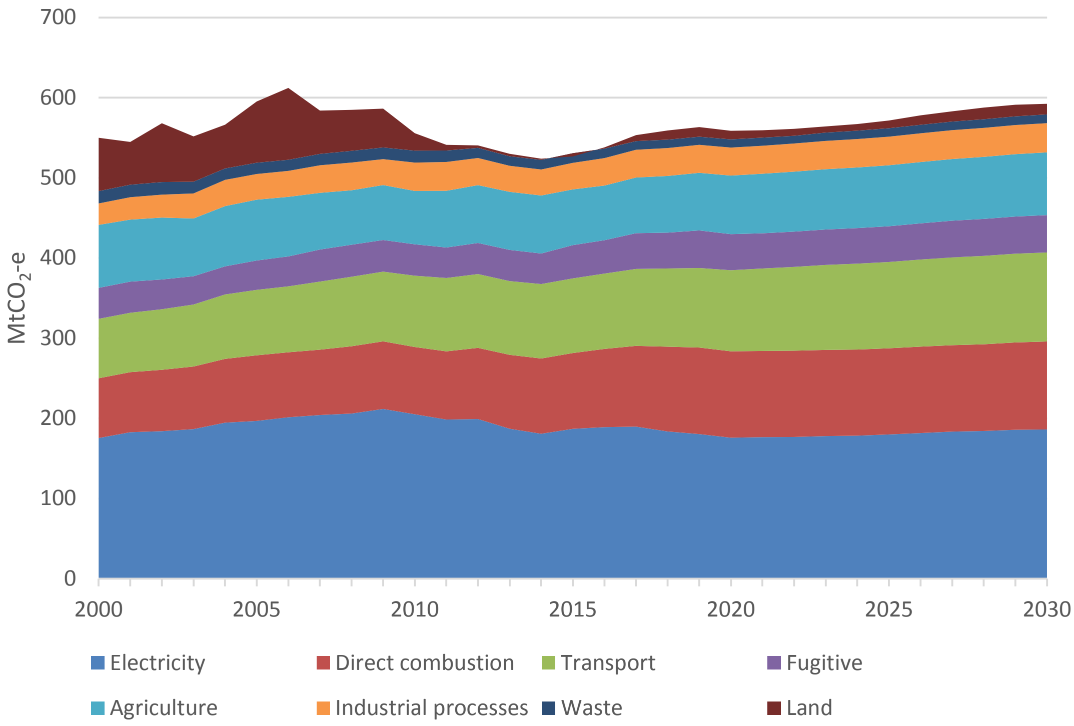

Source: Department of the Environment and Energy (2017)[9]

Going forward, the Department of the Environment and Energy projects that, in the absence of new policies, electricity sector emissions will fall in the near-term, dropping to 176 $MtCO_2$-e in 2020, before gradually climbing back to 186 $MtCO_2$-e in 2030 (Fig. 3). Outside of the electricity sector, emissions are expected to increase by 20% over the period 2015-2030, driven mainly by increasing emissions from gas production, coal mining, transport and the beef industry. As noted above, continued growth in

[9] Department of Environment and Energy (2017) *Australian Greenhouse Emissions Information System* (AGEIS). http://ageis.climatechange.gov.au/.

emissions to 2030 is expected to leave an abatement task of between 842-1202 $MtCO_2$-e to meet the 26-28% 2030 targets. This will require a suite of new policies, potentially covering all relevant sectors of the economy.

**Figure 3. Australia's emissions, actuals 2000-2015, projections 2016-2030, $MtCO_2$-e**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) Australia's emissions projections 2016.

# 3. Electricity sector and emission targets

In the absence of an economy-wide carbon price, there is a need for a sector-based approach, where the national abatement task is divided between the sectors and policy instruments are tailored to the characteristics of each sector. The division of the national abatement task between the sectors involves setting sector-specific emission reduction targets, as is proposed for the electricity sector under the CET.

There are three main competing approaches to setting sectoral emission reduction targets:

- equal proportional reduction approach, where the economy-wide emission reduction target is applied equally to all sectors;
- abatement cost approach, where sectoral targets are calibrated on the basis of the economy-wide target and the relative costs of reducing emissions in each sector;
- long-term investment signal approach, where targets for capital-intensive sectors, like the electricity sector, are calibrated to a long-term decarbonisation goal.

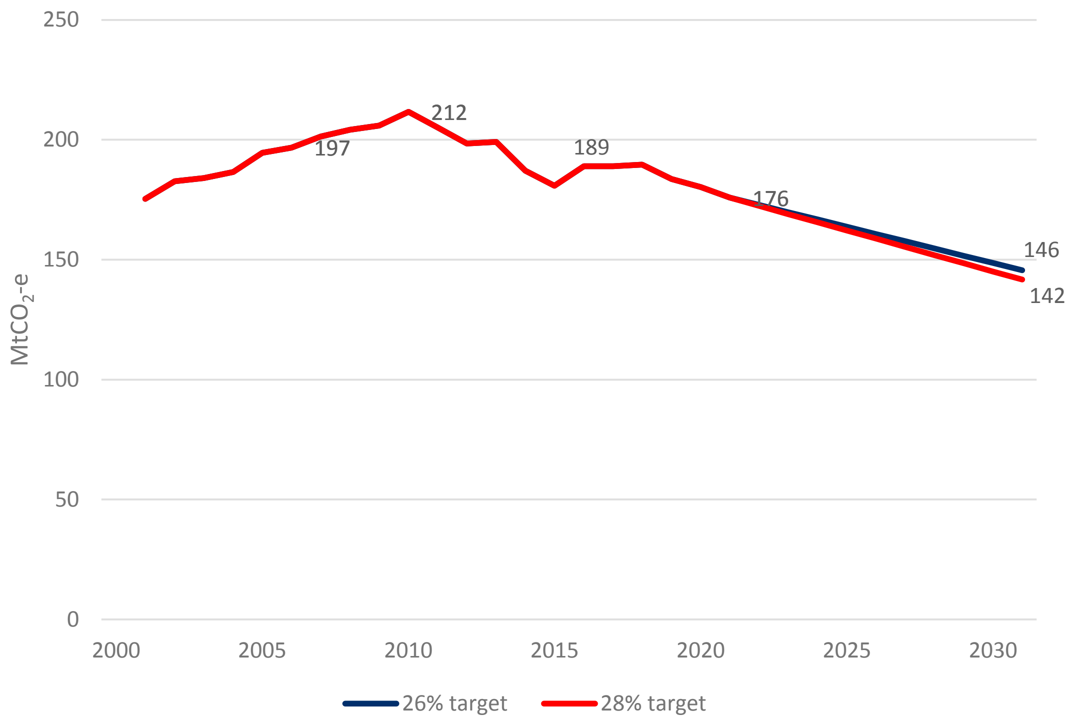
In the following sections, we consider how these approaches would apply to the determination of electricity sector targets for the proposed CET.

## EQUAL PROPORTIONAL REDUCTION APPROACH

The equal proportional reduction approach involves the application of the economy-wide emission reduction target to each sector on an equal basis, regardless of the relative abatement costs in each sector. Hence, if Australia pursues a 28% economy-wide reduction in emissions below 2005 levels, the electricity sector will be required to reduce its emissions by 28% relative to 2005 levels by 2030.

On the basis of the most recent emissions estimates, the application of a simple equal proportional reduction approach would result in an electricity sector target under the CET of between 142-146 $MtCO_2$-e for 2030, corresponding to the 26-28% below 2005 range (Fig. 4).

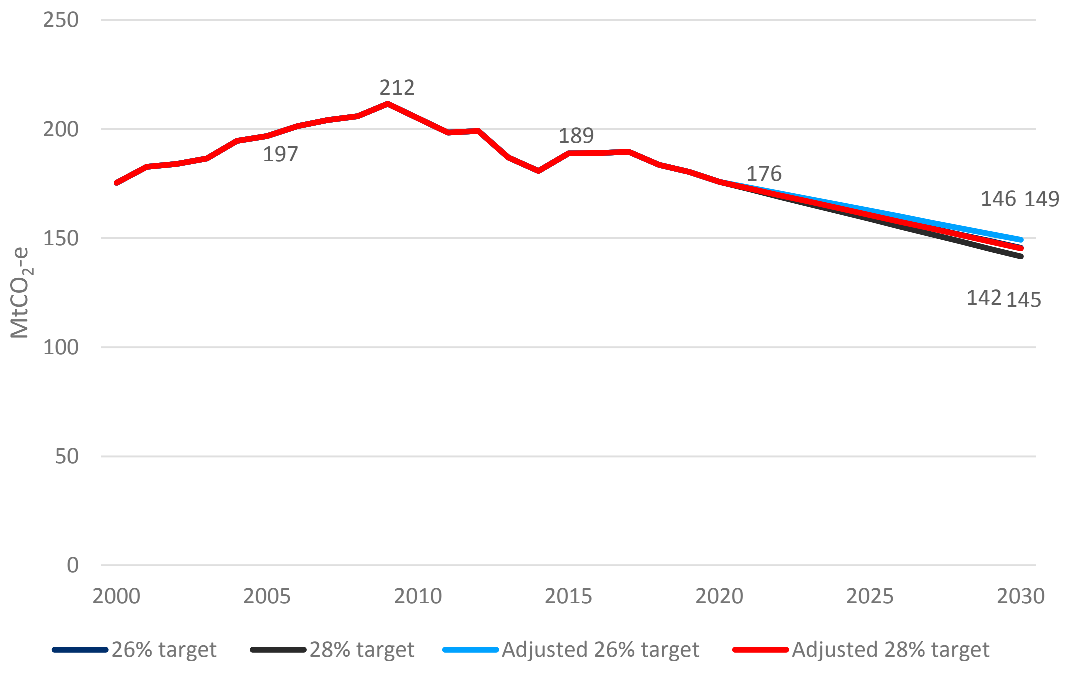
**Figure 4. Simple equal proportional reduction approach**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) *Australia's emissions projections 2016*; and author calculations.

One complication associated with the application of the equal proportional reduction approach is the treatment of 'carryover' amounts from Kyoto Protocol. Australia's cumulative emissions over the first commitment period of the Kyoto Protocol, 2008 to 2012, were 128 $MtCO_2$-e below its assigned amount. Under the Protocol's rules, Australia was entitled to carry the 128 $MtCO_2$-e forward and use it to meet its targets in the second commitment period, 2013-2020. The Australian Government is currently projecting it will meet its second commitment period target, after accounting for the carryover and other adjustments, by 207 $MtCO_2$-e. It is currently unclear whether Australia intends to carry this amount forward into the 2020-2030 period. The inclusion of the carryovers converts the 26% and 28% 2030 targets to 24% and 26% respectively, all below 2005. For the electricity sector, this results in 2030 targets of between 146-149 $MtCO_2$-e (Fig. 5).

**Figure 5. Equal proportional reduction approach with carryovers**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) *Australia's emissions projections 2016*; and author calculations.

## ABATEMENT COST APPROACH

The main attraction of the equal proportional reduction approach is its simplicity. Its primary disadvantage is it is likely to be inefficient as it does not account for the costs of abating emissions in each sector or the viability of designing policies that effectively capture these opportunities. The supply-side of the electricity sector is known to have some of the cheapest and most accessible abatement in the economy. This is because of the availability of mature low-emissions generation technologies and the concentrated nature of the sector, which lowers the degree of difficulty in designing effective policies to motivate their uptake. A further benefit associated with supply-side electricity sector abatement is it can catalyse emissions reductions in other sectors. In particular, decarbonisation of the electricity sector can drive emissions reductions through fuel switching in the transport and manufacturing sectors.

Due to this, there is a risk that, if the equal proportional reduction approach is adopted, it will shift a disproportionate amount of the abatement task onto other sectors like manufacturing, agriculture and the land sector where there are fewer low-cost and scaleable ways of reducing emissions, other than by cutting production. This would increase the economy-wide costs of meeting Australia's mitigation commitments. The Finkel Review explicitly acknowledged this, stating:

> It may be appropriate for governments to ask the electricity sector to do more than a direct application of the national target. The electricity sector may have more economically viable opportunities to reduce emissions than other sectors. Moreover, emissions reduction efforts through electrification in transportation and industrial processes will be enhanced by lowering the emissions intensity of the electricity sector.[10]

To test this, we compared the comparative levels of national and electricity sector abatement from three climate change policy modelling exercises conducted over the period 2008 to 2016:

- the Commonwealth Treasury and Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education modelling undertaken as part of the Climate Change Authority's 2014 Targets and Progress Review (CCA 2014);[11]
- the Commonwealth Treasury modelling undertaken to inform the *Clean Energy Future* package, which appeared in the Strong Growth, Low Pollution report of 2011 (SGLP 2011);[12] and
- the Commonwealth Treasury modelling undertaken for the purposes of the Australia's Low Pollution Future report in 2008 (ALPF 2008).[13]

From the three modelling exercises, five relevant scenarios were identified: two that were classified as ambitious (i.e. consistent with keeping the increase in the global average surface temperature to 2°C) [14] and three that were classified as unambitious (i.e. not consistent with keeping the increase in the global average surface temperature to 2°C). [15] We then compared the level of national and electricity sector abatement (reference level emissions minus mitigation scenario emissions) in each

[10] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 86

[11] In Climate Change Authority (2014) *Reducing Australia's greenhouse gas emissions – Targets and progress review: Final report*, http://climatechangeauthority.gov.au/reviews/targets-and-progress-review-3

[12] In Commonwealth of Australia (2011) *Strong growth, low pollution: Modelling a carbon price, http://carbonpricemodelling.treasury.gov.au/content/report.asp*

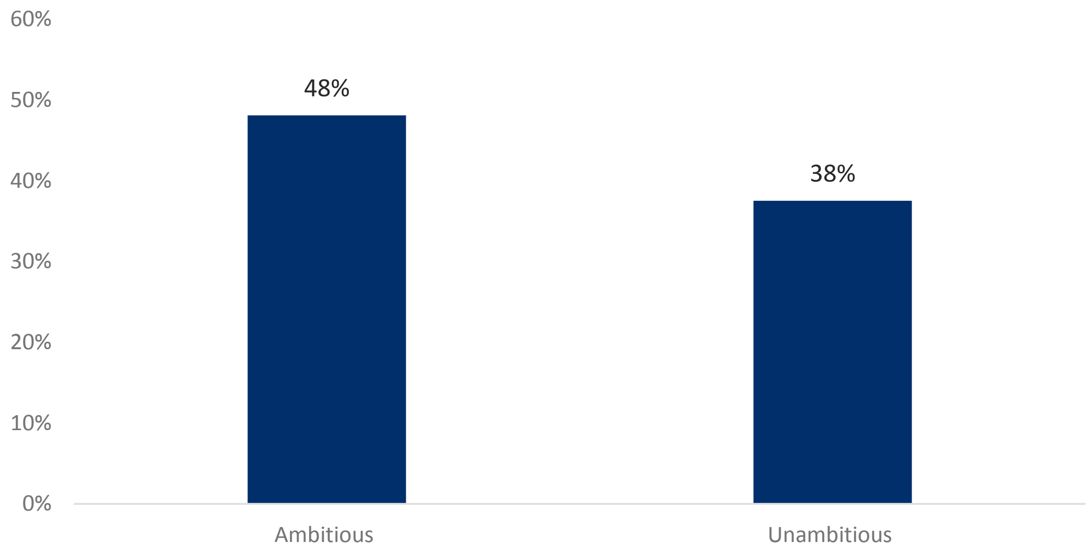
[13] Australian Treasury (2008) *Australia's low pollution future: The economics of climate change mitigation,* http://lowpollutionfuture.treasury.gov.au/

[14] The SGLP (2011) and CCA (2014) High Price scenarios.

[15] The CPRS-5 (ALPF 2008), Clean Energy Future (CEF) (SGLP 2011) and Central Policy (CCA 2014) scenarios.

scenario. The average proportion of national abatement provided by the electricity sector to 2030 in the ambitious and unambitious scenarios is shown in Figure 6.

**Figure 6. Electricity sector share of abatement task, average of scenarios**



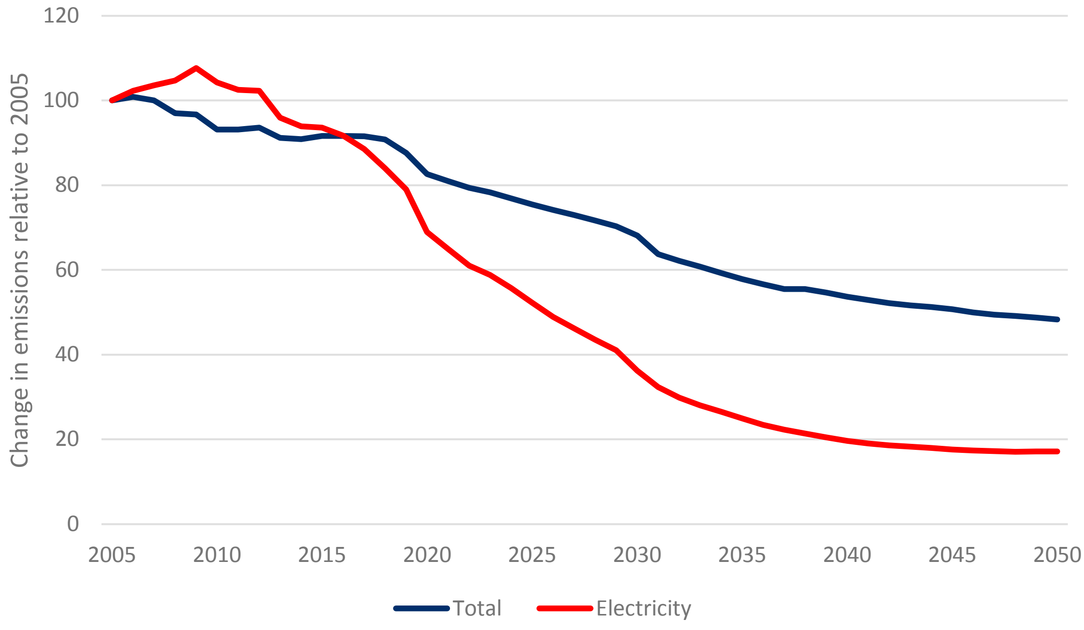

Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008

Figure 6 suggests a least-cost path to achieving national mitigation commitments is likely to involve the electricity sector making a disproportionate contribution to the abatement task. Despite the electricity sector comprising 33% of national emissions in the base years of the modelling, its average contribution to the abatement effort to 2030 under the ambitious scenarios was 48% and 38% under the unambitious scenarios.

The abatement cost approach is built on premise that it is in the best interests of society to minimise the economy-wide costs of achieving mitigation commitments. To achieve this, it calibrates sectoral targets on the basis of the relative costs of reducing emissions in each sector. The aim is to ensure total net emissions add up to the economy-wide target but sectors with relatively low abatement costs would be required to achieve higher proportional emission reductions than sectors with relatively high abatement costs. By setting sectoral targets on the basis of abatement costs, this approach ensures the mitigation commitments are achieved at or near least cost.

To provide insights on what the electricity sector target for the CET should be relative to 2005 emissions under the abatement cost approach, we analysed the change in total national emissions and electricity sector emissions relative to 2005 from each of the five scenarios identified above, as well as an additional 'ambitious' scenario from the Victoria University computable general equilibrium (CGE) modelling undertaken as part of the Climate Change Authority's 2016 Special Review into Australia's emissions reduction policies (CCA 2016).[16] The mean results from the six scenarios are presented in Figures 6 and 7, and tables 1 and 2. The results confirm that the adoption of an abatement cost approach to setting targets for the purposes of the CET is likely to result in the electricity sector having to make disproportionate reductions in emissions. Across all six scenarios, the reductions in electricity sector emissions relative to 2005 levels were greater than the reductions in total national emissions.

**Figure 6. Ambitious scenarios, reductions in total national and electricity sector emissions relative to 2005**




Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008 and CCA 2016

Figure 6 shows that under an abatement cost approach where Australia meets its emissions reduction targets, electricity sector emissions decline by a far greater proportion than overall emissions. The difference between percentage reduction in total abatement and electricity sector abatement for selected years is presented in Table 1 below:

[16] Victoria University (2016) *Simulation of the effects of greenhouse gas mitigation policies for the Australian electricity sector,* http://climatechangeauthority.gov.au/reviews/special-review/modelling-illustrative-electricity-sector-policies The scenario included was the Victoria University (2016) Reference Case, involving the application of an economy-wide carbon price consistent with achieving a 2°C outcome.

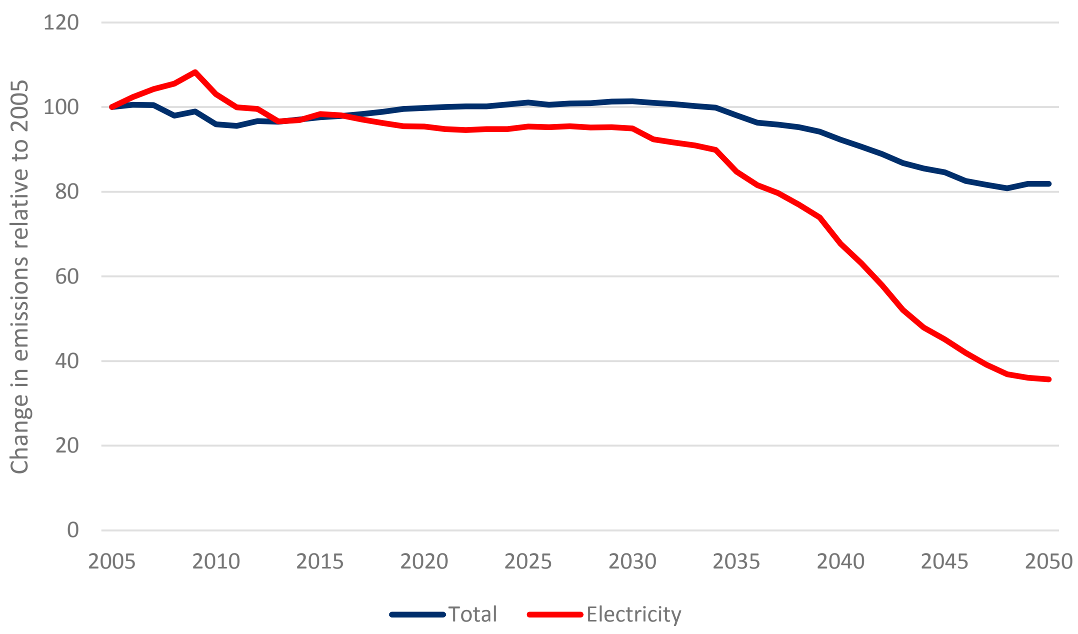
**Table 1. Ambitious scenarios, percentage point difference between reductions in total national and electricity sector emissions relative to base year**

| | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Mean** | 14 | 32 | 34 | 31 |

Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008 and CCA 2016

Figure 7 and Table 2 present the same calculations for the unambitious scenarios modelled in CCA 2014, SGLP 2011 and ALPF 2008

**Figure 7. Unambitious scenarios, reductions in total national and electricity sector emissions relative to 2005**




Source: Author's calculations

**Table 2. Unambitious scenarios, percentage point difference between reductions in total national and electricity sector emissions relative to base year**

| | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Mean** | 4 | 6 | 25 | 46 |

Source: Author's calculations

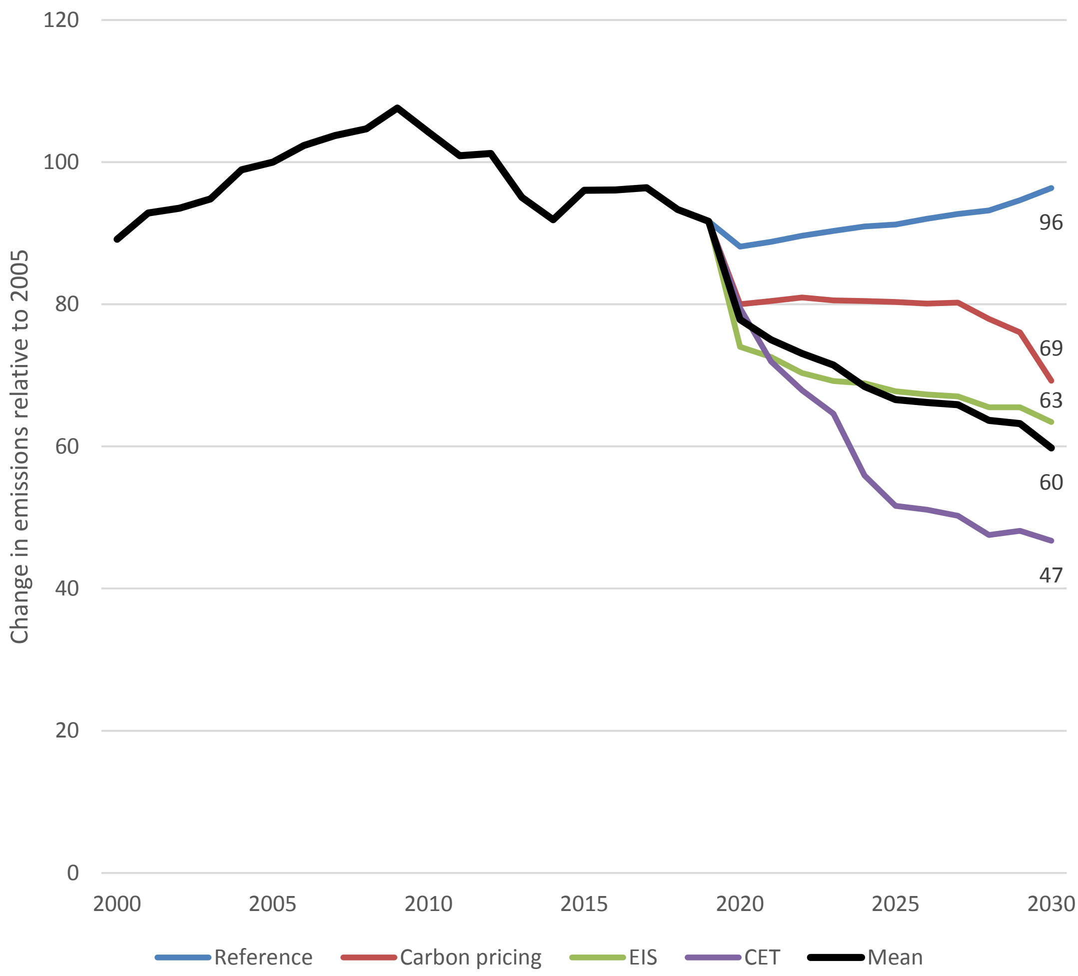
If Australia remains committed to its current 2030 (26%-28%) targets, an electricity sector target consistent with the abatement cost approach could be estimated using the percentage point difference from the unambitious scenarios identified in Table 2. For example, the average difference from the three scenarios at 2030, 6%, could be added to the 28% target, providing an electricity sector target of 34%.

Although this approach has the benefit of simplicity, it has a number of weaknesses that stem from the nature of the scenarios on which it is based, particularly the fact the scenarios all assume the relatively early deployment of an economy-wide carbon price. The early commencement of the carbon price allows for lower levels of abatement in the earlier decades. The delay in the deployment of a comprehensive policy to reduce emissions after the repeal of the carbon price in 2014 has necessitated more ambitious mitigation over the coming years. The dated nature of the modelling (2008, 2011 and 2014) also reduces its reliability; for example, more recent analysis captures the significant changes in the cost and viability of alternative technologies, and the changes in sectoral emissions over the past decade.

As part of the Climate Change Authority's 2016 Special Review, the Jacobs Group modelled scenarios consistent with achieving a 3°C global temperature outcome.[17] The results from this modelling provide a better approximation of the magnitude of the emissions reductions required in the electricity sector to meet the current 26-28% 2030 targets using an abatement cost approach. The modelling was conducted using a single carbon price path to devise an emissions budget for the electricity sector of approximately 2,800 Mt$CO_2$-e to 2050. The performance of different policy instruments in meeting the budget was then compared. The instruments compared included a carbon price, emissions intensity scheme (EIS), and a CET (only it was called a Low Emissions Target (LET)). The change in electricity sector emissions relative to 2005 under the 3°C reference, carbon price, EIS and CET scenarios are shown in Figure 8, along with the mean from the three mitigation scenarios.

[17] Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report,* http://climatechangeauthority.gov.au/reviews/special-review/modelling-illustrative-electricity-sector-policies

**Figure 8. Change in electricity sector emissions under the Jacobs 3°C reference, carbon price, EIS and CET scenarios, relative to 2005**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

Figure 8 shows the mean reduction in emissions in 2030 on 2005 levels across the three scenarios to 60% of 2005 levels. However, under the CET, the required reduction in electricity sector emissions was 53%. Based on these data, an abatement cost derived 2030 electricity sector target for the purposes of the CET is likely to have to be a minimum of 40% below 2005 levels, and possibly around 50%, just to meet the unambitious 26-28% Paris commitments.

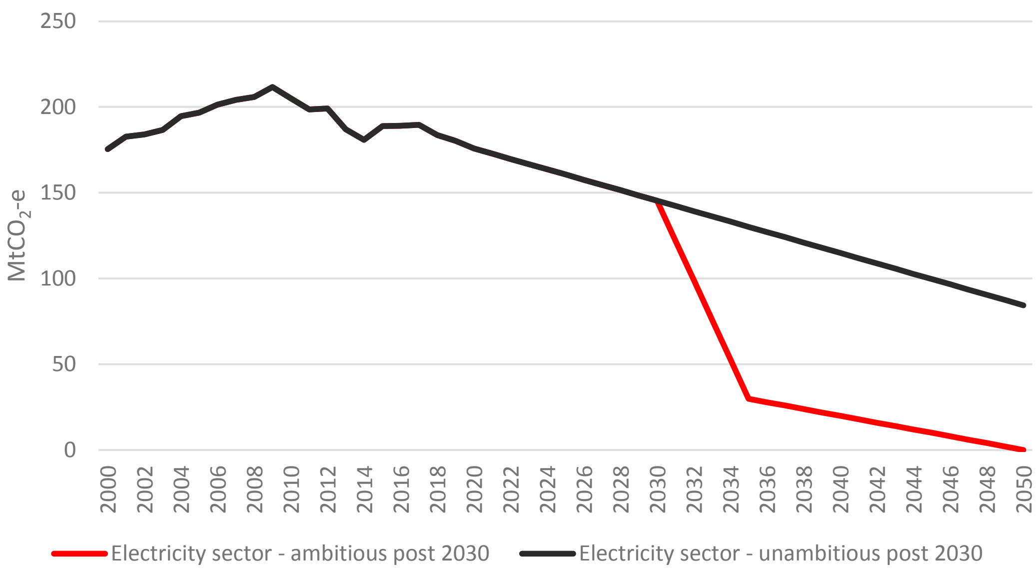
# LONG-TERM INVESTMENT SIGNAL APPROACH

An inherent weakness of both the equal proportional reduction and abatement cost approaches is they could create investment uncertainty in capital-intensive sectors like the electricity sector because of inconsistencies between short-term policy settings and long-term policy expectations.

Under the equal proportional reduction and abatement cost approaches, the electricity sector emission targets are likely to be calibrated to meet the 2030 economy-wide target. However, due to the unambitious nature of Australia's 2030 mitigation targets, it is likely there will have to be a rapid escalation of the abatement effort after 2030 in order for Australia's contribution to be consistent with the Paris Agreement's objectives. This creates uncertainty for investors in the electricity sector, as they are unable to gauge whether the long-term policy settings will be consistent with the Paris Agreement.

Electricity generation assets have long economic lives. This means investors need to consider both existing and future carbon-energy policy settings. The apparent incongruity between Australia's 2030 mitigation targets and the long-term commitments embodied in the Paris Agreement create uncertainty. Investors do not know whether the unambitious approach embodied in the 2030 targets will persist, or whether policy settings will be modified to give effect to the Paris Agreement's commitments. As the hypothetical scenarios in Figure 9 illustrate, the post-2030 policy settings could remain unambitious, which might translate into a gradual decline in electricity sector emissions under the CET through to 2050 and beyond. Alternatively, there may be a rapid increase in the level of ambition, requiring a sharp drop in electricity sector emissions in the 2030s and zero emissions by 2050. The uncertainty about post-2030 policy settings could deter investment and increase the cost of capital, with flow on effects for the price of electricity in the market.

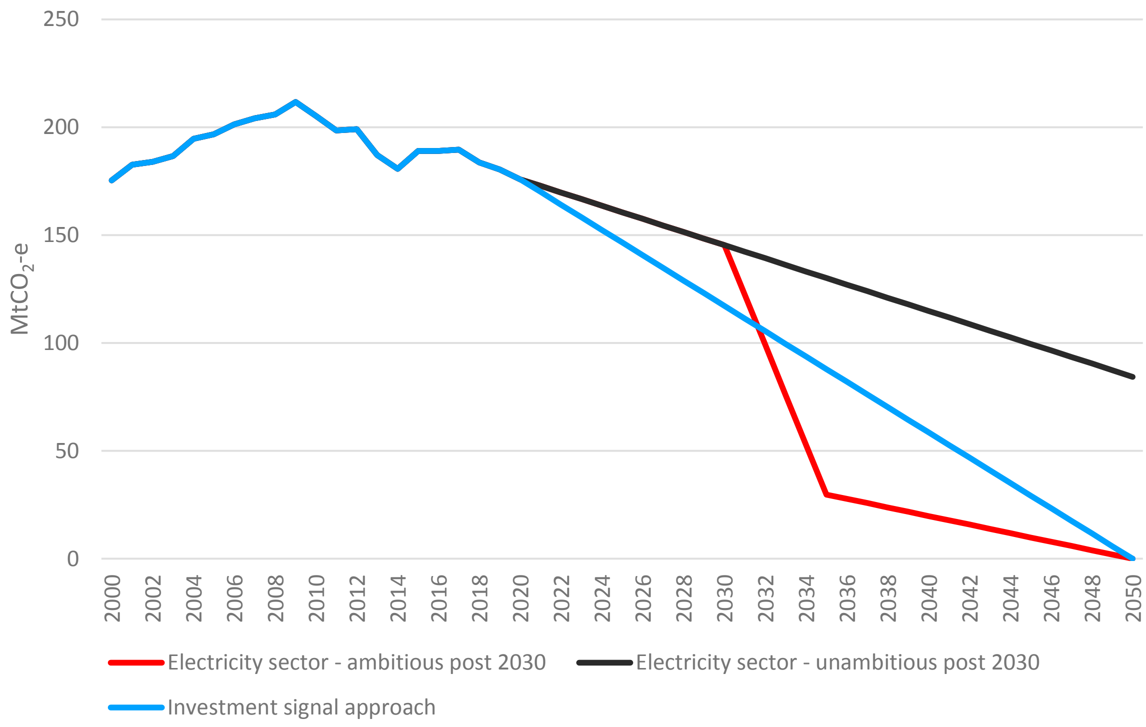
**Figure 9. Electricity sector emissions under possible future policy settings**



Source: Author's calculations

The long-term investment signal approach is designed to avoid this uncertainty by setting the emission targets for the electricity sector in a manner consistent with the long-term objective of decarbonisation at or before 2050. Figure 10 illustrates the basic premise behind the approach. Rather than facing the prospect of abrupt future changes in emissions, investors face a long-term emission path that provides them with certainty about policy settings over coming decades.

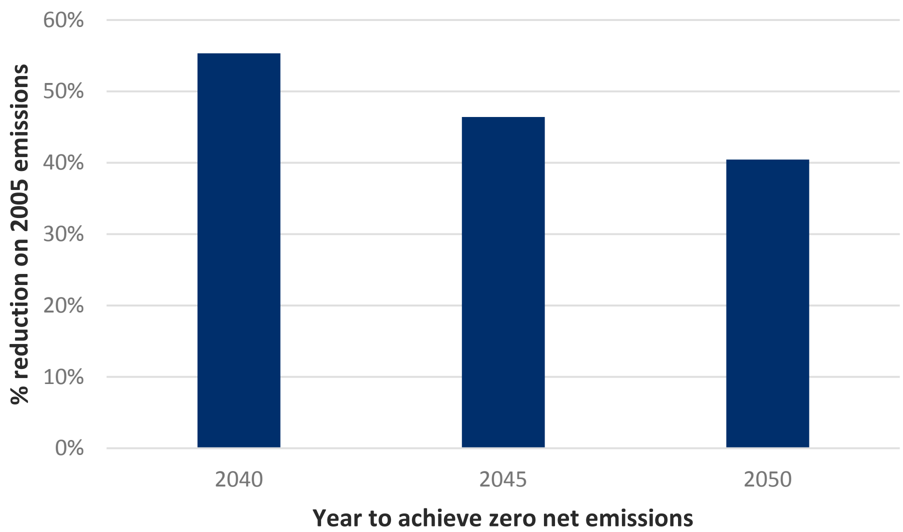
**Figure 10. Electricity sector emissions under possible future policy settings, including a long-term investment signal**




Source: Author's calculations

We estimated the 2030 electricity sector targets that would be consistent with a long-term investment signal approach by assuming a linear decline in electricity sector emissions from 2020 to net zero emissions in 2040, 2045 and 2050. The results are shown in Figure 11.

**Figure 11. 2030 CET target for the electricity sector under long-term investment signal approach**




Source: Author's calculations

Figure 11 shows that if net zero emissions are to be achieved between 2040 and 2050, the electricity sector will need to reduce its emissions by 40-55% by 2030 under a long-term investment approach. This is a far greater share of emissions than the current overall targets of 26-28% by 2030.

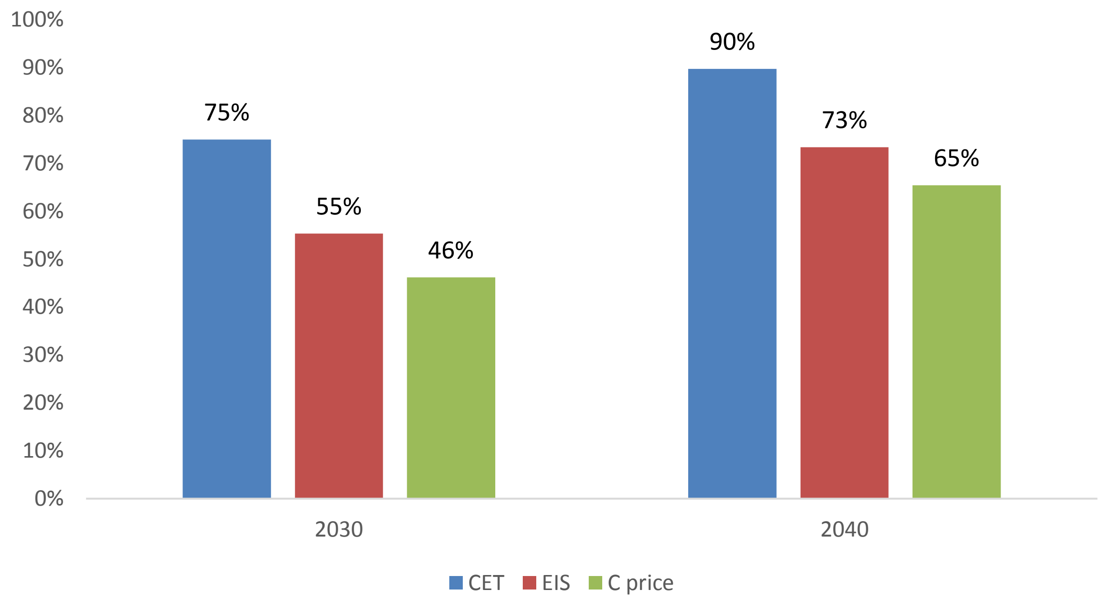
# 4. Renewable energy penetration

## INFLUENCE OF POLICY INSTRUMENT ON RENEWABLES PENETRATION

Meeting any reasonable 2030 electricity sector target is likely to require a significant increase in the proportion of electricity generation provided by renewable energy generators (renewable energy penetration). In addition to the magnitude of the electricity sector target, the other major determinant of the extent of renewable energy penetration is the nature of the policy instrument(s) used to achieve the target.

The different incentives provided by different policy instruments results in different patterns of abatement, and sources of electricity generation, through time. This issue was explored by the Climate Change Authority in its 2016 Special Review. As noted above, as part of the review, the Jacobs Group was commissioned to conduct modelling to compare the performance of different policy instruments in meeting specific emission constraints for the electricity sector. The instruments compared included a carbon price, EIS and a CET. Under Jacobs' 2°C scenarios, with a CET, the proportion of electricity generated by renewables was 75% in 2030, compared to 55% with an EIS and 46% with a CET (Figure 12). The pattern was the same in 2040: renewable energy penetration under the CET was 90%, 73% with an EIS and 65% with a carbon price. Similar results were observed in Jacobs' 3°C scenarios.

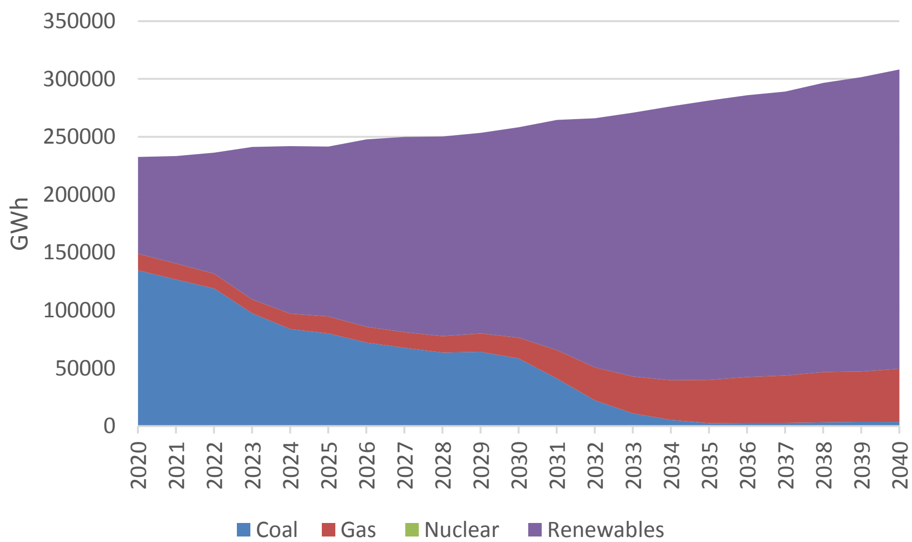
**Figure 12. Renewable generation share by policy instrument**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

The reason for the observed differences in renewable energy penetration relate to how the policy instruments affect the relative competitiveness of thermal and renewable generators in the electricity market. Of particular importance is the incentives provided for the deployment of new gas generation. As shown in Figures 13, 14 and 15, a CET provides less of an incentive for gas generation than an EIS or a carbon price.

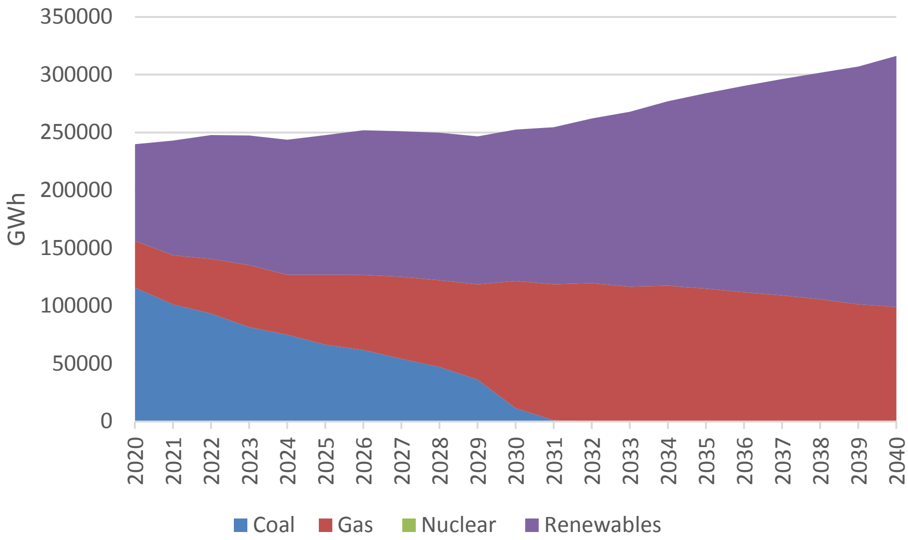
**Figure 13. Generation mix under CET, 2°C scenario**



Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

Figure 13 shows that under a CET the vast bulk of the generation mix is renewable from the mid-2020s. Only a small amount of gas generation is developed before coal-fired generation ends in the early 2030s. By contrast, Figure 14 shows that under an EIS, larger volumes of gas generation are developed earlier, forcing coal out of the mix in 2030 and maintaining a large share of generation out to 2040.

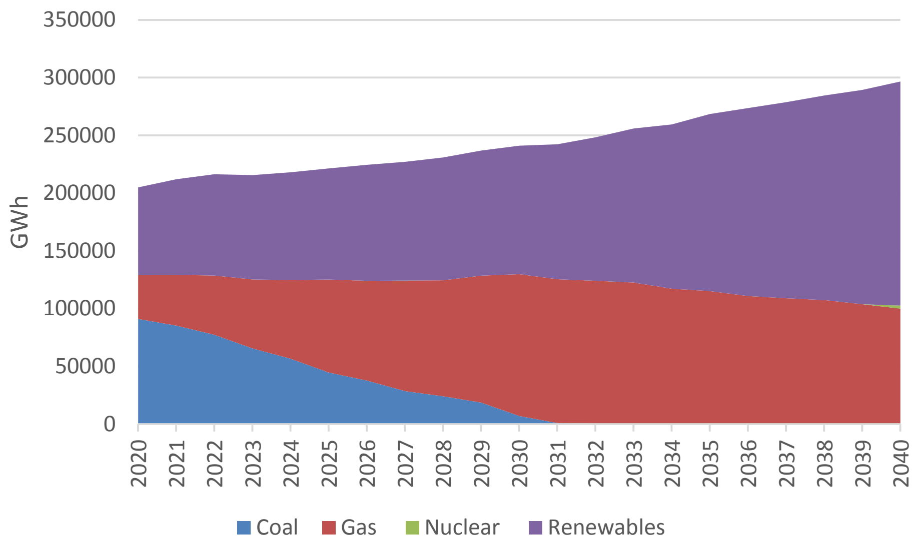
**Figure 14. Generation mix under EIS, 2°C scenario**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

As with the EIS modelled in Figure 14, Figure 15 below shows that under a carbon price, substantially more gas-fired generation is expected to be developed through the 2020s and persist into the 2030s:

**Figure 15. Generation mix under a carbon price, 2°C scenario**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

The overall message from the Jacobs modelling for the CCA is clear – a CET-like policy is likely to bring in the largest share of renewables. This would come particularly at the expense of gas, with coal-fired generation also lasting longest under a CET.

# RENEWABLES PENETRATION UNDER AN EQUAL PROPORTIONAL REDUCTION APPROACH

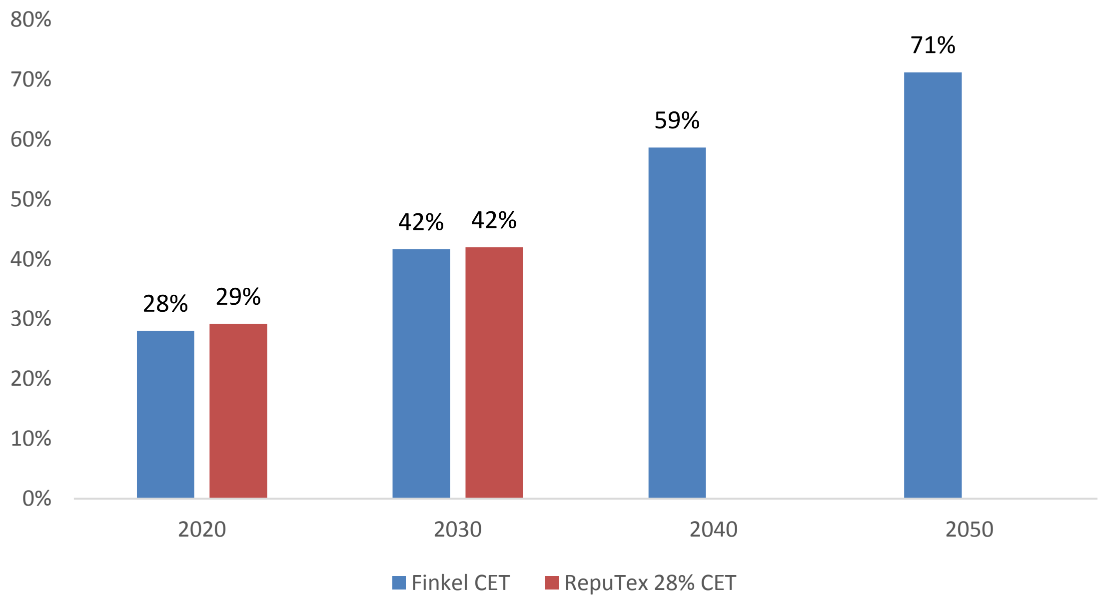
The generation mix under an equal proportional approach with a CET was modelled as part of the Finkel Review[18] and separately by consultancy, RepuTex.[19] Both found renewable energy would comprise approximately 42% of generation in 2030 (Fig. 16).[20] The Finkel Review's modelling also found that, in an unambitious scenario that saw electricity sector emissions decline linearly to near 60 $MtCO_2$-e in 2050, renewable generation would rise to over 70% by mid-century.

[18] Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply,* http://www.environment.gov.au/energy/publications/electricity-market-final-report

[19] Reputex modelled this with its National Electricity Market & Renewable Energy Simulator, with the results published in Reputex (2017) *It's the economics, stupid,* http://www.reputex.com/research-insights/update-its-the-economics-stupid-wholesale-price-scenarios-in-the-nem-to-2030/

[20] The modelling covered the National Electricity Market (NEM) only. The NEM accounts for approximately 80% of Australia's electricity consumption.

**Figure 16. Renewable generation under 28% CET**

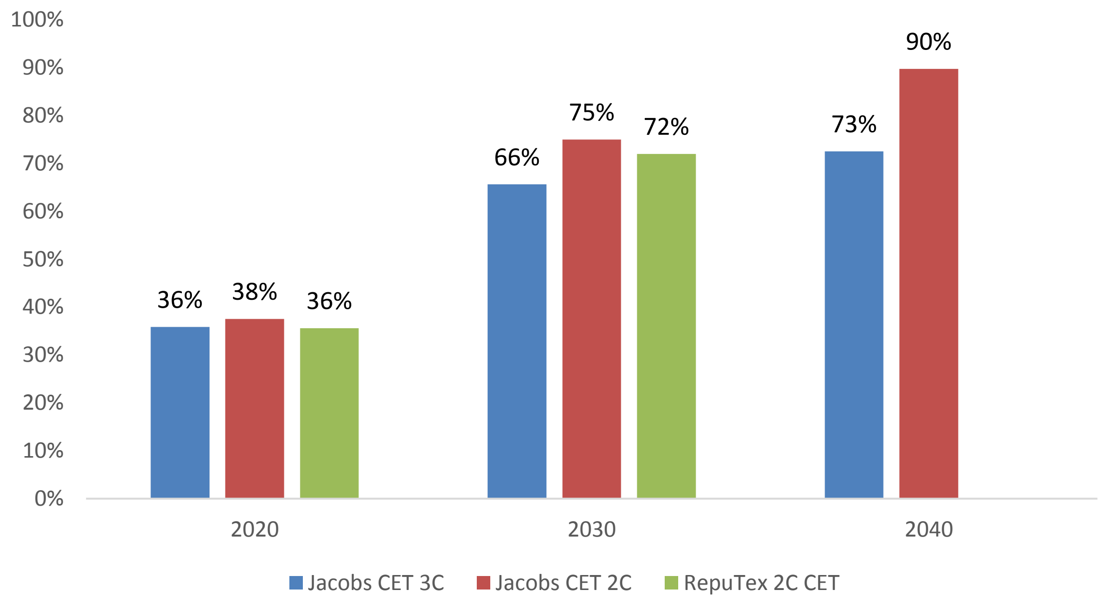



Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) It's *the economics, stupid*

## RENEWABLES PENETRATION UNDER AN ABATEMENT COST AND LONG-TERM INVESTMENT SIGNAL APPROACHES

Both the abatement cost and long-term investment signal approaches are likely to require 2030 emission reduction targets for the electricity sector of between 40%-55% below 2005 levels. The level of renewable energy penetration required to achieve emissions reductions of this magnitude under a CET-like policy have been modelled on several occasions in recent times, most notably by the Jacobs Group as part of the Climate Change Authority's 2016 Special Review into Australia's emissions reduction policies and RepuTex (2017). As shown in Figure 17, these two modelling exercises found renewable energy would comprise between 66% and 75% of generation in 2030.

**Figure 17. Renewable penetration, with 40%-55% CET**




Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) It's *the economics, stupid*

The implication from this is that, if an abatement cost approach is used to set the 2030 electricity sector target, and a CET-like policy is used to achieve it, renewable penetration is likely to be in the order of 66-75% by 2030. This is substantially higher than Federal Labor's current target of 50% renewable energy by 2030.

# 5. Conclusion

Australia's climate and energy debate continues to degenerate. As this conclusion is being written, Federal Parliament Question Time is being told that the Liddell power station should remain open to 2027, possibly at taxpayer expense, as renewable energy penetration has caused problems with energy security.

There are many problems with this view and they are being widely aired in the media and by non-government politicians. But it is ironic that government-commissioned modelling shows that the policies that would minimise renewable energy penetration such as carbon pricing and an EIS have already been rejected. All that remains is the CET that would bring in the largest share of renewable generation, or the prospect of failing to meet our Paris climate targets.

# Advance Australia's fair share

## Assessing the fairness of emissions targets

***The fairness of a country's emissions reduction targets can be assessed with regard to population, economic costs or a combination. Regardless of the approach, Australia's 26-28% Paris target is insufficient and will need to be ramped-up.***

**Richie Merzian**
**Rod Campbell**
**12 June 2018**

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# Summary

While Australia debates how to reach our Paris Agreement targets, wider issues such as whether these targets are appropriate and how they might need to be adjusted in the future are receiving scant attention.

Australia's current 2030 emissions reduction target is for a 26-28 percent reduction on 2005 levels. The Australian Labor Party has said that it would adopt a 2030 target of 45 percent below 2005 levels. In the context of the global carbon budget, neither policy would see Australia doing a 'fair share'.

The UN's Intergovernmental Panel on Climate Change (IPCC) estimates the world has a remaining emissions budget this century of 1,040 $GtCO_2$-e to have mid-probability of meeting the Paris goals. Different approaches are taken on the question of how to divide these remaining emissions and related abatement tasks between countries. Key approaches include:

- population-based approaches, which divide up the emissions budget between countries based on their current and projected populations;
- cost sharing approaches, which consider and try to equalise economic impacts;
- historic responsibility approaches, which consider countries' past emissions and responsibility for climate change; and
- hybrid approaches that combine population, cost and other measures of welfare.

If the remaining IPCC emissions budget was shared via a pure population approach, Australia would receive a share of 3,392 million tonnes. In 2015 Australia emitted 526 million tonnes, meaning at this rate our 'fair share' would be expended and Australia would need to have achieved net zero emissions in just over six years.

Using a modified population-based approach, which considers levels of development, the Climate Change Authority calculated Australia's emissions budget as 10,100 million tonnes $CO_2$-e for 2013-2050. Australia's current target of 26 percent reduction by 2030 would then require complete decarbonisation just five years later in 2035. Labor's 45 percent target requires complete decarbonisation by 2040.

Under a cost sharing approach, the IPCC estimates that achieving the Paris targets would see global consumption 1.7 percent lower in 2030 compared to a no-action scenario. Modelling for the Australian government estimates that a 26 percent target would see Australian consumption just 0.6 percent lower, while a 45 percent target would see consumption 0.9 percent lower in 2030. Both policies would see Australia's consumption grow, but experience reductions in growth of around half what is expected internationally.

Given Australia's high historic emissions, high per capita emissions and high income, other approaches to assessing nations' contributions to climate action all show that Australia's climate targets are not doing a 'fair share'. Any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge. All countries will need to ramp-up mitigation efforts. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.

# Introduction

Under international climate change processes, countries have periodically been asked to put forward targets to reduce greenhouse gas emissions by or over a specified period. The first of these was under the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Pressured by developing countries to show leadership in taking action to mitigate emissions, developed countries, including Australia, committed to 'individually or jointly' return their net emissions to 1990 levels by the turn of the century.[1] Soon after the UNFCCC came into force in 1994, negotiations commenced on the Kyoto Protocol, under which developed countries were ultimately required to adopt legally binding cumulative emission targets for the period 2008-2012, and later, for 2013-2020.[2]

The Kyoto Protocol's top-down, legally binding 'targets and timelines' structure was abandoned in the Paris Agreement in 2015.[3] In its place, the Paris Agreement adopted a bottom-up, soft law-based approach in which all parties, developed and developing alike, are required to submit non-binding pledges (known as 'Nationally Determined Contributions' (NDCs)) to take mitigation actions.[4] There is an expectation that developed country NDCs will take the form of 'economy-wide absolute emission reduction targets'.[5] Other countries have the flexibility to submit alternative types of NDCs—e.g. emission or energy intensity targets, sectoral targets or commitments to introduce particular policies—but are encouraged to 'move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances'.[6]

The NDCs of all parties are required to be periodically reviewed and updated with the aim of progressively increasing ambition to achieve the Paris Agreement's objective of keeping the increase in the global average surface temperature 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels' (Art. 2(1)).[7] Consistent with this, Article 4(3) of the Agreement requires each successive NDC of the parties to 'represent a progression' beyond the relevant country's existing NDC. Through 2018, a facilitative dialogue is being undertaken (known as the 'Talanoa Dialogue') to take stock of the efforts made to date under the Paris Agreement and inform the preparation of NDCs. The first formal review of the NDCs will take place in 2023 and every five years thereafter.[8]

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[1] UNFCCC, Art. 4(2)(b).

[2] Kyoto Protocol to the UNFCCC 1997, Art. 3 and UNFCCC Secretariat, *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its seventh session, held in Durban from 28 November to 11 December 2011* (UNFCCC, 2011), Decision 1/CMP.7.

[3] Paris Agreement to the UNFCCC 2015.

[4] Paris Agreement to the UNFCCC 2015, Arts. 3 and 4(2).

[5] Paris Agreement to the UNFCCC 2015, Art. 4(4).

[6] Ibid.

[7] Paris Agreement to the UNFCCC 2015, Arts. 2(1), 4(3), 4(13), 13 and 14.

Against this backdrop, there is debate about the adequacy of Australia's current 2030 emission reduction target of a 26-28 percent reduction on 2005 levels. This pledge was first made in 2015 as an indicative NDC in the lead up to the Paris Convention.[9] In accordance with the Paris Agreement processes, in November 2016, it became Australia's first NDC. The target has been subject to criticism from a number of quarters on the basis it is inconsistent with the Paris Agreement's 2°C objective.[10] The Australian Labor Party has said that, in government, it will adopt a 2030 target of 45 percent below 2005 levels.[11] While significantly more ambitious than the current Government's target, some have still argued that it does not represent a fair contribution to the global effort to keep warming to 2°C.[12]

This paper provides an overview of the approaches that can be used to determine mitigation targets and judge their adequacy in the context of the Paris Agreement's 2°C target. The adequacy of the targets put forward by the Australian Government and Opposition are evaluated using these approaches. In section 2, we outline the four main theoretical approaches to devising national emission targets. Section 3 uses two of these, population-based and cost sharing approaches, to provide an indication of the perceived fairness of the Australian Government's 26-28 percent 2030 target and the Opposition's 45 percent target. Section 4 provides a conclusion.

[8] Paris Agreement to the UNFCCC 2015, Art. 14(2).

[9] Australian Government, *Australia's Intended Nationally Determined Contribution to a new Climate Change Agreement* (Australian Government, 2015).

[10] Ecofys, Climate Analytics and New Climate Institute, *Climate Action Tracker: Australia* (Climate Action Tracker Partners, 2017); 'Australia's post-2020 climate target not enough to stop 2C warming: experts', *The Conversation*, 11 August 2015; Fraser, B., *Some Observations on Australia's Post-2020 Emissions Reduction Target: Statement by the Chair* (Climate Change Authority, 2015).

[11] Australia's first NDC states it will account for the 2030 target using UNFCCC inventory reporting and a net-net approach (Australian Government 2015). To ensure consistency, all Australian emissions data presented here is based on UNFCCC reporting rather than Kyoto Protocol reporting, which is used to account for the 2020 target.

[12] The Climate Institute, *Labor Climate Policy Credibility Assessment* (The Climate Institute, 2016); Environment Victoria, 'Environment Victoria welcomes ALP plan to cut pollution and clean up Australia's energy supply', media release (Environment Victoria, 27 April 2016).

# Setting climate targets

In practice, emissions reduction targets are set by national governments having regard to a collection of domestic and international environmental, economic and political factors. At its most simple, countries try to balance their domestic self-interest against the international benefits of collective action. Typically, self-interest drives countries to try to minimise their contribution to global mitigation efforts so as to reduce short- and medium-term economic and political costs. Working against this is the recognition that all parties face similar incentives to free-ride and the adverse impacts of climate change can only be managed effectively through an equitable sharing of the mitigation task.

The centrality of an equitable distribution of the mitigation task to global effort to combat climate change has spawned an extensive literature on ways of devising and evaluating national targets.[13] No consensus has emerged amongst policymakers or the academic community about what constitutes the best or fairest method of determining national mitigation objectives.[14] However, the methods that have been devised provide a guide as to what other countries are likely to view as Australia's fair share of the task. These methods can be placed in four broad categories:

- population-based approaches;
- cost sharing approaches;

[13] Beckerman, W. and J. Pasek. 1995. 'The equitable international allocation of tradable carbon emission permits'. *Global Environmental Change* 5(5):405-413; Rose, A., B. Stevens, J. Edmonds and M. Wise. 1998. 'International Equity and Differentiation in Global Warming Policy'. *Environmental and Resource Economics* 12:25-51; Baer, P., J. Harte, B. Haya, A. Herzog, J. Holdren, N. Hultman, D. Kammen, R. Norgaard and L. Raymond. 2000. 'Equity and Greenhouse Gas Responsibility'. *Science* 289:2287; Berk, M. and M. den Elzen. 2001. 'Options for differentiation of future commitments in climate policy: how to realise timely participation to meet stringent climate goals?'. *Climate Policy* 1:465-480; Germain, M. and V. van Steenberghe. 2003. 'Constraining Equitable Allocations of Tradable $CO_2$ Emission Quotas by Acceptability'. *Environmental and Resource Economics* 26:469–492; Gupta, S., D. Tirpak, N. Burger, J. Gupta, N. Höhne, A. Boncheva, G. Kanoan, C. Kolstad, J. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo and A. Sari, '2007: Policies, Instruments and Co-operative Arrangements', In B. Metz et al (eds), Climate *Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2007); Chakravarty, S., A. Chikkatur, H. de Coninck, S. Pacala, R. Socolow. 2009. 'Sharing global $CO_2$ emission reductions among one billion high emitters'. *Proceedings of the National Academy of Sciences (PNAS)* 106:11884-11888; Ekardt, F. and A. von Hövel. 2009. 'Distributive Justice, Competitiveness, and Transnational Climate Protection: "One Human - One Emission Right"'. *Carbon and Climate Law Review* 3(1):102-113; Meyer, A. 2004. 'Briefing: Contraction and convergence'. *Proceedings of the ICE - Engineering Sustainability* 157(4):189-192; Müller, B., N. Höhne and C. Ellermann. 2010. 'Differentiating (historic) responsibilities for climate change'. *Climate Policy* 9:593-611; Oberheitmann, A. 2010. A new post-Kyoto climate regime based on per-capita cumulative $CO_2$-emission rights—rationale, architecture and quantitative assessment of the implication for the $CO_2$-emissions from China, India and the Annex-I countries by 2050'. *Mitigation and Adaptation Strategies for Global Change* 15(2):137-168.
[14] Gupta et al. (2007), above n 13.

- historic responsibility approaches; and
- hybrids.[15]

# POPULATION-BASED APPROACHES

Research suggests there is a near linear relationship between cumulative global carbon dioxide emissions ($CO_2$) and projected global temperature change.[16] In its 5th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) found that, in order to provide a greater than 66 percent chance of keeping average surface temperature increases below 2°C above pre-industrial levels, cumulative $CO_2$ emissions from 2011 would need to be limited to 1,000 billion tonnes (1,000 Gt $CO_2$).[17] This suggests total emissions of the so-called 'Kyoto gases' (the gases reported under the UNFCCC and Kyoto Protocol)—$CO_2$, methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride ($SF_6$) and nitrogen triflouride ($NF_3$)—would need to be limited to around 1,200-1,400 Gt$CO_2$-e.[18] This cumulative global emissions limit is often referred to as the 'global emissions budget' or 'global emissions pie'.[19]

Population-based approaches start from the premise that the global emissions budget (or the freedom to emit up to the specified limit) is a resource that should be divided up amongst nations on the basis of their populations. Possibly the most well-known population-based approach is 'contraction and convergence', which was first put forward by Aubrey Meyer and the Global Commons Institute in the 1990s.[20] Under contraction and convergence, global emissions contract to net zero so as to stabilise atmospheric greenhouse gas concentrations at an agreed level, while national targets are set so per capita emissions converge and equalise at a given point in time.

There are a number of potential weaknesses associated with contraction and convergence. These include the fact it does not account for historical emissions and the economic capacity of countries and their ability to absorb the costs associated with mitigation. A further issue associated with contraction and convergence is that, due to the delay in convergence, it

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15 Macintosh, A. (2014) 'Mitigation Targets, Burden Sharing and the Role of Economic Modelling in Climate Policy', *Australian Journal of Public Administration* 73(2): 164-180; Climate Change Authority, *Comparing Countries' Emissions Targets: A Practical Guide* (Australian Government, 2015).

16 Intergovernmental Panel on Climate Change (IPCC), Climate Change 2014: Synthesis Report (IPCC, 2014) pp 62-63.

17 This equates to 273 Gt of carbon (C). See IPCC, above n 16, pp 62-64.

18 Based on non-$CO_2$ forcing from RCP2.6. Meinshausen, M., S. J. Smith, K. V. Calvin, J. S. Daniel, M. L. T. Kainuma, J.-F. Lamarque, K. Matsumoto, S. A. Montzka, S. C. B. Raper, K. Riahi, A. M. Thomson, G. J. M. Velders and D. van Vuuren (2011) 'The RCP Greenhouse Gas Concentrations and their Extension from 1765 to 2300', *Climatic Change* 109: 213-241.

19 Global Commons Institute (GCI), *Contraction and Convergence: A Global Solution to a Global Problem* (GCI, 1997); Broecker, W (2009) '$CO_2$ Arithmetic', *Science* 315: 1371; Macintosh, A. (2009) 'The Garnaut Review's Targets and Trajectories: A Critique', *Environmental & Planning Law Journal* 26: 88-112; Macintosh, above n 15.

20 GCI, above n 19.

necessarily results in the largest per capita emitters receiving a disproportionate share (based on population levels) of the remaining emissions budget.

Other than contraction and convergence, the other main 'pure' population-based approach is the simple per capita method, where national targets are determined on the basis of existing or projected population levels at a given time or over a given period.[21] One of the advantages of the simple per capita approach is it addresses the concerns associated with the delay in convergence. However, even with the simple per capita approach, it arguably still favours wealthy nations because it does not account for historical emissions, meaning that, in most cases, they will end up with a disproportionate share of cumulative emissions since the Industrial revolution (i.e. the all-time emissions budget).

# COST SHARING APPROACHES

In contrast to population-based approaches, cost sharing approaches start from the premise that targets should be based on a division of the global abatement task. This change in focus means target setting under cost sharing approaches essentially involves a division of an 'abatement pie' (the difference between what emissions would be in the absence of mitigation measures and where they need to be to achieve the desired climate outcome) rather than an emissions pie. In their pure form, cost sharing approaches divide the abatement pie on the basis of economic cost; the welfare losses associated with reducing emissions. This typically involves setting national targets so as to equalise welfare losses across countries.[22] The adoption of this approach means countries with fewer low cost abatement opportunities and higher overall mitigation costs receive higher targets (a smaller share of the abatement pie and a larger share of the emissions budget) and *vice versa*.

Historically, the Australian Government has relied heavily on cost sharing arguments to support its international negotiation positions. The Government, industry groups and others have repeatedly asserted that the costs of reducing emissions in Australia are high relative to most other nations because of its heavy reliance on fossil fuels and large agricultural (particularly beef) sector. On this basis, they have argued Australia should receive concessional targets relative to other nations because the welfare losses associated with the transition to a low carbon economy are higher.[23]

[21] Baer et al., above n 13; Gupta et al. (2007), above n 13.

[22] Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Rose et al., above n 13; Gupta et al. (2007), above n 13.

[23] Australian Bureau of Agricultural and Resource Economics (ABARE) and Department of Foreign Affairs and Trade (DFAT), *Global Climate Change: Economic Dimensions of a Cooperative International Policy Response Beyond 2000* (Australian Government, 1995); Brown, S., D. Donovan, B. Fisher, K. Hanslow, M. Hinchy, M. Matthewson, C. Polidano, V. Tulpulé and S. Wear, *The Economic Impact of International Climate Change Policy* (ABARE, 1997); Brown, S., D. Kennedy, C. Polidano, K. Woffenden, G. Jakeman, B. Graham, F. Jotzo and B. Fisher, *Economic Impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases* (ABARE, 1999); ABARE, *COP7: The economic implications of the Kyoto Protocol for Australia* (Australian Government, 2002); Australian Treasury, *Australia's Low*

Like population-based approaches, cost sharing approaches have a number of weaknesses. They ignore the resource characteristics of emissions entitlements (e.g. would it be fair to divide up an international mineral resource on the basis of the welfare losses countries would incur if they did not receive it?) and can skew allocations to wealthier nations that bear greater responsibility for historical emissions. They are inconsistent with the customary law principle that no state has the right to damage the environment outside their jurisdiction (called the 'no-harm principle').[24] They do not account for countries' capacity to absorb the costs of mitigation. From a practical perspective, they are also difficult to implement objectively because they are reliant on economic projections that are inherently unreliable, particularly over the decadal timeframes associated with global mitigation efforts.[25]

# HISTORIC RESPONSIBILITY APPROACHES

Historic responsibility approaches involve the determination of nation mitigation targets on the basis of historic responsibility for past emissions or warming. The most well-known of these is the so-called 'Brazilian proposal', which was put forward by the Brazilian Government during the Kyoto Protocol negotiations in 1997.[26] Under this proposal, targets were proposed to be set for developed countries on the basis of responsibility for emissions after 1990.

Historic responsibility approaches share a number of weaknesses with population-based and cost sharing approaches, including the fact they do not explicitly consider population levels or economic capacity. The other main deficiency of pure historic responsibility approaches is they never adequately addressed the question of when and how targets would be set for developing countries. Due to this deficiency, pure historic responsibility approaches are widely seen as lacking credibility. However, many believe past emissions are a relevant variable in setting national targets. A number of developing countries in particular continue to argue that developed countries and other high emitters have an emissions debt that should be reflected in future emission entitlements.

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*Pollution Future: The Economics of Climate Change Mitigation* (Australian Government, 2008); Australian Government, *Economic cost as an indicator for comparable effort: Submission to the AWG-KP and AWG-LCA* (Australian Government, 2009); Australian Government, *Setting Australia's Post-2020 Target for Reducing Greenhouse Gas Emissions: Final Report of the UNFCCC Taskforce* (Australian Government, 2015).

[24] Tol, R. and R. Verheyen (2004) 'State responsibility and compensation for climate change damages—a legal and economic assessment', *Energy Policy* 32:1109-1130.

[25] Climate Change Authority, *Reducing Australia's Greenhouse Gas Emissions – Targets and Progress Review* (Australian Government, 2014); Macintosh, above n 15.

[26] UNFCCC Secretariat, *Ad Hoc Group on the Berlin Mandate, Seventh Session, Bonn, 31 July - 7 August 1997, Implementation of the Berlin Mandate, Additional Proposals from Parties, Addendum, Paper No. 1, Brazil: Proposed Elements of a Protocol to the UNFCCC, Presented by Brazil in response to the Berlin Mandate* (UNFCCC, 1997).

# HYBRID APPROACHES

The various limitations of pure population-based, cost sharing and historic responsibility approaches has prompted the development of a range of hybrid models. Most of these have their intellectual origins in population-based and cost sharing approaches. For example, pure population-based approaches have been modified to give fast growing developing country emitters greater time to transition (known as 'modified contraction and convergence'),[27] to account for economic capacity to absorb costs (e.g. 'adjusted per capita' and 'common but differentiated convergence')[28] and to address perceived inequalities associated with the transition period in contraction and convergence (e.g. 'equal per capita emissions over time').[29] Similarly, cost sharing approaches have been adjusted to account for economic capacity, population levels and historic responsibility for past emissions (e.g. 'ability to pay', 'multi-criteria', 'triptych' and 'greenhouse development rights').[30] All hybrid models have strengths and weaknesses, the importance of which depends on the weighting assigned to different philosophical and practical considerations.

[27] Garnaut, R., *The Garnaut Climate Change Review* (Cambridge University Press, 2008); Climate Change Authority, above n 25.

[28] Gupta, S. and P. Bhandari. 1999. 'An effective allocation criterion for CO2 emissions – an application to tradeable permits'. *Energy Policy* 27(12): 727-736; Höhne, N., M. den Elzen and M. Weiss. 2006. 'Common but differentiated convergence (CDC): a new conceptual approach to long-term climate policy'. *Climate Policy* 6:181-199.

[29] Bode, S. 2004. 'Equal emissions per capita over time - a proposal to combine responsibility and equity of rights for post-2012 GHG emission entitlement allocation'. *European Environment* 14: 300-316.

[30] Jacoby, H., R. Prinn and R. Schmalensee. 1998. 'Kyoto's Unfinished Business'. *Foreign Affairs* 77(4):54-66; Ringius, L., A. Torvanger and B. Holtsmark. 1998. 'Can multi-criteria rules fairly distribute climate burdens? – OECD results from three burden sharing rules'. *Energy Policy* 26(10):777-793; Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Lecocq, F. and R. Crassous. 2003. *International climate regime beyond 2012 – Are quota allocation rules robust to uncertainty?* Washington DC: World Bank; Blok, K., G.J.M. Phylipsen, and J.W. Bode, 1997: The Triptych Approach, Burden Sharing Differentiation of CO2 emissions reduction Among EU Member States (Utrecht University, 1997); Kartha, S., Athanasiou, T., Baer, P., Cornland, D., *Cutting the Knot: Climate Protection, Political Realism and Equity as requirements of a Post-Kyoto regime* (GD Rights, 2005); Rose et al., above n 13.

# Judging the fairness of Australia's 2030 emission targets

In the absence of consensus on the best approach to setting national mitigation targets, there is no objective way of passing judgment on the fairness of Australia's 26-28% 2030 target or the Australian Labor Party's 45% target. However, the available approaches can be used to place these targets within a 'range of reasonableness'. To represent this range, we analysed what the application of population-based and cost sharing approaches imply for Australia and compared the results with the Government's and Opposition's proposed targets. For these purposes, we assume the world remains committed to the Paris Agreement's objective of keeping warming well below 2°C.

## POPULATION-BASED APPROACHES AND AUSTRALIA'S 2030 TARGETS

In its 2014 and 2015 target reviews, the Climate Change Authority adopted the modified contraction and convergence approach to advise on Australia's 2025 and 2030 targets.[31] For these purposes, it suggested the use of a global emission budget of 1,700 $GtCO_2$-e for the period 2000-2050 to give a 67 percent chance of a 2°C outcome.[32] This equates to a 2011-2050 budget of approximately 1,200. This global emission budget to 2050 aligns well with the IPCC's 5th Assessment Report estimates of the cumulative $CO_2$ emissions that are consistent with providing a greater than 66 percent probability of keeping temperatures below 2°C. As noted above, accounting for non-$CO_2$ emissions and forcings, the IPCC suggested a 2°C emission budget of 1,200-1,400 $GtCO_2$-e for all time from 2011.[33] The fact the Authority's estimate is at the low end of the IPCC range is accounted for by the need for a (small) budget for the post-2050 era.

Using the modified contraction and convergence approach, the Climate Change Authority calculated Australia's share of the global emissions budget as 10.1 $GtCO_2$-e for the period 2013-2050.[34] To keep cumulative emissions within this budget, the Authority recommended a 2025 target of 30 percent below 2000 levels, and a target range for 2030 of between 40-60

[31] Climate Change Authority, *Special Review Draft Report: Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, *Final report on Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, above n 25;

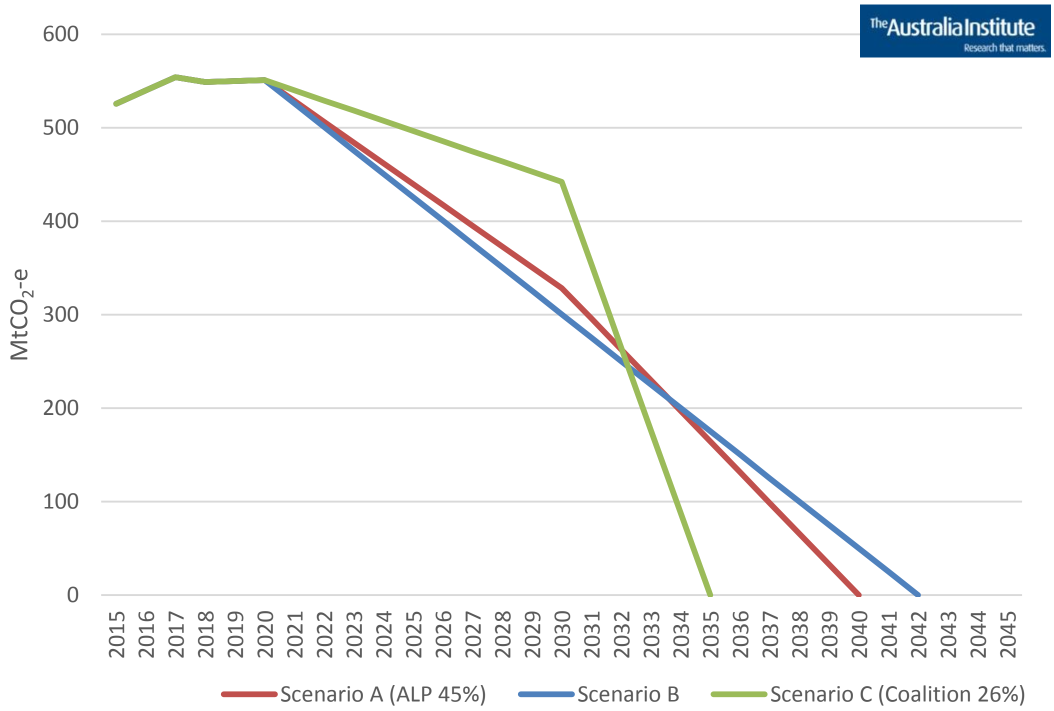
[32] The Authority also used budgets of 1,520 and 2,020 $GtCO_2$-e for the same period to give a 75 percent and 50 percent chance respectively of keeping temperatures below 2°C. For simplicity, we confine the analysis here to the 67 percent reference case.

[33] IPCC, above n 16.

[34] The full range for its scenarios was 8.5-13.1 $GtCO_2$-e. More recent emissions data suggest the budget may be slightly lower (EDGARv4.2 FT2012). We use the original estimate for simplicity.

percent below 2000 levels. The Authority's 2030 target equates to 45-63 percent below 2005 levels. Figure 1 below shows the trajectory of Australia's emissions to stay within this emissions budget calculated with the modified contraction and convergence approach. It shows a linear trajectory as well as the trajectories required under the government and opposition policies for 2030 abatement:

**Figure 1: Australia's emissions under modified contraction and convergence**




Source: Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018); Department of the Environment and Energy, *Australia's Emissions Projections 2017* (Australian Government, 2017).

Figure 1 shows that under the modified contraction and convergence approach, Australia's current target of 26 percent reduction by 2030 will then require complete decarbonisation in just five years. The difference between the Government's 26-28 percent target and the Climate Change Authority's target range equates to approximately 100-220 Mt$CO_2$-e in 2030, and 550-1,200 Mt$CO_2$-e cumulatively over the period 2021-2030. This is roughly 1.0-2.3 times Australia's 2015 emissions (526 Mt$CO_2$-e).[35]

On its face, the Opposition's 45 percent target matches the bottom of the range recommended by the Climate Change Authority. However, the adoption of this target still involves complete decarbonisation in 2040, two years earlier than under the linear trajectory. It is important to consider that a linear trajectory may not be optimal. While large emissions

[35] Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018).

reductions may be possible at low cost, the final emissions reductions from industries such as manufacturing, construction and agriculture may be difficult and costly.

While the Climate Change Authority's emission budget and associated mitigation targets are ambitious, they do not reflect the least self-interested population-based approach. A simple per capita division of the remaining global emissions budget better approximates an outer marker of what some might regard as equitable. For illustration, we divided the remaining global emissions budget from 2015 on the basis of 2015 population levels. To do this, we took the IPCC's mid-range estimate for 2°C (1,300 $GtCO_2$-e) and deducted estimated emissions over the period 2012-2015 (~260 $GtCO_2$-e), leaving a budget for the remainder of the century of 1,040 $GtCO_2$-e. We then used the United Nations population estimates for 2015 to divide the budget between countries.[36] This provides Australia with a budget for the remainder of the 21st century of 3.36 $GtCO_2$-e, as shown in Table 1 below:

### Table 1: Australian emissions budget under pure population approach

| | Low | Medium | High |
|---|---|---|---|
| **Global emissions budget from 2012 (Gt CO2-e)** | 1,000 | 1,300 | 1,500 |
| **Emissions 2012-15 (Gt CO2-e)** | 260 | 260 | 260 |
| **Remainder (Gt CO2-e)** | 740 | 1,040 | 1,240 |
| **Population 2015 (people)** | 7,349,472,000 | 7,349,472,000 | 7,349,472,000 |
| **Remaining emissions budget per person (t CO2-e)** | 101 | 142 | 169 |
| **Australian population (people)** | 23,969,000 | 23,969,000 | 23,969,000 |
| **Australia's share of emissions budget (Mt CO2-e)** | 2,413 | 3,392 | 4,044 |
| **Australian emissions 2015 (Mt CO2-e)** | 526 | 526 | 526 |
| **Years to budget** | 4.6 | 6.4 | 7.7 |

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Sources: IPCC (2015), UN (2015)

Table 1 shows that at current emission levels, this budget would be expended in just over six years. Assuming Australia's current climate policies remain in place until 2020, come 2021, Australia would have a little over 12 months to reach net zero emissions. While Australia could

[36] United Nations, *World Population Prospects 2017* (UN, 2017), available at: https://esa.un.org/unpd/wpp/ (20 March 2018).

not achieve cuts of such magnitude domestically, the target could potentially be achieve through the importation of foreign permits (carbon credits). Such a strategy would be dependent on the availability of international permits and extent of demand for them from other nations.

# COST SHARING APPROACHES AND AUSTRALIA'S 2030 TARGETS

The application of a pure cost sharing approach to evaluate Australia's 2030 targets requires a comparison between the average economic cost of meeting the 2°C target globally and the equivalent costs for Australia, assuming emissions reductions are done in the most cost-effective (or least-cost) way possible.

The requirement for the comparison to be done on the basis of the lowest (theoretically) possible economic cost of achieving the relevant mitigation targets is important. Cost sharing approaches would have no validity if welfare loss comparisons could be made using scenarios that assume parties make policy choices that increase costs. Such an approach would mean that, the less cost-effective a country's mitigation policies, the less they would be obligated to reduce their emissions (and greater share they would receive of the remaining global emissions budget). The adoption of such an approach to target setting would create perverse incentives and work against the collective global interest of reducing emissions in the cheapest way possible.

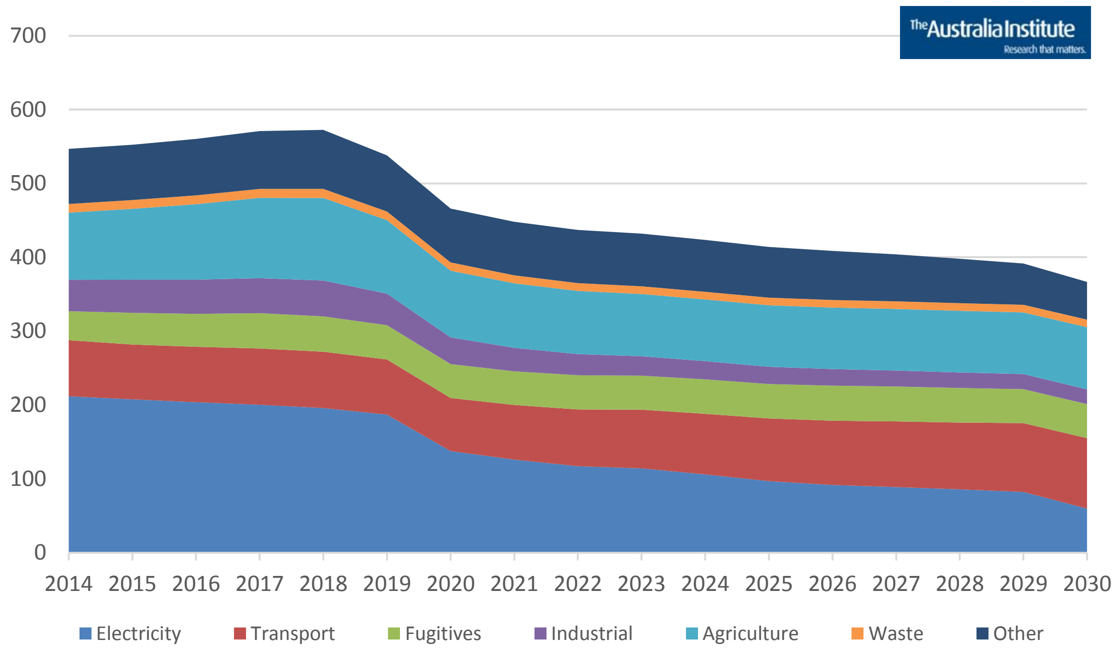
In its 5$^{th}$ Assessment Report, the IPCC estimated the impacts on global consumption of stabilising the atmospheric concentration of $CO_2$ in 2100 at 450 parts per million (ppm) (equivalent of a 2°C outcome). If done cost-effectively, consumption would continue to increase, but at a slightly lower annual growth rate. The IPCC's estimate of the difference in global consumption in 2030 was 1.7 percent lower, with a range of range 1.0-3.7 percent, relative to a reference case with no additional mitigation efforts.[37] This equates to a reduction in the average growth rate of consumption of 0.09 percent (range 0.06-0.2) over the period 2010 to 2030.

The modelling of the IPCC's assessment assumed the immediate adoption of mitigation measures in all countries and a single global carbon price. While the IPCC did not publish details of the resulting reductions in individual countries, a similar modelling exercise was undertaken by Victoria University on behalf of the Climate Change Authority in 2016 using the IPCC's 450 ppm global carbon price. The price began at $AUD33 per tonne in 2019 and increased steadily to 2050. The results suggest Australia's domestic contribution to a globally

[37] IPCC, *Climate Change 2014 Mitigation of Climate Change: Summary for Policymakers and Technical Summary* (IPCC, 2015) pp 56-60.

efficient effort to keep temperatures below 2°C would see emissions decline from 612 Mt in 2005 to 367 Mt, as shown in Figure 2 below.[38]

**Figure 2: Australia's emissions under 2C scenario, IPCC cost sharing approach**




Source: Adams (2016).

Figure 2 shows emissions declining by roughly 41 percent by 2030 relative to 2005 levels, significantly above the Government's 26-28 percent targets and slightly below the Opposition's 45 percent target. The largest reductions come from the electricity sector. Importantly this analysis had only partial coverage of the land sector where Australia has significant low-cost mitigation options.

A rough estimate of the economic costs associated with meeting the Government's and Opposition's 2030 targets can be derived from the modelling that was commissioned by the Government in 2015 to inform its target decision. For these purposes, the McKibbin Software Group was asked to model the economic impacts of four 2030 targets: reductions of 13, 26, 35 and 45 percent relative to 2005 levels (McKibbin Software Group 2015a; 2015b).[39] The modelling that was conducted had a number of limitations, including that the analysis did not consistently assume a cost-effective response across all countries. The analysis was also confined to $CO_2$ emissions in the energy sector, thereby excluding non-$CO_2$ emissions from energy, $CO_2$-e emissions from industrial processes, agriculture and waste, and $CO_2$-e emissions

[38] Adams, P., *Simulations of the Effects of Greenhouse Gas Mitigation Policies for the Australian Electricity Sector* (Victorian University, 2016).

[39] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a); McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b).

and $CO_2$ removals associated with the land sector.[40] Due to these and other factors, the results were heavily caveated, with the McKibbin Software Group stressing:

> There is considerable uncertainty in the assumptions used in the modelling. Given the difficulty of predicting future economic conditions and countries' actions, all results should be understood to be an expected outcome with a relatively large band of uncertainty around the point estimates. The estimates should be treated as indicative of the orders of magnitude of policy impacts and the likely relative size of impacts across sectors and countries, and should be used with caution.[41]

Noting these modelling limitations, the findings suggest the pursuit of a 26 percent 2030 target with cost-effective domestic policies (excluding international permits) would see Australia's consumption 0.91 percent lower in 2030, relative to a base case with no additional global mitigation. Allowing international permits reduced the estimated reduction in consumption to 0.60 percent in 2030. The equivalent results for the 45 percent target scenario were a 1.47 percent reduction in 2030 with no international permits and a 0.92 percent reduction in 2030 with international permits.

For the purposes of applying a pure cost sharing approach, only the lower consumption impact estimates involving the use of international permits are relevant. As noted above, in order for cost sharing approaches to have any validity, the cost comparisons need to be made on the assumption all parties pursue least-cost policies.

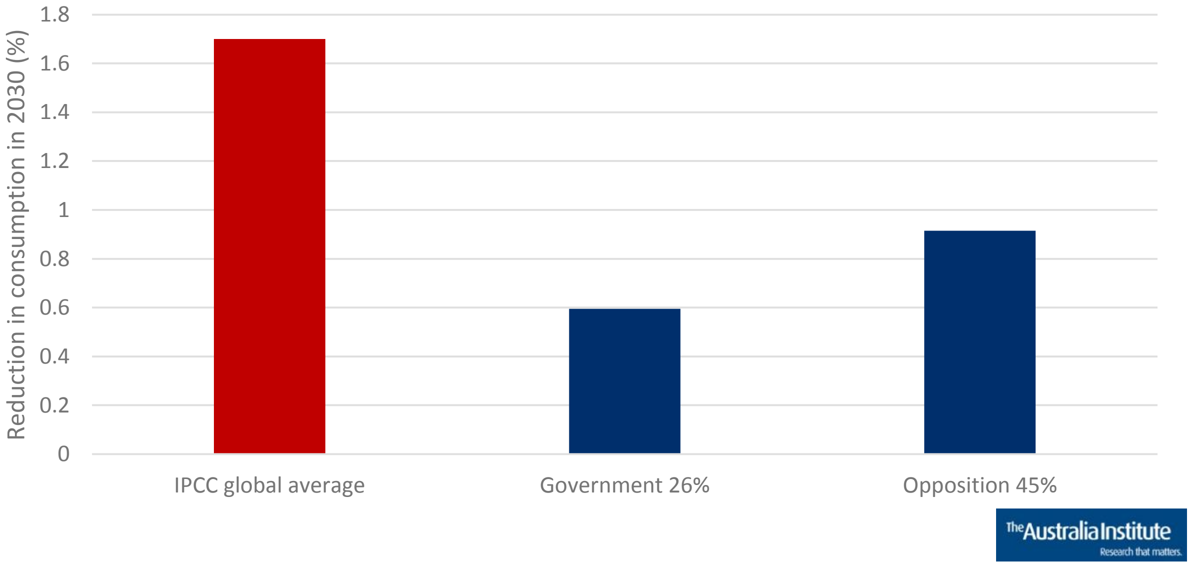
If the IPCC's estimate of the average global reduction in consumption relative to baseline growth to 2030 of 1.7 percent is used as a benchmark, it suggests the Government's 26-28 percent target is inadequate (Fig. 3).[42] The assessed reduction in consumption is less than half the global average. The Opposition's 45 percent target also falls outside of the range that might be considered consistent with a cost sharing approach. The assessed reduction in consumption in the 45% scenario, 0.92 percent in 2030, is almost 50 percent below the global average.

[40] The core target scenarios also assumed high end domestic technology costs.

[41] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a) p 7. See also McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b) p 7.

[42] The estimates of impacts on other economies in the McKibbin Software Group's modelling are not directly relevant because of the limited coverage of countries, gases and sectors, and the fact they do not assume a consistent cost-effective policy response across all countries.

**Figure 3: Reduction in 2030 consumption, IPCC global average, government and Labor targets**




Source: McKibbin Software Group (2015a; 2015b); IPCC (2015).

# COULD HYBRID MEASURES MAKE AUSTRALIA'S 2030 TARGETS APPEAR FAIRER?

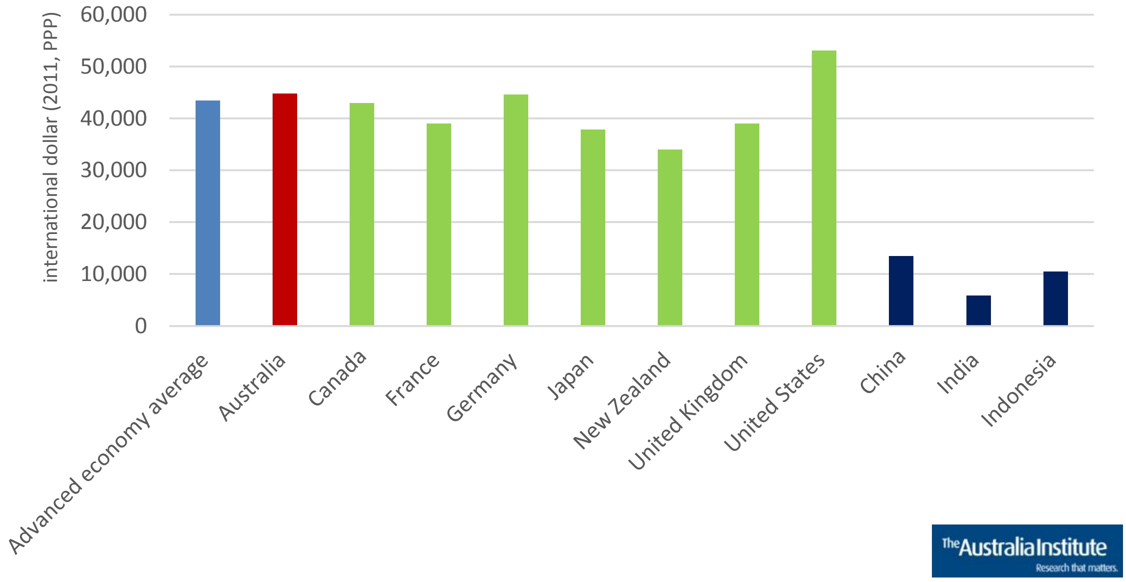
In the past, Australian Governments have presented a range of economic and emissions information to support the case its targets constitute an equitable contribution to global mitigation efforts.[43] The difficulty with this approach is that none of the recognised metrics used in hybrid models to modify the impacts of the 'pure' approaches supports Australia's position. The three most commonly employed are economic capacity, economic, human and social development, and historic emissions.

By any measure, Australia is a wealthy nation with a high economic capacity. As shown in Figure 4, Australia's GDP per capita is above the average for advanced nations, and above most other major developed countries, including the United Kingdom, Japan, Germany, France and Canada. In 2015, Australia's GDP per capita was also more than three times China's, almost eight times India's and more than four times Indonesia's.[44] The perceived fairness of Australia's 26-29 percent 2030 target, and the Opposition's 45 percent target, is not improved by the inclusion of economic capacity.

[43] See references in n 23.

[44] International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

**Figure 4: Major developed and developing economies, gross domestic product per capita, constant prices, international dollar (2011)**

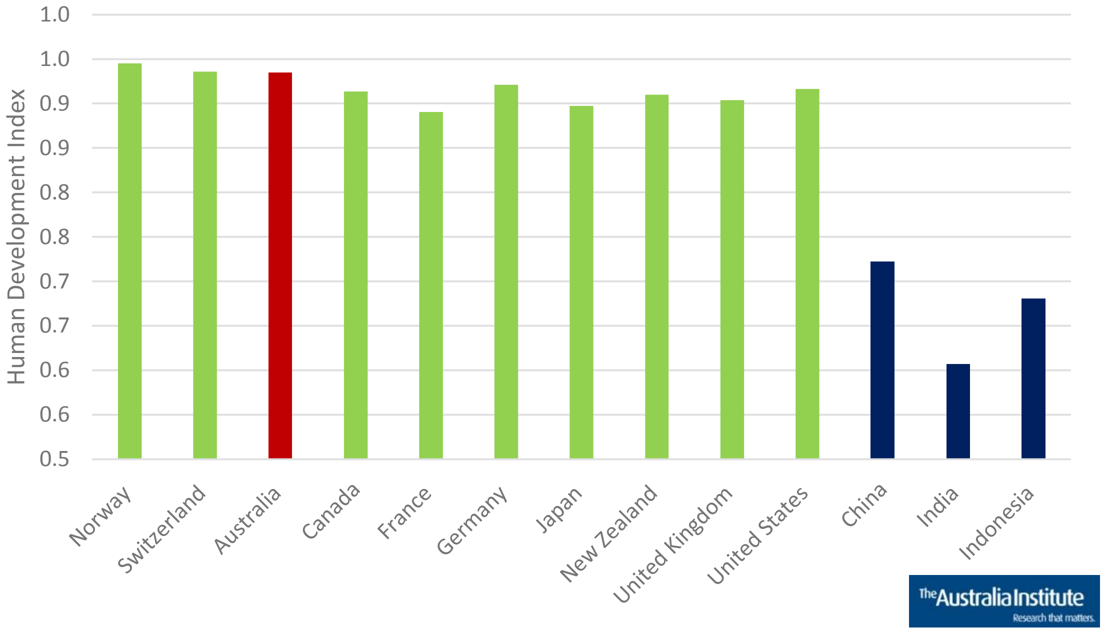



Source: International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

The use of composite measures of economic, human and social development produces a similar result. Australia has very high levels of economic, human and social development relative to other nations, suggesting it has a high capacity to mitigate emissions and make the necessary social and economic adjustments associated with the transition to a low carbon economy. The relative state of Australia's economic, human and social development is illustrated by the Human Development Index, a composite indicator that combines metrics on three dimensions: health, knowledge (education) and standard of living. The most recent HDI results (2015) place Australia second in the world behind Norway. The five year average (2011-2015) places Australia third in the world behind Norway and Switzerland, and significantly ahead of all other major developed and developing economies (Fig. 5).[45] Much like economic capacity, the perceived fairness of Australia's current targets and those proposed by the Opposition are not improved by the inclusion of composite measures of economic, human and social development.

[45] United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

**Figure 5: Average Human Development Index score for major developed and developing economies, 2011 to 2015**



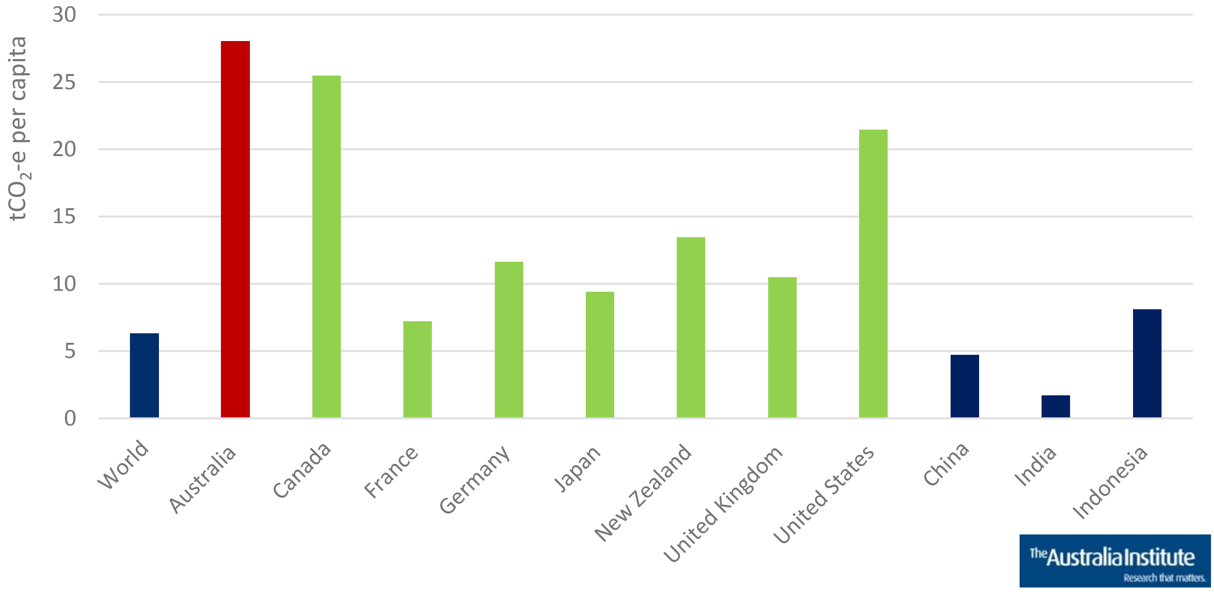

Source: United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

The same applies to historic emissions. Over the period 1990 to 2014, Australia was responsible for approximately 1.4 percent of global greenhouse gas emissions, while having only having 0.3 percent of the world's population.[46] The extent to which Australia is disproportionately responsible for historical emissions (relative to population) is illustrated by comparing average per capita emissions over the period 1990 to 2014 (Fig. 6). Australia's average per capita emissions for this period were 28 t$CO_2$-e per person, compared to the global average of 6.3 t$CO_2$-e per person. As Figure 5 shows, Australia's per capita emissions were above all of the major developed economies, with only Canada (25.5 t$CO_2$-e per person) and the United States (21.4 t$CO_2$-e per person) being reasonably comparable. Australia's per capita emissions were almost six times China's (4.7 tCO2-e per person), 16.7 times India's (1.7 tCO2-e per person) and 3.5 times Indonesia's (8.1 tCO2-e per person).[47]

[46] It is arguable that the period for historic responsibility should extend back further, possibly to the beginning of the Industrial revolution, because of the long atmospheric lifetime of long-lived greenhouse gases. However, the post-1990 period is generally used in historical responsibility approaches because, by 1990, the nature of climate change and its causes was widely known.

[47] World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

**Figure 6. Major developed and developing economies, average greenhouse gas emissions (including land use change and forestry) per capita, 1990-2014**




Source: World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

These indicators of economic development and historical emissions show that any hybrid assessment developed is likely to show that Australia's current emissions reduction targets are not in line with our share of the global abatement task. Australia is likely to be placed under pressure, either domestically or internationally, to take on a more reasonable share of climate action.

# Conclusion

In order to keep global average surface temperature increases to less than 2°C above pre-industrial levels, it is necessary for cumulative global greenhouse gas emissions to be limited to roughly 950 $GtCO_2$-e from 2018. If global emissions remain at current levels, this budget will be expended within 19 years. The only way to expand the size of the budget is through the development and deployment of one or more large-scale negative emissions technologies that remove greenhouse gases from the atmosphere.[48] While the development of such technologies is possible, it would be a high risk strategy to base global mitigation policy on the prospect of their emergence.[49] The small size of the remaining global emissions budget means all nations need to rapidly decarbonise.

Despite the apparent urgency of the situation, to date, the international community has struggled to agree on an equitable division of the global emissions budget. This is mainly attributable to the reluctance of nations to incur the short- and medium-term economic and political costs of mitigation, at least in the absence of collective action. The resolution of this impasse requires all major emitting nations to simultaneously pursue aggressive emission reductions.

In the absence of an internationally agreed method of determining each nation's contribution to this effort, this paper has sought to judge whether the Australian Government's and Opposition's 2030 mitigation targets fall within a 'range of reasonableness', judged according to the most widely used principle-based approaches to target setting. The results suggest the Australian Government's 26-28 percent target is inadequate according to any recognised principle-based approach. It falls well outside the ranges suggested by both population-based and cost sharing approaches, and its fairness is not improved by the inclusion of metrics from hybrid models.

The Opposition's target lies at the lower end of the range suggested by pure population-based approaches and outside of the range implied by cost sharing approaches. The inclusion of the main metrics used in hybrid models concerning economic capacity, economic, human and social development, and historic emissions undermines the case that the Opposition's target is fair. Given this, a 45 percent target for 2030 can be regarded as the bare minimum necessary for Australia to be considered to be making an equitable contribution to the achievement of

[48] Smith, P. et al. (2016) 'Biophysical and economic limits to negative emissions', *Nature Climate Change* 6: 42-50; Gasser, T., Guivarch, C., Tachiiri, K., Jones, C., Ciais, P. (2015) 'Negative emissions physically needed to keep global warming below 2 °C', *Nature Communications* 6: 7958; Fuss, S. et al. (2014), 'Betting on negative emissions', *Nature Climate Change* 4: 850-853; van Vuuren, D., Deetman, S., an Vliet, J., van den Berg, M., van Ruijven, B., Koelbl, B. (2013) 'The role of negative CO2 emissions for reaching 2°C—insights from integrated assessment modelling', *Climatic Change* 118: 15-27.

[49] Ibid.

the Paris Agreement's 2°C target, judged according to the main principle-based approaches to target setting.

One of the main reasons why the Australian Government's and Opposition's targets lie outside, and at the edge respectively, of what principle-based approaches suggest is reasonable is the small size of the remaining global emissions budget. With only roughly 950 $GtCO_2$-e remaining, any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge for the Paris Agreement's iterative structure, whereby nations are intended to progressively ramp-up mitigation efforts in 5-yearly cycles. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.

# Harming farming

## The cost to agriculture from the **government's emissions reduction** plan

***A sector by sector proportional emissions reduction approach will mean agriculture will have to reduce emissions by 26 per cent by 2030. Agriculture lacks significant emissions reduction projects, so this emissions cut will come at a large cost.***

Discussion paper

**Matt Grudnoff**

**July 2018**

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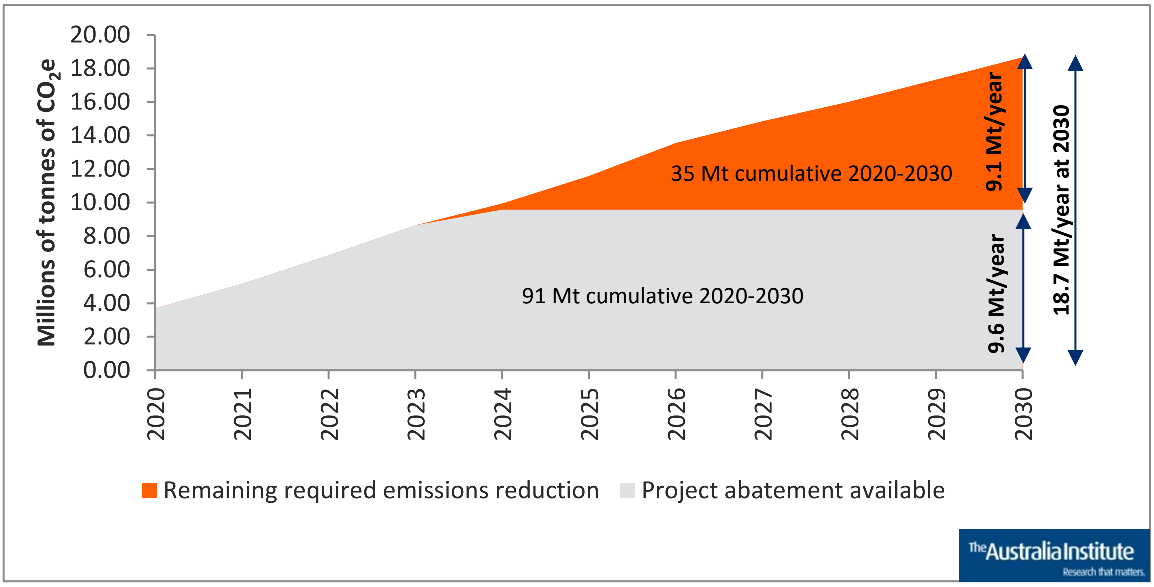
# Summary

Australia's commitment under the Paris climate agreement is to reduce carbon emissions by 26 to 28 per cent below 2005 levels by 2030. With the announcement of the National Energy Guarantee the government has required the electricity sector to reduce its emissions by 26 per cent. This implies other sectors such as agriculture will also need to reduce emissions by at least 26 per cent by 2030. This approach will impose significant costs on agriculture and other sectors that do not have the existing, commercially available technologies for emissions reduction that the electricity sector has.

We have calculated that the government's plan will require agriculture to reduce emissions per year by 18.7 million tonnes (Mt) of $CO_2e$ by 2030. Between 2020 and 2030, this represents 126 Mt of $CO_2e$ not emitted compared to business as usual, since the reduction in yearly emissions is expected to occur incrementally.

Emissions reduction projects identified by energy analytics firm RepuTex could reduce agriculture's emissions by a maximum of 9.6 Mt of $CO_2e$ per year and from 2024 onwards the agriculture sector would be unable to abate emissions in line with a 26 per cent reduction trajectory. By 2030 there would be 9.1 Mt per year gap in emissions reductions which will have to come from reducing agricultural production, including significant reductions in livestock numbers. In 2030, this would include 2.9 million fewer beef cattle, 8 million fewer sheep, 290,000 fewer dairy cows and 270,000 fewer pigs.

**Figure - Total agricultural sector abatement and project abatement**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

This represents an emissions reduction through lower production of 11 per cent by 2030, roughly equivalent to the 15 per cent reduction in emissions through lower production caused by the major Millennium Drought in South East Australia (from 1996 to 2010).

This unnecessarily high cost is a product of the government's decision that every sector should reduce emissions by 26 per cent. If those sectors that are able to most cheaply reduce emissions are allowed to do so, then sectors like electricity generation would reduce emissions by far more than 26 per cent and sectors like agriculture would reduce emissions by less than 26 per cent.

This is particularly important as the government attempts to lock in a 26 per cent reduction target for electricity generation. If the government succeeds in doing this, it will increase the cost to sectors like agriculture.

# Introduction

Australia's commitment under the Paris climate agreement is to reduce carbon emissions by 26 to 28 per cent below 2005 levels by 2030.[1] The federal government plans to lock in a 26 per cent reduction in the electricity sector with its proposed National Energy Guarantee. This implies that it intends to reach the Paris target using a proportional sector by sector approach where each sector would need to reduce emissions by at least 26 per cent. The sectors are:[2]

- Electricity
- Stationary energy excluding electricity (also known as direct combustion)
- Transport
- Fugitive emissions
- Industrial processes and product use
- Agriculture
- Waste

This approach is likely to increase the cost of reducing emissions when compared to a sector neutral approach which would see emissions reduced in the sector that can do it most cheaply. This is because some sectors, such as electricity, have an abundance of relatively cheap, commercially proven technologies and techniques for reducing emissions. Other sectors, like agriculture, have fewer and more expensive emissions reduction options.

This paper looks at the potential for the agriculture sector to achieve a 26 per cent reduction by 2030 and the possible costs of doing so. Abatement cost estimates of emissions reduction projects in the agricultural sector have been provided by analysts, RepuTex. These projects reduce the emissions intensity of farming. That is, they reduce the emissions from agriculture without reducing agricultural output. Land use, land use change and forestry (LULUCF) projects have been excluded because a large portion of them would reduce agricultural output. Many of the projects involve reforesting farmland.

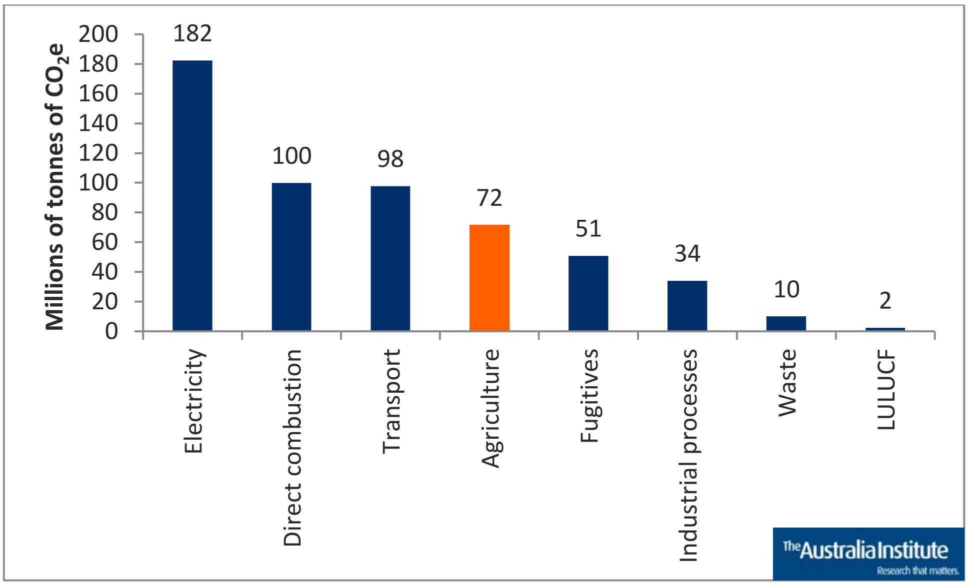
[1] Department of Foreign Affairs and Trade (2015) *Australia's intended Nationally Determined Contribution to a new climate change agreement*

[2] Land use, land use change and forestry (LULUCF) has been excluded from this analysis. LULUCF can be a carbon sink or a source of carbon. Currently it is a very small source of carbon (2 Mt $CO_2e$) and its exclusion does not make a meaningful difference out to 2030.

# Emissions reduction projects

Australia's emissions come from many sources. As shown in Figure 1 below, there are seven key sectors of the Australian economy in relation to greenhouse emissions:

**Figure 1 - Emissions by sector in 2018, projection**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Figure 1 shows that the electricity sector is responsible for a third of Australia's carbon emissions (33 per cent). By contrast, agriculture contributes just 13 per cent of Australia's emissions, expected to rise to 14 per cent by 2020.[3] Of the seven emissions producing sectors, it is the fourth highest.

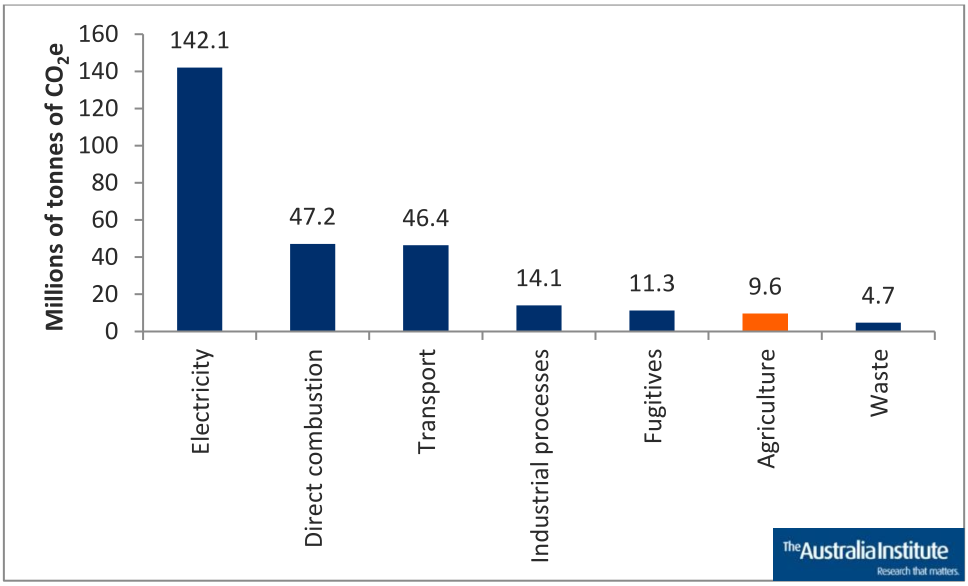
Energy analysts RepuTex have compiled a list of emissions reduction projects across all sectors of the economy, including estimates of the amount of emissions that each project can reduce and the cost of doing so.[4] The amount of emissions reduction available to each sector is shown in Figure 2, below. Just as it contributes the greatest share of emissions, the electricity sector also has the largest amount of potential

[3] All figures of Australia's emissions come from Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

[4] RepuTex (2018) *Marginal Abatement Cost Curve - 2030*, provided to The Australia Institute. Some details are available here: https://www.reputex.com/research-insights/report-meeting-a-2c-target-a-marginal-abatement-cost-mac-curve-for-australia/

emissions reduction projects. The agricultural sector has relatively few projects for its size.

**Figure 2 - Total amount of emissions reduction available from projects by sector**




Source: RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

Given the large amount of low-cost abatement options available to the electricity sector, most economists and emissions analysts suggest that it should shoulder more of Australia's abatement task.[5] This would reduce the burden on, and costs to, industries such as agriculture.

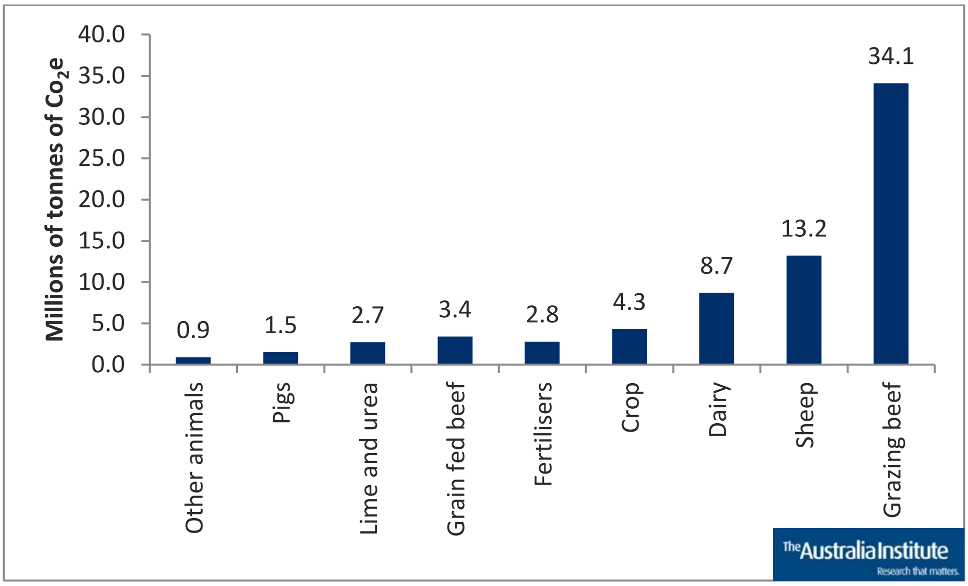
However, government policy appears not to be concerned with minimising cost or the potential of each sector to reduce emissions. This paper will take a close look at implications of this for the agricultural sector. It will look at how much emissions reduction the agriculture sector can achieve with the projects known to RepuTex and what the cost of that reduction would be.

[5] See for example Campbell (2017) *Meeting our Paris commitment,* http://www.tai.org.au/sites/defualt/files/P439%20Meeting%20our%20Paris%20Commitment%20-%20TAI%20Climate%20and%20Energy%20Program%20-%20September%202017.pdf

# Agricultural emissions

In agriculture, the top three emissions producing subsectors all involve livestock rearing. The largest is beef grazing, which makes up almost half of agricultural emissions (48 per cent). When grain-fed beef is included (5 per cent), beef makes up 52 per cent of agricultural emissions. This is followed by sheep (18 per cent) and dairy (12 per cent). Together the top three emitters make up over three quarters of carbon emissions in the agricultural sector (83 per cent), as shown in Figure 3 below:

**Figure 3 - Agricultural emissions by subsector in 2018**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Clearly, if the agriculture sector is to reduce its emissions by 26 per cent then these three subsectors are going to have to play a significant role.

The main source of $CO_2e$ from livestock is enteric methane emissions produced by the animal as it breaks down feed. This is done by microorganisms fermenting and breaking down ingested feed and producing methane, most of which is belched.[6] Emissions from pigs do not occur in this way, hence the lower emissions shown in Figure 3. Emissions from pigs mainly relate to the breakdown of manure in effluent ponds.[7]

[6] Lines-Kelly (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

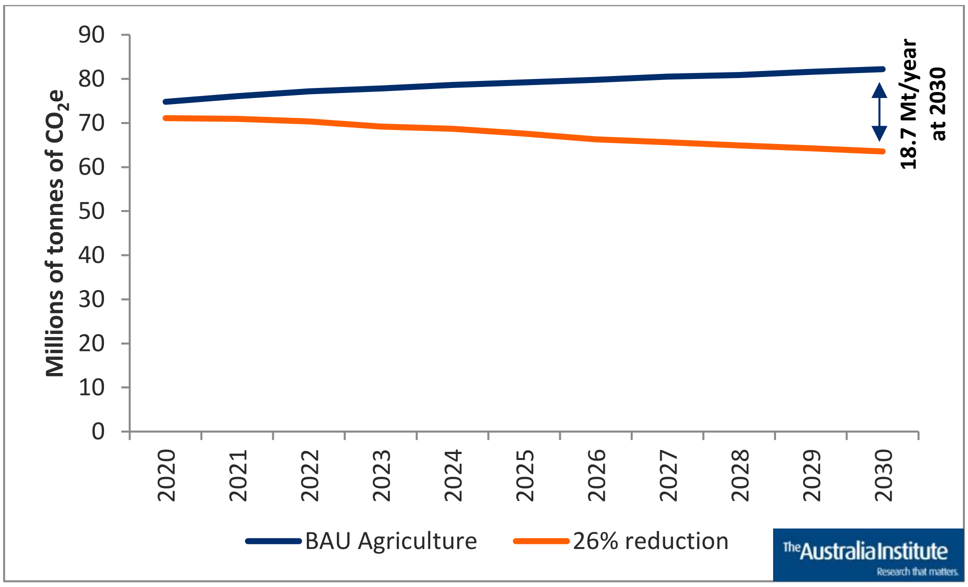
[7] Massey et al. (2013) *Pork Production and Greenhouse Gas Emissions*

Even with the current policies to reduce emissions, including the Carbon Farming Initiative and the Emissions Reduction Fund, agricultural emissions are expected to rise out to 2030 by 10 Mt $CO_2$e per annum. Half of that increase will be in beef (including grain fed beef). Emissions from sheep will increase by about 2 Mt of $CO_2$e while Dairy is projected to increase by about 1 Mt $CO_2$e.[8]

These increases in agricultural emissions include the impact of the Carbon Farming Initiative and the Emissions Reduction Fund. Agricultural emissions would rise even faster without these projects. The RepuTex emissions reduction projects are in addition to the emissions reduction work already underway. Work on reducing agriculture emissions is already underway but in order to reach a 26 per cent reduction target by 2030 a lot more would need to be done.

Agricultural emissions are currently 72 Mt $CO_2$e per year, but they are expected to rise to 82.2 Mt $CO_2$e by 2030 in the business as usual scenario (BAU). To reach the Paris target by 2030 agricultural emissions would instead need to fall to 63.5 Mt $CO_2$e. The difference between the increase in emissions if there is no change in policy and the reduction required to meet the Paris target is the size of the abatement task. This means the total abatement task for agriculture is for emissions to be 18.7 Mt $CO_2$e per year lower in 2030 than they are currently. The total abatement task from 2020 to 2030 added together is 126 Mt $CO_2$e. This is shown in Figure 4 as the area between the two lines.

**Figure 4 - Agricultural sector emissions business as usual and 26% reduction task**

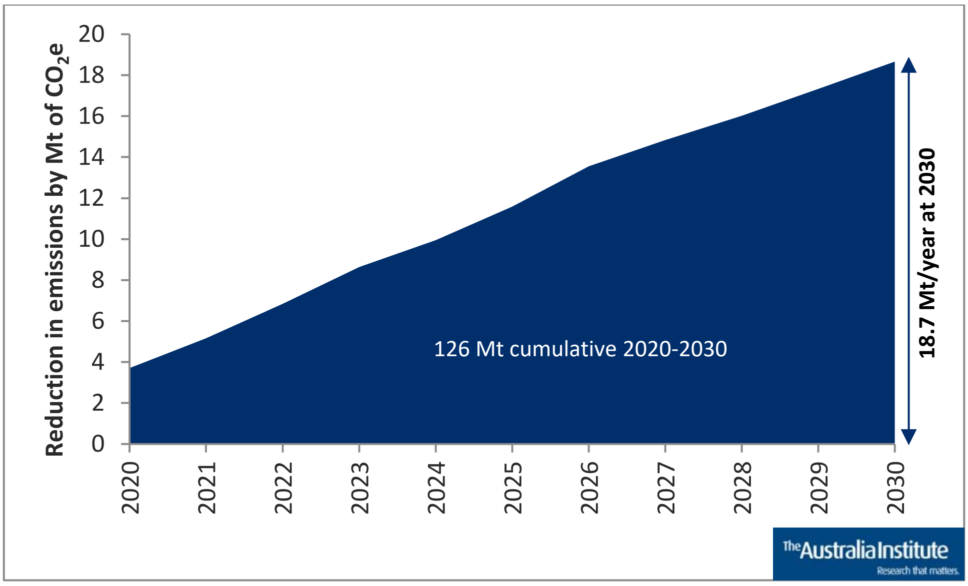



[8] Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

As shown in Figure 5, the emissions abatement task in agriculture will rise steadily in line with a 26 per cent reduction in sectoral emissions.

**Figure 5 - Agricultural sector abatement task 2020 to 2030**

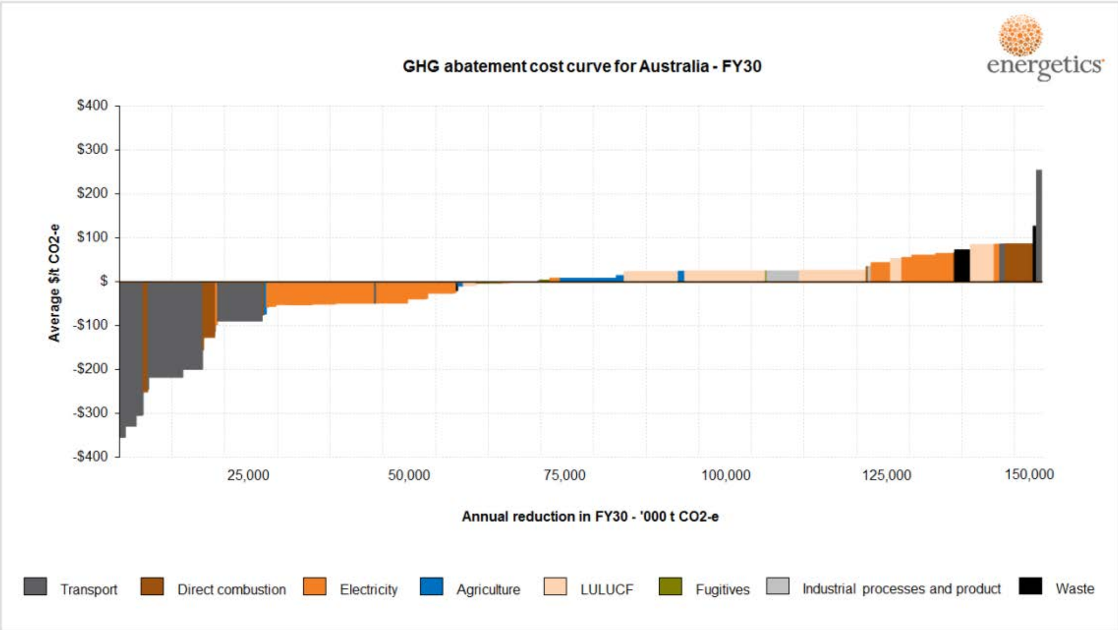



Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and Australia Institute calculations

Reducing emissions in the agriculture sector is costly when compared to other sectors in the Australian economy. There are proportionately more abatement projects at lower costs in other sectors. This can be seen in the Government's commissioned Abatement Cost Curve 2030 by Energetics, reproduced in Figure 6 which shows numerous available abatement opportunities in transport, electricity and direct combustion sectors.[9] Many of the available activities incur a negative cost (i.e. will ultimately save the activity undertaker money). The government's decision that each sector should contribute to emissions reduction in the same proportion will lead to an unnecessary increase in cost.

[9] Energetics (2016) *Australia's 2030 climate change emissions reduction target – abatement potential,* http://www.environment.gov.au/climate-change/publications/modelling-and-analysis-australias-abatement-opportunities

### Figure 6 - Energetics cost curve




Source: Energetics (2016) *Australia's 2030 climate change emissions reduction target – abatement potential*, http://www.environment.gov.au/climate-change/publications/modelling-and-analysis-australias-abatement-opportunities

That is not to say that the agriculture sector should be excluded from reducing emissions. There are some projects within the agriculture sector that have the potential to reduce emissions at a relatively cheap, or even negative, cost. These projects should be encouraged. Further research and development into other ways to reduce emissions in the agricultural sector should also be encouraged.

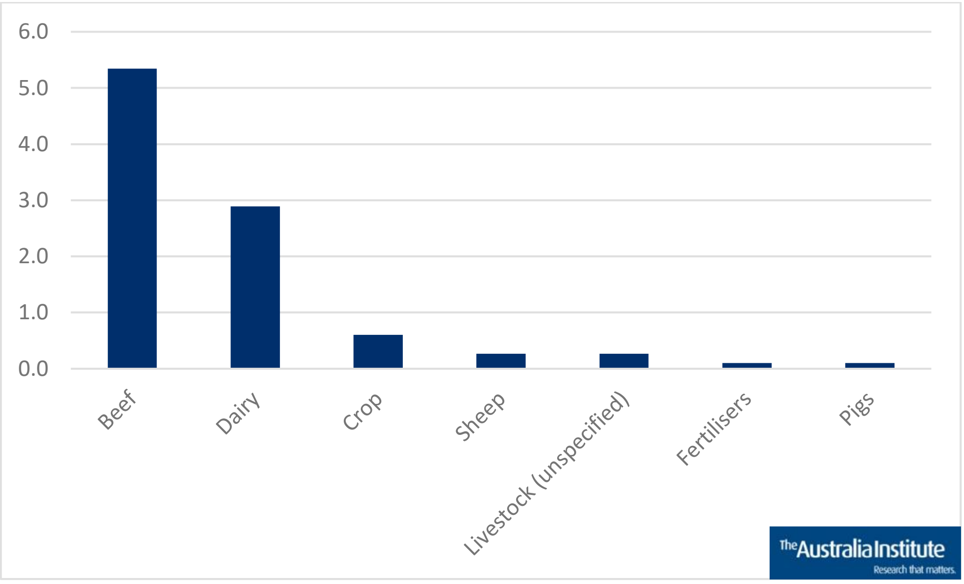
The selection of emissions reduction projects should be based on a comparison with all possible projects in Australia. Sector-specific targets should be based on good policy; assigning the same target for each sector will only increase the cost of reducing emissions.

# Agricultural emissions reduction projects

RepuTex has a large database of emissions reduction projects from all sectors. Each project provides for an ongoing reduction in emissions. The database identifies 11 emissions reduction projects, covering most of the agriculture subsectors. They are all considered technologically feasible, meaning they could be implemented at any time. If they were all implemented, they have the potential to reduce agriculture emissions by 9.6 million tonnes of $CO_2e$ each year.[10]

Figure 7 shows the abatement available from agriculture projects in RepuTex's database, sorted by The Australia Institute into subsectors. Our calculations combine the grazing beef and grain fed beef subsectors as it is not always clear which subsector a beef project would belong to.

**Figure 7 - Mt per year abatement available from agriculture projects**




Beef is the largest source of emissions and has projects that could reduce emissions by the largest amount. These projects include:

- Optimising grazing patterns so that more carbon is sequestered into the soil of grasslands. This includes converting land from crops to pasture, rejuvenating

[10] RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

pasture through seeding, changing stocking rates, changing the duration or intensity of grazing including resting pasture.[11]
- Active feeding programs that allow cows to gain weight more quickly with higher quality feed, which can reduce emissions per day and also reduce the time it takes to bring an animal to slaughter weight, thus reducing lifetime emissions.[12]

The dairy subsector has projects that could reduce emissions by the second largest amount, although it is the third largest source of emissions. The projects include:

- Capturing the methane from dairy waste in covered ponds. The methane is then burnt off and could be further used to generate electricity.[13]
- Reducing methane emissions by feeding dairy cows high fat feed supplements. This allows better digestion of lower quality feeds.[14]

There are also significant projects to reduce emissions from sheep including:

- A similar project to that of cattle that involves optimising grazing patterns so that more carbon is sequestered into the soil of grasslands. This includes converting land from crops to pasture, rejuvenating pasture through seeding, changing stocking rates, changing the duration or intensity of grazing including resting pasture.[15]
- Sheep can also use active feeding programs to allow the lambs and sheep to gain weight more quickly with higher quality feed, which can reduce emissions per day and also reduce the time it takes to bring an animal to slaughter weight, thus reducing lifetime emissions.[16]

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[11] Australian Government (2018) *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination, 2014,* https://www.legislation.gov.au/Details/F2014L00987

[12] Lines-Kelly (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

[13] Australian Government (2015) *Carbon Credits (Carbon Farming Initiative) (Destruction of Methane Generated from Dairy Manure in Covered Anaerobic Ponds) Methodology Determination 2012,* https://www.legislation.gov.au/Details/F2015C00573

[14] Department of the Environment and Energy (2014) *Feeding dairy additives to milking cows,* http://www.environment.gov.au/climate-change/government/emissions-reduction-fund/cfi/publications/factsheet-dairy-additives-milking-cows

[15] Australian Government (2018) *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination, 2014,* https://www.legislation.gov.au/Details/F2014L00987

[16] Lines-Kelly R (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

Crop emissions can also be reduced with a number of projects including:

- Soil conservation to improve nitrogen mineralisation and soil structure. This increases the amount of carbon captured in the soil. It is achieved through changing from annual cropping to pasture, retaining field stubble and increasing biomass yields through sustainable intensification (nutrient management, soil acidity management, new irrigation and pasture renovation).[17]

There are also projects to reduce piggery emissions including:

- Covering the lagoons that store effluent, collecting the biogas and combusting the gas. The biogas could also be used to generate electricity.[18]

Emissions reduction projects also target fertiliser use including:

- Efficiency improvements in the use of nitrogen fertilisers used by irrigated cotton farmers. Nitrogen fertiliser wastage is as high as 92 per cent, mainly through denitrification, leaching, runoff and volatilization.[19]

[17] Federal Register of Legislation (2015) *Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015,* https://www.legislation.gov.au/Details/F2016C00263

[18] Australian Government (2015*) Carbon Credits (Carbon Farming Initiative) (Destruction of Methane Generated from Manure in Piggeries—1.1) Methodology Determination 2013,* https://www.legislation.gov.au/Details/F2013L00856

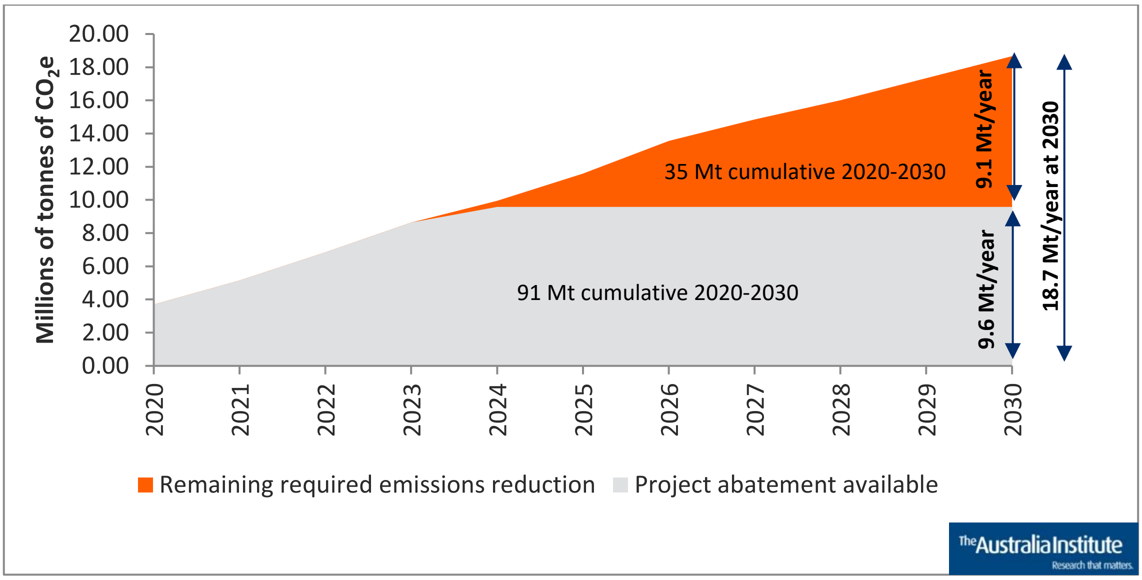
[19] Australian Government (2015) *Carbon Credits (Carbon Farming Initiative—Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton) Methodology Determination 2015,* https://www.legislation.gov.au/Details/F2015L00584

# Emissions targets vs reduction potential

Assuming that all, but only, the existing agricultural emissions reduction projects can be implemented in full, the agriculture sector would still be unable to meet its emissions reduction target. This is because the maximum reduction available from the projects identified by RepuTex is 9.6 Mt $CO_2$e per year but the required abatement per year becomes larger than this from 2024.

Figure 8 shows the agriculture sector's abatement task, as calculated in Figures 4 and 5, as well as the emissions reduction available with projects identified in the RepuTex data. It assumes that agriculture follows the Australia-wide trajectory to the 26% reduction by 2030 outlined in *Australia's emissions projections 2017.* It does this by incrementally adopting the projects identified by RepuTex until all agriculture projects have been implemented. Figure 8 shows that after 2024 the required annual abatement becomes larger than the annual abatement available from abatement projects.

**Figure 8 - Total agricultural sector abatement and project abatement**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

Assuming this steady pace of project implementation, the cumulative shortfall in emissions reduction from 2024 to 2030 is almost 36 Mt of $CO_2$e – the area between the curves in Figure 8. If all projects were implemented earlier, the shortfall would be smaller; if projects were not all implemented by 2024, the shortfall would be larger. The year this shortfall is largest is 9.1 Mt of $CO_2$e in 2030. This is the emissions reduction required in 2030 to meet the 26 per cent reduction target after all agricultural emissions reduction projects have been implemented.

Emissions reduction projects in the agricultural sector can reduce emissions without large cost to the sector. They are designed to change the way production happens so that less emissions are produced from the same amount of production. This is important because reduction projects should ideally allow the same amount of production with lower emissions.

# Abatement costs and projects from an economic perspective

If all agriculture emissions reduction projects identified are implemented, RepuTex estimate they would reduce emissions by a maximum of 9.6 million tonnes of $CO_2$e per year at an estimated cost from 2020 to 2030 of $1.8 billion. However, while these estimates may be accurate from an engineering perspective, from an economic perspective there appear to be unstated assumptions that need to be explored.

Many of the projects are estimated to have a “negative cost”, meaning that if farmers implement them they should actually save more money in energy efficiency than the project costs to implement. However, if a project truly is negative cost, economists would expect farmers to implement these projects without any form of policy intervention. The fact that these projects have not been implemented means either that there are hidden costs, risks, or that there is some aspect of market failure.

Examples of market failures that could affect emissions reduction projects are large upfront costs, a lack of information or expertise among farmers or the financial benefits are so uncertain that it is not worth the risk.

This paper assumes that the impediments to these projects occurring will be overcome without further cost. In practice, the government may have to pay incentives to farmers to convince them to adopt these projects or the government might have to fund some of these projects directly (the government might get some or all of its money back). None of this funding is included in the cost figures below, which should be seen as optimistic.

Furthermore, not all projects identified by RepuTex are at a commercial stage. If the agriculture sector is to reach at 26 per cent reduction by 2030 then many of these projects will need to come on line quickly. As explained below, all the projects will need to be up and running by 2024. This may not be possible with some of these projects.

To get the full emissions reduction of 9.6 Mt of $CO_2$e all projects would need to be fully implemented with the full emissions reduction achieved. This seems optimistic as some projects would cover a large number of producers, many of whom are small scale farmers. Compliance will need to be closely monitored to ensure full emissions reduction is realised. Recent reporting of compliance and enforcement in the Emissions Reduction Fund suggests compliance can be problematic.[20]

On the other hand, it is likely that new emissions reduction methods and technologies will be devised over the coming years. While these calculations do not factor in any technology change, it should be noted that any new projects will be experimental and in an earlier stage of development. They might take time before they can be commercially rolled out and the activity methodologies achieve accreditation (by the Clean Energy Regulator in order to generate carbon credits). This means that it is unlikely in the short term that total amount of emissions reduction possible from agricultural projects will be significantly greater than what is included in the RepuTex data. This is particularly the case because, as we will show below, all the projects will need to be implemented by 2024.

[20] See for example Hasham (2018) *'Serious questions' over whether Australia's emissions cuts are real*, https://www.smh.com.au/politics/federal/serious-questions-over-whether-australia-s-emissions-cuts-are-real-20180710-p4zqln.html

# Direct emissions reduction

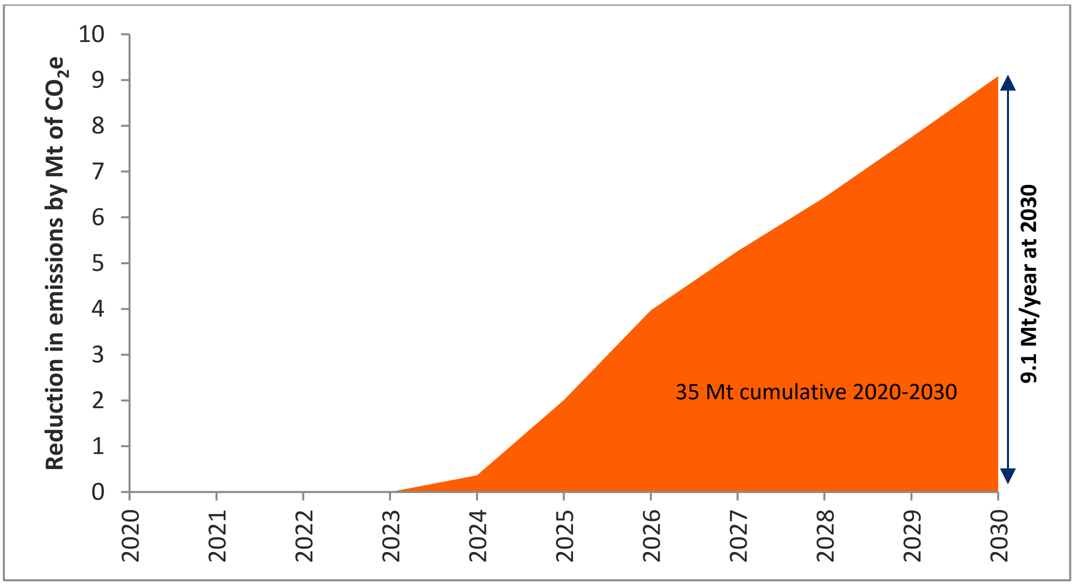
Emissions can also be reduced more directly by reducing production. In the agriculture sector emissions from production are mainly methane from animals. If the agricultural sector does not have enough emissions reduction projects then to meet its targets it will have to reduce its emissions by directly reducing production.

An important distinction is total emissions versus emissions intensity. The emissions reduction projects aim to improve emissions intensity. That is they aim to reduce the amount of emissions for each unit of output such as per kilogram carcass weight or fleece weight. This is a way of reducing emissions without reducing output.

While reducing emissions by reducing the emissions intensity of agriculture is the preferred way of reducing emissions, it is not the only way. Total emissions can be decreased by simply reducing overall production. This is a less desirable way of reducing emissions because the agricultural sector has a reduced income and consumers will have less agricultural produce to consume.

The agriculture sector would run out of emissions reduction projects by 2024, unless new abatement methods can be developed. This is the first year that the sector would have to start reducing production to reduce emissions. Figure 9 shows the emissions shortfall that would have to be made up by reductions in production.

**Figure 9 - Shortfall in emissions reduction after all projects fully implemented**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve – 2030*

# The cost of direct reductions

By 2030 the agriculture sector would have a shortfall of over 9 Mt of $CO_2$e or about 11 per cent of total agricultural emissions. To reduce emissions in the agricultural sector by this amount would require a significant reduction in agricultural output. If the sector was to reduce emissions in proportion to output then beef production would require the largest reduction in output, 4.7 Mt of $CO_2$e in 2030. This is the equivalent of 2.9 million fewer cattle from the current Australian herd of 23.6 million meat cattle – or, to put it another way, all the beef cattle in Victoria and South Australia put together.[21]

Sheep farming would require the second largest reduction in emissions, 1.7 Mt of $CO_2$e in 2030. This is equivalent to eight million fewer sheep, from the current Australian flock of 72.1 million. This reduction in sheep is almost double the number of sheep in Tasmania and Queensland put together (4.2 million). Dairy would need to reduce emissions by 1.1 Mt $Co_2$e, the equivalent to 290,000 cows, or all the dairy cows in NSW. Pig farming would need to reduce emissions by 0.2 Mt $CO_2$e (270,000 pigs).

The reduction in livestock is summarised in Table 1.

**Table 1 - Summary of emissions and livestock reduction by subsector**

| Livestock | Mt of $CO_2$e reduced | Reduction in livestock |
|---|---|---|
| **Beef (including grain fed beef)** | 4.7 | 2,900,000 |
| **Sheep** | 1.7 | 8,000,000 |
| **Dairy** | 1.1 | 290,000 |
| **Pig** | 0.2 | 270,000 |

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Source: Australian Bureau of Statistics (2018) *7121.0 - Agricultural Commodities, Australia, 2016-17* and Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

[21] Reductions in livestock have been calculated using Australian Bureau of Statistics (2018) *7121.0 - Agricultural Commodities, Australia, 2016-17* and reducing the numbers by the equivalent shortfall in emissions, which is 11.1 per cent. This should be considered the equivalent impact that would occur today. By 2030 livestock number would have increased and so the decrease in numbers would be larger.

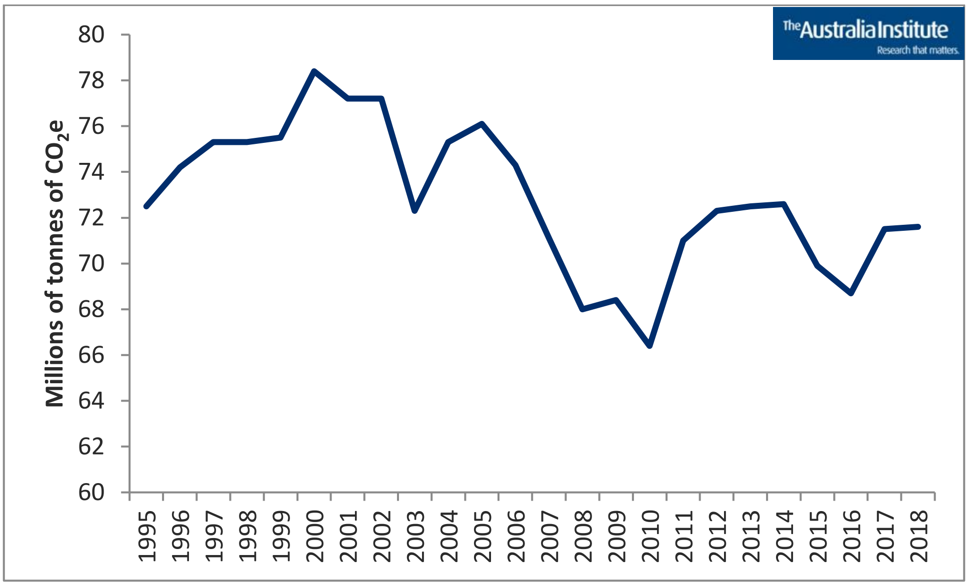
Livestock makes up about 85 per cent of emissions from agriculture. The remaining 15 per cent or 1.4 Mt of $CO_2e$ in 2030 would need to come from the other agriculture subsectors including crops, fertiliser and lime and urea. While reductions in these sectors are far smaller than those of the livestock sectors they will still cause significant reductions in output.

# Comparison to Millennium Drought fall in production

A good example of the agricultural sector reducing emissions because of a decrease in output occurred during the 2000s Millennium Drought. During the Millennium Drought total agriculture emissions fell because the drought conditions forced farmers to reduce the number of animals. Fewer animals meant fewer emissions.

The Millennium Drought was underway by the year 2000 and lasted, on and off until 2010. Agricultural emissions peaked in 2000 at 78 Mt of $Co_2e$ and fell 15 per cent to a low of 66 Mt of $CO_2e$ in 2010. The drop in agricultural emissions because of the Millennium Drought can be seen in Figure 10.

**Figure 10 - Agricultural emissions during the Millennium Drought (2000 to 2010)**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Note: The axis has been shortened to better show the impact of the Millennium Drought

Looked at another way, the agricultural sector would need to reduce its emissions in excess of emissions reduction projects in 2030 by 11 per cent. This is roughly equivalent to the impact of the Millennium Drought, which reduced emissions by 15 per cent.

# Conclusion

A sector by sector approach to emissions reduction will harm sectors that have few cheap sources of abatement. Reducing emissions by 26 per cent in the agricultural sector would come at significant cost. This does not need to be the case.

Sectors like electricity generation have commercially available, relatively cheap abatement projects. Additional abatement in these sectors above the 26 per cent target means that sectors like agriculture would have to do less. The more that electricity generation reduces emissions the less the agricultural sector needs to do.

Those who are concerned about the cost to the agricultural sector need to be concerned with the government's plans to reduce emissions on a sector by sector basis. They should also be concerned by the government's National Energy Guarantee if it locks in a 26 per cent reduction in the electricity sector. If the electricity sector does not reduce emissions beyond 26 per cent then other sectors, including agriculture, will have to do more.

The cheapest method to reach the Paris target is to judge a sector on how cheaply it can reduce its emissions, not on arbitrary sector by sector targets. Building walls between sectors will only increase the cost of reaching the Paris target.

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# Gorgon-tuan Problem

***Chevron's Gorgon LNG project released millions of tonnes CO2 last year that were meant to be sequestered by its carbon capture and storage (CCS) project. This failure represents half of the national increase in emissions over the last year. If required to offset these emissions, Gorgon would need to pay more than $55m million a year. However, Gorgon will face no penalties and is in line to receive $60m in taxpayer subsidy. Under the safeguard mechanism, it has an emission limit that assumes CCS is not operating.***

**Tom Swann**
**November 2018**

Australia's greenhouse gas emissions have increased for three years in a row. The Department of Energy and Environment's *National Greenhouse Gas Inventory Quarterly Update* for March 2018 says:

> Emissions for the year to March 2018 increased 1.3 per cent or 6.8 Mt $CO_2$-e. This increase was mainly driven by LNG production for export.[1]

LNG emissions come from stationary energy (gas used in LNG processing) and fugitives (release of $CO_2$ and methane). LNG also increases emissions from electricity, which is used in the extraction and transport of gas.

[1] Department of Energy and Environment (2018) *Environment's National Greenhouse Gas Inventory Quarterly Update - March 2018,* https://www.environment.gov.au/system/files/resources/63391569-7ffa-4395-b245-e53893158566/files/nggi-quarterly-update-mar-2018.pdf

The single largest source of LNG emissions is the Gorgon LNG Project off the North West of Western Australia. The main stake in the project is held by Chevron.

The gas in the Gorgon reservoir is relatively high in CO2. The Gorgon Project intends to sequester this CO2 with carbon capture and storage (CCS). The Gorgon LNG Project is often lauded as the CCS flagship project. For example, on ABC RN the CEO of the Minerals Council Tania Constable pointed to Gorgon as the largest CCS project in the world, when it starts in 2019.[2] Ms Constable did not explain that the Gorgon Project's CCS has failed for the past two years emitting millions of tonnes of CO2 that it promised to sequester.

Fugitive emissions from Gorgon are included in the National Greenhouse Gas Inventory.[3] They therefore make it harder to reach our emissions targets. The Government's emissions projections for future years include Gorgon CCS coming on "as currently scheduled" – presumably meaning as rescheduled for 2019, after two years of failure.[4] These projections will need to be adjusted further if there are further failures.

The Gorgon CCS project has CCS capacity of 3.4 to 4Mt per year.[5] Chevron previously estimated the Gorgon CCS project was to sequester between 5.5 and 7.8Mt of CO2 over the first two years of operation.[6] It is likely the emissions from the second year of operation would be larger than the first, as production ramps up. There have also been some issues with production, but it is unclear whether and by how much this has reduced fugitive emissions.[7]

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[2] ABC RN (2018) *RN Breakfast, Tania Constable, CEO of the MCA,* https://abcmedia.akamaized.net/rn/podcast/2018/10/bst_20181012_0816.mp3

[3] Senate Environment and Communications Committee (2018) *Question on Notice 162,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber162

[4] Senate Environment and Communications Committee (2018) *Question on Notice 164,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber164

[5] Global CCS Institute (2018) *Gorgon Carbon Dioxide Injection,* https://www.globalccsinstitute.com/projects/gorgon-carbon-dioxide-injection-project

[6] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant,* https://thewest.com.au/business/oil-gas/carbon-hiccup-for-chevron-with-5-million-tonne-greenhouse-gas-problem-at-gorgon-lng-plant-ng-b88694565z

[7] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant,*

In short, in a year when Australia's total emissions increased by 6.8Mt CO2, Chevron's failing Gorgon CCS project emitted up to 4Mt CO2. Gorgon's CCS failure so far represents a significant part, likely half or more, of Australia's emissions increase.

Chevron's fact sheet on the project not only ignores its failures to date, but further notes:

> The Australian Government has committed $60 million to the Gorgon Carbon Dioxide Injection Project as part of the Low Emissions Technology Demonstration Fund (LETDF).[8]

## Penalties for emitting millions of tonnes of CO2?

There is no federal requirement for Gorgon to sequester these emissions; it is not part of the federal approval.[9] As discussed below, Gorgon's emissions are subject to the safeguard mechanism, but Chevron has set itself an emissions limit that does not assume CCS operates successfully.

The WA Government approval for Gorgon requires it to sequester at least 80% of its fugitive emissions over a five year period. It is unclear how this is now possible and purchasing offsets to meet this target would cost tens of millions of dollars.

The WA Government has decided not to impose penalties, citing uncertainty about the meaning of "commencement of operations".

Failing to follow through on compliance through requiring offsets not only increases emissions sets a precedent that undermines the force of such obligations in the future.[10]

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[8] Chevron (2018) *Gorgon carbon dioxide injection project*, https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf

[9] Senate Environment and Communications Committee (2018) *Question on Notice 163,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber163

[10] Diss (2018) *How the Gorgon gas plant could wipe out a year's worth of Australia's solar emissions savings,* https://www.abc.net.au/news/2018-06-21/gorgon-gas-plant-wiping-out-a-year-of-solar-emission-savings/9890386

On 17 October 2018, the WA Government gave Chevron "the benefit of the doubt", saying they would revisit the question of offsets if the CCS was not working in "six months or a year's time".[11]

The Federal Government indemnified the Western Australian Government over long term risks from CO2 leaks from Gorgon. This appears in every federal budget as a 'contingent liability'.[12]

## Safeguard mechanism?

Gorgon is covered by the Commonwealth Government's safeguard mechanism. This policy is intended to limit emissions increases from large industrial and extractive facilities in Australia. Every facility has 'baseline', or emissions limit. Companies with facilities that breach their limit may need to buy offsets to cover the breach.

Gorgon's emissions limit is a 'calculated baseline' based on Chevron's projection of emissions from the project.[13] Specifically, the limit is set at the emissions projected by Chevron for the year of highest production (of LNG) in the first five years of operation.

The emissions limit for 'Gorgon Operations' is set at 8.3Mt CO2-e per year.[14] 'Gorgon Upstream' and 'Gorgon Downstream' are listed as separate facilities with their own much smaller limits, together bringing Gorgon's *total* emissions limit to 8.7Mt per year.

It is unclear when the projections used to set Gorgon's emission limit assume CCS will be operational. The Clean Energy Regulator says all details of the projection are confidential.[15] However it appears the Gorgon emissions limit does not include operational CCS.

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[11] Milne (2018) *Chevron Gets Lifeline on Delayed Gorgon Capture,* https://thewest.com.au/business/energy/chevron-gets-lifeline-on-delayed-gorgon-carbon-capture-ng-b88992451z

[12] Senate Environment and Communications Committee (2018) *Question on Notice 164,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId3-EstimatesRoundId3-PortfolioId17-QuestionNumber164

[13] A calculated baseline is the projected emissions in the year of projected highest production (of LNG) in its first five years of operation:
CER (2018) *Calculated Baseline,* http://www.cleanenergyregulator.gov.au/NGER/The-safeguard-mechanism/Baselines/Calculated-baseline

[14] CER (2018) *Safeguard baselines table,* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Safeguard-baselines-table#Safeguard-baselines-table

[15] CER Personal communication.

Chevron says CCS will reduce the project's emissions by around 40%:

> The Project plans to inject between 3.4 and 4 million tonnes of reservoir CO2 each year. This will reduce greenhouse gas emissions from the Gorgon Project by approximately 40 percent. [16]

It is unclear whether this refers to peak production, or is averaged over the life of the project. At any rate, we can infer the (average or peak) total CO2 emissions *before* CCS are 8.5 to 10Mt per year, and the CO2 emissions *after* CCS are at 5.1 to 6Mt per year. Since the emissions limit for the project is 8.7Mt, or 8.3Mt just for Gorgon Operations, it appears Chevron's emissions limit is based on a year where CCS is not operating.

Despite Chevron's emphasis on CCS at Gorgon, it has set an emissions limit that does not include CCS being operational. Gorgon will face no penalty for this failure under the safeguard mechanism.

If Gorgon's CCS had been projected as operational from the beginning, the baseline would have been set at a level assuming CCS operates. It therefore would have imposed an obligation if CCS failed.

All details about Chevron's projection are confidential. We cannot even find out what date Chevron applied for the limit.[17] However it appears to be late 2017, after Gorgon had operated for a year without CCS and as production continued to ramp up.

Gorgon's emissions limit was as 'updated' in November 2017[18] and the Clean Energy Regulator advised this was Chevron's first emissions limit.[19] The last deadline to submit that limit was 31 October 2017.[20] In December 2017, Chevron reported to the WA Government that Gorgon's CCS would be delayed again.[21] If Chevron submitted its limit in late 2017, it likely knew at the time that CCS would not be operational soon.

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[16] Chevron (2018) Gorgon carbon dioxide injection project, https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf

[17] CER Personal communication.

[18] Table updated in November for Gorgon Operations, projections lodged beforehand. CER (2018) *Safeguard baselines table* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Safeguard-baselines-table#Safeguard-baselines-table

[19] Prior to this it had the default baseline of 100,000 tonnes CO2e.

[20] CER Personal communication

[21] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant* https://thewest.com.au/business/oil-gas/carbon-hiccup-for-chevron-with-5-million-tonne-greenhouse-gas-problem-at-gorgon-lng-plant-ng-b88694565z

Moreover, this was during the ramp up of production. LNG production started in March 2016, ramping up in October 2016 and again in March 2017.[22] The 2017-18 year would have been projected as having higher production and it appears it, or a later year, was projected assuming CCS was not operational.

If CCS does not become operational Chevron may still be at risk of breaching the safeguard mechanism. Chevron reports that 'Gorgon Operations' emitted 7.7Mt CO2-e in 2016-17.[23] The emissions limit was 8.3Mt. So during the ramp-up of production, Gorgon came within 0.6Mt of hitting its limit under the safeguard mechanism. Emissions are likely to be higher in 2017-18, with increased production.

Facilities that breach their emissions limit may be required to purchase offsets. This can be avoided however if they can bring down emissions in future year to keep the three year average below the emissions limit.

## Cost of offsetting Gorgon's failing CCS

If Gorgon were required to offset the emissions it did not sequester, it might do this by purchasing Australian Carbon Credit Units (ACCUs).

The average price of ACCUs following the sixth government auction in December 2017 was $13.08. Offsetting 4Mt of CO2 at this price would cost $52 million. It would likely cost Gorgon more as lower cost abatement options are generally exhausted first.

If CCS continues to fail while the world and Australia takes action in line with the Paris Agreement, the cost of offsetting could be ten times greater. This is according to the projected carbon price in such a scenario put forward by the Climate Change Authority.[24]

## Conclusion

Despite being widely lauded as a success story for CCS, the Gorgon LNG Project has failed to sequester CO2 as promised over its first two years. This has led to millions of

[22] WA DJTSI (2018) *WA Liquefied Natural Gas Industry Profile* https://www.jtsi.wa.gov.au/docs/default-source/default-document-library/wa-lng-profile-0218.pdf?sfvrsn=8

[23] Gorgon Upstream and Downstream are listed as separate facilities with far smaller emissions limits. CER (2018) *2016-17 Safeguard facility reported emissions,* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/safeguard-facility-reported-emissions/safeguard-facility-emissions-2016-17

[24] See Ogge (2018) *NT Options for the implementation of Recommendation 9.8 of NT Fracking Inquiry* http://www.tai.org.au/sites/default/files/P637%20NT%20offset%20paper%20%5BWEB%5D_0.pdf

tonnes of additional emissions, likely at least half as large as the increase in national emissions last year. Chevron will not however face a penalty for this. It does not face penalties for breaching its Western Australian approval, and the WA government remains ambiguous about when it would require Chevron to purchase offsets. It has set an emissions limit for itself under the safeguard mechanism that does not include operational CCS.

# Offset Upset

## The WA EPA’s climate offset requirements and the LNG backlash

***WA LNG projects are pushing up Australia’s emissions. The EPA recommended offsets to stop emissions rising. Contrary to industry claims, FOI documents show the EPA consulted with industry who opposed offsets.***

***Gas companies can afford to buy offsets at very small shares of their profits. They already use internal carbon prices, which they should disclose.***

***A large expansion in gas exports is not consistent with solving climate change. If approved, new projects should offset exported emissions or ensure exported gas is burned under climate policies consistent with Paris Agreement goals.***

Submission

**Tom Swann**

**Audrey Quicke**

**September 2019**

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# Summary

Australia's emissions are rising, not falling, because there is no credible national climate and energy policy. Western Australia (WA) is the only state where greenhouse gas emissions have increased over the past decade, largely due to large expansions in the emissions intensive production and export of Liquified Natural Gas (LNG).

In the absence of a climate policy, further increases in LNG exports will only further increase Australia's emissions and further damage the climate.

This was the situation confronting the WA Environmental Protection Authority (EPA) earlier this year.

On 7 March 2019, the EPA published comprehensive guidelines under which it would recommend that high emitting new project be required to purchase offsets (pay a price) for all direct emissions. The backlash from the gas industry resulted in the WA Premier taking heed of industry's concerns and soon after the EPA taking the unprecedented move of withdrawing the guidelines and putting them out for further consultation.

Gas companies and their industry groups claimed the guidelines were ad hoc, were not given due consultation, went far beyond requirements under the Paris Agreement, and would have severe negative economic impacts in particular on employment.

This report shows these are all inaccurate, and in the latter case irrelevant to EPA consideration.

One week before the EPA's consultation finished, the WA Government announced a new aspirational 2050 net-zero emissions target. This target is empty without policies to prevent new projects from increasing emissions. The timing of the new policy also raises further questions about how gas industry pressure on the government has lead the WA Government to pressure the EPA.

The EPA is an independent advisory body that must by law consider and make recommendations based on environmental science. Contrary to industry and government claims, its decisions are not to be based on economic factors. The pressure on the EPA threatens its independence and sets yet another alarming precedent threatening the future of science-based policy in WA and across Australia.

FOI documents released to The Australia Institute show the EPA did consult as required with industry groups via its stakeholder reference group. Months before finalising the guidelines, the EPA told the group it was concerned about rising emissions in the lack of policy, and that its offset expectations would be increased. Industry group submissions to the consultations objected to offsetting, in particular on the basis of cost. Conservation groups gave detailed environmental and legal evidence and arguments that projects must not be allowed to increase emissions – either through

offsetting, or rejection of approvals. The EPA then told the stakeholder reference group it was likely to require full offsetting for scope 1 emissions, one week in advance of releasing the policy.

Documents tabled in WA Parliament show the WA Department of Water and Energy Regulation (DWER) was also told of the offset requirements in advance of publication, as was the respective Minister at least two weeks in advance. The advice to the Minister was that the cost of offsetting was “likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment”.

LNG companies are already planning to pay for their emissions by using ‘shadow carbon prices’ in their investment decisions. This includes Woodside, who use prices

> “that reflect our expectations of future carbon prices. These vary over time and jurisdiction. We also use include high and low sensitivities to test major decisions, with the high sensitivity reflecting our understanding of a 2°C scenario.”

Carbon pricing is both widely used and widely understood. Even the Australian Petroleum Production & Exploration Association (APPEA),  has suggested projects only be approved if they are assessed using a carbon price.

However while some companies do disclose these prices, WA LNG companies Woodside and Chevron do not. The EPA should ask them to do so as part of their assessment. Proponents should be required to demonstrate the role of the project in scenarios consistent with a 1.5-2°C warming under the Paris Agreement. Since Woodside already does this analysis, such disclosure should not be difficult.

While WA LNG projects are a major and increasing source of domestic emissions, the projects are by the company’s own claims very profitable, and so well able to pay to offset those emissions. Offsets at current prices would cost Woodside 1.1% of ‘gross margins’ at Pluto and 1.5% of gross margins at North West Shelf. For Chevron’s Gorgon and Wheatstone projects, current prices would see offsets cost 2.6% of ‘cash margins’. These offset cost estimates were validated by the WA DWER. Even using Shell’s shadow carbon price of US$40 per tonne of $CO_2e$, offsets would cost Woodside 4.6% of Pluto’s margins and 6.2% of North-West Shelf’s margins.

Woodside is currently proposing to extend, expand and link the Pluto and North West Shelf LNG projects to develop the Browse and Scarborough fields. The emissions from the projects will be larger than emissions from the existing operations at the LNG plants. Given the projects will use existing infrastructure is therefore reasonable to assume the margins enjoyed on these projects will be similar to if not lower than those enjoyed on the existing NWS LNG project, and the cost of offsetting is likely to be similarly small by comparison.

A key question raised by the EPA in its recent consultation is whether it should assess and put conditions on scope 3 exported emissions. After decades of fossil fuel companies trying to disown responsibility for exported emissions, it is surprising to see the gas industry seek to use scope 3 arguments to justify increased emissions in Australia.

The gas industry and government supporters are fond of saying that exporting more gas “can” reduce emissions by displacing coal. But the fact that gas power is cleaner than coal power has little bearing on whether extracting and exporting more gas results in less coal being burnt. On the contrary, more gas risks displacing zero carbon energy investment required to meet the goals of the Paris Agreement. More gas supply and gas infrastructure locks in more gas use for longer.

While the gas industry usually gives no evidence of its coal to gas claims, when it does it usually points to the International Energy Agency (IEA). A closer look at the IEA’s reports and data shows global gas consumption expands only in scenarios where the Paris Agreement fails to meet its goal. The preferred scenario is the Sustainable Development Scenario (SDS), which delivers economic growth, universal energy access, and rapid decarbonisation. The SDS sees emissions from gas fall out to 2040. Current approved supply is sufficient to meet demand in the short term. Gas production globally increases by a small amount in the short term, then declines again to 2040.

The gas industry cites approvingly a recent IEA report on gas. That report shows coal to gas switching has played a very small role in abatement relative to baseline in China, the US, EU and India. More abatement was from renewables and “structural economic changes and efficiency” than displacement from gas. The IEA says there is abatement potential from more gas generation at existing power stations, but emphasises this needs regulation and does not support new gas generation.

As the IEA warns, new infrastructure locks in future emissions. New fossil fuel infrastructure now makes environmental outcomes more difficult and costly to achieve. Recent studies published in *Nature* examined the stock of fossil fuel infrastructure globally finding locked in emissions from existing infrastructure exhausts the 1.5C carbon budget and most of the 2C budget. As the Intergovernmental Panel on Climate Change recently showed, the peer reviewed literature requires gas consumption not to increase or to fall out to 2030 and then decline dramatically to 2050.

A simple way to prevent environmental damage from scope 3 emissions from LNG projects is to not allow them to be built. However scope 3 emissions could be managed through conditions on the approvals. The EPA could implement export management plans so that gas is only exported to countries with an emissions cap or price or other policies that ensure any gas does displace coal, does not lock in new long-term emissions, and is in line with the goals of the Paris Agreement. Alternatively, the EPA could require projects to fully offset their scope 3 emissions or pay a levy on exported emissions that could fund domestic mitigation. This could be adjusted so that it applies only where and to the extent that customer countries do not have appropriate mitigation policies in place.

There are risks and costs associated with offsetting that must be considered. If the offsets do not work, then Australia's emissions will increase. The policy of allowing LNG expansion even if offset is still a risk to Australia's emissions targets. The project proponents should be made responsible for this risk, not the government. Moreover, policies used to offset WA LNG emissions cannot also be used to reduce Australia's emissions. If companies get access to lower cost abatement options to offset LNG emissions, this may increase the cost of reducing Australia's emissions.

If, however, the EPA is to approve large increases in emissions in the absence of effective climate policy, the EPA it must ensure they are fully offset.

# Introduction

Australia's emissions are rising, not falling, because there is no credible national climate policy. Australia will not meet its current Paris Agreement targets, according to Australian Government projections, despite an essential objective of the Agreement being a commitment to increase national ambition.

In this context, state governments and authorities must act to reduce emissions. Acting now reduces both environmental damage and the economic costs of later action.

WA is the only state where emissions have increased over the past decade mainly due to increasing production and export of Liquified Natural Gas (LNG). WA accounts for most of Australia's LNG exports and most of the increase in recent years. LNG is very emissions intensive to produce, so as LNG exports from WA have increased so too have WA emissions. In the absence of a climate policy, further increases in LNG exports will further increase Australia's emissions and further damage the climate.

This was the situation confronting the West Australian Environmental Protection Authority (EPA) earlier this year. The EPA is responsible for independently assessing the environmental impacts of projects in WA and recommending measures to mitigate those impacts. The EPA considered the increasingly concerning climate science, WA's rising emissions and the lack of federal climate policy.

On 7 March 2019, the EPA published comprehensive guidelines for how it would assess projects, including the *Technical Guidance- Mitigating Greenhouse Gas Emissions* (the Technical Guidance).[1] New and expanding projects with direct emissions of more than 100,000 tonnes of CO2e a year would be required to fully offset all those emissions.

The backlash from the gas industry was immediate and fierce. Lobby groups and companies complained about lack of consultation and threats of job losses. They met with the WA Premier in Parliament House. They launched paid advertising campaigns. Swayed by this reaction, the Premier and the Federal Ministers also criticised the EPA. Just one week later, on March 14, the EPA took the Technical Guidance off its website and began a new public consultation. [2]

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[1] WA EPA (2019) *Technical Guidance- Mitigating Greenhouse Gas Emissions* (withdrawn 14 March).

[2] WA EPA (2019) *Greenhouse gas emissions assessment Technical Guidance- consultation* http://www.epa.wa.gov.au/pages/greenhouse-gas-emissions-assessment-Technical Guidance-consultation

This report examines the key claims put forward by the industry during its backlash, and the debate that has followed. Gas companies and their industry groups claimed the guidelines were ad hoc, were not given due consultation, went far beyond requirements under Paris, and would have severe negative economic impacts, in particular on employment.

As this report argues, the former claims are inaccurate, and the latter claim is both inaccurate and irrelevant to the EPA's statutory role.

Over the past year, and in response to the EPA's latest round of consultation, gas companies and federal government ministers have argued that increased LNG emissions are justified by the coal power being displaced overseas. The industry should therefore be comfortable with regulation on that basis. The report examines the evidence for their claims.

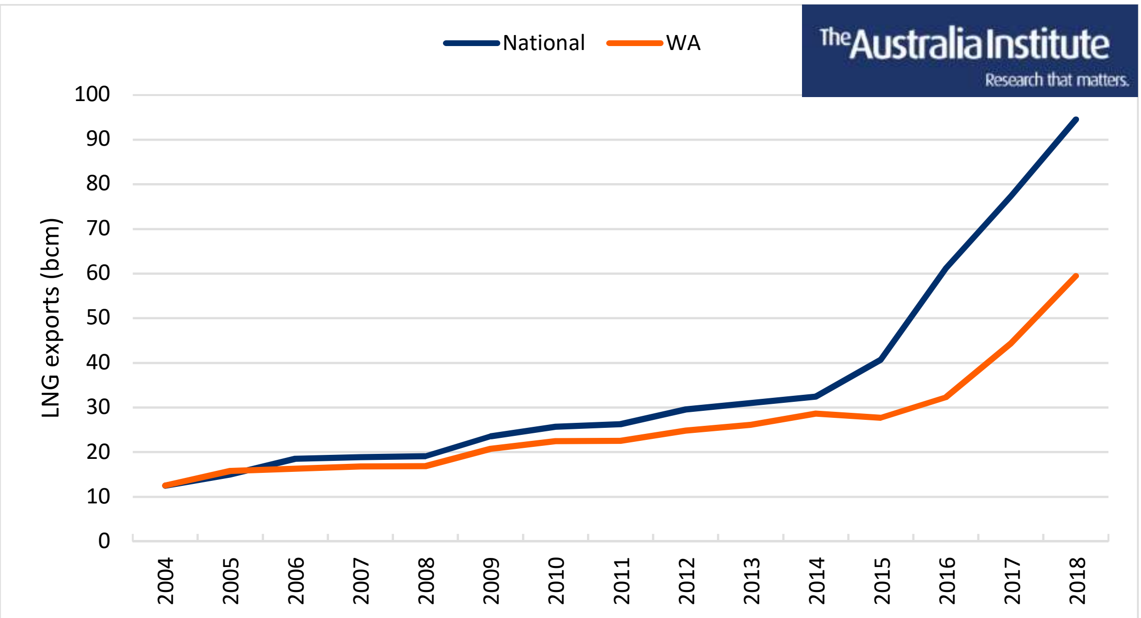
# WA LNG pushing up emissions

Australia is the world's largest exporter of LNG and WA is Australia's biggest producer of LNG.[3] While emissions in all other Australian states are declining, emissions in WA are increasing, due to the large increase in LNG production and export out of WA.

Extracting and exporting LNG is very emissions intensive, including gas leakage, vented CO2, flaring and energy-intensive processing. LNG also produces emissions when burnt overseas and while these emissions are not traditionally counted as Australian emissions, they are significant and cause damage.

Most Australian LNG exports are from Western Australia (WA) which has also been responsible for most of the national growth. Further WA LNG projects are under consideration.

**Figure 1: LNG Exports – National and WA**




Source: National year to December from DEE (2019) *National Greenhouse Gas Inventory Quarterly Update March 2019*, Figure 9; WA from WA DMIRS (2018) *2018 Major commodities resources file*, tonnes to bcm with BP conversion factors.

As large emitters (over 100,000 tCO2e per year), LNG facilities are subject to the national safeguard mechanism. This mechanism was ostensibly introduced to prevent

[3] Western Australian Department of Jobs, Tourism, Science and Innovation (2019) *Oil and Gas.* https://www.jtsi.wa.gov.au/invest-in-wa/sector/resource-services/oil-gas

emissions across the economy from increasing, despite government purchases of abatement through the Emission Reduction Fund (ERF), now rebranded the Climate Solutions Fund (CSF). However, the safeguard mechanism allows new high emitting facilities to be built and allowed existing high emitting facilities to increase their emissions.

The Gorgon LNG plant has been granted an emission limit that assumes its carbon capture and storage (CCS) project does not work; Gorgon's multi-year failure to meet the legal obligation to operate CCS has resulted in emissions equivalent to half of Australia's 2018 emissions growth.[4]

Without a credible emissions policy, new LNG projects will push Australia's emissions further up, rather than down, cause more environmental damage, and undermine future efforts to reduce that damage.

## NEW WA POLICY STATEMENT INADEQUATE

The WA Government recently announced an 'aspirational' target of net zero emissions by 2050.[5]

Meeting such targets is necessary to align with the global goals of the Paris Agreement. It is not however sufficient. The new target is empty without a credible policy to prevent emissions from increasing.

Greenhouse gases are a stock pollutant. What matters is accumulated emissions over time. A net zero target means little if emissions are allowed to increase.

In its new policy statement, the WA government says it will require new high emitting projects to set out plans to mitigate their emissions. This is already required under EPA assessment. The EPA has a long-established mitigation hierarchy including offsets. The new guidelines merely changed the level of mitigation expected.

The WA government document gives little information on what mitigation will be required. It does not say if the government will prevent new projects from increasing WA and Australia's emissions.

Approving new LNG projects without full emissions mitigation will push emissions up rather than down. Given the lack of credible policy, this is not environmentally sound.

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[4] Swann (2018) *Gorgon-tuan-problem.* http://www.tai.org.au/content/gorgon-tuan-problem

[5] Hon Bill Johnston (2019) Media Statements, *State Government details emissions policy for major projects*. https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/08/State-Government-details-emissions-policy-for-major-projects.aspx

# EPA independence undermined

The WA EPA provides independent, science-based advice to the West Australian government, in particular through principled assessment of development proposals.

That is precisely what the EPA was doing in drafting the GHG Technical Guidance.

The WA EPA is established under the *Environmental Protection Act 1986* (WA) (The EPA Act) as an independent body that assesses the environmental impacts of development proposals and provides advice and recommendations to the Minister for Environment.[6]

The WA EPA provides advice but has no approval power. That resides with the Minister for Environment who, in accordance with the EPA Act must consider the EPA's independent environmental advice and recommendations along with economic, commercial and social factors.

The WA EPA is required to consider only environmental factors. Its Act gives it no power to consider non-environmental factors, including economic considerations, in themselves. This was expressly stated by the Western Australian Supreme Court in the case of *Coastal Waters Alliance* (1996), where it held the EPA could not weigh environmental against economic and commercial considerations.[7] Justice Rowland stated:

> "An overview of the [EPA] Act would seem to confirm that there is some limit to the powers of the Environmental Protection Authority. There is nothing in s 17 which sets out the Environmental Protection Authority powers which would indicate a function that its advice is to be given on other than "environmental matters" in that s l7(3)(b), in particular, so limits the matter."[8]

As the detrimental effects of GHG emissions on WA's environment have been clearly established, under the EPA's governance framework it is proper and indeed necessary for the EPA to consider and seek to mitigate these emissions.

It is expressly *not* within their governance framework to balance environmental against economic impacts of requiring emissions to be offset.

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[6] EDO (WA), Media Release, 14 March 2019.http://www.edowa.org.au/2019/03/14/media-release-edowas-response-to-epa-Technical Guidance-on-greenhouse-gas-emissions/

[7] *Coastal Waters Alliance of Western Australia Incorporated* (1996) 90(2) LGRA 136.

[8] Rowland J, *Coastal Waters Alliance of Western Australia Incorporated* (1996) 90(2) LGRA 136, 151 p2.

The backlash to the GHG Technical Guidance demonstrated widespread misunderstanding of the EPA's statutory obligations. APPEA complained the EPA "has not considered the social or economic impact of its guidelines".[9] Even Premier Mark McGowan flagged threats to jobs as a major criticism of the Technical Guidance. [10]

The EPA may consider economic factors *in so far* as they relate to the environment and measures to protect the environment. But industry complaints went far beyond this and so were inconsistent with their legal role.

The removal of a WA EPA policy from the EPA website pending industry consultation is unprecedented.[11] EPA chair, Dr Hatton indicated this is the first time West Australian EPA guidelines have been published after consultation with the Stakeholder Reference Group, only to be withdrawn pending further consultation.[12]

It threatens the independence of the EPA and sets yet another alarming precedent threatening the future of science-based policy in WA and across Australia.

[9] Dr Malcolm Roberts (APPEA Chief Executive) (2019) *Media Release: WA EPA Guidelines put investment at risk*. https://www.appea.com.au/media_release/wa-epa-guidelines-put-investment-at-risk/

[10] Elicia Kennedy et al (2019) *WA Premier Mark McGowan arracks EPA guidelines aimed at cutting carbon emissions* https://www.abc.net.au/news/2019-03-08/mark-mcgowan-attacks-epa-carbon-emissions-policy/10882946

[11] Tom Hatton (2019)*Greenhouse gas emissions- Where to from here in WA?* ABC https://www.abc.net.au/radio/perth/programs/focus/epa/10912410

[12] Ibid.

# FOI shows EPA consultation

Gas companies and lobby groups claim the Technical Guidance was produced without adequate consultation, warning or rationale. APPEA described the Guidance as "ad-hoc".[13] Premier Mark McGowan echoed their views:

> "They [industry] indicated they thought the consultation in relation to the Technical Guidance was not sufficient and they were not given sufficient opportunity to provide their views on the policy that was ultimately released."[14]

The WA EPA is required to consult with stakeholders over proposed changes to its policies and guidelines. For this purpose the EPA consults with an EPA 'Stakeholder Reference Group' (SRG).[15]

The SRG includes multiple industry groups representing the resource sector, including

- the Australian Petroleum Production and Exploration Association (APPEA),
- the Association of Mining and Exploration Companies (AMEC),
- and the Chamber of Minerals and Energy (CME).

The SRG also includes the West Australian Local Government Association (WALGA) and conservation organisations.

Given consultation is required and established practice for the EPA, it would have been unusual if the EPA had not consulted, as the gas companies claimed.

## CONSULTATION WITH STAKEHOLDERS

The Australia Institute requested the documents sent between the EPA and SRG members over this matter under Freedom of Information (FOI) laws. After delays, the Department processing the request released most of the requested documents.

[13] APPEA (2019) WA EPA Technical Guidelines put investment at risk, https://www.appea.com.au/media_release/wa-epa-guidelines-put-investment-at-risk/
[14] Mercer and de Kruijff (2019) *Industry carbon emissions guidelines,* The West Australian. https://thewest.com.au/news/environment/epa-bows-to-pressure-withdraws-indsutry-carbon-emissions-guidelines-ng-b881135984z
[15] EPA (2019) *Stakeholder Reference Group- Terms of Reference.* http://www.epa.wa.gov.au/stakeholder-reference-group-terms-reference

APPEA objected to release of their submission, which was curious given industry complaints about alleged EPA secrecy. However APPEA later released this document, as part of their new public submission to the new EPA consultation.

The documents confirm that the EPA did indeed consult with SRG, including the industry groups for the gas and other resource companies. This is outlined in Table 1.

**Table 1: FOI documents: EPA Consultation over emissions guidance and offsets**

| Date | Events |
|---|---|
| **21 Nov 2018** | **EPA SRG Meeting No 47.** EPA tells SRG members they will soon receive a draft copy of the EPA's new *Technical Guidance on GHG Emissions.* EPA explains the elements of the new Technical Guidance will include offsetting provisions and the EPA's expectations will be higher than in previous versions.[16] |
| **21 Jan 2019** | **CME submission:** opposes state-based offset programs. |
| **1 Feb** | **AMEC submission:** offsets will be a major additional impost on proponents. **APPEA submission**: four sentences on offsets; should not be required "over and above any national emissions reduction approach". |
| **4 Feb** | **WALGA submission**: if offsetting cannot be implemented to prevent emissions from rising, projects should *not* be approved. |
| **6 Feb** | **Conservation NGOs submission:** includes detailed legal and environmental argument supporting rejecting proposals or requiring full emissions offsetting. |
| **27 Feb** | **SRG Meeting No 48.** The EPA updates the SRG that, as a result of submissions, the EPA has clarified offset requirements: the EPA will recommend offsets for all residual scope 1 emissions. |
| **7 Mar** | **EPA publishes** *Draft Technical Guidance* on their website. They require offsets for all residual scope 1 emissions. |
| **7-13 March** | **Industry backlash**, including advertising campaigns and industry meetings with the Premier, who criticises the EPA. |
| **14 Mar** | **EPA withdraws** *Draft Technical Guidance*, pending further consultation. |

Source: documents from WA EPA released under FOI to The Australia Institute, media reports.

[16] FOI (2019) DN 2_SRG meeting, p7.

In November 2018 the EPA Chairman met with the SRG. The minutes record the following:

**Figure 2: Minutes of EPA meeting with stakeholder reference group November 2018**

**7. Air Quality Environmental Factor Guideline and Technical Guidance – Greenhouse Gas (GHG) Emissions**

The EPA Chairman noted that:

- SRG members will soon receive a draft copy of the EPA's Air Quality Environmental Factor Guideline (revised) and Technical Guidance on GHG Emissions (new) which set out how GHG emissions will be considered by the EPA;
- In its preparation, the EPA has considered advice from the Climate Change Unit of the Department of Water and Environmental Regulation, and has also taken into account that Australia appears unlikely to meet its GHG emissions commitments in 2030, particularly given the projects in WA;
- The elements of the new technical guidance will be familiar to members (benchmarking, continuous improvement, offsetting), but the EPA's expectations will be better defined and will be higher;
- SRG members are asked to provide comments on the draft documents, prior to finalisation by the EPA early in 2019;
- SRG Members were also asked to consider the draft documents under embargo until finalised and published by the EPA.

Source: FOI, SN 2_SRF meeting 21 Nov, highlight added

The minutes show the EPA told the SRG it was acting on WA projects pushing up emissions, that there would be new guidance, it would include offsetting and that the expectations would be better defined and higher than previous. AMEC was present, CME was an apology and APPEA is not listed. All members of the SRG were sent the minutes.

January 2019, SRG members were provided with Draft Technical Guidance.[17] It said;

> "The EPA will consider carbon offset proposals with the capacity to make very large contributions to the State's emissions. In particular, offsets will be considered for those emissions not likely to be addressed by adoption of best practice technologies. …
>
> The EPA notes that offset requirements are prescriptive, and likely to be non-complementary to a broad-based market mechanism such as a carbon price or 'cap and trade' emissions trading scheme. Until emissions from proposals are covered in this manner, offsets will continue to be considered where relevant and appropriate."[18]

[17] FOI (2019) D4_CME feedback.
[18] FOI (2019) D10_Draft Guidelines, p 7-8.

From February 2019, SRG members provided the EPA with their submissions on the Draft Technical Guidance, including feedback on GHG offsetting.

APPEA, CME and AMEC all commented directly on the offsetting provisions of the Draft Technical Guidance. All raised concerns about offsets although with limited argument.

APPEA for example provides only four sentences on offsets almost as an afterthought at the end of its submission. While offsets "provide a potentially important way to reduce emissions", they should not be required "over and above any national emissions reduction approach".[19]

But this is consistent with what the EPA proposed. The EPA proposed offsets because there is no national or indeed state emissions reduction approach. The EPA's proposal, to which APPEA was responding, made explicit offsets were not complementary to a carbon price or cap and would only be required "Until emissions from proposals are covered in this manner".

Bizarrely, the APPEA submission also pleads that "the level of emissions from a facility may be influenced by many factors outside of the control of facility proponent".[20] Plainly, a proponent is primarily responsible for the existence of the facility. Under the EPA Act, the EPA must pursue "the polluter pays principle — those who generate pollution and waste should bear the cost of containment, avoidance or abatement."[21]

A range of more detailed submissions from conservation groups provides extensive environmental and legal arguments in support of offsets. Submissions from the WA EDO point to the *Gloucester Resources (2019)* judgement in which the Chief Justice of the NSW Land and Environment Court rejected a mine proposal on grounds that emissions from the exported coal would cause climate change by undermining the Paris goal of 'net zero emissions'.

On 20 February 2018, SRG members were told they would soon receive a draft of the new Technical Guidance. They were again told the elements would:

> "be familiar to members (benchmarking, continuous improvement, offsetting), but the EPA's expectations will be better defined and will be higher."[22]

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[19] APPEA (2019) *SRG Submission to WA EPA*. https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-–-CONSULTATION-APPEA-Submission.pdf p 16.

[20] Ibid.

[21] *Environmental Protection Act* 1986 (WA) s 4A- Objects and principles of Act

[22] FOI (2019) DN 16_Email EPA to SRG, SRG Agenda notes, p6.

At a meeting on 27 February, the EPA provided the SRG with an account of the Draft Technical Guidelines. The minutes show the EPA made clear they will "likely recommend offsets for all residual (after avoid/reduce) scope 1 emissions from a facility".[23]

**Figure 3: Minutes from EPA stakeholder meeting, 27 Feb 2019**

- Provided clarity on the degree to which the EPA will advise on offsets; specifically, the EPA will likely recommend offsets for all residual (after avoid/reduce) scope 1 emissions from a facility; the EPA will expect the offsets to be legitimate and will encourage the development to achieve those offsets in WA, recognising that because these emissions affect us through a global process, they could be achieved anywhere on the planet and have the same effect in terms of climate. The EPA understands the significant impost that this advice places on industry, but the objective of the Authority is to use its best endeavours to protect the environment and it is the Government's role to consider social and economic factors. The EPA advice will apply to all new projects and changed projects, recognising the need for a transition phase to give proponents time to develop plans.

Source: FOI DN 1_SRG meeting 27 Feb

The documents released under FOI clearly show the EPA consulted with LNG industry representative groups and told them about potential offsetting requirements months before the Technical Guidance was published. The industry groups were made aware that the requirements would apply to the whole of a project's emissions more than a week prior to the Technical Guidance being published.

The EPA was persuaded by environmental evidence and performed its legal duty.

The gas companies that criticised the EPA appear not to have criticised their own industry groups for their performance in the consultation process.

# INFORMING GOVERNMENT

Documents tabled in WA Parliament show the EPA also informed the Department and Minister about the Guidelines.[24]

Advice to the Minister on 20 February regarding the EPA offset requirements, noted that there would be costs "broadly consistent with the internal carbon price such

[23] FOI (2019) DN_SRG meeting 27 feb, p5.
[24] WA DWER (2019) *Tabled Paper No. 2783* http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

organisations are using for business risk assessment purposes" and would include potential "environmental and economic co-benefits for the State".[25]

**Figure 4: Advice to WA Environment Minister, 20 February 2019**

The EPA's revised approach to offsets may place significant burden on proponents, with proposed requirements to offset all residual direct (scope 1) emissions. In addition, the threshold for consideration of offsets has been lowered from very large proposals to all proposals with emissions (scope 1 and scope 2) above 100,000 tonnes of carbon dioxide equivalent, noting that only scope 1 emissions will be subject to offset requirements.

Compliance costs for large liquefied natural gas projects are likely to be substantial, although these are likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment purposes. As different offsets have significantly different cost profiles, compliance costs associated with offsetting scope 1 emissions from the Wheatstone project may be between $30 and $130 million per annum at full production. As the EPA guidance acknowledges, offsets are not complementary to some national emissions policies and, if applied, should be removed if national market-based measures are in place.

In terms of economic co-benefits for the State, offsets applied under Part IV of the EP Act have the potential to be a significant source of demand for the local offset market. This would include potential environmental and economic co-benefits for the State.

Source: WA DWER (2019) *Tabled Paper No. 2783*

The advice to the Minister also suggested that the government might instead pay companies to pollute less, and the Department would consider alternative policies.

A further Ministerial briefing dated 27 February responds to the 21 February advice. It notes "the EPA's new guidance … adds requirements for offsets for scope 1 emissions."

It further notes the benefits of requiring local offsets "have the potential to be a strong demand source for State offsets, with associated benefits for regional economies, diversification and jobs."

Rather than look at ways of maximising benefits to the state, the Department note they were "evaluating options, including the establishment of a carbon abatement fund underpinned by industry contributions." [26]

Such a fund could be an adequate alternative only if it is mandatory and delivers revenue sufficient to offset the increase in emissions.

[25] Ibid.

[26] WA DWER (2019) Tabled Paper No. 2783 http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

# LNG companies are planning to pay

Despite claims the EPA proposal was ‘out of the blue’, most LNG companies have been planning to pay for their pollution for some time. All of the major WA gas companies are preparing to pay for carbon, and disclose these risks to their shareholders.

## DISCLOSURES TO SHAREHOLDERS

Annual reports show that both Chevron and Woodside consider GHG emissions policy to represent a material risk. Woodside’s 2018 Annual report states:

> Woodside faces climate change related risks including changes in product demand, carbon pricing, uncertainty surrounding future regulatory frameworks and increased stakeholder expectations.”[27]

Chevron’s 2018 Annual report notes:

> the potential liability for remedial actions or assessments under existing or future environmental regulations and litigation; significant operational, investment or product changes required by existing or future environmental statutes and regulations, including international agreements and national or regional legislation and regulatory measures to limit or reduce greenhouse gas emission[28]

The companies and their shareholders are not blind to the risks of future climate policy.

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[27] Woodside (2018) *Annual Report 2018*, https://www.woodside.com.au/investors/reports-publications/report/annual-report-2018, p 62.

[28] Chevron (2018) *Annual Report 2018,* https://australia.chevron.com/-/media/shared-media/documents/annual-report-supplement-2018.pdf, p 56.

# SHADOW CARBON PRICES

It is common for major corporations to assess investment decisions against an internal or 'shadow carbon price'. For example, Woodside's disclosure to CDP (a voluntary but widely used climate disclosure platform) makes clear that Woodside uses

> carbon prices that reflect our expectations of future carbon prices. These vary over time and jurisdiction. We also use include high and low sensitivities to test major decisions, with the high sensitivity reflecting our understanding of a 2°C scenario.

Woodside says the "Type of internal carbon price" includes "Implicit" prices as well as "Offsets". As rationale Woodside states:

> By including carbon prices in our commercial and operational decisions, we ensure that the actual regulatory costs associated with these decisions are considered and results in more efficient design and operation than would be the case if we did not apply carbon prices.

Woodside does not however disclose its shadow carbon prices. This contrasts with other major oil and gas companies, and indeed other major Australian corporations.

Shell for example has applied internal carbon prices of US$40-$80 per tonne since 2000, while BHP has applied prices of US$24-$80 per tonne since 2004.[29] Wesfarmers discloses a shadow carbon price starting low but reaching A$26 per tonne by year 8 and $53 per tonne by year 16.[30]

Such actions have not of course prevented these companies from obstructing policy progress to implement such policies over many decades. They do however leave little doubt that the companies are prepared to pay for the cost of their emissions.

This is widely understood, including by the WA government. Documents tabled in Parliament show the Departmental officials advising that the cost of purchasing offsets are "likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment".[31]

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[29] Centre for Climate and Energy Solutions (2019) *Companies set their own price on carbon* https://www.c2es.org/2017/09/companies-set-their-own-price-on-carbon/

[30] Wesfarmers (2018) *Wesfarmers sustainability report 2018* https://sustainability.wesfarmers.com.au/our-principles/environment/climate-change-resilience/shadow-carbon-price/

[31] WA DWER (2019) Tabled Paper No. 2783, p 2. http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

Similarly, in APPEA's February 2019 submission to the SRG consultation APPEA argues that assessment of major projects should be based on "leading indicators" of how well project design mitigates emissions. As an example, APPEA cited "has the proponent applied an international carbon price in assessing design options?"[32]

While this proposal is not repeated in APPEA's subsequent submission, it is worth supporting, but only if substantially strengthened. For such considerations to be effective, proponents should be required to disclose the carbon prices applied and what climate scenarios they consider this consistent with.

Such disclosure would implement the key recommendations of the G20 financial Stability Board's *Taskforce on Climate Related Financial Disclosures*. The disclosure could be made through existing platforms, such as CDP. Such disclosures would also enable scrutiny of gas industry claims that their projects are necessary for tackling climate change.

Requiring full offsetting would impose the same incentives to design for abatement as a rigorously applied shadow carbon price.

[32] APPEA (2019) *SRG Submission to WA EPA*. https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-—-CONSULTATION-APPEA-Submission.pdf p 16.

# Cost of offsetting LNG emissions

While WA LNG projects are a major and increasing source of domestic emissions, the projects are so profitable they are well able to pay to offset those emissions.

As noted above, the EPA is required not to assess economic factors themselves. If a project cannot afford to fully mitigate its emissions, in the absence of credible climate policy conditions the EPA would be justified in recommending conditions that would prevent the project from going ahead.

However it is necessary to correct misleading industry claims about the impacts of offsetting. The gas industry claimed fully offsetting scope 1 emissions would put jobs at risk.

The Australia Institute's calculations show the cost of offsetting emissions, in line with the EPA's Technical Guidance would represent a very small share of the project's profits, as outlined below (detailed calculations and all references in Appendix).

The offset cost estimates have been validated by the WA Department of Environment Water and Resources (DWER), in documents tabled to the WA Parliament.

The offsetting requirements of the Technical Guidance would only affect new projects. However calculations for current projects can be used as a proxy for future projects.

There are four operational LNG projects in WA (excluding the floating Prelude):

- Woodside's Pluto and North West Shelf projects, and
- Chevron's Wheatstone and Gorgon projects.[33]

The calculations use scope 1 project emissions.  Multiplying these by offset prices per tonne gives the total offset cost by project. The companies disclosed figures for revenue less key production costs. This allows comparison of offset costs compared with profits.

## EMISSIONS AND OFFSET COSTS

For Woodside, data is from disclosures under the safeguard mechanism. For Chevron, as Gorgon has faced problems during ramp up, especially with its carbon capture and

[33] APPEA (2019) *Australia LNG Projects* https://www.appea.com.au/oil-gas-explained/operation/australian-lng-projects/

storage (CCS) commitment, the data are full capacity expected emissions, with and without CCS.

The base offset cost is the average per Australian Carbon Credit Unit (ACCU) in the eighth Emissions Reduction Fund held in December 2018 ($13.87 per tonne CO2e).[34] For sensitivity we also use the Shell shadow carbon price of US$40 (A$58) and a much higher price of A$150 / tonne.

On 13 June 2019, the WA Department of Environment Water and Resources (DWER) tabled documents in the WA Parliament estimating the cost to large Liquified Natural Gas (LNG) projects of offsetting greenhouse gas emissions.[35]

**Table 2: Cost estimates for offsetting emissions from WA LNG projects**

| LNG Projects | WA Government estimate ($m) | The Australia Institute estimate ($m) |
|---|---|---|
| **Wheatstone + Gorgon (Chevron)** | $242m | $228m |
| **North West Shelf (Woodside)** | $100m | $106m |

DWER's figures validate The Australia Institute earlier estimates using the ACCU costs. Indeed, the Department provides even lower estimates using far cheaper, less rigorous units.

# WOODSIDE - NORTH WEST SHELF, PLUTO

Woodside's annual report discloses the "gross margin" for their interest in Pluto and North West Shelf projects.[36] This is revenue less production costs, depreciation and amortisation, and "other". The gross margins in 2018 were 55%-56% respectively.

At current ACCU prices, fully offsetting scope 1 emissions would cost Woodside 1.1-1.5% of gross margins for Pluto and the North-West Shelf respectively.

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[34] CER (2018) *ERF Auction Results, December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018

[35] WA DWER (2019) Tabled Paper No. 2783 http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

[36] Woodside (2018) *Annual Report 2018* https://files.woodside/docs/default-source/investor-documents/major-reports-(static-pdfs)/annual-report-2018.pdf?sfvrsn=c9a46145_6, page 28-30

At the Shell shadow carbon price, it would cost Woodside 4.6%-6.2% of gross margins.

Even up to $150 per tonne of CO2, Woodside would be paying only 12%-16% of gross margins for these projects.

Woodside boasts "Our high margin, low cost operations will generate cash flow" in a range of scenarios.[37] These calculations support Woodside's self-assessment.

# CHEVRON - GORGON, WHEATSTONE

Last year Chevron boasted to media and investors that the Wheatstone and Gorgon projects were "becoming strong cash generators with cash margins of more than $US30 per barrel at a $US50 Brent price". The reporter noted this would have been delivering margins of $32 million per day.[38] The offset costs would take around a week to pay off.

At the time (February 2018) Brent prices were at US$68 per barrel. At the time of The Australia Institute's earlier analysis (March 2019) they were at US$66 per barrel; presently (September 2019) they are at US$58 per barrel.

At current ACCU prices and Brent prices of between $58-$68 per barrel, offsetting these emissions would amount to just 2.1%-2.6% of Chevron's cash margins.

While Chevron's development approval for Gorgon requires it to sequester most of the CO2 fugitives it produces, this did not occur for the first years of its operations. Chevron has now announced its carbon capture and storage (CCS) facility is ramping up, but it is unclear at what rate and given previous problems ongoing operation is uncertain. Chevron's failed CCS project led Gorgon to emit the equivalent of half of Australia's annual 2018 increase in emissions.[39]

The cost of offsetting Chevron's two major projects would drop to only 1.6-2.0% if the long-awaited carbon capture and storage (CCS) facility becomes fully operational.

The Shell shadow carbon price would see Chevron paying between 6.9% of its margins, at the higher oil price and assuming CCS operates, and 10.8% if CCS fails and at the lower oil price.

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[37] Woodside (2018) *Annual Report 2018*, p 20. https://www.woodside.com.au/investors/reports-publications/report/annual-report-2018

[38] Peter Milne (2018) *Chevron LNG projects Gorgon and Wheatstone earning $32 million a day* https://thewest.com.au/business/oil-gas/chevron-lng-projects-gorgon-and-wheatstone-earning-32-million-a-day-ng-b88734044z

[39] Swann (2018) *Gorgon-tuan-problem.* http://www.tai.org.au/content/gorgon-tuan-problem

## WOODSIDE - BROWSE, BURRUP, SCARBOROUGH

Woodside is currently proposing to extend, expand and link the Pluto and North West Shelf LNG projects. It plans to develop Browse and connect it to the NWS LNG project via a long sea pipeline, to replace input gas from fields due to phase down, extending the NWS LNG terminal's operations by many decades. Woodside also has plans to develop the Scarborough field, with gas piped for export from Pluto, expanding Pluto, and connecting Pluto to NSW.

These are all separate development applications. From an environmental perspective they should be considered in terms of the emissions they enable, not simply emissions from point sources under each proposal.

The Browse gas field is far offshore. Parts of Browse are in state waters surrounding a reef far from the coast. Most proposed wells are in Commonwealth waters. However, the EPA should consider all emissions from extracting and processing gas that would be exported from NWS, including gas extracted from Commonwealth waters.

These projects will require some new capital expenditure, especially the very long sea pipeline from Browse. However much of the plant already exists, especially the capital-intensive LNG processing and export facilities.

It is therefore reasonable to assume the margins enjoyed on these projects will be similar to those enjoyed on the existing NWS LNG project, and the cost of offsetting is likely to be similarly small by comparison.

# EPA should consider scope 3

A key question raised in the EPA background paper is whether the EPA should consider scope 3 emissions. These are emissions not directly emitted from projects (scope 1) or their electricity supply (scope 2). For fossil fuel extraction, scope 3 emissions are primarily emissions from burning the fuel; exported scope 3 emissions occur overseas.

Exported emissions are beyond the scope of greenhouse accounting under the UN Framework Convention on Climate Change. This approach is, however only one half of the picture. This is clear when considering countries like Australia that export most of what they extract. Australia is the 14th largest direct emitter but fifth largest miner and third largest exporter of fossil fuel CO2.[40]

The Australia Institute has argued for many years that climate policy should address both fossil fuel demand *and* supply. The arguments for supply policy are well elaborated elsewhere. In short, attempting to reduce demand without reducing supply is like trying to cut emissions with one arm of a pair of scissors; both must work together.

For decades fossil fuel companies in Australia, their lobby groups and governments have all argued that climate policy should not try to constrain supply, and that exported emissions are another country's responsibility.

It is therefore surprising to see gas companies, lobby groups and governments now appeal to scope 3 emissions as justification for increased domestic emissions from increased LNG supply. At least it is now agreed that Australian environmental policy should consider scope 3 emissions.

APPEA argues such 'displacement' emission reductions should be disclosed and considered as part of the approval process. APPEA then caveats (in bold) "this disclosure should not be confused with a requirement for regulation."[41]

If gas companies want to claim reductions in emissions overseas to justify increased emissions in Australia, they cannot expect to avoid regulation on exported emissions.

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[40] Swann (2019) *High Carbon from a Land Down Under* https://www.tai.org.au/sites/default/files/P667%20High%20Carbon%20from%20a%20Land%20Down%20Under%20%5BWEB%5D_0.pdf

[41] APPEA (2019) *Background Paper on Greenhouse Gas Assessment Guidance: APPEA Comments,* p10 https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-%E2%80%93-CONSULTATION-APPEA-Submission.pdf

## COAL TO GAS CLAIMS

Surprisingly, gas proponents rarely provide evidence for their claims that gas exports reduce emissions.

Woodside claims “LNG can displace higher emissions energy sources in transport and power generation”.[42] The key word here is ‘can’. They give no evidence it *is* happening.

Recently the federal Minister for Energy and Emission Reduction Angus Taylor made a stronger claim:

> "In the last year there is a 0.6 per cent increase but it was more than accounted for by the very strong growth in LNG exports that are reducing global emissions. We're seeing a reduction in emissions as a result of Australia's gas exports, but we have to wear a small increase as a result of that. While that is not great for carbon accounting it is a good outcome for the world."[43]

Yet again no evidence is provided.

The fact that gas power is cleaner than coal power has little bearing on whether extracting and exporting more gas results in less coal being burnt.

On the contrary, more gas risks displacing zero carbon energy investment required to meet the goals of the Paris Agreement. More gas supply and gas infrastructure locks in more gas use for longer.

## WHAT THE IEA SAYS ABOUT GAS

On the rare occasions gas proponents do give evidence, they usually point to the International Energy Agency’s New Policies Scenario (NPS).

The NPS sees gas consumption increasing to 2040. It assumes failure on climate change with global warming of 3-4 degrees.

The preferred scenario is the Sustainable Development Scenario (SDS), which delivers economic growth, universal energy access, and rapid decarbonisation. The SDS sees

[42] Woodside (2019) *Climate Change* https://www.woodside.com.au/sustainability/climate-change

[43] Taylor quoted in Long (2019) *Australia’s carbon emissions continue to rise despite Government assurances about climate change policy,* ABC Online, https://www.abc.net.au/news/2019-08-30/emissions-drop-but-year-long-trend-on-the-rise/11464816

emissions from gas fall out to 2040.[44] Under the SDS, gas production globally increases by a small amount then declines again to 2040.[45]

Current LNG proposals "approved for investment" would exceed even the NPS in the short term.[46] While the IEA does not compare the infrastructure 'pipeline' with the SDS, it is clear that increased supply to meet the NPS would breach the SDS and the climate goals of Paris.

The IEA has set out short term actions to enable mitigation in line with SDS. Reviewing the first two years of progress, the IEA finds the world is going backwards on oil and gas methane leakage, and is far behind on reducing inefficient coal power generation. Only renewable energy installation is 'on track'.[47]

The increase in gas is not delivering the result the gas companies claim.

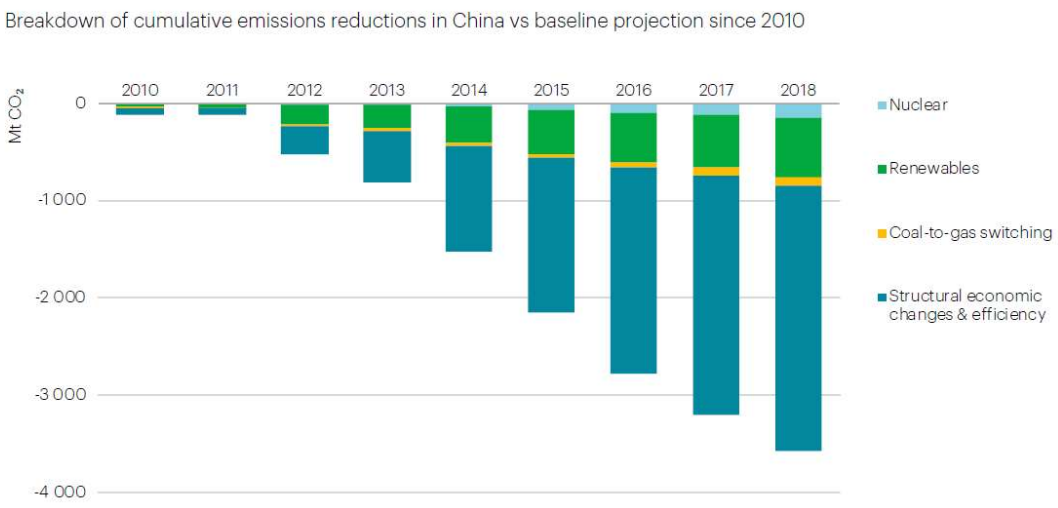
In a recent report on gas, the IEA examines historical coal to gas switching and potential for further switching. APPEA cites this approvingly, in their submission to the most recent EPA consultation. However, the IEA gas report is in fact highly circumspect:

> [Gas] can bring environmental benefits, but it remains a source of emissions in its own right and new gas infrastructure can lock in these emissions for the future. … the benefits provided by gas need to be weighed against the risks of locking in future gas-related emissions
>
> … beating the most carbon-intensive fuel is not in itself a persuasive case for gas if there are lower emissions and lower-cost alternatives to both fuels. The falling cost of renewable technologies in the power sector is the clearest case in point. In many markets, wind and solar PV are already among the cheapest options for new generation.[48]

The IEA finds coal power has fallen and gas power has increased in some countries (relative to baseline). They call this 'switching'. However in every case study – US, EU, China, India – coal to gas switching has played a very small role in abatement, smaller than renewable energy and far smaller than "structural economic changes and efficiency". For example, Figure 5 shows the tiny role of gas in abatement in China.

[44] IEA (2018) *WEO*, page 88
[45] IEA (2018) *WEO*,
[46] IEA (2018) *WEO*, Annex A, Current Policies and Sustainable Development Scenarios, page 521
[47] IEA (2018) *WEO,* page 109
[48] IEA (2019) *Role of Gas in Today's Energy Transitions,* p42

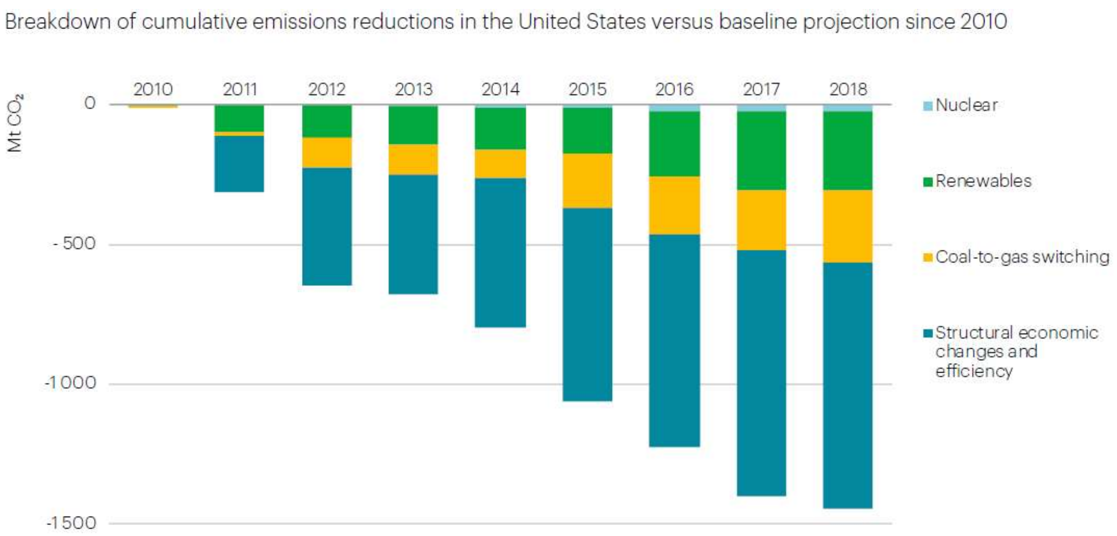
### Figure 5: IEA estimate of source of abatement in China




Source: IEA (2019) *Role of Gas in Today's Energy Transitions,* page 73

Figure 6 shows somewhat more switching has occurred in the US, however even there it is smaller than from renewables and most abatement has occurred from structural and efficiency changes.

### Figure 6: IEA estimate of source of abatement in USA




Source: IEA (2019) *Role of Gas in Today's Energy Transitions* page 47

The IEA gas report finds "We estimate that up to 1.2 gigatonnes of CO2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive."[49] APPEA quotes this directly in their submission

[49] IEA (2019) *Role of Gas in Today's Energy Transitions* page 4

to the EPA consultation but ignores the IEA's following sentence is that "The vast majority of this potential lies in the United States and in Europe." These are not major customer countries for Australia's LNG. APPEA also ignores IEA focus on *regulation* for increased use of *existing* generators, due to concerns about lock in. Even then, the IEA sees gas switching accounting for only 8% of required abatement under SDS, far smaller than energy efficiency and renewable energy.

Taken together, IEA data and the projections undermine rather than support gas company claims about the environmental benefits of large increases in gas production.

# NO NEW FOSSIL FUEL INFRASTRUCTURE

Just as climate change is caused by the accumulated stock of greenhouse gas emissions, carbon emissions are caused by the stock of infrastructure. Building new supply and generation infrastructure means both supply and demand are possible a lower short-run marginal cost. New fossil fuel infrastructure now makes environmental outcomes more difficult and costly to achieve, requiring 'stranded assets' and conflict with established facilities.

Recent studies published in *Nature* examined the stock of fossil fuel infrastructure globally, comparing the extent of greenhouse gas emissions 'locked in' to the carbon budget required for a given probability of meeting climate targets.

One study in *Nature* finds current fossil fuel infrastructure, if simply retired at the end of expected lifetimes, would deliver a 64% chance of meeting the Paris goal of limiting warming to 1.5°C. Allowing new infrastructure out to 2030 makes this unfeasible without early retirement ('stranded assets').[50]

A later study in *Nature* finds existing fossil fuel infrastructure already exceeds the 1.5 target and exhausts most of the 2C upper limit:

> "our estimates suggest that little or no new $CO_2$-emitting infrastructure can be commissioned, and that existing infrastructure may need to be retired early (or be retrofitted with carbon capture and storage technology) in order to meet the Paris Agreement climate goals."[51]

The Intergovernmental Panel on Climate Change recently examined the costs of global temperature increases above 1.5°C, as targeted in the Agreement, and what is

[50] Smith et al. (2019) *Current fossil fuel infrastructure does not yet commit us to 1.5°C warming,* Nature Communications 10 (101). https://www.nature.com/articles/s41467-018-07999-w

[51] Tong et al. (2019) *Committed emissions from existing energy infrastructure jeopardize 1.5°C,* Nature 572. https://www.nature.com/articles/s41586-019-1364-3

required to prevent that from happening. It found very significant environmental costs associated with breaching that limit. The IPCC assessed peer-reviewed literature and concluded there is unlikely to be a greater role for gas in meeting the Paris 1.5°C goal. Gas power generation must stay flat or reduce out to 2030 and then decline dramatically out to 2050.[52]

These scenarios are more stringent than the IEA's SDS, however even the IEA's SDS gives little to no role for large new gas expansions.

# CONDITIONS ON SCOPE 3 EMISSIONS

There are many ways environmental approvals could seek to prevent gas exports from increasing global emissions.

The EPA could mandate export management plans to be conditional on exports only to certain countries. This approach was taken recently by the NSW Independent Planning Commission in conditions on a coal mine approval.[53] However, stronger specification of export conditions is needed for meaningful environmental protection aligned with the environmental goals of the Paris Agreement.

Export management plans could be constrained to countries and in contexts where "relative prices and regulation" support or mandate levels of mitigation aligned with the Paris Agreement. Conditions could include restricting exports to customer countries with economy wide or electricity sector carbon caps or prices, as urged by gas companies themselves. To ensure gas helps reduce rather than lock in excess emissions, customer countries could be constrained to those whose Paris targets and policies align with the global goals of the Paris Agreement.

Alternatively, the EPA could require projects to fully offset their scope 3 emissions or pay a levy on exported emissions that could fund domestic mitigation. This could be implemented where and to the extent that customer countries do not have appropriate mitigation policies in place. Concerns about complementarity could be addressed by setting obligations net of explicit or implicit emissions prices in the customer countries. If difficulties implementing such arrangements a major concern this should weigh against approving such exported emissions.

[52] IPCC (2019) *Special Report: Global Warming of 1.5°C, Mitigation pathways compatible with 1.5°C in the context of sustainable development,* Table 2.7. https://www.ipcc.ch/sr15/chapter/chapter-2/

[53] NSW Government IPC (2019) *Statement of reasons for decision: United Wambo Open Cut Coal Mine Project*. https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/11/united-wambo-open-cut-coal-mine-project-ssd-7142/determination/uwjv--sor--final.pdf par 309 onwards

# Offsets undermine emissions reductions

There are many environmental issues with emissions offsets, including ensuring additionality and integrity. These are alleviated somewhat by requiring the National Carbon Offsets Standards, or surrender of Australian Carbon Credit Units. However, issues arise here as well, with projects granted ACCUs under the Emissions Reduction Fund (ERF) facing allegations or even admitting they are not additional (i.e. would have happened anyway).

If the offsets do not work, then Australia's emissions will increase. The policy of allowing LNG expansion when offset is still a risk to Australia's emissions targets. The project proponents should be made responsible for this risk, not the government.

A further, more fundamental point is rarely made;

Offsetting WA LNG emissions will not reduce emissions. It will only stop emissions from increasing. Moreover, given that Australia must reduce its emissions, any offsets must also be additional to what we need to do to reduce emissions.

Put differently, policies used to offset WA LNG emissions cannot also be used to reduce emissions. If companies get access to lower cost abatement options to offset LNG emissions, this may increase the cost of reducing Australia's emissions.

If the lower cost options go towards reducing Australia's emissions, this may increase the cost of offsetting WA emissions.

It is therefore doubtful that requiring offsets for increased emissions is cost effective environmental policy.

However, if however the EPA is to approve large increases in emissions in the absence of effective climate policy, the EPA it must ensure they are fully offset. The need for state agencies like the EPA to take such action again reflects the need for federal action and the costs created by failing to have an effective carbon price or other policy.

# Appendix - Estimated offset costs

## WOODSIDE

| | | NWS LNG | Pluto LNG |
|---|---|---|---|
| **Gross profit**[54] | US$m | 826 | 1,546 |
| **Gross profit**[55] | A$m | 1,165 | 2,180 |
| **Emissions** | | | |
| **2016-17 project emissions**[56] | mtCO2e | 7.66 | 1.97 |
| **Woodside interest in project**[57] | % | 17% | 90% |
| **Woodside emissions** | tCO2e | 1.28 | 1.78 |
| **Offset costs** | | | |
| **ACCU offset price**[58] | A$/tCO2e | 13.87 | 13.87 |
| **Total offset cost** | $m | 18 | 25 |
| ***/ gross profit*** | % | 1.5% | 1.1% |
| **BP / Shell shadow carbon price**[59] | US$/t | 40 | 40 |
| | A$/t[60] | 58 | 58 |
| **Total offset cost** | A$m | 74 | 103 |
| ***/ gross profit*** | % | 6.2% | 4.6% |
| **higher offset / carbon price** | A$/t | 150 | 150 |
| **total offset cost** | A$m | 192 | 266 |
| ***/ gross profit*** | % | 16% | 12% |

[54] Woodside (2018) *Annual Report* https://files.woodside/docs/default-source/investor-documents/major-reports-(static-pdfs)/annual-report-2018.pdf?sfvrsn=c9a46145_6, page 28-30
[55] At $1.45
[56] CER (2019) Safeguard Facilities Reported Emissions http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/safeguard-facility-reported-
[57] Woodside (2018) *Annual Report*
[58] CER (2018) *ERF Auction Results December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018
[59] Macdonald-Smith (2019) *WA Slaps Down EPA Amid Calls for Reckless Carbon Rule to Be Rescinded* https://www.afr.com/business/energy/gas/wa-slaps-down-epa-amid-calls-for-reckless-carbon-rule-to-be-rescinded-20190313-h1cc33
[60] At $1.45

# CHEVRON

| Emissions at capacity production | | | | | |
|---|---|---|---|---|---|
| **Wheatstone**[61] | Mt CO2e | 10.4 | | | |
| **Gorgon (w CCS)**[62] | Mt CO2e | 6 | | | |
| **Gorgon (no CCS)** | Mt CO2e | 10 | | | |
| **Total w CCS** | Mt CO2e | 16.4 | | | |
| **Total no CCS** | Mt CO2e | 20.4 | | | |
| **Offset costs** | | | | | |
| **Offset price**[63] | A$/t | **$13.87** | | **$50** | |
| **Offset cost (w CCS)** | A$m | $282.9 | | $1,183 | |
| **Offset cost (no CCS)** | A$m | $227.5 | | $951 | |
| **Surplus** | | | | | |
| **Cash costs per barrel**[64] | US$ | 20 | | | |
| **Production capacity**[65] | Barrels /day | 545,000 | | | |
| **Brent crude oil price**[66] | US$ /Barrel | **68** | **58** | **68** | **58** |
| **Margin per barrel** | US$/Barrel | 48 | 38 | 48 | 48 |
| **Total margin** | US$m | $9,548 | $7,559 | $9,548 | $9,548 |
| | A$:US$ | 1.45 | 1.45 | 1.45 | 1.45 |
| | A$m | $13,845 | $10,961 | $13,845 | $10,961 |
| **Offset cost as % of cash surplus** | | | | | |
| **max, no CCS** | % | 2.04% | 2.58% | 8.55% | 10.79% |
| **max, w CCS** | % | 1.64% | 2.08% | 6.87% | 8.68% |

[61] SBS (2018) *Chevron LNG project facing emissions row* https://www.sbs.com.au/news/chevron-lng-project-facing-emissions-row

[62] Chevron (2018) Fact sheet: *Gorgon carbon dioxide injection project* https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf

[63] CER (2018) *ERF Auction Results December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018

[64] Peter Milne (2018) *Chevron LNG projects Gorgon and Wheatstone earning $32 million a day* https://thewest.com.au/business/oil-gas/chevron-lng-projects-gorgon-and-wheatstone-earning-32-million-a-day-ng-b88734044z

[65] Ibid.

[66] Prices as at time of cash margin claim, and presently from Oil Price (2019) https://oilprice.com/

# Driving Norse: Electric Vehicle policies in Norway

***Norway has implemented a suite of policies to boost electric vehicle uptake. These policies should be considered in Australia's electric vehicle debate.***

**Audrey Quicke**
**April 2019**

## Norwegian leadership in electric vehicles

The Nordic countries (defined in this briefing note as Norway, Denmark, Sweden, Finland and Iceland) represent the world's third-largest electric vehicle market by share of sales, despite being far smaller in population than the top two markets, China and the United States of America. Norway is a prominent leader in electric vehicle (EV) policy amongst the Nordic countries and the world. In Norway, the number of new car registrations that are EVs is now over 50%.[1]

Norway's success has been driven by government leadership, creating a policy environment to drive a large-scale and sustainable shift to EV use. Norway's policy

[1] Norsk Ebilforening (2019) *Norway reaches historical electric car market share* https://elbil.no/norway-reaches-historic-electric-car-market-share/

framework to boost uptake of EVs has been in place since 1990.[2] The country has the highest share of EVs per-capita in the world[34] and is aiming for all new cars sold to be EVs by 2050.[5]

By contrast, in Australian EV sales last year were only about 0.2 per cent of the total compared with just under 2 per cent globally.[6]

Norwegian policies serve as a useful roadmap for OECD members suffering from low-uptake, such as Australia. A useful English language source on Norwegian EV policies is the recent International Energy Agency report, *Nordic EV Outlook 2018 Insights from leaders in electric mobility.*

## Policy levers at play

Norwegian EV policies can be roughly divided into three categories:

- **Purchase incentives**: Aim to reduce the upfront cost of EVs as compared to ICE vehicles. These policies tend to have the most influence, as consumers appear to be more influenced by short-term expenditure than longer-term savings.[7]
- **Use incentives**: Aim to reduce the cost of using EVs as compared to ICE vehicles.
- **Access incentives**: Incentivise EVs by allowing them access to bus lanes and designated parking.

The following table (Table 1) outlines the EV policies for five Nordic countries. The policies are explained in more depth below, with specific reference to Norway.

[2] International Energy Agency (2018) *Nordic EV Outlook 2018 Insights from leaders in electric mobility*, https://webstore.iea.org/nordic-ev-outlook-2018 p 8.

[3] The International Council on Clean Transportation (2018) *Using vehicle taxation policy to lower transport emissions: An overview*, p ii https://www.theicct.org/sites/default/files/publications/EU_vehicle_taxation_Report_20181214_0.pdf

[4] IEA(2018) p8

[5] https://elbil.no/english/norwegian-ev-policy/

[6] Bloomberg New Energy Finance (2018) *Cumulative Global EV Sales Hit 4 Million* https://about.bnef.com/blog/cumulative-global-ev-sales-hit-4-million/

[7] Ibid, p 25

**Table 1: Nordic Policies to Encourage Uptake of Electric Vehicles**

| | Denmark | Finland | Iceland | Norway | Sweden |
|---|---|---|---|---|---|
| Purchase Incentives | Registration tax rebate | Registration tax rebate | | Registration tax rebate | Registration tax rebate |
| | | | Registration tax exemption | Registration tax exemption | |
| | | | GST exemption | GST exemption | |
| | | | | | Tax Credits |
| Use Incentives | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions |
| | Waived fees for tolls, parking, ferries at the local level | | | Waived fees for tolls, parking, ferries | Waived fees for tolls, parking, ferries at the local level |
| | | | | | Tax credits for company cars |
| Access Incentives | Free/dedicated parking | | Free/dedicated parking | Free/dedicated parking | |
| | | | | Access to bus lanes | |

*Source: International Energy Agency (2018)*

# Purchase Incentives

### *Registration tax rebates and exemptions*

In all Nordic countries, car registration is a one-off 'registration tax' (though it is more similar to a fee in Australia). In Norway, this registration fee is 30% for an average ICE car.[8] In Norway, the registration fee is differentiated between vehicles based on their weight, carbon dioxide ($CO_2$) emissions and nitrogen oxide (NOx) emissions. Norway's registration tax keeps up to date with the latest technological advancements too, changing how $CO_2$ and NOx emission levels are taken into account to incentivise models with the highest environmental standards.

[8] IEA (2018) p 20.

A registration fee rebate returns some of the money charged as registration fee, whilst registration fee exemptions means that certain vehicles pay no registration fee at all. By reducing the amount of registration tax paid on EVs, customers are incentivised to choose EVs over ICE vehicles, due to the lower upfront costs. An example is provided in Figure 1 comparing standard European car in both ICE and EV models. [9]

### *GST exemption*

Goods and services tax (GST or value-added tax, VAT) exemptions have a similar effect as registration tax rebates/exemptions. In Norway, zero-emissions vehicles have been exempt from a 25% GST on purchase since 2001.[10] This reduces the upfront cost of EVs, encouraging consumers to purchase them over ICE vehicles.[11]

For example, the following table shows the difference in drive away price between an ICE Volkswagen Golf and an electric Volkswagen Golf in Norway. Although the import price is higher for the electric Golf, once registration and GST exemptions have been applied, the electric Golf retails at a comparatively lower price.

**Table 2: Import and retail price for electric and non-electric VW Golf in Norway**

| (AUD) | Volkswagen Golf (VW golf TSI 110 hk) | Volkswagen e-Golf (Electric) |
|---|---|---|
| **Import Price:** | $31,377 | $45,148 |
| **$CO_2$ tax:** | $5,528 | 0 |
| **NOx tax:** | $393 | 0 |
| **Weight tax:** | $3,739 | 0 |
| **Scrapping fee:** | $417 | $417 |
| **GST:** | $10,364 | 0 |
| **Retail Price:** | $51,818 | $45,565 |
| **Comparative Saving** | **13% more** | **13% less** |

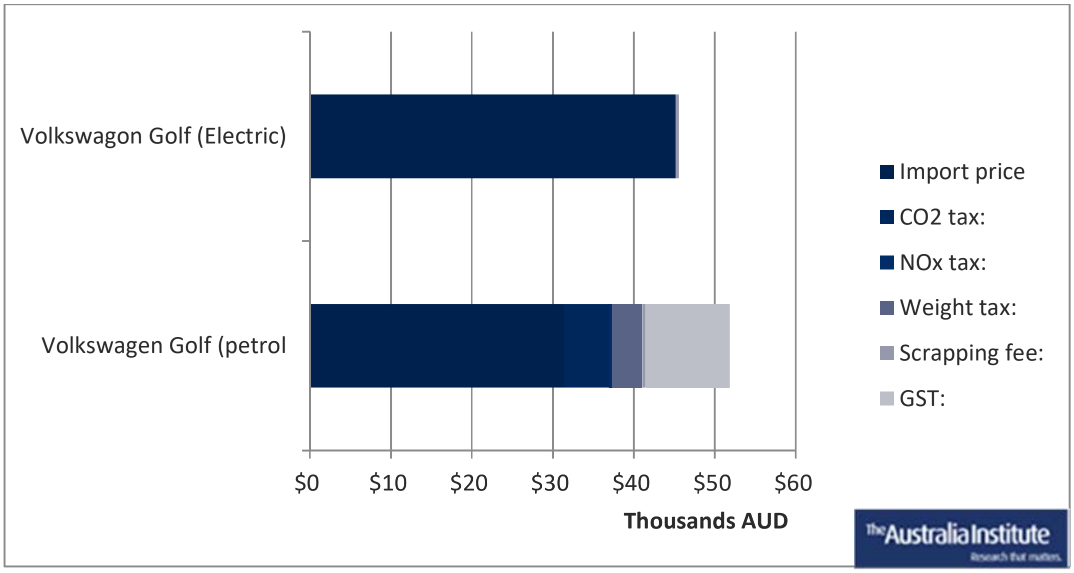
*Source: 'Norwegian EV policy', https://elbil.no/english/norwegian-ev-policy/*
*Note: prices converted to $AUD at the rate of 1AUD = 5.75660 NOK current at 12/04/2019*

[9] Ibid.

[10] IEA (2018) p 21

[11] The International Council on Clean Transportation (2018) *Using vehicle taxation policy to lower transport emissions: An overview,* p ii https://www.theicct.org/sites/default/files/publications/EU_vehicle_taxation_Report_20181214_0.pdf

**Figure 1: VW Golf - Petrol vs Electric**




*Source: 'Norwegian EV policy', [https://elbil.no/english/norwegian-ev-policy/](https://elbil.no/english/norwegian-ev-policy/)*
*Note: prices converted to $AUD at the rate of 1AUD = 5.75660 NOK current at 12/04/2019*

## Use Incentives

### *Circulation tax rebates/exemptions*

Circulation tax requires an annual fee to allow the vehicle to operate on public roads. In most Nordic countries, circulation taxes are differentiated based on fuel consumption, weight, and/or $CO_2$ per km rating. In Norway, it is based just on the type of fuel and full electric vehicles will pay the minimum amount, NOK 455 (AUD 75).[12]

### *Waivers on fees (tolls, parking, ferries)*

Nordic countries have toll roads, similar to most Australian capital cities. Tolled ferries also connect parts of the national road network. Norway waives or lower these fees for EVs, incentivising their uptake.

## Access Incentives

Some Nordic Countries offer free or discounted parking for EVs. This policy can be used at multiple levels of governance, and is the most widely applied policy instrument at the local level. Norway also allows EVs to access bus lanes. These incentives encourage

[12] IEA (2018) p 25.

the use of EVs on Norwegian roads by making driving and parking easier and more accessible to EVs.[13]

## Charging Infrastructure

The availability of publicly accessible charging stations encourages consumers to purchase EVs and enables longer distance trips for EV drivers. The Norwegian government has established a program to finance a minimum of two fast charging stations per every 50km of main road.[14] In addition, the European Union has funded fast-charge networks across Europe to enable long-distance cross-border EV journeys.[15]

## Conclusion

Australia has a long way to go before it can catch-up to the impressive uptake of EVs in Norway and other Nordic countries. However it is all well within reach through targeted government policies. Equally important, many of these policies are popular with Australians. Recent Australia Institute's research has found three in five Australian's support a national program to switch to an electrically charged transport system (62%).

When it comes to specific policies there is an overwhelming majority of Australians (79%) who support the Government building a network of EV charging stations across the country. The majority of Australians support for governments to procure electric vehicle fleets (76%) and providing loans for electric vehicle uptake (55%).[16] While some policies are not very popular in Australia, including allowing EVs to use dedicated bus lanes, there remains a menu of choices the government can choose from and implement in the next year. All that is missing is the leadership to drive the change.

[13] Ibid, p 26.

[14] Fleetcarma (2019) *How Norway became the leading EV market* https://www.fleetcarma.com/norway-became-leading-ev-market/

[15] Rapid Charge Network (2019) *EU-funded fast-charge network opens up pan-european travel* http://rapidchargenetwork.com/news_post.php?id=34

[16] Merzian (2019) *Poll: Overwhelming Support for Electric Vehicle Incentives* http://www.tai.org.au/content/poll-overwhelming-support-electric-vehicle-incentives

The Australia Institute
Research that matters.

# Submission: Interim Report on the Liquid Fuel Security Review

***The Interim Report outlines significant risks to Australia's transport energy security. Addressing these security risks requires reducing oil consumption and accelerating the transition to electric vehicles***

**Tom Swann**
**July 2019**

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# Summary

The Department of the Environment and Energy is conducting a Liquid Fuel Security review and public consultations on the Interim Report. This report is an edited version of The Australia Institute's submission to that consultation.

The *Interim Report on Liquid Fuel Security* shows Australia is ill-equipped to deal with a liquid fuel security crisis. In FY2018 Australia had on average access to liquid fuel that would cover only 20 days of consumption. Alarmingly, the Interim Report reveals the emergency powers to ration fuel stocks would take up to three weeks to be implemented in the event of a fuel emergency.

The Interim Report makes it clear that producing more oil in Australia is a dubious response to the issue of fuel security. Australia's oil production has already peaked and is likely to continue to decline. There is great uncertainty surrounding the scale, quality and viability of oil production in prospective resources like the Great Australian Bight and Beetaloo Basin.

Reducing oil use requires both increased fuel efficiency and substitution to non-oil based transport, including active transport, public transport, and electric passenger vehicles.

The Australia Institute strongly supports a review of the *LFE Act*, as announced by the Minister for Energy. The Review should refocus away from liquid fuel and towards transport, and ensure its scenarios integrate Paris-consistent emissions targets. The Department's ongoing work in this area should include scenarios consistent with Australia's commitment under the Paris Agreement to consider increasing targets consistent with a 2 degree budget.

In developing the final Review and relevant scenarios, the Department should ensure it consults with industries required to drive this transition and includes policies with specific electric vehicle targets and fuel efficiency standards.

# Introduction

The Australia Institute is a public policy research organisation based in Canberra. Our dedicated Climate and Energy program conducts a range of research into issues, including energy and emissions relating to transport. The Australia Institute welcomed the opportunity to respond to the *Interim Report on the Liquid Fuel Security Review* ("Interim Report").[1]

The Review is framed in terms of security of *liquid fuel*. This framing is misplaced and inconsistent with much of the content of the Interim Report. The Department's concern should not be security of fuel for its own sake, but security of energy services. Liquid fuel consumption in Australia is dominated by transport, with smaller roles for peaking electricity and non-energy uses. It would be more appropriate to approach the issue from a broader perspective of energy security, and specifically for transport. As the Interim Report itself emphasises, there is a great need to increase fuel efficiency and transition to non-oil energy sources.

The Interim Report outlines significant risks to Australia's transport energy security, due to reliance on imported oil and access to only a limited number of days of consumption at any one time. The Interim Report shows that in a major security situation fuel stocks could be greatly eroded before emergency powers come into force. Importantly, the Interim Report doubts new domestic oil supply will ameliorate those risks. Rather, it emphasises the need to reduce consumption and diversify sources of energy.

These significant findings are strongly endorsed and extended in this report. Reducing oil dependency is imperative for energy security, national security and climate change mitigation.

[1] Department of Energy (2019) *Liquid Fuel Security Review* https://www.energy.gov.au/government-priorities/energy-security/energy-security-assessments/liquid-fuel-security-review ("Interim Report")

# Strategic risk

As highlighted by the Interim Report, the Australian economy is currently highly dependent on imported liquid fuel:[2]

- 90 per cent of the fuel consumed in Australia is derived from oil sourced outside of Australia.
- Australia imports 60 per cent of its refined oil.
- Of the crude oil refined in Australia, 80 per cent is imported.

Further, Australia is in breach of international obligations regarding fuel stocks. Even more concerning is that these stocks leave Australia with access at any one time to only a limited number of days' worth of consumption.

In 2017-2018 Australia had an average of only 20 days of consumption cover of refined fuel.[3] This means if all oil supply into Australia's supply chains were to cease immediately, consumption at current rates would continue for only 20 days on average across fuel types.

Of course consumption cover figures are only a guide for risks of more complex system disruptions.[4] It is nonetheless clear that the consequences of any significant impact on oil supply could be substantial to both the Australian economy and security.

Such disruptions could have many causes, which could be concurrent and interacting, and the risk is fuelled by increasing climate extremes. There could be a range of strategic implications, for example, on supply chains for all essential goods, like food.

In this context it is useful to highlight recent regional supply disruptions.

- In late 2012, Shell's Geelong oil refinery suffered system failures, stopping production of 50 percent of Victoria's diesel supply. Diesel supplies ran out for two days in North West Victoria, in the middle of harvest period for farmers.[5]
- In May 2014, issues with imported diesel led to a shortage across the Perth Metropolitan area. BP confirmed an acute supply shortage, diesel was unavailable at more than 100 service stations across Perth and regions, and the WA Department of

[2] Interim Report, p 3.

[3] Ibid p 47.

[4] Such a disruption would likely impact demand, and supply is more likely limited than completely cut off. Conversely, there could be panic buying, hoarding, increased demand from addressing the disruption itself (e.g. natural disaster, defence requirements), or other countervailing factors.

[5] NRMA (Prepared by John Blackburn AO) (2013) *Australia's Liquid Fuel Security Part 2,* https://www.aph.gov.au/DocumentStore.ashx?id=677ff8dd-ce35-40ee-9af8-bfec1e43d125&subId=301736 p 12

Mines Industry Regulation and Safety advised drivers not to drive without checking ahead of a trip to see if fuel was available. [6]

These events occurred even with the availability of the broader supply chain. While short term, they are likely to have had significant economic impacts.

## EMERGENCY POWERS INADEQUATE

Given the strategic risks outlined above, it is highly concerning to learn from the Interim Report that emergency powers to ration fuel stocks, under the *Liquid Fuel Emergency Act 1984* ("the *LFE Act*"), would take up to three weeks to be implemented.

The long time period for implementing the rationing and direction powers exhausts much of and potentially all of the total consumption coverage.

There are also risks of panic buying and hoarding in the intervening period, reducing stocks available for rationing.

During Senate Estimates, a Departmental official stated that such a disruption could be viewed in advance, giving increased lead time. This seems a poor basis for strategic planning, given the uncertain nature of disruptions.

Clearly, the current arrangements are leaving Australia ill-equipped to deal with a liquid fuel security crisis.

This economic and strategic risk is emblematic of how poorly successive governments have managed the issue of transport energy security in Australia.

The Australia Institute strongly support a review of the *LFE Act*, as announced by the Minister for Energy. The review of the emergency response should be informed by longer-term changes needed to increase energy security.

[6] BP (2014) *BP confirms WA diesel supply,* https://www.bp.com/en_au/australia/media/media-releases/bp-confirms-wa-diesel-supply.html
WA Department of Mines Industry Regulation and Safety (2014) *Diesel buying advice for WA drivers,* https://www.commerce.wa.gov.au/announcements/diesel-buying-advice-wa-drivers

# New domestic supply a dubious response

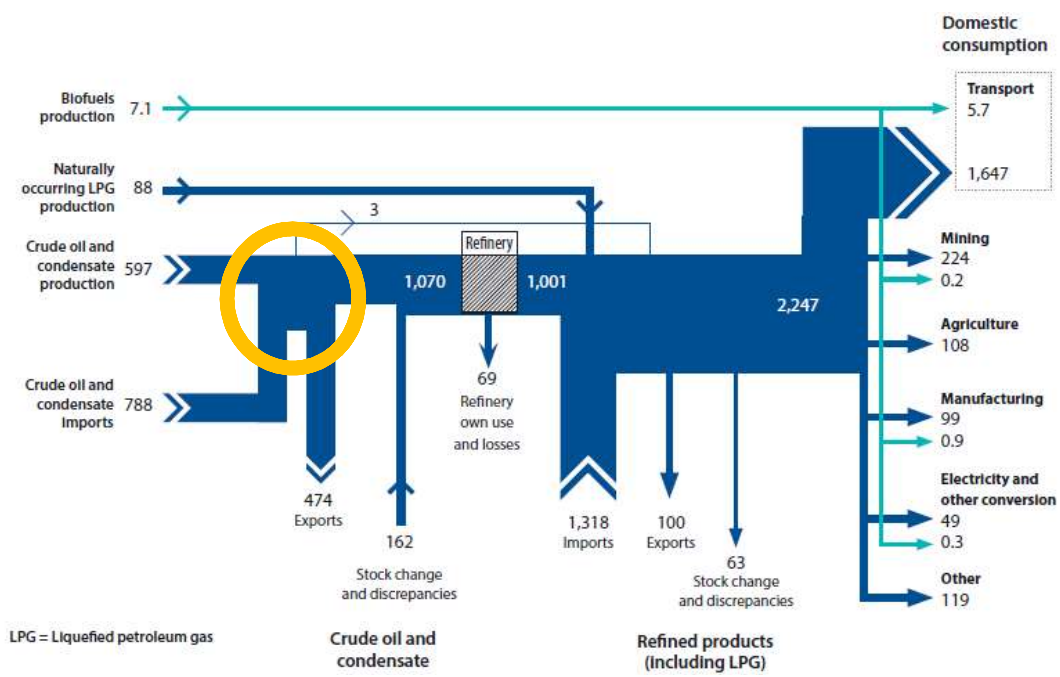
If Australia's transport energy security is threatened by reliance on imported oil, the question arises as to whether it is possible to increase Australia's consumption of domestic oil.

The Interim Report makes it clear that producing more oil in Australia is a dubious response to this issue.

Australia produces some oil domestically, but most of this is exported, while most refinery feedstocks are imported. This is because of a mismatch between the type of product extracted, the design of Australian refineries and Australian demand.

This fact should be made more clearly in the final report. Figure 1 (reproduced below) shows annual flow of Australian liquid fuel. However, as highlighted with an orange circle, the figure fails to show that most primary production is exported, and most input into Australian refineries is imported.

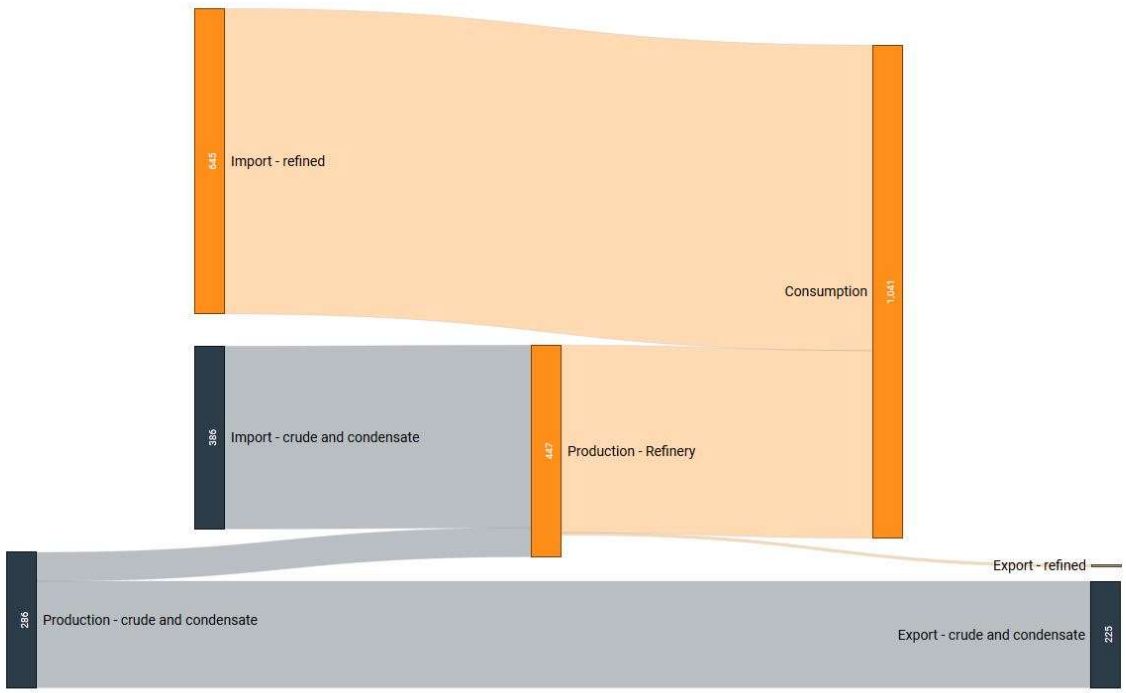
**Figure 1: Australian liquid fuel flows, petajoules, 2016-7**




Source: Liquid Fuel Security Review, p 6, figure 1, amended by TAI

Figure 1 obscures the extent of Australia’s dependency on imports by hiding the tiny share of domestic demand met by domestic production. Figure 2 (below) presents liquid fuel flows using data from the Office of the Chief Economist’s *Resource and Energy Quarterly.* Domestic primary oil production is a very small share of consumption, even if all non-exported primary oil production is refined and consumed domestically, as assumed in the diagram.[7]

**Figure 2: Australian liquid fuel flows, kb/d, 2017-8**




Source: The Australia Institute’s figure using data from Office of the Chief Economist (2019) *Resource and Energy Quarterly March 2018*

The Interim Report gives many further reasons to think domestic supply is a dubious response to transport energy security risks.

- Australia’s oil production is likely to continue to decline. It is already far below its 2000 peak, which was 59% higher than current production.
- There is great uncertainty surrounding the viability of oil production in prospective resources like the Great Australian Bight and Beetaloo Basin. Such projects may not be commercial. They may rely on significant subsidies, which would be better directed to other energy security measures.
- The Interim Report notes the scale and viability of oil production in the Bight is largely unknown. It cites industry consultants who put it at “between 15 and 40 per cent of [Australian] demand for 20 years”, not coming into full production “until

[7] Assumptions include that production of primary oil is either

after 2030 given the complexity of infrastructure installation."[8] The Interim Report also states global oil demand is expected to peak in the 2030s.[9]

It is also important to point out:

- Oil produced in these projects may not be compatible with Australian refineries and demand requirements. Oil industry representatives, in whose interests it is to justify such claims, have been unable to provide evidence that new Australian oil production will be refined, or refinable, in Australia. The Minister for Resources has also been unable to provide such evidence.
- The social license for fracked shale oil in the Northern Territory or for drilling in the Great Australian Bight is at best contentious, and likely to erode further. Public opinion research has found strong opposition across the country to allowing drilling for oil in the Bight,[10] and strong opposition in the NT for fracking for gas.[11]

Even if domestic supply is increased, declining refinery capacity and resilience increases reliance on imports. The Report casts doubts on the viability of Australian oil refineries:

- Remaining Australian oil refineries are shutting down. The Port Stanvac refinery closed in 2003. The Clyde refinery closed its doors in 2012, followed by Kurnell in 2014, and Bulwer in 2015.[12]
- New Australian refineries are uneconomical, due to competition with Asian mega-refineries, and transition risks are also a major consideration for investors.[13]
- Ageing refineries are also less resilient to the effects of climate change. They are likely impacted by increasing average and extreme temperatures, extreme weather, and as coastal infrastructure, rising sea levels and increased storm surges.

[8] Interim Report, p 26.

[9] Interim Report, p 4.

[10] The Australia Institute (2019) *National Poll: Australians Opposed to Drilling in the Great Australian Bight,* http://tai.org.au/content/national-poll-australians-opposed-drilling-great-australian-bight

[11] ReachTEL (2018) *Solomon – Final Results,* http://www.tai.org.au/sites/defualt/files/TAI-28March18-Solomon%20-%20Fracking%20Poll%20ReachTEL.pdf

[12] Sydney Moring Herald (2014) *BP refinery closure leaves Australia more reliant on fuel imports,* https://www.smh.com.au/business/companies/bp-refinery-closure-leaves-australia-more-reliant-on-fuel-imports-20140402-35y4p.html

[13] Ibid.

# Reducing oil use

Currently Australia's oil use is increasing. It is argued throughout the Interim Report that transport energy security requires reducing oil use.

This requires both increased fuel efficiency and substitution to non-oil based transport, including active transport, public transport, and electric passenger vehicles. In this respect Australia is a long way behind where it should be.

## FUEL STANDARDS

Australia's weak fuel standards leave us among the least fuel-efficient fleets in the OECD. This is clearly not in Australia's economic and security interests.

Even the Business Council of Australia, which counts many oil companies amongst its members, has long called for increased fuel efficiency standards, arguing it would save Australia money and reduce emissions.[14]

Government refusal to take even this modest step is making our transport systems more expensive, less secure and more emissions intensive.

Australia is currently entirely reliant on imported passenger vehicles. This makes it hard to understand why governments will not impose requirements on these imports to bring them at least in line with comparable markets.

Given the timescales involved in vehicle stock turn over, increasing fuel standards for the flow of all imported cars should be an urgent priority.

## ELECTRIC VEHICLES

Rapid cost reductions in electric vehicles (EVs) are creating enormous opportunities for increased transport energy security. Replacing imported fuel with domestically produced electricity will have benefits for energy security.

Most obviously, it will increase the domestic supply of transport energy. The decentralisation and diversification possible in renewable energy systems can also create further resilience in energy supply.

[14] See for example: BCA (2016) *Vehicle Emissions Discussion Paper,* https://d3n8a8pro7vhmx.cloudfront.net/bca/pages/4038/attachments/original/1528953385/Submission_to_Vehicle_Emissions_Discussion_Paper_FINAL_April_22.pdf?1528953385

Moreover, CSIRO modelling shows that policy to better integrate EVs into Australia's grid can reduce both emissions and power prices, by making better use of grid infrastructure.[15]

As the Report notes, Australia is lagging far behind the rest of the world when it comes to electric vehicle uptake.[16] This is largely because there is no national policy to promote EVs.

By contrast, policies in Norway, a major exporter of oil, have seen electric vehicles make up the majority of new car sale in the past year.[17] Jurisdictions with end-dates for the last sale of oil-based cars include the UK, France, California, India and China.

Even without policy, Australia will be affected by the shift by most major manufacturers to electric vehicles and away from internal combustion engine vehicles. Failing to plan for this shift is itself an energy security risk.

Policy to shift to EVs is therefore a crucial component of any transport energy security framework.

Beyond increasing uptake of electric vehicles, Australia could further improve its transport energy security by embracing associated manufacturing opportunities.

Despite the much publicised exit of the Australian car manufacturing industry, ABS data show that 30,000 Australians are employed in motor vehicle and motor vehicle part manufacturing, including a number of factories producing EVs, with more planned. Currently there are battery factories announced and planned at various regional cities, and proposals in Western Australia to increase the value of Australia's dominant position in global battery minerals markets.

Enhancing these economic opportunities would further increase Australia's transport energy security.

# POLICY WINDOW OPEN

Policy implementation in complex areas often requires a 'window' of opportunity.

The Australia Institute's research shows the window is wide open, with strong public support for measures that would increase transport energy security.

[15] CSIRO and ENA (2017) *Electric Network Transformation Roadmap,* https://www.energynetworks.com.au/electricity-network-transformation-roadmap

[16] Interim Report, p81

[17] Quicke (2019) *Driving Norse: Electric Vehicle Policies in Norway,* http://www.tai.org.au/sites/default/files/P718%20NPC%20Driving%20Norse%20-%20EV%20Policy_0.pdf

Nearly four in five Australians support requiring new cars sold in Australia to be more efficient, even if they cost a bit more up front. There is also strong public support for a range of policies to support electric vehicle uptake, including

- government built charging stations (79% support),
- government procurement of EVs for its own fleet (76%),
- requiring new apartment blocks to include EV charging stations (73%), and
- government loans for EVs (55%).[18]

Notably, respondents were responding to policies without any explanation of energy security benefits. Awareness of such benefits are likely to increase support further.

# HYDROGEN AND BIO FUELS

While EVs with batteries have been the focus here, we note that a range of other alternatives exist, including both biofuels and hydrogen. Notwithstanding the rapid commercialisation and scale of EVs, there is a role for appropriate research, development and deployment support to other energy sources.

One issue with these approaches to transport energy security is ensuring their production is not itself linked to liquid fuels. Fossil fuel based hydrogen would be heavily reliant on fossil liquid fuels, especially when produced from coal. Biofuels produced in reliance on the agriculture sector would also be reliant on fossil fuel.

Such approaches are unlikely to support transport energy security.

# PUBLIC AND ACTIVE TRANSPORT

The Interim Report appears to pass over the opportunities and need to increase public and active transport (e.g. bicycle and walking).

Australia has high rates of car use, even in our metropolitan cities. Policies to encourage public and active transport would reduce energy insecurity, especially where public transport is electricity based. Policies could include behavioural nudges, financial incentives, changes to planning zones and infrastructure financing. Electrification of public transport (e.g. electric buses) can further decrease emissions and increase security.

[18] The Australia Institute (2019) *Polling – Policies for low emissions and electric cars,* http://www.tai.org.au/sites/default/files/Electric%20Vehicle%20Polling%20-%20Aus%20Institute%20%5BWEB%5D.pdf

While these issues span jurisdictional levels, the Commonwealth can play a strong role in promoting and coordinating progress. These issues should be central to consideration of reducing reliance on imported oil.

# Commitment to decarbonise transport

The discussion above illustrates how increasing transport energy security could at the same time address Australia's commitment to decarbonise its transport sector. The lack of policy on transport energy security is also increasing Australia's emissions. Conversely, decarbonising transport may be easier when supported by the strong policy arguments arising from energy security.

The goal of the Paris Agreement, to limit warming to well below two degrees, should be central to all policy discussion of energy security. In the Paris Agreement, Australia noted that current pledges to cut emissions by 2030 are not enough and committed to increase these pledges in the future. Australia also committed to phase out fossil fuel use in the second half of the century.

The transport sector is the third highest polluting sector in the Australian economy, making up 18% of current emissions, having increased by 57% on 1990 levels.[19] Cars currently represent the largest source of emissions within the transport sector. Car emissions have grown by 25% since 1990.[20]

## ELECTRIC VEHICLES CHARGER WITH CLEAN ENERGY

A common argument against electric vehicles in Australia is that they substitute oil for a largely coal based energy system, increasing emissions.

This argument is misguided for three reasons.

First, the energy system is already decarbonising and can decarbonise much quicker, as the cost of renewables and storage comes down quickly. Second, many EVs owners are likely to capture benefits from their EV 'behind the meter', linking it up with a solar PV array and household storage.

Third, increased grid demand from EVs would induce new supply, which given the economics of new generation would be renewable. The CSIRO has shown that solar and wind, backed up with six hours of storage, is now the lowest cost form of new generation.

[19] Commonwealth of Australia (2016) *National Greenhouse Gas Inventory,* http://ageis.climatechange.gov.au/NGGI.aspx

[20] Climate Analytics (2019), *Australia's Vehicle Fleet- Dirty and falling further behind,* https://climateanalytics.org/publications/2019/australia-climate-factsheets-vehicle-emissions/

Even while the *average* generation on the grid is largely coal power, the *marginal* generation on the grid -- that is, from new investment -- is likely to be renewable.[21]

Additionally, increased demand from EVs will not only save consumers on reduced petrol consumption with the right policy can also downwards pressure on power prices for everyone. CSIRO and ENA find that flexible use of existing grid assets, planning and coordinating EV demand profiles and responses to market prices will help reduce both power prices and emissions.[22] Changes to market rules to increase competition, such as demand response aggregation and 'the five minute' bidding rule, will favour EVs and enable them to make greater value use of the grid.

Similar points apply to energy peaking or remote electricity requirements. While liquid fuel is currently used in these contexts, it is relatively expensive and increasingly replaced by solar, wind, batteries, pumped hydro and demand response. Increased requirements for grid flexibility and falling costs of meeting those requirements create needs and opportunities for reducing liquid fuel reliance.

## NEED FOR A PARIS-CONSISTENT SCENARIO ANALYSIS

Failing to take action on climate change is itself an energy security risk. Climate change will impact on transport energy security directly, but energy transition risks also create threats to energy security, through uncertainty, disruption and risks of stranded assets. 'Transition risks' are only exacerbated by ongoing delay in action.

In a best-practice approach, an energy security framework would integrate Paris-consistent emissions targets.

As a minimum, the Department should *consider* a transport energy system under a Paris-consistent scenario.

'Scenario analysis' is used by energy analysts and increasingly in the corporate world under the recommendations of the G20's *Taskforce on Climate-related Financial Disclosures* (TCFD), to explore risks and opportunities of success under the Paris Agreement. As the International Energy Agency's *Sustainable Development Scenario* shows, mitigating climate change, reducing air pollution and sustaining economic growth are all possible together. However, for this to happen there must be greatly increased policy ambition, including tighter fuel standards and increased EV uptake.

[21] Richardson (2018) *Submission to the Senate Inquiry into electric vehicles* http://www.tai.org.au/content/submission-senate-inquiry-electric-vehicles

[22] CSIRO and ENA (2017) *Electric Network Transformation Roadmap* https://www.energynetworks.com.au/electricity-network-transformation-roadmap

The Department's ongoing work in this area should use and emphasise scenarios relating to alternative uptake scenarios, including scenarios consistent with Australia's commitment under Paris to consider increasing targets consistent with a 2 degree budget.

## CONSULTATION WITH NEW TRANSPORT INDUSTRIES

In developing the final Review and relevant scenarios, the Department should ensure it increases the consultation with industries required to drive this transition, including electric vehicle companies, renewables and smart energy companies, and the financial sector. Historically the debate has been dominated by fossil fuel company interests, reflected in the very framing of the issue as "liquid fuel security". It is important that non-oil and non-liquid fuel industry perspectives are considered fully, as they are central to reducing transport energy security risks.

# Conclusion

To meet our obligations under the Paris Agreement and address risks to transport energy security, Australia must reduce its reliance on imported fuel and shift towards locally generated power, a more decentralised energy system, and higher uptake of electric vehicles. This requires government policies with specific electric vehicle targets and fuel efficiency standards, and government incentives for low and zero emissions vehicles. By contrast, domestic supplies of oil and failing to change the vehicle fleet will both increase emissions and do little to improve energy security.

In conjunction, the review of the *LFE Act* announced by the Minister is clearly pressing. Focus is needed on the provisions of the *LFE Act* which currently hamper effective Government responses to a fuel emergency.

# Meeting our Paris Commitment

## Modelling shows 66-75% renewable energy generation required to meet Australia's emissions target and avoid transferring major burden onto other sectors.

*If Australia is to achieve the Abbott Government's climate targets new energy policies will be required. Existing government modelling shows that renewable energy generation of 75% in 2030 could be required if an abatement cost or long-term incentive approach guides climate policy.*

Discussion paper

**Rod Campbell**
**September 2017**

# ABOUT THE AUSTRALIA INSTITUTE

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# Summary

Under the Abbott Government, Australia signed the Paris climate agreement, committing to reduce carbon emissions by 26-28% below 2005 levels by 2030. The electricity sector will play a significant role in meeting these targets, as it accounts for 35% of the country's total emissions.

A central question concerning the electricity sector's role in meeting Australia's mitigation targets is whether it should reduce its emissions by 26-28%, consistent with the national target, or whether it should shoulder a larger part of the abatement task.

While an equal proportion approach has the benefit of simplicity, it is inefficient because it will push the abatement task onto other industries, where the costs of abatement are higher. The electricity sector can turn to renewable energy which is already commercially available, while other sectors such as agriculture, construction and manufacturing do not have similarly available and cost-effective options. Because of this it has long been assumed that the electricity sector would reduce emissions by more than other parts of the economy.

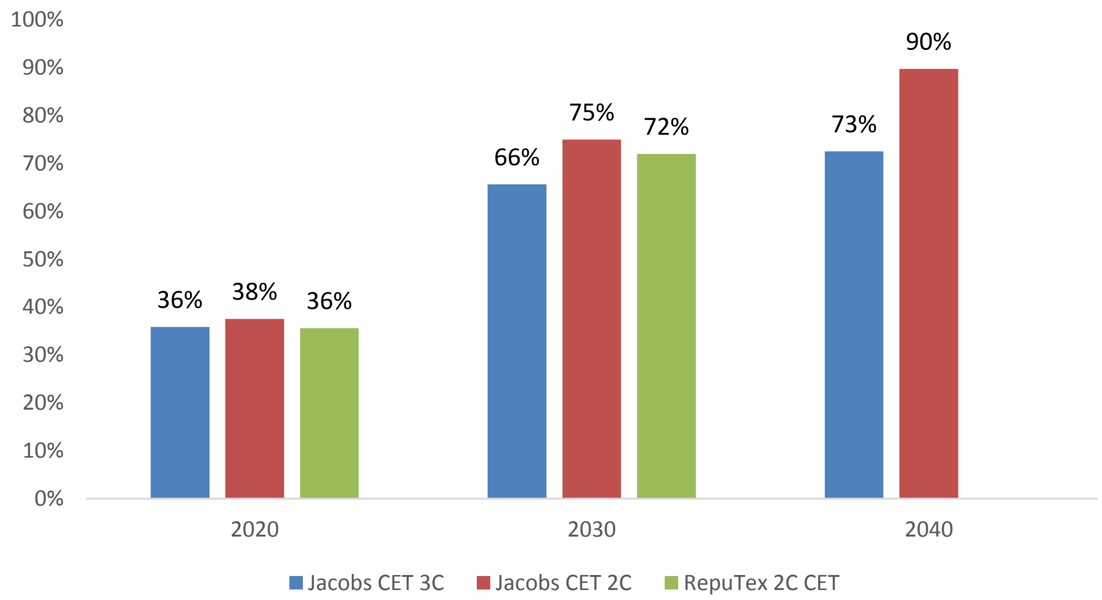
Alternatives to a proportional approach include setting policy with reference to costs of abatement, or to incentives for long term investment.

Government agencies have conducted modelling exercises that consider the size of the task of the electricity sector, what policies could help achieve this and what level of renewable energy generation would result from these policies. This report collates and compares the results of these modelling exercises, showing the likely outcomes from current policy options.

A key result is that under the more efficient abatement cost and long-term investment signal approaches, the electricity sector will need to reduce emissions by between 40%-55% below 2005 levels in 2030.

The level of renewable energy penetration required to achieve emissions reductions of this magnitude under a CET-like policy have been estimated in separate assessments by well-known consultants Jacobs Group and RepuTex, with results summarised in the chart below:

### Renewable penetration, with 40%-55% CET




Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) *It's the economics, stupid*

These studies show that if an abatement cost approach is used to set the 2030 electricity sector target, and a CET-like policy is used to achieve it, renewable penetration is likely to be in the order of 66-75% by 2030.

# 1. Introduction

Under the Paris Climate Change Agreement, all parties are required to submit and maintain nationally determined contributions (NDCs) that they intend to achieve and 'pursue domestic mitigation measures, with the aim of achieving the objectives of such contributions'. Collectively, the successive NDCs are intended to realise the agreement's objective of 'holding the increase in the global average temperature to well below 2°C above pre-industrial levels'.[1] Australia's first NDC, which was officially submitted in November 2016, commits it to an economy-wide emission reduction target of between 26-28% below 2005 levels by 2030. Although expressed as a single year target, the Australian Government intends to develop it into an emissions budget covering 2021-2030, meaning there will be a target level of cumulative emissions over this period.[2]

The Australian Government currently has a number of policies that are intended to reduce greenhouse gas emissions, including the Emission Reduction Fund (ERF), Large-scale Renewable Energy Target (LRET) and the minimum energy efficiency standards set under the *Greenhouse and Energy Minimum Standards Act 2012* (Cth). There are also a number of state, territory and local government policies that aim to abate emissions like the Victorian and Australian Capital Territory (ACT) renewable energy target schemes, and the energy efficiency schemes that operate in Victoria, South Australia, New South Wales and the ACT. Despite the existence of these policies, additional measures are likely to be required to meet the 2030 targets. The Australian Government's latest projections suggest emissions will have to be reduced by a further 842-1202 million tonnes (Mt) of carbon dioxide equivalent ($CO_2$-e) to meet the NDC commitments.[3]

In addition to the need for measures to reduce emissions, the Australian Government has faced pressure to respond to the escalating crisis in the electricity sector. In recent years, the National Electricity Market (NEM) has been beset by rapidly increasing prices, which have adversely affected residential, commercial and industrial electricity

[1] *Paris Agreement,* p 2, http://unfccc.int/files/home/application/pdf/paris_agreement.pdf

[2] See for e.g. Department of Foreign Affairs and Trade (2015) *Australia's intended Nationally Determined Contribution to a new climate change agreement,* http://dfat.gov.au/international-relations/themes/climate-change/submissions/Pages/australias-intended-nationally-determined-contribution-to-a-new-climate-change-agreement-august-2015.aspx

[3] Department of the Environment and Energy (2016) *Australia's emissions projections 2016,* p 8, https://www.environment.gov.au/system/files/resources/9437fe27-64f4-4d16-b3f1-4e03c2f7b0d7/files/aust-emissions-projections-2016.pdf

consumers. The escalating prices are attributable to a combination of factors, particularly high gas prices, increased retail margins, the closure of aging coal-fired generators and a lack of investment in new generation capacity beyond that supported by the LRET. One of the major reasons for the generation investment drought is the absence of stable long-term climate policy signals. Fluctuations in climate policy over the past decade have created uncertainty, undermining the ability of investors to judge the economic viability of alternative energy investments. Those considering investments in fossil fuel generators have been concerned about potential increases in the stringency of climate policy constraints. Similarly, those considering investments in low emissions generators have been stymied by the absence of short-term incentives outside of the LRET and uncertainty about the longer-term trajectory of climate policy.

To address the challenges facing the electricity sector, the Australian Government commissioned the Independent Review into the Future Security of the National Electricity Market, led by the Chief Scientist, Dr Alan Finkel (Finkel Review).[4] The Review highlighted the adverse impacts of ongoing policy uncertainty and called for long-term policy stability and clarity.

> Uncertainty related to emissions reduction policy and how the electricity sector will be expected to contribute to future emissions reduction efforts has created a challenging investment environment in the NEM. Ageing generators are retiring from the NEM, but are not being replaced by comparable dispatchable capacity. Policy stability is required to give the electricity sector confidence to invest in the NEM.
>
> Reliability in the NEM will be strengthened by establishing a framework for an orderly transition to a low emissions future. This must include a long-term emissions reduction target for the electricity sector, a credible and enduring mechanism for the sector to achieve the emissions reduction trajectory and better management of generator closures.[5]

To address concerns about policy uncertainty, and drive emissions reductions, the Finkel Review made a number of recommendations, the most relevant of which were:

- the Australian and State and Territory governments agree to an emissions reduction trajectory for the NEM; and

[4] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, http://www.environment.gov.au/system/files/resources/1d6b0464-6162-4223-ac08-3395a6b1c7fa/files/electricity-market-review-final-report.pdf

[5] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 33

- the Australian Government introduce a Clean Energy Target (CET) to help meet Australia's Paris Agreement commitments and improve security and reliability in the electricity sector.[6]

A CET is a type of tradeable permit scheme in which new electricity generators (or existing generators who generate above a historic baseline) receive certificates for electricity they generate as long as their emissions are below a threshold per unit of electricity (emissions intensity). Depending on the emissions intensity of their generation, they are awarded more or less of these certificates. The emissions intensity threshold mooted in the Finkel Review was 0.6 tonnes of carbon dioxide equivalent ($CO_2$-e) per MWh, meaning a generator with an emissions intensity of 0 $tCO_2$-e/MWh would receive 1 certificate per MWh, a generator with an emissions intensity of 0.3 $tCO_2$-e/MWh would receive 0.5 of a certificate per MWh, and a generator with an emissions intensity of ≥0.6 $tCO_2$-e/MWh would receive no certificates. Generators who receive CET certificates would sell them to electricity retailers, who would be required by law to purchase a prescribed number each year. The cost of purchasing these certificates would be passed onto electricity consumers through their electricity bills.

This process is similar to the LRET, under which eligible generators are awarded one 'large-scale generation certificate' (LGC) for each MWh of generation. Retailers are required to buy a set number of LGCs each year from eligible generators. The two main differences between the LRET and a CET are:

- a CET awards certificates in proportion to the extent to which their emissions intensity is below the prescribed threshold (under the LRET, eligible generators receive 1 LGC for each MWh of generation); and
- under a CET, the generation target, which determines the number of certificates retailers are required to purchase, is calibrated to achieve an emissions target for the electricity sector (under the LRET, the target is set to achieve a prescribed amount of eligible generation).

To give effect to the Finkel Review's recommendations and implement the CET, the Australian Government must set an emissions reduction trajectory for the electricity sector. The Review only considered the trajectory briefly, commenting:

> At a minimum, the electricity sector should have a trajectory consistent with a direct application of the national target of 26 to 28 per cent reduction on 2005

[6] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 21 onwards

> levels by 2030, as per Australia's international obligations under the Paris Agreement.[7]

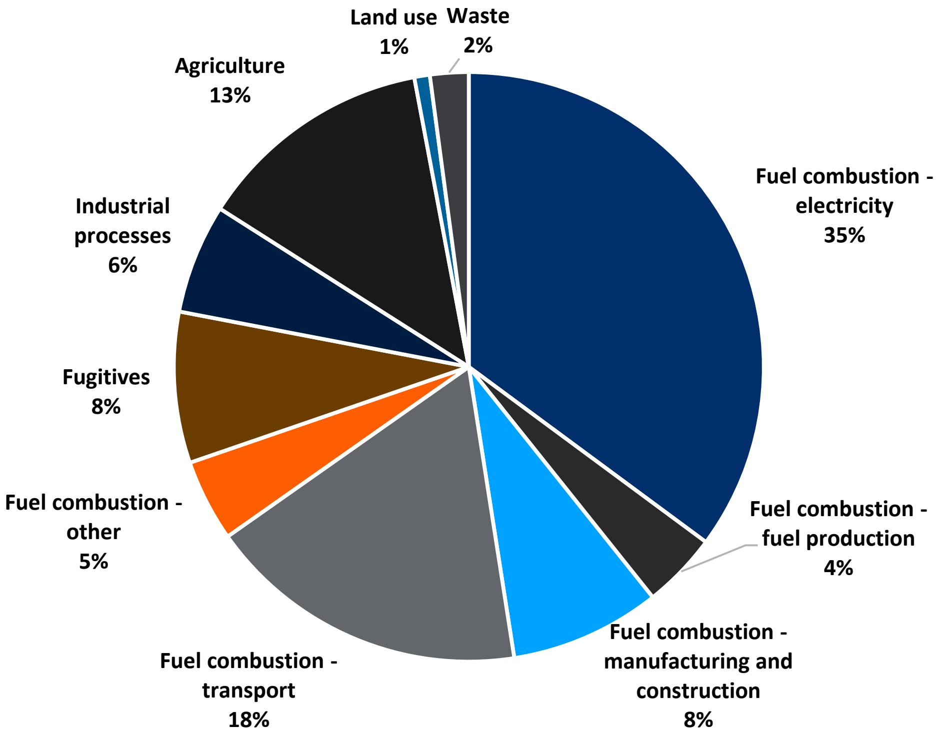
This report considers what emission reduction targets should be adopted for the electricity sector and what amount of renewable energy generation is likely to be required to meet them. Both issues are of high current policy interest. The Australian Government is currently considering whether to implement the proposed CET and what targets it might set for the electricity sector as part of its 2017 Climate Policy Review. The Opposition has signalled 'in principle' support for a CET and has committed to a 50% renewable energy target by 2030, which has been ridiculed by the Government and conservative commenters. The remainder of the report is set out as follows. Section 2 provides background information on Australia's greenhouse gas emissions and the current generation mix in Australia's electricity sector. Section 3 analyses what emission reduction targets should be adopted for the electricity sector. The analysis draws on the major climate change modelling exercises undertaken by and for the Australian Government and Australian Government agencies over the past decade, and recent modelling by RepuTex. Section 4 looks at the required level of renewable energy penetration under a CET to achieve alternative electricity sector targets and section 5 concludes.

[7] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 86

# 2. Australia's emissions and electricity generation

Approximately 70% of Australia's emissions come from the combustion of fuels for energy, with the remainder coming from a combination of agriculture (mainly methane from animals' digestion and methane and nitrous oxide emissions associated with manure and soils), fugitive emissions from mining and oil and gas production, industrial processes like metal, cement and chemical production, waste and the net emissions from land use (e.g. net carbon dioxide emissions and sequestration associated with deforestation and native forest harvesting, and agricultural soils) (Fig. 1). Fuel combustion associated with electricity generation is the largest single source of emissions. In 2015, it constituted 35% of Australia's emissions, or 189 $MtCO_2$-e.

**Figure 1. Australia's emissions, by sector, 2015 (total 538 $MtCO_2$-e)**



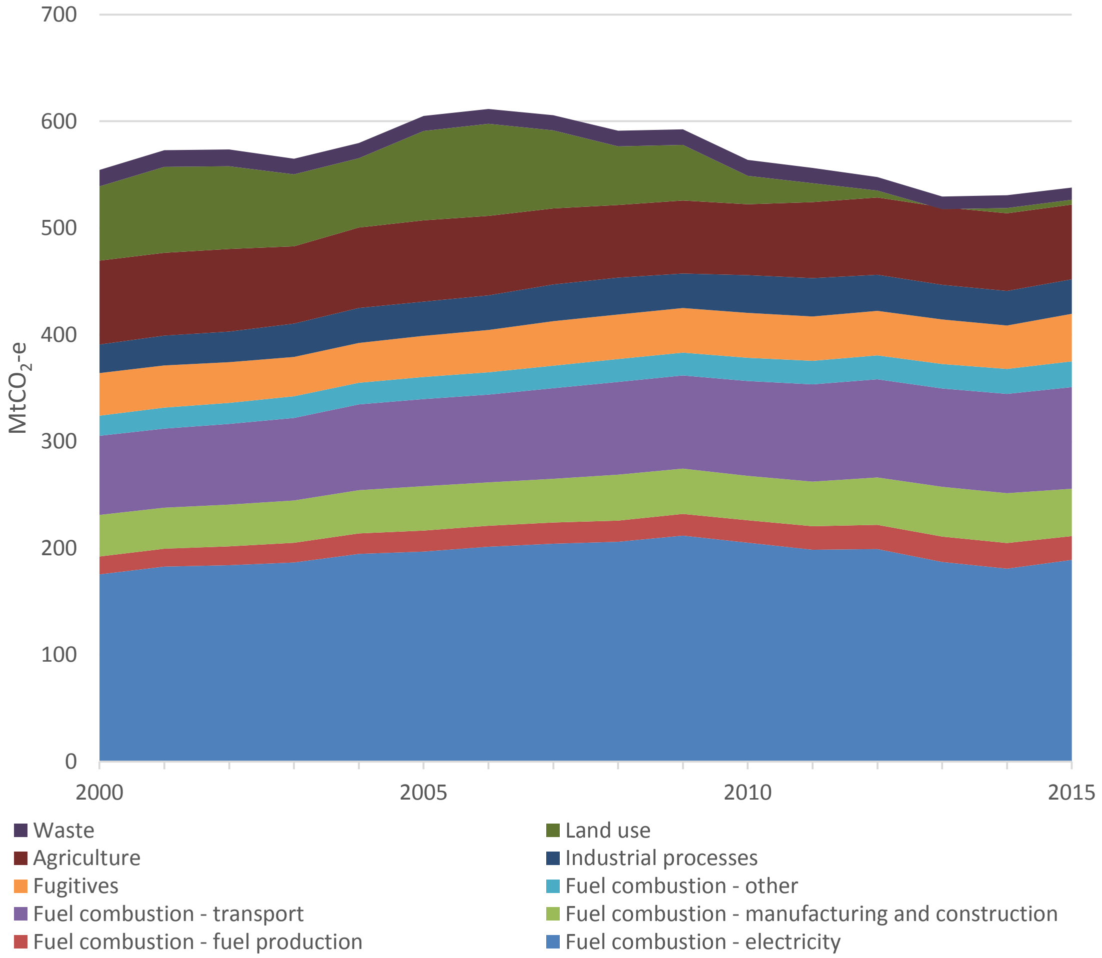

Source: Department of the Environment and Energy (2017)[8]

As Figure 2 shows, over the period 2000-2009, there was steady growth in emissions across the energy sector, including from electricity generation. After 2009, the rate of

[8] Department of Environment and Energy (2017) *Australian Greenhouse Emissions Information System* (AGEIS). http://ageis.climatechange.gov.au/.

growth in these sectors slowed and, in the case of the electricity sector, they declined, falling from 211 $MtCO_2$-e to a low of 181 $MtCO_2$-e in 2014. After the repeal of the carbon pricing mechanism in 2014, electricity sector emissions increased in 2015, mainly as a consequence of a decline in hydroelectric generation. Since then, electricity sector emissions have remained relatively stable.

**Figure 2. Australia's emissions, by sector, 2000-2015, $MtCO_2$-e**



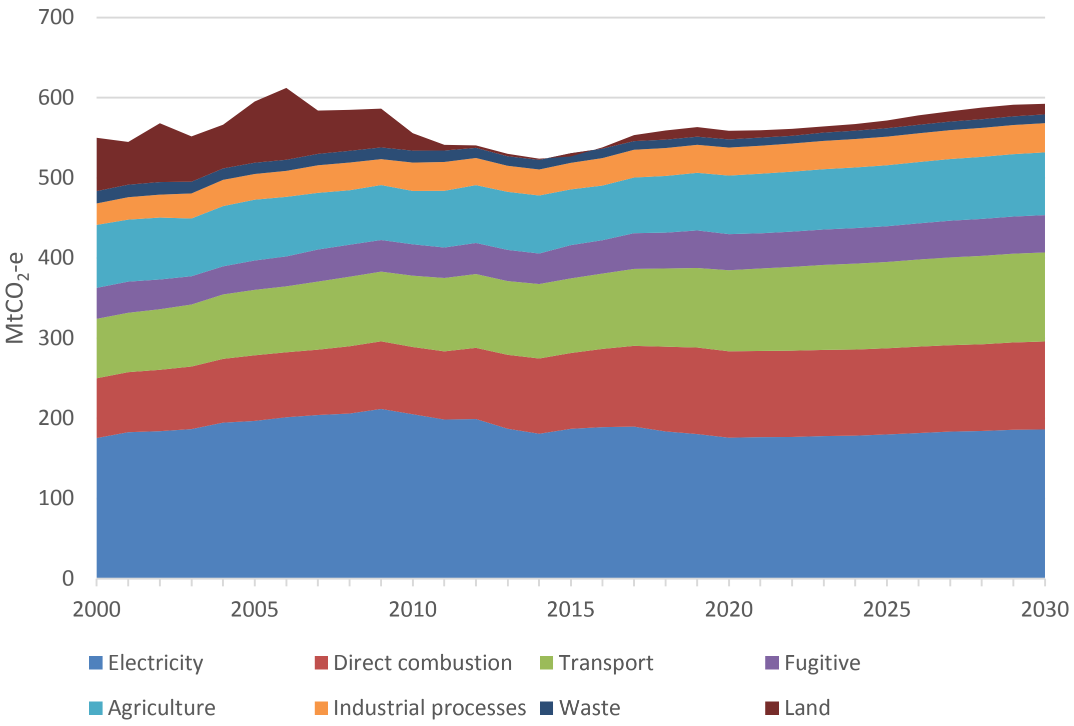

Source: Department of the Environment and Energy (2017)[9]

Going forward, the Department of the Environment and Energy projects that, in the absence of new policies, electricity sector emissions will fall in the near-term, dropping to 176 $MtCO_2$-e in 2020, before gradually climbing back to 186 $MtCO_2$-e in 2030 (Fig. 3). Outside of the electricity sector, emissions are expected to increase by 20% over the period 2015-2030, driven mainly by increasing emissions from gas production, coal mining, transport and the beef industry. As noted above, continued growth in

[9] Department of Environment and Energy (2017) *Australian Greenhouse Emissions Information System* (AGEIS). http://ageis.climatechange.gov.au/.

emissions to 2030 is expected to leave an abatement task of between 842-1202 $MtCO_2$-e to meet the 26-28% 2030 targets. This will require a suite of new policies, potentially covering all relevant sectors of the economy.

**Figure 3. Australia's emissions, actuals 2000-2015, projections 2016-2030, $MtCO_2$-e**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) Australia's emissions projections 2016.

# 3. Electricity sector and emission targets

In the absence of an economy-wide carbon price, there is a need for a sector-based approach, where the national abatement task is divided between the sectors and policy instruments are tailored to the characteristics of each sector. The division of the national abatement task between the sectors involves setting sector-specific emission reduction targets, as is proposed for the electricity sector under the CET.

There are three main competing approaches to setting sectoral emission reduction targets:

- equal proportional reduction approach, where the economy-wide emission reduction target is applied equally to all sectors;
- abatement cost approach, where sectoral targets are calibrated on the basis of the economy-wide target and the relative costs of reducing emissions in each sector;
- long-term investment signal approach, where targets for capital-intensive sectors, like the electricity sector, are calibrated to a long-term decarbonisation goal.

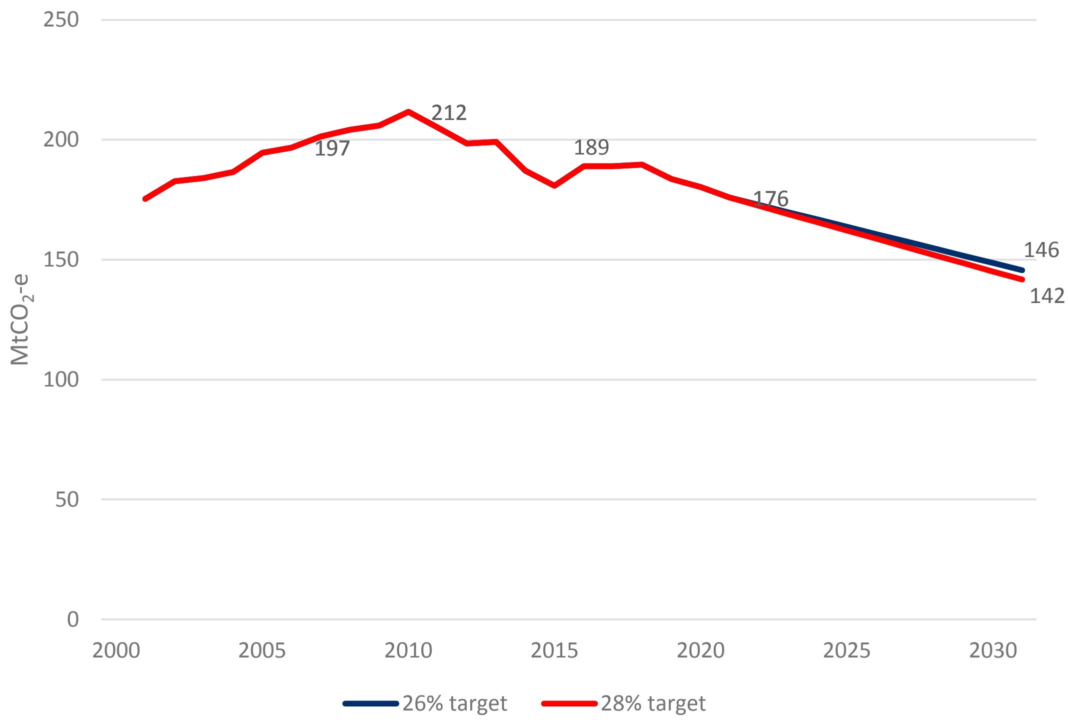
In the following sections, we consider how these approaches would apply to the determination of electricity sector targets for the proposed CET.

## EQUAL PROPORTIONAL REDUCTION APPROACH

The equal proportional reduction approach involves the application of the economy-wide emission reduction target to each sector on an equal basis, regardless of the relative abatement costs in each sector. Hence, if Australia pursues a 28% economy-wide reduction in emissions below 2005 levels, the electricity sector will be required to reduce its emissions by 28% relative to 2005 levels by 2030.

On the basis of the most recent emissions estimates, the application of a simple equal proportional reduction approach would result in an electricity sector target under the CET of between 142-146 $MtCO_2$-e for 2030, corresponding to the 26-28% below 2005 range (Fig. 4).

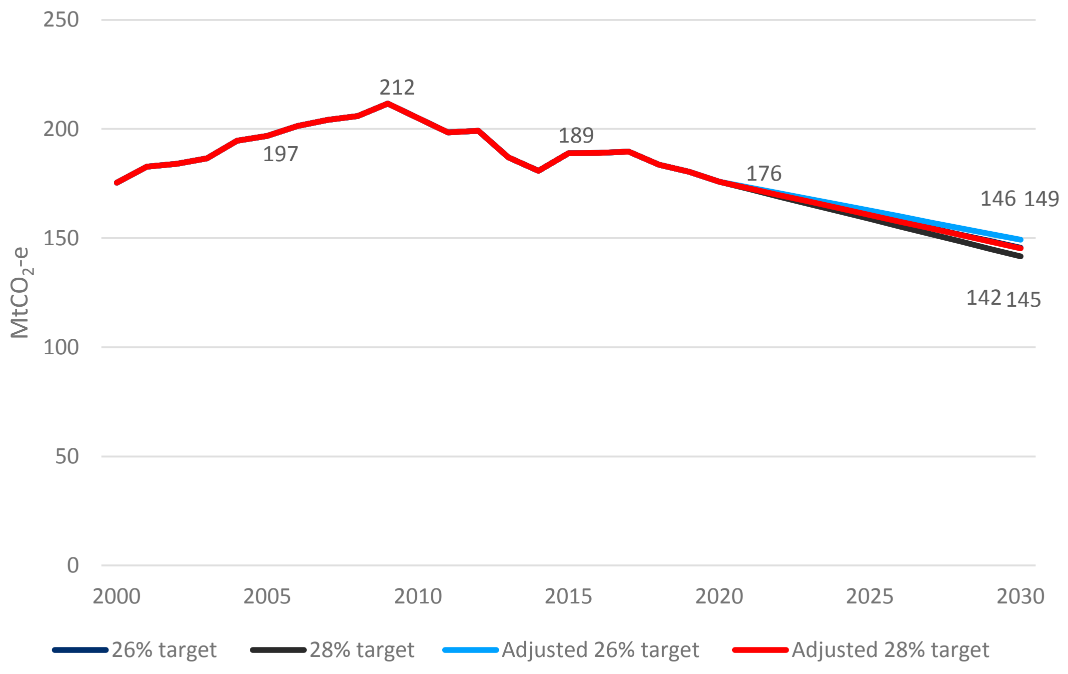
**Figure 4. Simple equal proportional reduction approach**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) *Australia's emissions projections 2016*; and author calculations.

One complication associated with the application of the equal proportional reduction approach is the treatment of 'carryover' amounts from Kyoto Protocol. Australia's cumulative emissions over the first commitment period of the Kyoto Protocol, 2008 to 2012, were 128 $MtCO_2$-e below its assigned amount. Under the Protocol's rules, Australia was entitled to carry the 128 $MtCO_2$-e forward and use it to meet its targets in the second commitment period, 2013-2020. The Australian Government is currently projecting it will meet its second commitment period target, after accounting for the carryover and other adjustments, by 207 $MtCO_2$-e. It is currently unclear whether Australia intends to carry this amount forward into the 2020-2030 period. The inclusion of the carryovers converts the 26% and 28% 2030 targets to 24% and 26% respectively, all below 2005. For the electricity sector, this results in 2030 targets of between 146-149 $MtCO_2$-e (Fig. 5).

**Figure 5. Equal proportional reduction approach with carryovers**




Source: Department of the Environment and Energy (2017) Australian Greenhouse Emissions Information System (AGEIS); Department of the Environment and Energy (2016) *Australia's emissions projections 2016*; and author calculations.

# ABATEMENT COST APPROACH

The main attraction of the equal proportional reduction approach is its simplicity. Its primary disadvantage is it is likely to be inefficient as it does not account for the costs of abating emissions in each sector or the viability of designing policies that effectively capture these opportunities. The supply-side of the electricity sector is known to have some of the cheapest and most accessible abatement in the economy. This is because of the availability of mature low-emissions generation technologies and the concentrated nature of the sector, which lowers the degree of difficulty in designing effective policies to motivate their uptake. A further benefit associated with supply-side electricity sector abatement is it can catalyse emissions reductions in other sectors. In particular, decarbonisation of the electricity sector can drive emissions reductions through fuel switching in the transport and manufacturing sectors.

Due to this, there is a risk that, if the equal proportional reduction approach is adopted, it will shift a disproportionate amount of the abatement task onto other sectors like manufacturing, agriculture and the land sector where there are fewer low-cost and scaleable ways of reducing emissions, other than by cutting production. This would increase the economy-wide costs of meeting Australia's mitigation commitments. The Finkel Review explicitly acknowledged this, stating:

> It may be appropriate for governments to ask the electricity sector to do more than a direct application of the national target. The electricity sector may have more economically viable opportunities to reduce emissions than other sectors. Moreover, emissions reduction efforts through electrification in transportation and industrial processes will be enhanced by lowering the emissions intensity of the electricity sector.[10]

To test this, we compared the comparative levels of national and electricity sector abatement from three climate change policy modelling exercises conducted over the period 2008 to 2016:

- the Commonwealth Treasury and Department of Industry, Innovation, Climate Change, Science, Research and Tertiary Education modelling undertaken as part of the Climate Change Authority's 2014 Targets and Progress Review (CCA 2014);[11]
- the Commonwealth Treasury modelling undertaken to inform the *Clean Energy Future* package, which appeared in the Strong Growth, Low Pollution report of 2011 (SGLP 2011);[12] and
- the Commonwealth Treasury modelling undertaken for the purposes of the Australia's Low Pollution Future report in 2008 (ALPF 2008).[13]

From the three modelling exercises, five relevant scenarios were identified: two that were classified as ambitious (i.e. consistent with keeping the increase in the global average surface temperature to 2°C) [14] and three that were classified as unambitious (i.e. not consistent with keeping the increase in the global average surface temperature to 2°C). [15] We then compared the level of national and electricity sector abatement (reference level emissions minus mitigation scenario emissions) in each

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[10] Finkel (2017) *Independent review into the Future Security of the National Electricity Market*, p 86

[11] In Climate Change Authority (2014) *Reducing Australia's greenhouse gas emissions – Targets and progress review: Final report*, http://climatechangeauthority.gov.au/reviews/targets-and-progress-review-3

[12] In Commonwealth of Australia (2011) *Strong growth, low pollution: Modelling a carbon price,* *http://carbonpricemodelling.treasury.gov.au/content/report.asp*

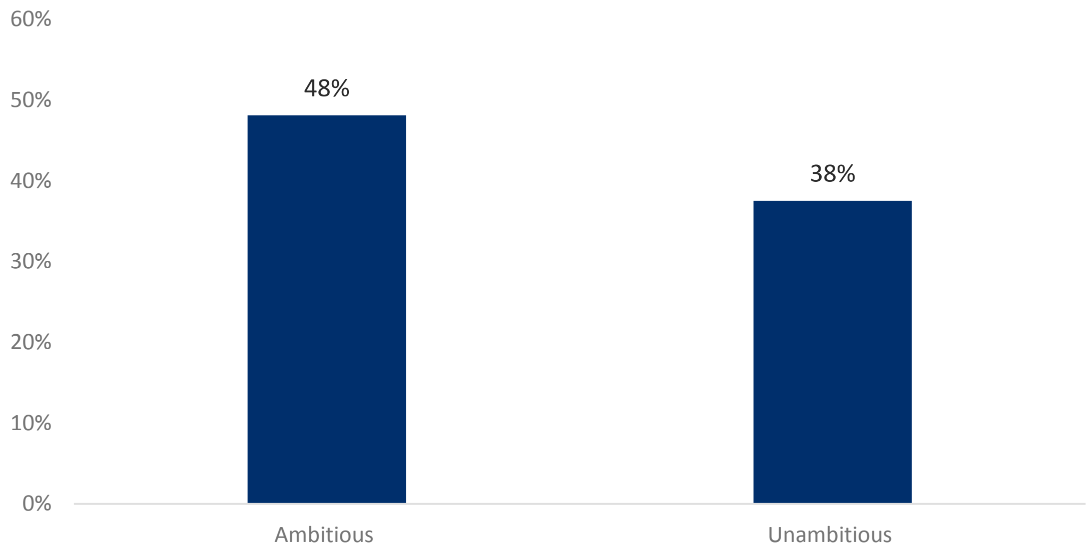
[13] Australian Treasury (2008) *Australia's low pollution future: The economics of climate change mitigation,* http://lowpollutionfuture.treasury.gov.au/

[14] The SGLP (2011) and CCA (2014) High Price scenarios.

[15] The CPRS-5 (ALPF 2008), Clean Energy Future (CEF) (SGLP 2011) and Central Policy (CCA 2014) scenarios.

scenario. The average proportion of national abatement provided by the electricity sector to 2030 in the ambitious and unambitious scenarios is shown in Figure 6.

**Figure 6. Electricity sector share of abatement task, average of scenarios**



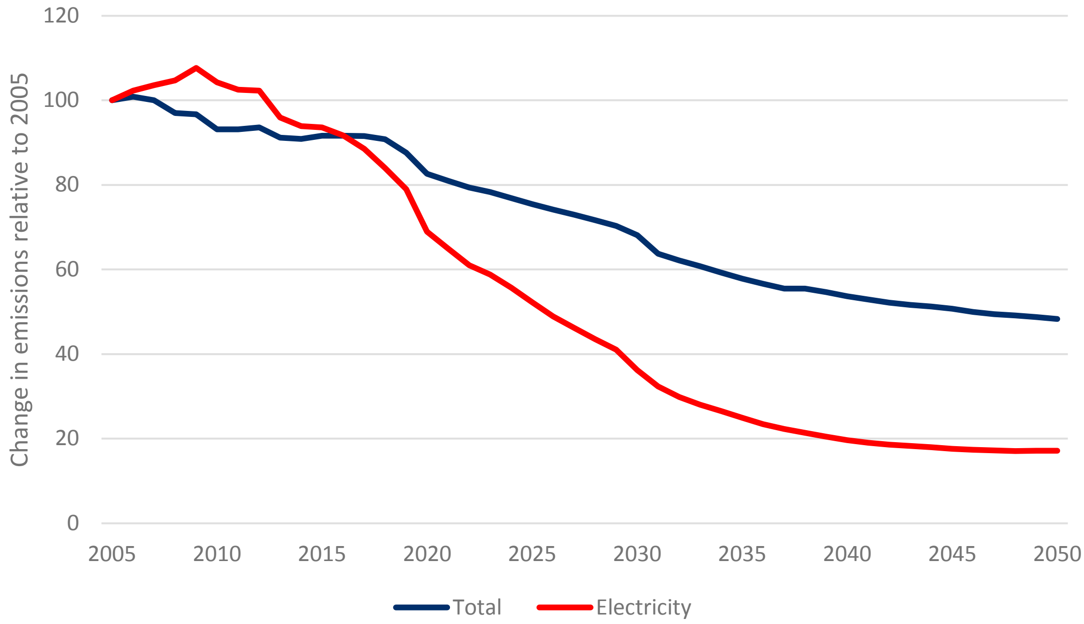

Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008

Figure 6 suggests a least-cost path to achieving national mitigation commitments is likely to involve the electricity sector making a disproportionate contribution to the abatement task. Despite the electricity sector comprising 33% of national emissions in the base years of the modelling, its average contribution to the abatement effort to 2030 under the ambitious scenarios was 48% and 38% under the unambitious scenarios.

The abatement cost approach is built on premise that it is in the best interests of society to minimise the economy-wide costs of achieving mitigation commitments. To achieve this, it calibrates sectoral targets on the basis of the relative costs of reducing emissions in each sector. The aim is to ensure total net emissions add up to the economy-wide target but sectors with relatively low abatement costs would be required to achieve higher proportional emission reductions than sectors with relatively high abatement costs. By setting sectoral targets on the basis of abatement costs, this approach ensures the mitigation commitments are achieved at or near least cost.

To provide insights on what the electricity sector target for the CET should be relative to 2005 emissions under the abatement cost approach, we analysed the change in total national emissions and electricity sector emissions relative to 2005 from each of the five scenarios identified above, as well as an additional 'ambitious' scenario from the Victoria University computable general equilibrium (CGE) modelling undertaken as part of the Climate Change Authority's 2016 Special Review into Australia's emissions reduction policies (CCA 2016).[16] The mean results from the six scenarios are presented in Figures 6 and 7, and tables 1 and 2. The results confirm that the adoption of an abatement cost approach to setting targets for the purposes of the CET is likely to result in the electricity sector having to make disproportionate reductions in emissions. Across all six scenarios, the reductions in electricity sector emissions relative to 2005 levels were greater than the reductions in total national emissions.

**Figure 6. Ambitious scenarios, reductions in total national and electricity sector emissions relative to 2005**




Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008 and CCA 2016

Figure 6 shows that under an abatement cost approach where Australia meets its emissions reduction targets, electricity sector emissions decline by a far greater proportion than overall emissions. The difference between percentage reduction in total abatement and electricity sector abatement for selected years is presented in Table 1 below:

[16] Victoria University (2016) *Simulation of the effects of greenhouse gas mitigation policies for the Australian electricity sector,* http://climatechangeauthority.gov.au/reviews/special-review/modelling-illustrative-electricity-sector-policies The scenario included was the Victoria University (2016) Reference Case, involving the application of an economy-wide carbon price consistent with achieving a 2°C outcome.

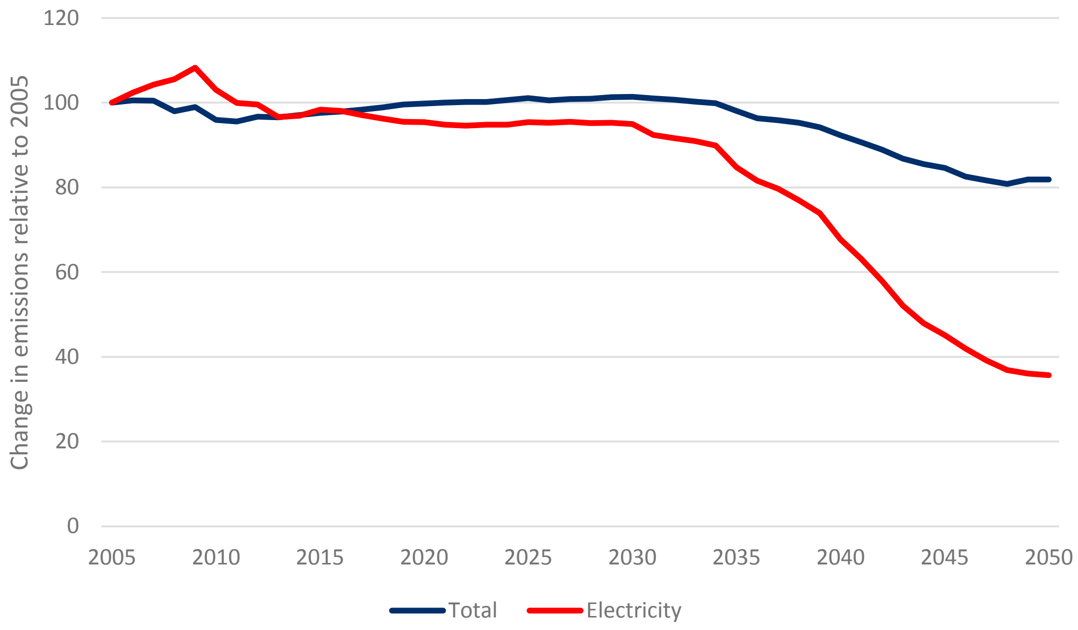
**Table 1. Ambitious scenarios, percentage point difference between reductions in total national and electricity sector emissions relative to base year**

| | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Mean** | 14 | 32 | 34 | 31 |

Source: Author's calculations based on CCA 2014, SGLP 2011, ALPF 2008 and CCA 2016

Figure 7 and Table 2 present the same calculations for the unambitious scenarios modelled in CCA 2014, SGLP 2011 and ALPF 2008

**Figure 7. Unambitious scenarios, reductions in total national and electricity sector emissions relative to 2005**




Source: Author's calculations

**Table 2. Unambitious scenarios, percentage point difference between reductions in total national and electricity sector emissions relative to base year**

| | 2020 | 2030 | 2040 | 2050 |
|---|---|---|---|---|
| **Mean** | 4 | 6 | 25 | 46 |

Source: Author's calculations

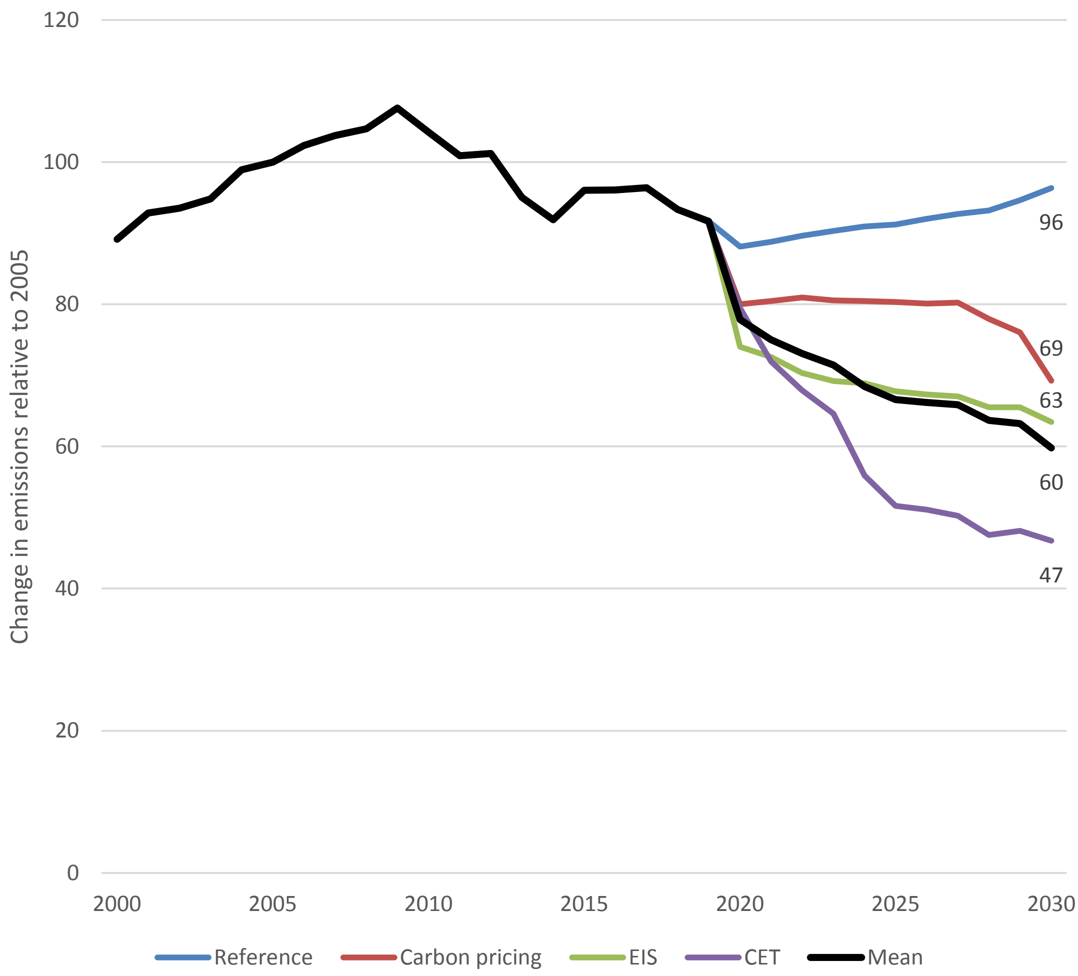
If Australia remains committed to its current 2030 (26%-28%) targets, an electricity sector target consistent with the abatement cost approach could be estimated using the percentage point difference from the unambitious scenarios identified in Table 2. For example, the average difference from the three scenarios at 2030, 6%, could be added to the 28% target, providing an electricity sector target of 34%.

Although this approach has the benefit of simplicity, it has a number of weaknesses that stem from the nature of the scenarios on which it is based, particularly the fact the scenarios all assume the relatively early deployment of an economy-wide carbon price. The early commencement of the carbon price allows for lower levels of abatement in the earlier decades. The delay in the deployment of a comprehensive policy to reduce emissions after the repeal of the carbon price in 2014 has necessitated more ambitious mitigation over the coming years. The dated nature of the modelling (2008, 2011 and 2014) also reduces its reliability; for example, more recent analysis captures the significant changes in the cost and viability of alternative technologies, and the changes in sectoral emissions over the past decade.

As part of the Climate Change Authority's 2016 Special Review, the Jacobs Group modelled scenarios consistent with achieving a 3°C global temperature outcome.[17] The results from this modelling provide a better approximation of the magnitude of the emissions reductions required in the electricity sector to meet the current 26-28% 2030 targets using an abatement cost approach. The modelling was conducted using a single carbon price path to devise an emissions budget for the electricity sector of approximately 2,800 Mt$CO_2$-e to 2050. The performance of different policy instruments in meeting the budget was then compared. The instruments compared included a carbon price, emissions intensity scheme (EIS), and a CET (only it was called a Low Emissions Target (LET)). The change in electricity sector emissions relative to 2005 under the 3°C reference, carbon price, EIS and CET scenarios are shown in Figure 8, along with the mean from the three mitigation scenarios.

[17] Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report,* http://climatechangeauthority.gov.au/reviews/special-review/modelling-illustrative-electricity-sector-policies

**Figure 8. Change in electricity sector emissions under the Jacobs 3°C reference, carbon price, EIS and CET scenarios, relative to 2005**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

Figure 8 shows the mean reduction in emissions in 2030 on 2005 levels across the three scenarios to 60% of 2005 levels. However, under the CET, the required reduction in electricity sector emissions was 53%. Based on these data, an abatement cost derived 2030 electricity sector target for the purposes of the CET is likely to have to be a minimum of 40% below 2005 levels, and possibly around 50%, just to meet the unambitious 26-28% Paris commitments.

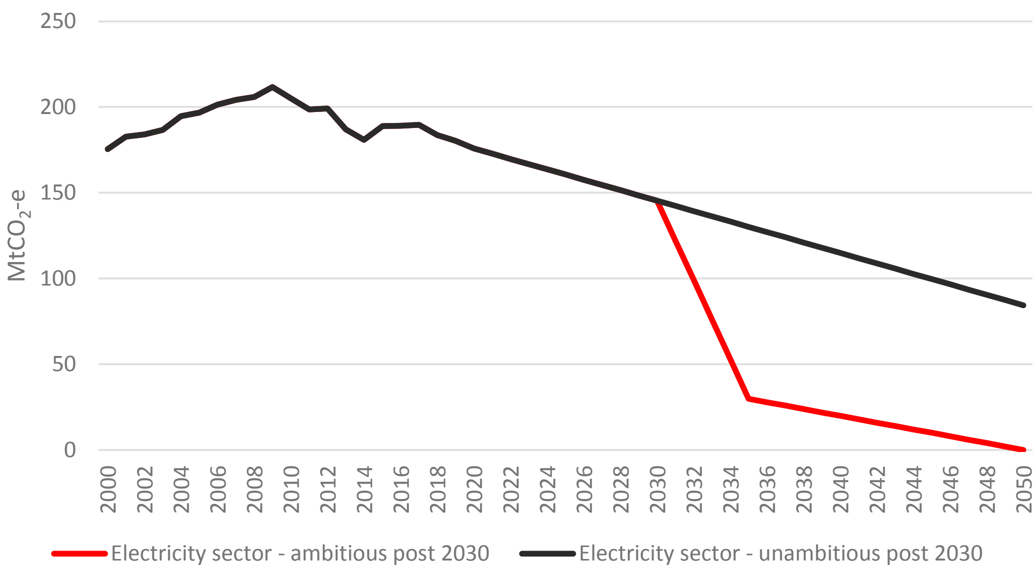
## LONG-TERM INVESTMENT SIGNAL APPROACH

An inherent weakness of both the equal proportional reduction and abatement cost approaches is they could create investment uncertainty in capital-intensive sectors like the electricity sector because of inconsistencies between short-term policy settings and long-term policy expectations.

Under the equal proportional reduction and abatement cost approaches, the electricity sector emission targets are likely to be calibrated to meet the 2030 economy-wide target. However, due to the unambitious nature of Australia's 2030 mitigation targets, it is likely there will have to be a rapid escalation of the abatement effort after 2030 in order for Australia's contribution to be consistent with the Paris Agreement's objectives. This creates uncertainty for investors in the electricity sector, as they are unable to gauge whether the long-term policy settings will be consistent with the Paris Agreement.

Electricity generation assets have long economic lives. This means investors need to consider both existing and future carbon-energy policy settings. The apparent incongruity between Australia's 2030 mitigation targets and the long-term commitments embodied in the Paris Agreement create uncertainty. Investors do not know whether the unambitious approach embodied in the 2030 targets will persist, or whether policy settings will be modified to give effect to the Paris Agreement's commitments. As the hypothetical scenarios in Figure 9 illustrate, the post-2030 policy settings could remain unambitious, which might translate into a gradual decline in electricity sector emissions under the CET through to 2050 and beyond. Alternatively, there may be a rapid increase in the level of ambition, requiring a sharp drop in electricity sector emissions in the 2030s and zero emissions by 2050. The uncertainty about post-2030 policy settings could deter investment and increase the cost of capital, with flow on effects for the price of electricity in the market.

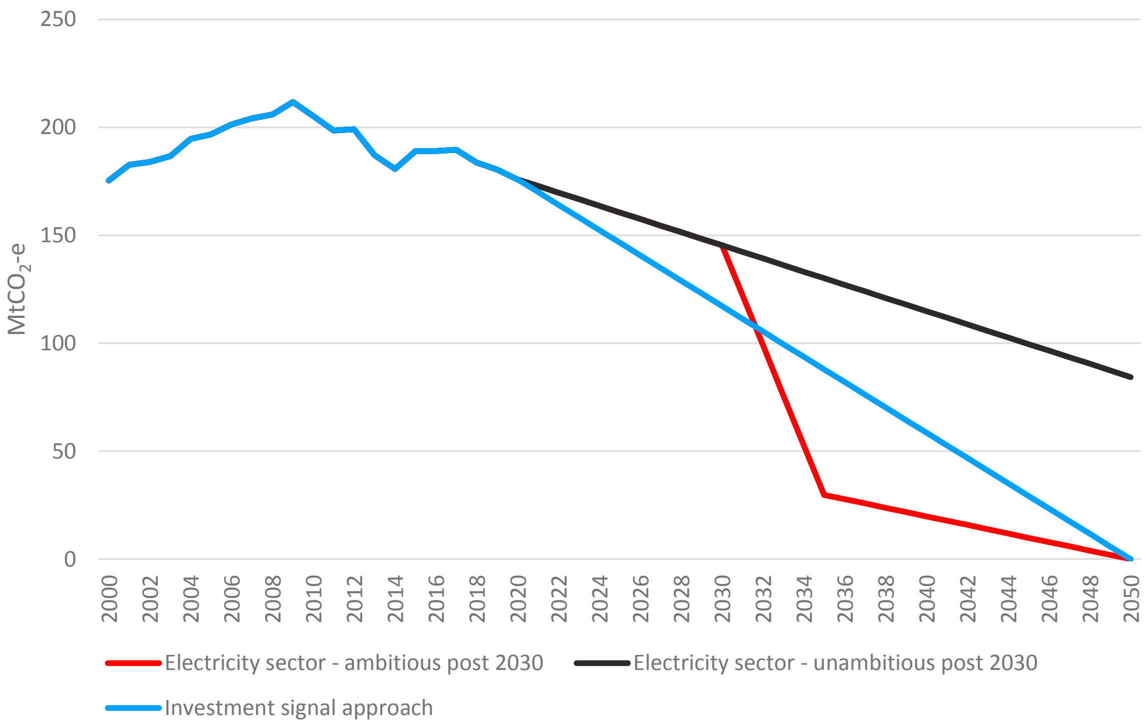
**Figure 9. Electricity sector emissions under possible future policy settings**



Source: Author's calculations

The long-term investment signal approach is designed to avoid this uncertainty by setting the emission targets for the electricity sector in a manner consistent with the long-term objective of decarbonisation at or before 2050. Figure 10 illustrates the basic premise behind the approach. Rather than facing the prospect of abrupt future changes in emissions, investors face a long-term emission path that provides them with certainty about policy settings over coming decades.

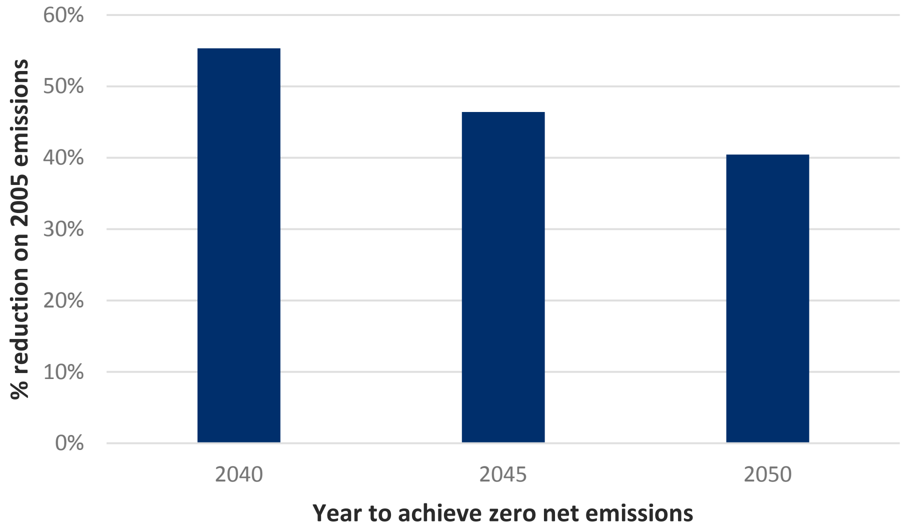
**Figure 10. Electricity sector emissions under possible future policy settings, including a long-term investment signal**




Source: Author's calculations

We estimated the 2030 electricity sector targets that would be consistent with a long-term investment signal approach by assuming a linear decline in electricity sector emissions from 2020 to net zero emissions in 2040, 2045 and 2050. The results are shown in Figure 11.

**Figure 11. 2030 CET target for the electricity sector under long-term investment signal approach**




Source: Author's calculations

Figure 11 shows that if net zero emissions are to be achieved between 2040 and 2050, the electricity sector will need to reduce its emissions by 40-55% by 2030 under a long-term investment approach. This is a far greater share of emissions than the current overall targets of 26-28% by 2030.

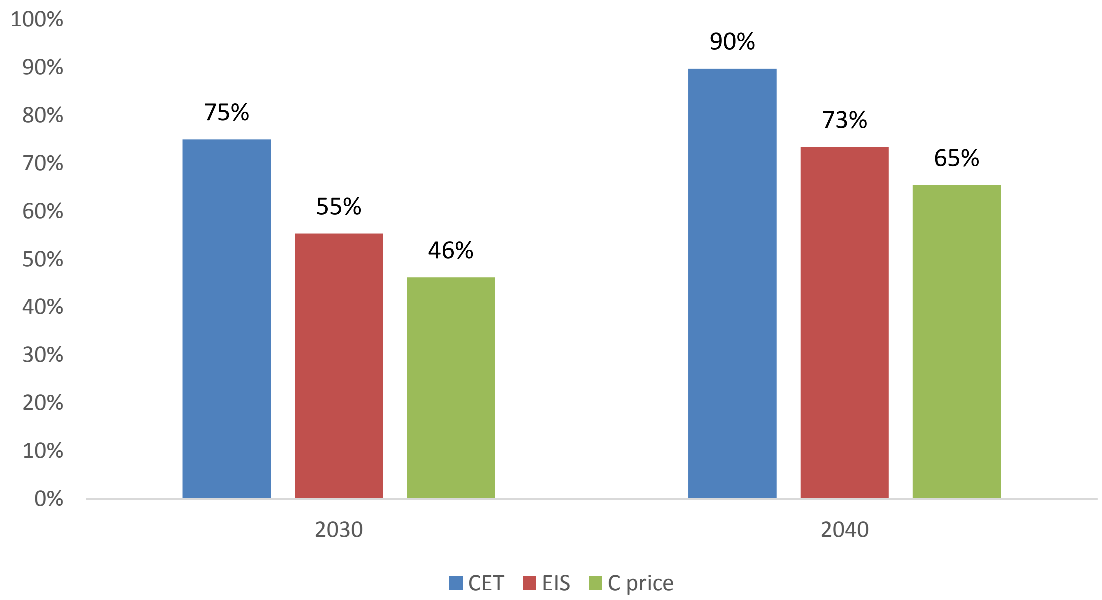
# 4. Renewable energy penetration

## INFLUENCE OF POLICY INSTRUMENT ON RENEWABLES PENETRATION

Meeting any reasonable 2030 electricity sector target is likely to require a significant increase in the proportion of electricity generation provided by renewable energy generators (renewable energy penetration). In addition to the magnitude of the electricity sector target, the other major determinant of the extent of renewable energy penetration is the nature of the policy instrument(s) used to achieve the target.

The different incentives provided by different policy instruments results in different patterns of abatement, and sources of electricity generation, through time. This issue was explored by the Climate Change Authority in its 2016 Special Review. As noted above, as part of the review, the Jacobs Group was commissioned to conduct modelling to compare the performance of different policy instruments in meeting specific emission constraints for the electricity sector. The instruments compared included a carbon price, EIS and a CET. Under Jacobs' 2°C scenarios, with a CET, the proportion of electricity generated by renewables was 75% in 2030, compared to 55% with an EIS and 46% with a CET (Figure 12). The pattern was the same in 2040: renewable energy penetration under the CET was 90%, 73% with an EIS and 65% with a carbon price. Similar results were observed in Jacobs' 3°C scenarios.

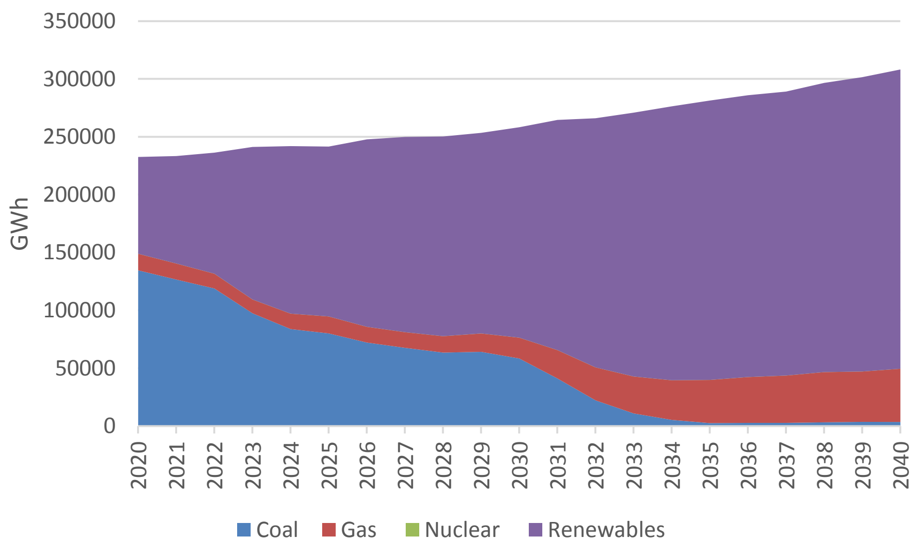
**Figure 12. Renewable generation share by policy instrument**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

The reason for the observed differences in renewable energy penetration relate to how the policy instruments affect the relative competitiveness of thermal and renewable generators in the electricity market. Of particular importance is the incentives provided for the deployment of new gas generation. As shown in Figures 13, 14 and 15, a CET provides less of an incentive for gas generation than an EIS or a carbon price.

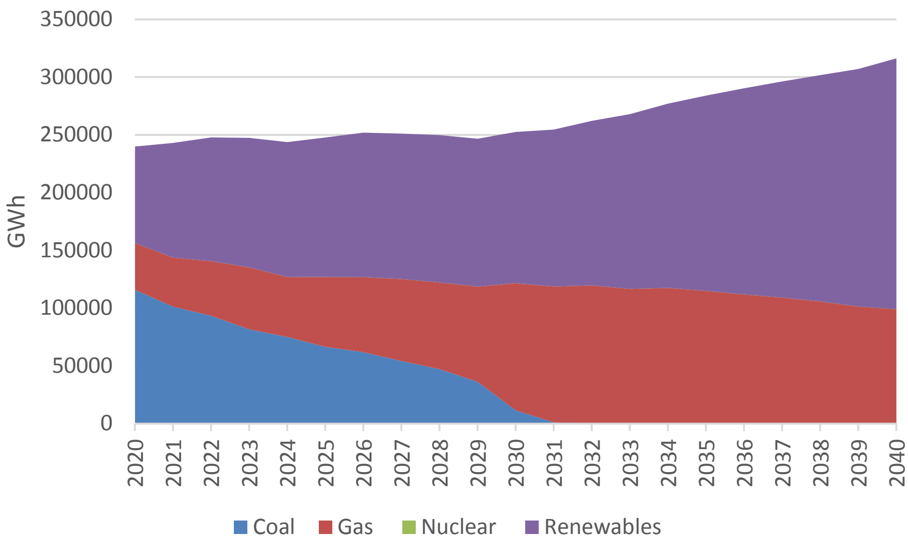
**Figure 13. Generation mix under CET, 2°C scenario**



Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

Figure 13 shows that under a CET the vast bulk of the generation mix is renewable from the mid-2020s.  Only a small amount of gas generation is developed before coal-fired generation ends in the early 2030s. By contrast, Figure 14 shows that under an EIS, larger volumes of gas generation are developed earlier, forcing coal out of the mix in 2030 and maintaining a large share of generation out to 2040.

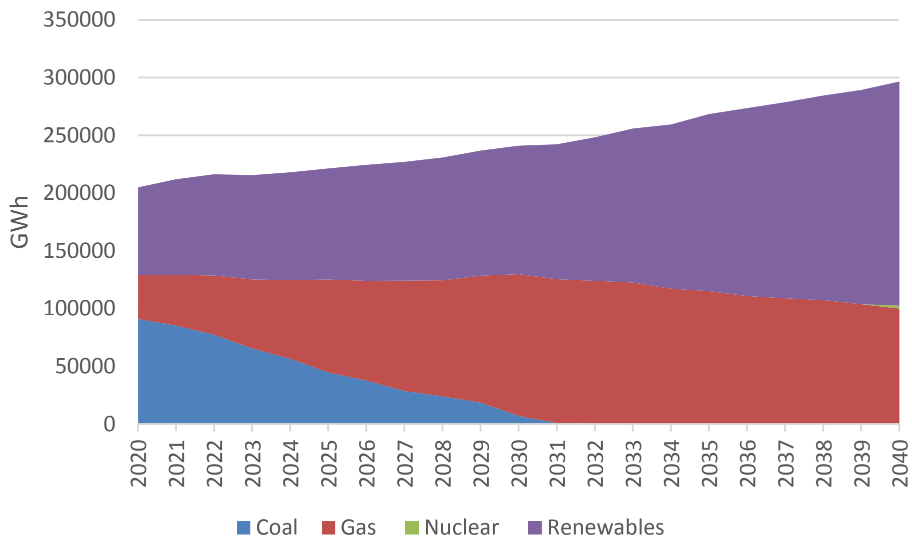
**Figure 14. Generation mix under EIS, 2°C scenario**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

As with the EIS modelled in Figure 14, Figure 15 below shows that under a carbon price, substantially more gas-fired generation is expected to be developed through the 2020s and persist into the 2030s:

**Figure 15. Generation mix under a carbon price, 2°C scenario**




Source: Jacobs (2017) *Modelling illustrative electricity sector emissions reductions policies: Final report*

The overall message from the Jacobs modelling for the CCA is clear – a CET-like policy is likely to bring in the largest share of renewables. This would come particularly at the expense of gas, with coal-fired generation also lasting longest under a CET.

# RENEWABLES PENETRATION UNDER AN EQUAL PROPORTIONAL REDUCTION APPROACH

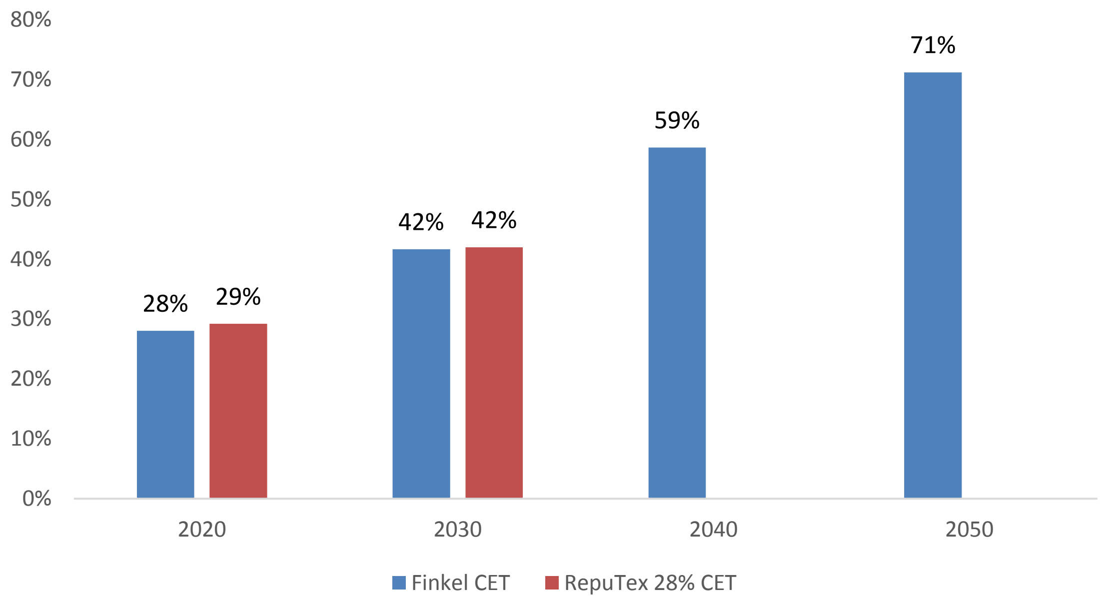
The generation mix under an equal proportional approach with a CET was modelled as part of the Finkel Review[18] and separately by consultancy, RepuTex.[19] Both found renewable energy would comprise approximately 42% of generation in 2030 (Fig. 16).[20] The Finkel Review's modelling also found that, in an unambitious scenario that saw electricity sector emissions decline linearly to near 60 $MtCO_2$-e in 2050, renewable generation would rise to over 70% by mid-century.

[18] Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply,* http://www.environment.gov.au/energy/publications/electricity-market-final-report

[19] Reputex modelled this with its National Electricity Market & Renewable Energy Simulator, with the results published in Reputex (2017) *It's the economics, stupid,* http://www.reputex.com/research-insights/update-its-the-economics-stupid-wholesale-price-scenarios-in-the-nem-to-2030/

[20] The modelling covered the National Electricity Market (NEM) only. The NEM accounts for approximately 80% of Australia's electricity consumption.

**Figure 16. Renewable generation under 28% CET**

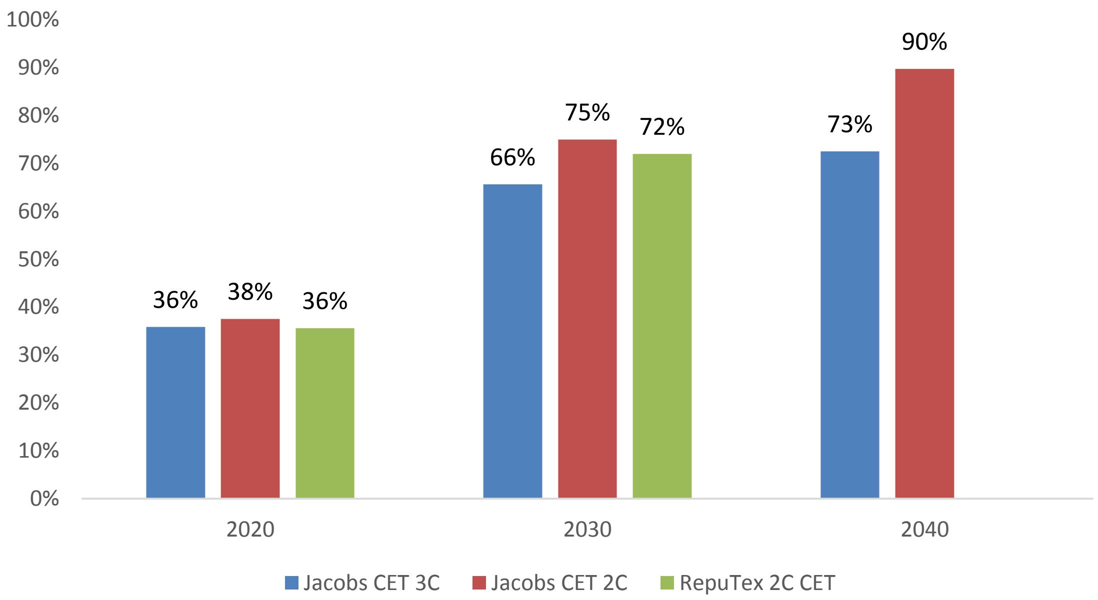



Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) It's *the economics, stupid*

## RENEWABLES PENETRATION UNDER AN ABATEMENT COST AND LONG-TERM INVESTMENT SIGNAL APPROACHES

Both the abatement cost and long-term investment signal approaches are likely to require 2030 emission reduction targets for the electricity sector of between 40%-55% below 2005 levels. The level of renewable energy penetration required to achieve emissions reductions of this magnitude under a CET-like policy have been modelled on several occasions in recent times, most notably by the Jacobs Group as part of the Climate Change Authority's 2016 Special Review into Australia's emissions reduction policies and RepuTex (2017). As shown in Figure 17, these two modelling exercises found renewable energy would comprise between 66% and 75% of generation in 2030.

**Figure 17. Renewable penetration, with 40%-55% CET**




Source: Jacobs (2017) *Report to the independent review into the Future Security of the National Energy Market: Emission mitigation policies and security of electricity supply* and Reputex (2017) It's *the economics, stupid*

The implication from this is that, if an abatement cost approach is used to set the 2030 electricity sector target, and a CET-like policy is used to achieve it, renewable penetration is likely to be in the order of 66-75% by 2030. This is substantially higher than Federal Labor's current target of 50% renewable energy by 2030.

# 5. Conclusion

Australia’s climate and energy debate continues to degenerate. As this conclusion is being written, Federal Parliament Question Time is being told that the Liddell power station should remain open to 2027, possibly at taxpayer expense, as renewable energy penetration has caused problems with energy security.

There are many problems with this view and they are being widely aired in the media and by non-government politicians. But it is ironic that government-commissioned modelling shows that the policies that would minimise renewable energy penetration such as carbon pricing and an EIS have already been rejected. All that remains is the CET that would bring in the largest share of renewable generation, or the prospect of failing to meet our Paris climate targets.

# Advance Australia's fair share

## Assessing the fairness of emissions targets

***The fairness of a country's emissions reduction targets can be assessed with regard to population, economic costs or a combination. Regardless of the approach, Australia's 26-28% Paris target is insufficient and will need to be ramped-up.***

**Richie Merzian**
**Rod Campbell**
**12 June 2018**

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# Summary

While Australia debates how to reach our Paris Agreement targets, wider issues such as whether these targets are appropriate and how they might need to be adjusted in the future are receiving scant attention.

Australia's current 2030 emissions reduction target is for a 26-28 percent reduction on 2005 levels. The Australian Labor Party has said that it would adopt a 2030 target of 45 percent below 2005 levels. In the context of the global carbon budget, neither policy would see Australia doing a 'fair share'.

The UN's Intergovernmental Panel on Climate Change (IPCC) estimates the world has a remaining emissions budget this century of 1,040 $GtCO_2$-e to have mid-probability of meeting the Paris goals. Different approaches are taken on the question of how to divide these remaining emissions and related abatement tasks between countries. Key approaches include:

- population-based approaches, which divide up the emissions budget between countries based on their current and projected populations;
- cost sharing approaches, which consider and try to equalise economic impacts;
- historic responsibility approaches, which consider countries' past emissions and responsibility for climate change; and
- hybrid approaches that combine population, cost and other measures of welfare.

If the remaining IPCC emissions budget was shared via a pure population approach, Australia would receive a share of 3,392 million tonnes. In 2015 Australia emitted 526 million tonnes, meaning at this rate our 'fair share' would be expended and Australia would need to have achieved net zero emissions in just over six years.

Using a modified population-based approach, which considers levels of development, the Climate Change Authority calculated Australia's emissions budget as 10,100 million tonnes $CO_2$-e for 2013-2050. Australia's current target of 26 percent reduction by 2030 would then require complete decarbonisation just five years later in 2035. Labor's 45 percent target requires complete decarbonisation by 2040.

Under a cost sharing approach, the IPCC estimates that achieving the Paris targets would see global consumption 1.7 percent lower in 2030 compared to a no-action scenario. Modelling for the Australian government estimates that a 26 percent target would see Australian consumption just 0.6 percent lower, while a 45 percent target would see consumption 0.9 percent lower in 2030. Both policies would see Australia's consumption grow, but experience reductions in growth of around half what is expected internationally.

Given Australia's high historic emissions, high per capita emissions and high income, other approaches to assessing nations' contributions to climate action all show that Australia's climate targets are not doing a 'fair share'. Any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge. All countries will need to ramp-up mitigation efforts. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.

# Introduction

Under international climate change processes, countries have periodically been asked to put forward targets to reduce greenhouse gas emissions by or over a specified period. The first of these was under the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Pressured by developing countries to show leadership in taking action to mitigate emissions, developed countries, including Australia, committed to 'individually or jointly' return their net emissions to 1990 levels by the turn of the century.[1] Soon after the UNFCCC came into force in 1994, negotiations commenced on the Kyoto Protocol, under which developed countries were ultimately required to adopt legally binding cumulative emission targets for the period 2008-2012, and later, for 2013-2020.[2]

The Kyoto Protocol's top-down, legally binding 'targets and timelines' structure was abandoned in the Paris Agreement in 2015.[3] In its place, the Paris Agreement adopted a bottom-up, soft law-based approach in which all parties, developed and developing alike, are required to submit non-binding pledges (known as 'Nationally Determined Contributions' (NDCs)) to take mitigation actions.[4] There is an expectation that developed country NDCs will take the form of 'economy-wide absolute emission reduction targets'.[5] Other countries have the flexibility to submit alternative types of NDCs—e.g. emission or energy intensity targets, sectoral targets or commitments to introduce particular policies—but are encouraged to 'move over time towards economy-wide emission reduction or limitation targets in the light of different national circumstances'.[6]

The NDCs of all parties are required to be periodically reviewed and updated with the aim of progressively increasing ambition to achieve the Paris Agreement's objective of keeping the increase in the global average surface temperature 'to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels' (Art. 2(1)).[7] Consistent with this, Article 4(3) of the Agreement requires each successive NDC of the parties to 'represent a progression' beyond the relevant country's existing NDC. Through 2018, a facilitative dialogue is being undertaken (known as the 'Talanoa Dialogue') to take stock of the efforts made to date under the Paris Agreement and inform the preparation of NDCs. The first formal review of the NDCs will take place in 2023 and every five years thereafter.[8]

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[1] UNFCCC, Art. 4(2)(b).

[2] Kyoto Protocol to the UNFCCC 1997, Art. 3 and UNFCCC Secretariat, *Report of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol on its seventh session, held in Durban from 28 November to 11 December 2011* (UNFCCC, 2011), Decision 1/CMP.7.

[3] Paris Agreement to the UNFCCC 2015.

[4] Paris Agreement to the UNFCCC 2015, Arts. 3 and 4(2).

[5] Paris Agreement to the UNFCCC 2015, Art. 4(4).

[6] Ibid.

[7] Paris Agreement to the UNFCCC 2015, Arts. 2(1), 4(3), 4(13), 13 and 14.

Against this backdrop, there is debate about the adequacy of Australia's current 2030 emission reduction target of a 26-28 percent reduction on 2005 levels. This pledge was first made in 2015 as an indicative NDC in the lead up to the Paris Convention.[9] In accordance with the Paris Agreement processes, in November 2016, it became Australia's first NDC. The target has been subject to criticism from a number of quarters on the basis it is inconsistent with the Paris Agreement's 2°C objective.[10] The Australian Labor Party has said that, in government, it will adopt a 2030 target of 45 percent below 2005 levels.[11] While significantly more ambitious than the current Government's target, some have still argued that it does not represent a fair contribution to the global effort to keep warming to 2°C.[12]

This paper provides an overview of the approaches that can be used to determine mitigation targets and judge their adequacy in the context of the Paris Agreement's 2°C target. The adequacy of the targets put forward by the Australian Government and Opposition are evaluated using these approaches. In section 2, we outline the four main theoretical approaches to devising national emission targets. Section 3 uses two of these, population-based and cost sharing approaches, to provide an indication of the perceived fairness of the Australian Government's 26-28 percent 2030 target and the Opposition's 45 percent target. Section 4 provides a conclusion.

[8] Paris Agreement to the UNFCCC 2015, Art. 14(2).

[9] Australian Government, *Australia's Intended Nationally Determined Contribution to a new Climate Change Agreement* (Australian Government, 2015).

[10] Ecofys, Climate Analytics and New Climate Institute, *Climate Action Tracker: Australia* (Climate Action Tracker Partners, 2017); 'Australia's post-2020 climate target not enough to stop 2C warming: experts', *The Conversation*, 11 August 2015; Fraser, B., *Some Observations on Australia's Post-2020 Emissions Reduction Target: Statement by the Chair* (Climate Change Authority, 2015).

[11] Australia's first NDC states it will account for the 2030 target using UNFCCC inventory reporting and a net-net approach (Australian Government 2015). To ensure consistency, all Australian emissions data presented here is based on UNFCCC reporting rather than Kyoto Protocol reporting, which is used to account for the 2020 target.

[12] The Climate Institute, *Labor Climate Policy Credibility Assessment* (The Climate Institute, 2016); Environment Victoria, 'Environment Victoria welcomes ALP plan to cut pollution and clean up Australia's energy supply', media release (Environment Victoria, 27 April 2016).

# Setting climate targets

In practice, emissions reduction targets are set by national governments having regard to a collection of domestic and international environmental, economic and political factors. At its most simple, countries try to balance their domestic self-interest against the international benefits of collective action. Typically, self-interest drives countries to try to minimise their contribution to global mitigation efforts so as to reduce short- and medium-term economic and political costs. Working against this is the recognition that all parties face similar incentives to free-ride and the adverse impacts of climate change can only be managed effectively through an equitable sharing of the mitigation task.

The centrality of an equitable distribution of the mitigation task to global effort to combat climate change has spawned an extensive literature on ways of devising and evaluating national targets.[13] No consensus has emerged amongst policymakers or the academic community about what constitutes the best or fairest method of determining national mitigation objectives.[14] However, the methods that have been devised provide a guide as to what other countries are likely to view as Australia's fair share of the task. These methods can be placed in four broad categories:

- population-based approaches;
- cost sharing approaches;

[13] Beckerman, W. and J. Pasek. 1995. 'The equitable international allocation of tradable carbon emission permits'. *Global Environmental Change* 5(5):405-413; Rose, A., B. Stevens, J. Edmonds and M. Wise. 1998. 'International Equity and Differentiation in Global Warming Policy'. *Environmental and Resource Economics* 12:25-51; Baer, P., J. Harte, B. Haya, A. Herzog, J. Holdren, N. Hultman, D. Kammen, R. Norgaard and L. Raymond. 2000. 'Equity and Greenhouse Gas Responsibility'. *Science* 289:2287; Berk, M. and M. den Elzen. 2001. 'Options for differentiation of future commitments in climate policy: how to realise timely participation to meet stringent climate goals?'. *Climate Policy* 1:465-480; Germain, M. and V. van Steenberghe. 2003. 'Constraining Equitable Allocations of Tradable $CO_2$ Emission Quotas by Acceptability'. *Environmental and Resource Economics* 26:469–492; Gupta, S., D. Tirpak, N. Burger, J. Gupta, N. Höhne, A. Boncheva, G. Kanoan, C. Kolstad, J. Kruger, A. Michaelowa, S. Murase, J. Pershing, T. Saijo and A. Sari, '2007: Policies, Instruments and Co-operative Arrangements', In B. Metz et al (eds), Climate *Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2007); Chakravarty, S., A. Chikkatur, H. de Coninck, S. Pacala, R. Socolow. 2009. 'Sharing global $CO_2$ emission reductions among one billion high emitters'. *Proceedings of the National Academy of Sciences (PNAS)* 106:11884-11888; Ekardt, F. and A. von Hövel. 2009. 'Distributive Justice, Competitiveness, and Transnational Climate Protection: "One Human - One Emission Right"'. *Carbon and Climate Law Review* 3(1):102-113; Meyer, A. 2004. 'Briefing: Contraction and convergence'. *Proceedings of the ICE - Engineering Sustainability* 157(4):189-192; Müller, B., N. Höhne and C. Ellermann. 2010. 'Differentiating (historic) responsibilities for climate change'. *Climate Policy* 9:593-611; Oberheitmann, A. 2010. A new post-Kyoto climate regime based on per-capita cumulative $CO_2$-emission rights—rationale, architecture and quantitative assessment of the implication for the $CO_2$-emissions from China, India and the Annex-I countries by 2050'. *Mitigation and Adaptation Strategies for Global Change* 15(2):137-168.
[14] Gupta et al. (2007), above n 13.

- historic responsibility approaches; and
- hybrids.[15]

# POPULATION-BASED APPROACHES

Research suggests there is a near linear relationship between cumulative global carbon dioxide emissions ($CO_2$) and projected global temperature change.[16] In its 5th Assessment Report, the Intergovernmental Panel on Climate Change (IPCC) found that, in order to provide a greater than 66 percent chance of keeping average surface temperature increases below 2°C above pre-industrial levels, cumulative $CO_2$ emissions from 2011 would need to be limited to 1,000 billion tonnes (1,000 Gt $CO_2$).[17] This suggests total emissions of the so-called 'Kyoto gases' (the gases reported under the UNFCCC and Kyoto Protocol)—$CO_2$, methane ($CH_4$), nitrous oxide ($N_2O$), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), sulphur hexafluoride ($SF_6$) and nitrogen triflouride ($NF_3$)—would need to be limited to around 1,200-1,400 Gt$CO_2$-e.[18] This cumulative global emissions limit is often referred to as the 'global emissions budget' or 'global emissions pie'.[19]

Population-based approaches start from the premise that the global emissions budget (or the freedom to emit up to the specified limit) is a resource that should be divided up amongst nations on the basis of their populations. Possibly the most well-known population-based approach is 'contraction and convergence', which was first put forward by Aubrey Meyer and the Global Commons Institute in the 1990s.[20] Under contraction and convergence, global emissions contract to net zero so as to stabilise atmospheric greenhouse gas concentrations at an agreed level, while national targets are set so per capita emissions converge and equalise at a given point in time.

There are a number of potential weaknesses associated with contraction and convergence. These include the fact it does not account for historical emissions and the economic capacity of countries and their ability to absorb the costs associated with mitigation. A further issue associated with contraction and convergence is that, due to the delay in convergence, it

[15] Macintosh, A. (2014) 'Mitigation Targets, Burden Sharing and the Role of Economic Modelling in Climate Policy', *Australian Journal of Public Administration* 73(2): 164-180; Climate Change Authority, *Comparing Countries' Emissions Targets: A Practical Guide* (Australian Government, 2015).

[16] Intergovernmental Panel on Climate Change (IPCC), Climate Change 2014: Synthesis Report (IPCC, 2014) pp 62-63.

[17] This equates to 273 Gt of carbon (C). See IPCC, above n 16, pp 62-64.

[18] Based on non-$CO_2$ forcing from RCP2.6. Meinshausen, M., S. J. Smith, K. V. Calvin, J. S. Daniel, M. L. T. Kainuma, J.-F. Lamarque, K. Matsumoto, S. A. Montzka, S. C. B. Raper, K. Riahi, A. M. Thomson, G. J. M. Velders and D. van Vuuren (2011) 'The RCP Greenhouse Gas Concentrations and their Extension from 1765 to 2300', *Climatic Change* 109: 213-241.

[19] Global Commons Institute (GCI), *Contraction and Convergence: A Global Solution to a Global Problem* (GCI, 1997); Broecker, W (2009) '$CO_2$ Arithmetic', *Science* 315: 1371; Macintosh, A. (2009) 'The Garnaut Review's Targets and Trajectories: A Critique', *Environmental & Planning Law Journal* 26: 88-112; Macintosh, above n 15.

[20] GCI, above n 19.

necessarily results in the largest per capita emitters receiving a disproportionate share (based on population levels) of the remaining emissions budget.

Other than contraction and convergence, the other main 'pure' population-based approach is the simple per capita method, where national targets are determined on the basis of existing or projected population levels at a given time or over a given period.[21] One of the advantages of the simple per capita approach is it addresses the concerns associated with the delay in convergence. However, even with the simple per capita approach, it arguably still favours wealthy nations because it does not account for historical emissions, meaning that, in most cases, they will end up with a disproportionate share of cumulative emissions since the Industrial revolution (i.e. the all-time emissions budget).

# COST SHARING APPROACHES

In contrast to population-based approaches, cost sharing approaches start from the premise that targets should be based on a division of the global abatement task. This change in focus means target setting under cost sharing approaches essentially involves a division of an 'abatement pie' (the difference between what emissions would be in the absence of mitigation measures and where they need to be to achieve the desired climate outcome) rather than an emissions pie. In their pure form, cost sharing approaches divide the abatement pie on the basis of economic cost; the welfare losses associated with reducing emissions. This typically involves setting national targets so as to equalise welfare losses across countries.[22] The adoption of this approach means countries with fewer low cost abatement opportunities and higher overall mitigation costs receive higher targets (a smaller share of the abatement pie and a larger share of the emissions budget) and *vice versa*.

Historically, the Australian Government has relied heavily on cost sharing arguments to support its international negotiation positions. The Government, industry groups and others have repeatedly asserted that the costs of reducing emissions in Australia are high relative to most other nations because of its heavy reliance on fossil fuels and large agricultural (particularly beef) sector. On this basis, they have argued Australia should receive concessional targets relative to other nations because the welfare losses associated with the transition to a low carbon economy are higher.[23]

[21] Baer et al., above n 13; Gupta et al. (2007), above n 13.

[22] Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Rose et al., above n 13; Gupta et al. (2007), above n 13.

[23] Australian Bureau of Agricultural and Resource Economics (ABARE) and Department of Foreign Affairs and Trade (DFAT), *Global Climate Change: Economic Dimensions of a Cooperative International Policy Response Beyond 2000* (Australian Government, 1995); Brown, S., D. Donovan, B. Fisher, K. Hanslow, M. Hinchy, M. Matthewson, C. Polidano, V. Tulpulé and S. Wear, *The Economic Impact of International Climate Change Policy* (ABARE, 1997); Brown, S., D. Kennedy, C. Polidano, K. Woffenden, G. Jakeman, B. Graham, F. Jotzo and B. Fisher, *Economic Impacts of the Kyoto Protocol: Accounting for the three major greenhouse gases* (ABARE, 1999); ABARE, *COP7: The economic implications of the Kyoto Protocol for Australia* (Australian Government, 2002); Australian Treasury, *Australia's Low*

Like population-based approaches, cost sharing approaches have a number of weaknesses. They ignore the resource characteristics of emissions entitlements (e.g. would it be fair to divide up an international mineral resource on the basis of the welfare losses countries would incur if they did not receive it?) and can skew allocations to wealthier nations that bear greater responsibility for historical emissions. They are inconsistent with the customary law principle that no state has the right to damage the environment outside their jurisdiction (called the 'no-harm principle').[24] They do not account for countries' capacity to absorb the costs of mitigation. From a practical perspective, they are also difficult to implement objectively because they are reliant on economic projections that are inherently unreliable, particularly over the decadal timeframes associated with global mitigation efforts.[25]

# HISTORIC RESPONSIBILITY APPROACHES

Historic responsibility approaches involve the determination of nation mitigation targets on the basis of historic responsibility for past emissions or warming. The most well-known of these is the so-called 'Brazilian proposal', which was put forward by the Brazilian Government during the Kyoto Protocol negotiations in 1997.[26] Under this proposal, targets were proposed to be set for developed countries on the basis of responsibility for emissions after 1990.

Historic responsibility approaches share a number of weaknesses with population-based and cost sharing approaches, including the fact they do not explicitly consider population levels or economic capacity. The other main deficiency of pure historic responsibility approaches is they never adequately addressed the question of when and how targets would be set for developing countries. Due to this deficiency, pure historic responsibility approaches are widely seen as lacking credibility. However, many believe past emissions are a relevant variable in setting national targets. A number of developing countries in particular continue to argue that developed countries and other high emitters have an emissions debt that should be reflected in future emission entitlements.

*Pollution Future: The Economics of Climate Change Mitigation* (Australian Government, 2008); Australian Government, *Economic cost as an indicator for comparable effort: Submission to the AWG-KP and AWG-LCA* (Australian Government, 2009); Australian Government, *Setting Australia's Post-2020 Target for Reducing Greenhouse Gas Emissions: Final Report of the UNFCCC Taskforce* (Australian Government, 2015).

[24] Tol, R. and R. Verheyen (2004) 'State responsibility and compensation for climate change damages—a legal and economic assessment', *Energy Policy* 32:1109-1130.

[25] Climate Change Authority, *Reducing Australia's Greenhouse Gas Emissions – Targets and Progress Review* (Australian Government, 2014); Macintosh, above n 15.

[26] UNFCCC Secretariat, *Ad Hoc Group on the Berlin Mandate, Seventh Session, Bonn, 31 July - 7 August 1997, Implementation of the Berlin Mandate, Additional Proposals from Parties, Addendum, Paper No. 1, Brazil: Proposed Elements of a Protocol to the UNFCCC, Presented by Brazil in response to the Berlin Mandate* (UNFCCC, 1997).

# HYBRID APPROACHES

The various limitations of pure population-based, cost sharing and historic responsibility approaches has prompted the development of a range of hybrid models. Most of these have their intellectual origins in population-based and cost sharing approaches. For example, pure population-based approaches have been modified to give fast growing developing country emitters greater time to transition (known as 'modified contraction and convergence'),[27] to account for economic capacity to absorb costs (e.g. 'adjusted per capita' and 'common but differentiated convergence')[28] and to address perceived inequalities associated with the transition period in contraction and convergence (e.g. 'equal per capita emissions over time').[29] Similarly, cost sharing approaches have been adjusted to account for economic capacity, population levels and historic responsibility for past emissions (e.g. 'ability to pay', 'multi-criteria', 'triptych' and 'greenhouse development rights').[30] All hybrid models have strengths and weaknesses, the importance of which depends on the weighting assigned to different philosophical and practical considerations.

[27] Garnaut, R., *The Garnaut Climate Change Review* (Cambridge University Press, 2008); Climate Change Authority, above n 25.

[28] Gupta, S. and P. Bhandari. 1999. 'An effective allocation criterion for CO2 emissions – an application to tradeable permits'. *Energy Policy* 27(12): 727-736; Höhne, N., M. den Elzen and M. Weiss. 2006. 'Common but differentiated convergence (CDC): a new conceptual approach to long-term climate policy'. *Climate Policy* 6:181-199.

[29] Bode, S. 2004. 'Equal emissions per capita over time - a proposal to combine responsibility and equity of rights for post-2012 GHG emission entitlement allocation'. *European Environment* 14: 300-316.

[30] Jacoby, H., R. Prinn and R. Schmalensee. 1998. 'Kyoto's Unfinished Business'. *Foreign Affairs* 77(4):54-66; Ringius, L., A. Torvanger and B. Holtsmark. 1998. 'Can multi-criteria rules fairly distribute climate burdens? – OECD results from three burden sharing rules'. *Energy Policy* 26(10):777-793; Babiker, M., R. Eckhaus. 2002. 'Rethinking the Kyoto targets'. *Climatic Change* 54:99-114; Lecocq, F. and R. Crassous. 2003. *International climate regime beyond 2012 – Are quota allocation rules robust to uncertainty?* Washington DC: World Bank; Blok, K., G.J.M. Phylipsen, and J.W. Bode, 1997: The Triptych Approach, Burden Sharing Differentiation of CO2 emissions reduction Among EU Member States (Utrecht University, 1997); Kartha, S., Athanasiou, T., Baer, P., Cornland, D., *Cutting the Knot: Climate Protection, Political Realism and Equity as requirements of a Post-Kyoto regime* (GD Rights, 2005); Rose et al., above n 13.

# Judging the fairness of Australia's 2030 emission targets

In the absence of consensus on the best approach to setting national mitigation targets, there is no objective way of passing judgment on the fairness of Australia's 26-28% 2030 target or the Australian Labor Party's 45% target. However, the available approaches can be used to place these targets within a 'range of reasonableness'. To represent this range, we analysed what the application of population-based and cost sharing approaches imply for Australia and compared the results with the Government's and Opposition's proposed targets. For these purposes, we assume the world remains committed to the Paris Agreement's objective of keeping warming well below 2°C.

## POPULATION-BASED APPROACHES AND AUSTRALIA'S 2030 TARGETS

In its 2014 and 2015 target reviews, the Climate Change Authority adopted the modified contraction and convergence approach to advise on Australia's 2025 and 2030 targets.[31] For these purposes, it suggested the use of a global emission budget of 1,700 $GtCO_2$-e for the period 2000-2050 to give a 67 percent chance of a 2°C outcome.[32] This equates to a 2011-2050 budget of approximately 1,200. This global emission budget to 2050 aligns well with the IPCC's 5th Assessment Report estimates of the cumulative $CO_2$ emissions that are consistent with providing a greater than 66 percent probability of keeping temperatures below 2°C. As noted above, accounting for non-$CO_2$ emissions and forcings, the IPCC suggested a 2°C emission budget of 1,200-1,400 $GtCO_2$-e for all time from 2011.[33] The fact the Authority's estimate is at the low end of the IPCC range is accounted for by the need for a (small) budget for the post-2050 era.

Using the modified contraction and convergence approach, the Climate Change Authority calculated Australia's share of the global emissions budget as 10.1 $GtCO_2$-e for the period 2013-2050.[34] To keep cumulative emissions within this budget, the Authority recommended a 2025 target of 30 percent below 2000 levels, and a target range for 2030 of between 40-60

[31] Climate Change Authority, *Special Review Draft Report: Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, *Final report on Australia's future emission reduction targets* (Australian Government, 2015); Climate Change Authority, above n 25;

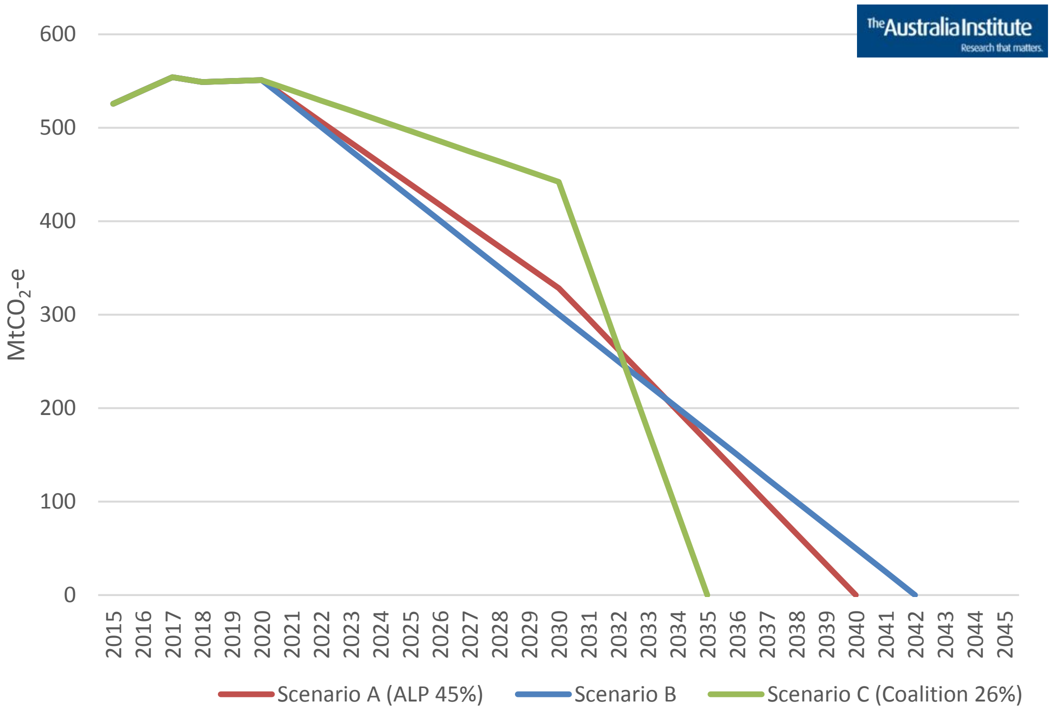
[32] The Authority also used budgets of 1,520 and 2,020 $GtCO_2$-e for the same period to give a 75 percent and 50 percent chance respectively of keeping temperatures below 2°C. For simplicity, we confine the analysis here to the 67 percent reference case.

[33] IPCC, above n 16.

[34] The full range for its scenarios was 8.5-13.1 $GtCO_2$-e. More recent emissions data suggest the budget may be slightly lower (EDGARv4.2 FT2012). We use the original estimate for simplicity.

percent below 2000 levels. The Authority's 2030 target equates to 45-63 percent below 2005 levels. Figure 1 below shows the trajectory of Australia's emissions to stay within this emissions budget calculated with the modified contraction and convergence approach. It shows a linear trajectory as well as the trajectories required under the government and opposition policies for 2030 abatement:

### Figure 1: Australia's emissions under modified contraction and convergence




Source: Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018); Department of the Environment and Energy, *Australia's Emissions Projections 2017* (Australian Government, 2017).

Figure 1 shows that under the modified contraction and convergence approach, Australia's current target of 26 percent reduction by 2030 will then require complete decarbonisation in just five years. The difference between the Government's 26-28 percent target and the Climate Change Authority's target range equates to approximately 100-220 $MtCO_2$-e in 2030, and 550-1,200 $MtCO_2$-e cumulatively over the period 2021-2030. This is roughly 1.0-2.3 times Australia's 2015 emissions (526 $MtCO_2$-e).[35]

On its face, the Opposition's 45 percent target matches the bottom of the range recommended by the Climate Change Authority. However, the adoption of this target still involves complete decarbonisation in 2040, two years earlier than under the linear trajectory. It is important to consider that a linear trajectory may not be optimal. While large emissions

[35] Department of the Environment and Energy, 'Australian Greenhouse Emissions Information System (AGEIS)', available at: http://ageis.climatechange.gov.au/ (20 March 2018).

reductions may be possible at low cost, the final emissions reductions from industries such as manufacturing, construction and agriculture may be difficult and costly.

While the Climate Change Authority's emission budget and associated mitigation targets are ambitious, they do not reflect the least self-interested population-based approach. A simple per capita division of the remaining global emissions budget better approximates an outer marker of what some might regard as equitable. For illustration, we divided the remaining global emissions budget from 2015 on the basis of 2015 population levels. To do this, we took the IPCC's mid-range estimate for 2°C (1,300 $GtCO_2$-e) and deducted estimated emissions over the period 2012-2015 (~260 $GtCO_2$-e), leaving a budget for the remainder of the century of 1,040 $GtCO_2$-e. We then used the United Nations population estimates for 2015 to divide the budget between countries.[36] This provides Australia with a budget for the remainder of the 21st century of 3.36 $GtCO_2$-e, as shown in Table 1 below:

### Table 1: Australian emissions budget under pure population approach

| | Low | Medium | High |
|---|---|---|---|
| **Global emissions budget from 2012 (Gt CO2-e)** | 1,000 | 1,300 | 1,500 |
| **Emissions 2012-15 (Gt CO2-e)** | 260 | 260 | 260 |
| **Remainder (Gt CO2-e)** | 740 | 1,040 | 1,240 |
| **Population 2015 (people)** | 7,349,472,000 | 7,349,472,000 | 7,349,472,000 |
| **Remaining emissions budget per person (t CO2-e)** | 101 | 142 | 169 |
| **Australian population (people)** | 23,969,000 | 23,969,000 | 23,969,000 |
| **Australia's share of emissions budget (Mt CO2-e)** | 2,413 | 3,392 | 4,044 |
| **Australian emissions 2015 (Mt CO2-e)** | 526 | 526 | 526 |
| **Years to budget** | 4.6 | 6.4 | 7.7 |

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Sources: IPCC (2015), UN (2015)

Table 1 shows that at current emission levels, this budget would be expended in just over six years. Assuming Australia's current climate policies remain in place until 2020, come 2021, Australia would have a little over 12 months to reach net zero emissions. While Australia could

[36] United Nations, *World Population Prospects 2017* (UN, 2017), available at: https://esa.un.org/unpd/wpp/ (20 March 2018).

not achieve cuts of such magnitude domestically, the target could potentially be achieve through the importation of foreign permits (carbon credits). Such a strategy would be dependent on the availability of international permits and extent of demand for them from other nations.

# COST SHARING APPROACHES AND AUSTRALIA'S 2030 TARGETS

The application of a pure cost sharing approach to evaluate Australia's 2030 targets requires a comparison between the average economic cost of meeting the 2°C target globally and the equivalent costs for Australia, assuming emissions reductions are done in the most cost-effective (or least-cost) way possible.

The requirement for the comparison to be done on the basis of the lowest (theoretically) possible economic cost of achieving the relevant mitigation targets is important. Cost sharing approaches would have no validity if welfare loss comparisons could be made using scenarios that assume parties make policy choices that increase costs. Such an approach would mean that, the less cost-effective a country's mitigation policies, the less they would be obligated to reduce their emissions (and greater share they would receive of the remaining global emissions budget). The adoption of such an approach to target setting would create perverse incentives and work against the collective global interest of reducing emissions in the cheapest way possible.

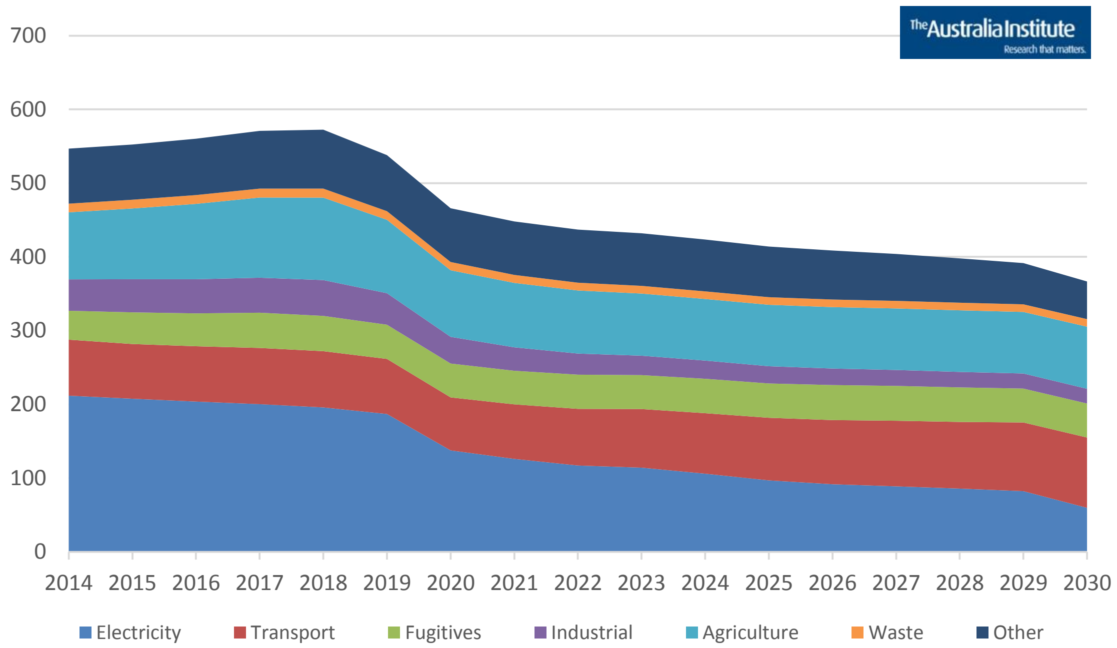
In its 5$^{th}$ Assessment Report, the IPCC estimated the impacts on global consumption of stabilising the atmospheric concentration of $CO_2$ in 2100 at 450 parts per million (ppm) (equivalent of a 2°C outcome). If done cost-effectively, consumption would continue to increase, but at a slightly lower annual growth rate. The IPCC's estimate of the difference in global consumption in 2030 was 1.7 percent lower, with a range of range 1.0-3.7 percent, relative to a reference case with no additional mitigation efforts.[37] This equates to a reduction in the average growth rate of consumption of 0.09 percent (range 0.06-0.2) over the period 2010 to 2030.

The modelling of the IPCC's assessment assumed the immediate adoption of mitigation measures in all countries and a single global carbon price. While the IPCC did not publish details of the resulting reductions in individual countries, a similar modelling exercise was undertaken by Victoria University on behalf of the Climate Change Authority in 2016 using the IPCC's 450 ppm global carbon price. The price began at $AUD33 per tonne in 2019 and increased steadily to 2050. The results suggest Australia's domestic contribution to a globally

[37] IPCC, *Climate Change 2014 Mitigation of Climate Change: Summary for Policymakers and Technical Summary* (IPCC, 2015) pp 56-60.

efficient effort to keep temperatures below 2°C would see emissions decline from 612 Mt in 2005 to 367 Mt, as shown in Figure 2 below.[38]

**Figure 2: Australia's emissions under 2C scenario, IPCC cost sharing approach**




Source: Adams (2016).

Figure 2 shows emissions declining by roughly 41 percent by 2030 relative to 2005 levels, significantly above the Government's 26-28 percent targets and slightly below the Opposition's 45 percent target. The largest reductions come from the electricity sector. Importantly this analysis had only partial coverage of the land sector where Australia has significant low-cost mitigation options.

A rough estimate of the economic costs associated with meeting the Government's and Opposition's 2030 targets can be derived from the modelling that was commissioned by the Government in 2015 to inform its target decision. For these purposes, the McKibbin Software Group was asked to model the economic impacts of four 2030 targets: reductions of 13, 26, 35 and 45 percent relative to 2005 levels (McKibbin Software Group 2015a; 2015b).[39] The modelling that was conducted had a number of limitations, including that the analysis did not consistently assume a cost-effective response across all countries. The analysis was also confined to $CO_2$ emissions in the energy sector, thereby excluding non-$CO_2$ emissions from energy, $CO_2$-e emissions from industrial processes, agriculture and waste, and $CO_2$-e emissions

[38] Adams, P., *Simulations of the Effects of Greenhouse Gas Mitigation Policies for the Australian Electricity Sector* (Victorian University, 2016).

[39] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a); McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b).

and $CO_2$ removals associated with the land sector.[40] Due to these and other factors, the results were heavily caveated, with the McKibbin Software Group stressing:

> There is considerable uncertainty in the assumptions used in the modelling. Given the difficulty of predicting future economic conditions and countries' actions, all results should be understood to be an expected outcome with a relatively large band of uncertainty around the point estimates. The estimates should be treated as indicative of the orders of magnitude of policy impacts and the likely relative size of impacts across sectors and countries, and should be used with caution.[41]

Noting these modelling limitations, the findings suggest the pursuit of a 26 percent 2030 target with cost-effective domestic policies (excluding international permits) would see Australia's consumption 0.91 percent lower in 2030, relative to a base case with no additional global mitigation. Allowing international permits reduced the estimated reduction in consumption to 0.60 percent in 2030. The equivalent results for the 45 percent target scenario were a 1.47 percent reduction in 2030 with no international permits and a 0.92 percent reduction in 2030 with international permits.

For the purposes of applying a pure cost sharing approach, only the lower consumption impact estimates involving the use of international permits are relevant. As noted above, in order for cost sharing approaches to have any validity, the cost comparisons need to be made on the assumption all parties pursue least-cost policies.

If the IPCC's estimate of the average global reduction in consumption relative to baseline growth to 2030 of 1.7 percent is used as a benchmark, it suggests the Government's 26-28 percent target is inadequate (Fig. 3).[42] The assessed reduction in consumption is less than half the global average. The Opposition's 45 percent target also falls outside of the range that might be considered consistent with a cost sharing approach. The assessed reduction in consumption in the 45% scenario, 0.92 percent in 2030, is almost 50 percent below the global average.

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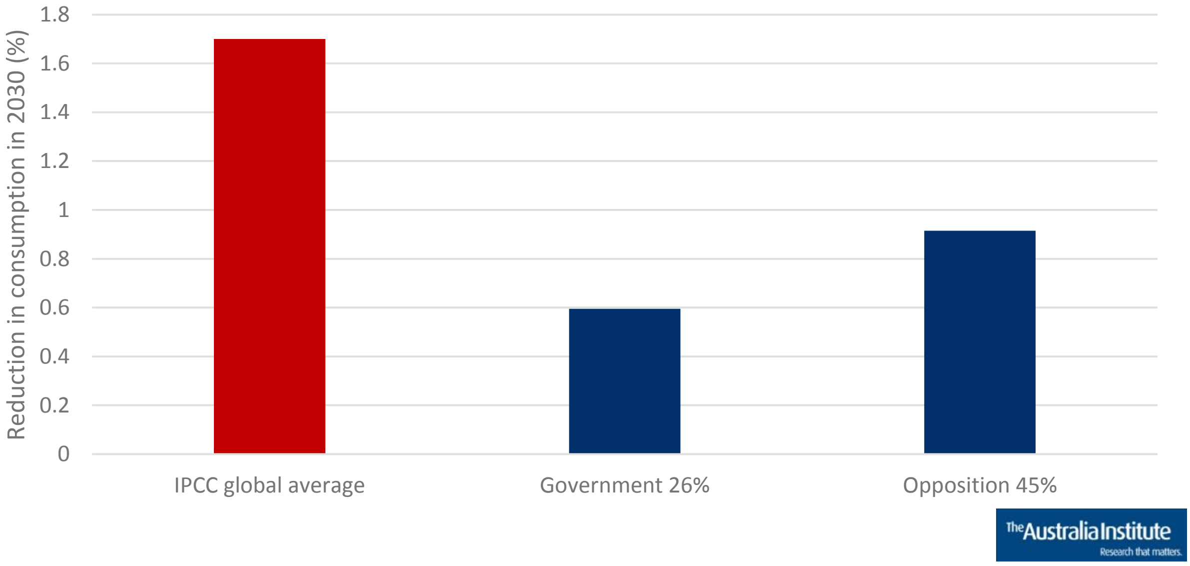
[40] The core target scenarios also assumed high end domestic technology costs.

[41] McKibbin Software Group, *Report 1: 2015 Economic Modelling of International Action under a New Global Climate Change Agreement* (Australian Government, 2015a) p 7. See also McKibbin Software Group, *Report 2: 2015 Economic Modelling of Australian Action under a New Global Climate Change Agreement* (Australian Government, 2015b) p 7.

[42] The estimates of impacts on other economies in the McKibbin Software Group's modelling are not directly relevant because of the limited coverage of countries, gases and sectors, and the fact they do not assume a consistent cost-effective policy response across all countries.

**Figure 3: Reduction in 2030 consumption, IPCC global average, government and Labor targets**




Source: McKibbin Software Group (2015a; 2015b); IPCC (2015).

## COULD HYBRID MEASURES MAKE AUSTRALIA'S 2030 TARGETS APPEAR FAIRER?

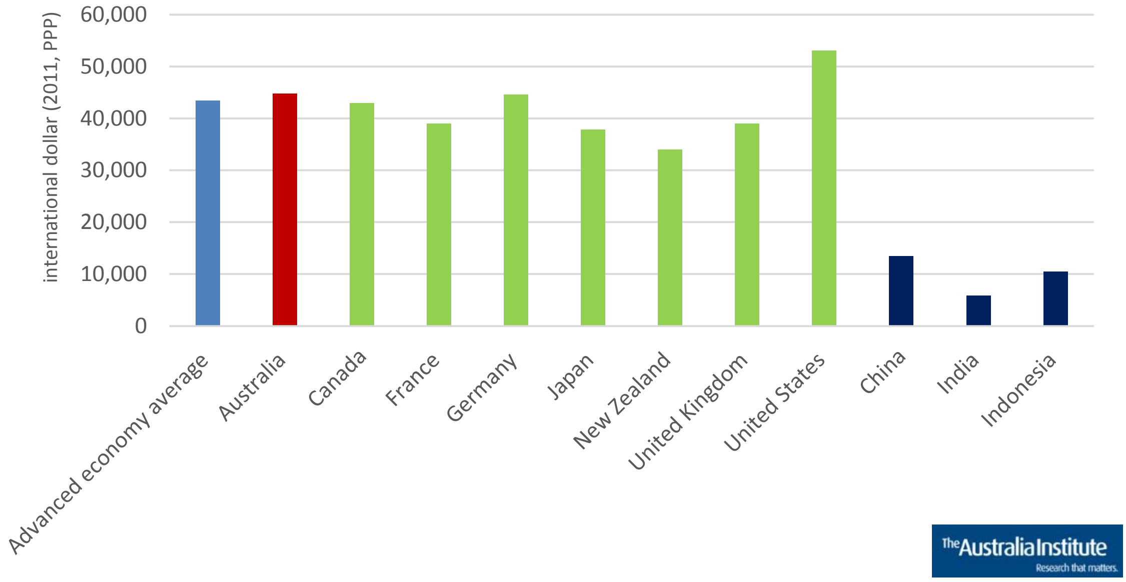
In the past, Australian Governments have presented a range of economic and emissions information to support the case its targets constitute an equitable contribution to global mitigation efforts.[43] The difficulty with this approach is that none of the recognised metrics used in hybrid models to modify the impacts of the 'pure' approaches supports Australia's position. The three most commonly employed are economic capacity, economic, human and social development, and historic emissions.

By any measure, Australia is a wealthy nation with a high economic capacity. As shown in Figure 4, Australia's GDP per capita is above the average for advanced nations, and above most other major developed countries, including the United Kingdom, Japan, Germany, France and Canada. In 2015, Australia's GDP per capita was also more than three times China's, almost eight times India's and more than four times Indonesia's.[44] The perceived fairness of Australia's 26-29 percent 2030 target, and the Opposition's 45 percent target, is not improved by the inclusion of economic capacity.

[43] See references in n 23.

[44] International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

**Figure 4: Major developed and developing economies, gross domestic product per capita, constant prices, international dollar (2011)**

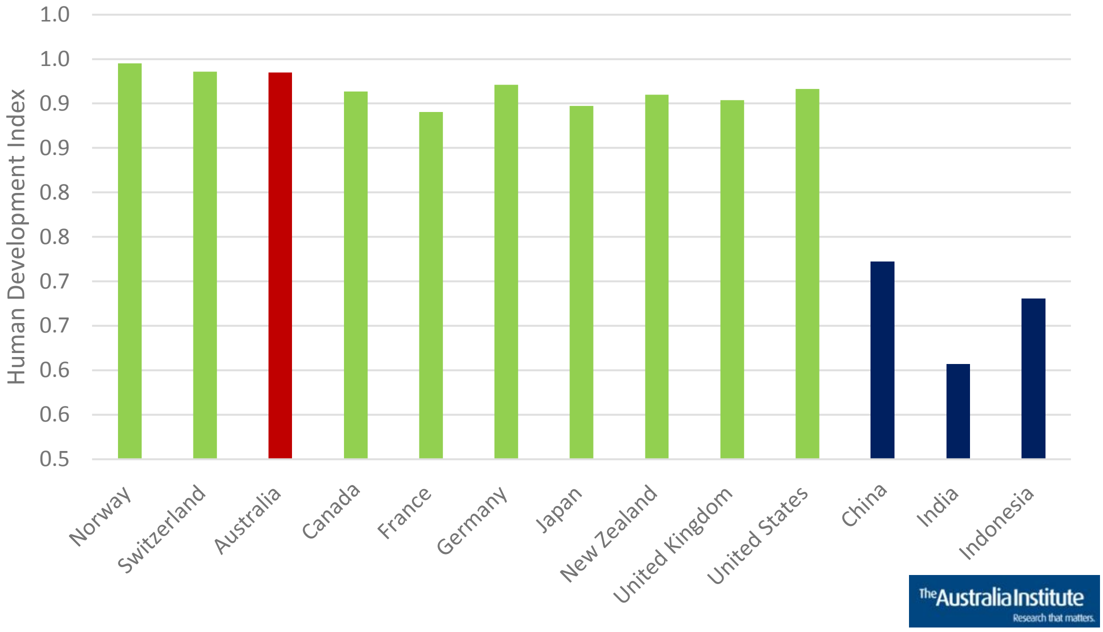



Source: International Monetary Fund (IMF), 'World Economic Outlook Database' (IMF, October 2017), available at: https://www.imf.org/external/pubs/ft/weo/2017/02/weodata/index.aspx (20 March 2018).

The use of composite measures of economic, human and social development produces a similar result. Australia has very high levels of economic, human and social development relative to other nations, suggesting it has a high capacity to mitigate emissions and make the necessary social and economic adjustments associated with the transition to a low carbon economy. The relative state of Australia's economic, human and social development is illustrated by the Human Development Index, a composite indicator that combines metrics on three dimensions: health, knowledge (education) and standard of living. The most recent HDI results (2015) place Australia second in the world behind Norway. The five year average (2011-2015) places Australia third in the world behind Norway and Switzerland, and significantly ahead of all other major developed and developing economies (Fig. 5).[45] Much like economic capacity, the perceived fairness of Australia's current targets and those proposed by the Opposition are not improved by the inclusion of composite measures of economic, human and social development.

[45] United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

**Figure 5: Average Human Development Index score for major developed and developing economies, 2011 to 2015**



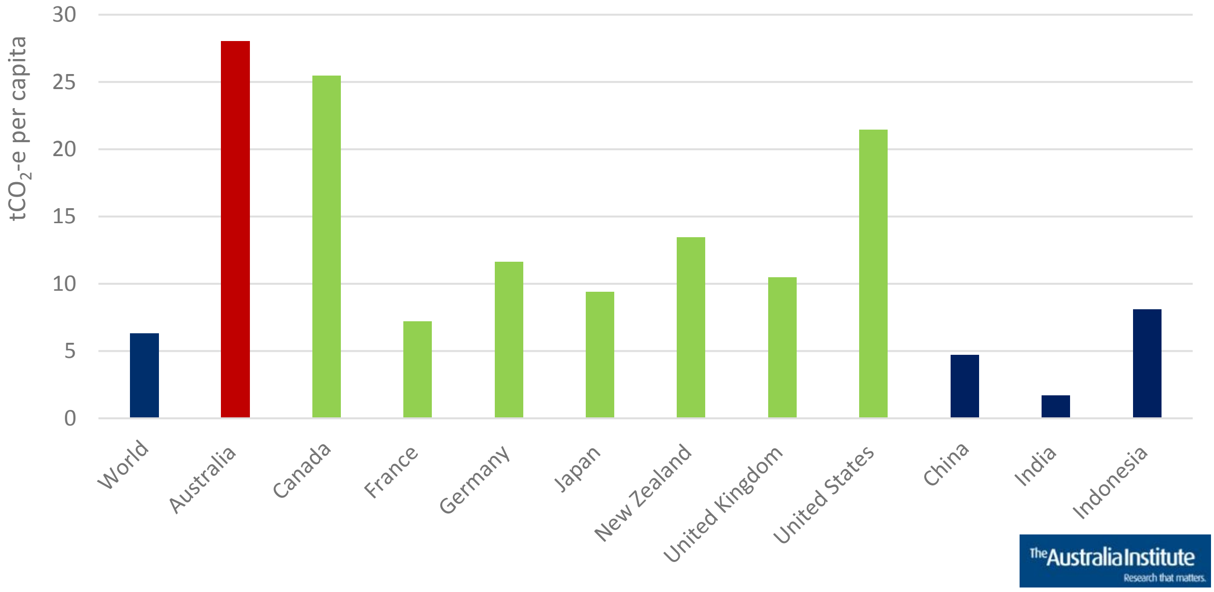

Source: United Nations Development Programme, 'Human Development Data (19900-2015)', available at: http://hdr.undp.org/en/data (20 March 2018).

The same applies to historic emissions. Over the period 1990 to 2014, Australia was responsible for approximately 1.4 percent of global greenhouse gas emissions, while having only having 0.3 percent of the world's population.[46] The extent to which Australia is disproportionately responsible for historical emissions (relative to population) is illustrated by comparing average per capita emissions over the period 1990 to 2014 (Fig. 6). Australia's average per capita emissions for this period were 28 $tCO_2$-e per person, compared to the global average of 6.3 $tCO_2$-e per person. As Figure 5 shows, Australia's per capita emissions were above all of the major developed economies, with only Canada (25.5 $tCO_2$-e per person) and the United States (21.4 $tCO_2$-e per person) being reasonably comparable. Australia's per capita emissions were almost six times China's (4.7 tCO2-e per person), 16.7 times India's (1.7 tCO2-e per person) and 3.5 times Indonesia's (8.1 tCO2-e per person).[47]

[46] It is arguable that the period for historic responsibility should extend back further, possibly to the beginning of the Industrial revolution, because of the long atmospheric lifetime of long-lived greenhouse gases. However, the post-1990 period is generally used in historical responsibility approaches because, by 1990, the nature of climate change and its causes was widely known.

[47] World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

**Figure 6. Major developed and developing economies, average greenhouse gas emissions (including land use change and forestry) per capita, 1990-2014**




Source: World Resources Institute (WRI), 'CAIT Climate Data Explorer' (WRI, 2017), available at: http://cait.wri.org (20 March 2018).

These indicators of economic development and historical emissions show that any hybrid assessment developed is likely to show that Australia's current emissions reduction targets are not in line with our share of the global abatement task. Australia is likely to be placed under pressure, either domestically or internationally, to take on a more reasonable share of climate action.

# Conclusion

In order to keep global average surface temperature increases to less than 2°C above pre-industrial levels, it is necessary for cumulative global greenhouse gas emissions to be limited to roughly 950 $GtCO_2$-e from 2018. If global emissions remain at current levels, this budget will be expended within 19 years. The only way to expand the size of the budget is through the development and deployment of one or more large-scale negative emissions technologies that remove greenhouse gases from the atmosphere.[48] While the development of such technologies is possible, it would be a high risk strategy to base global mitigation policy on the prospect of their emergence.[49] The small size of the remaining global emissions budget means all nations need to rapidly decarbonise.

Despite the apparent urgency of the situation, to date, the international community has struggled to agree on an equitable division of the global emissions budget. This is mainly attributable to the reluctance of nations to incur the short- and medium-term economic and political costs of mitigation, at least in the absence of collective action. The resolution of this impasse requires all major emitting nations to simultaneously pursue aggressive emission reductions.

In the absence of an internationally agreed method of determining each nation's contribution to this effort, this paper has sought to judge whether the Australian Government's and Opposition's 2030 mitigation targets fall within a 'range of reasonableness', judged according to the most widely used principle-based approaches to target setting. The results suggest the Australian Government's 26-28 percent target is inadequate according to any recognised principle-based approach. It falls well outside the ranges suggested by both population-based and cost sharing approaches, and its fairness is not improved by the inclusion of metrics from hybrid models.

The Opposition's target lies at the lower end of the range suggested by pure population-based approaches and outside of the range implied by cost sharing approaches. The inclusion of the main metrics used in hybrid models concerning economic capacity, economic, human and social development, and historic emissions undermines the case that the Opposition's target is fair. Given this, a 45 percent target for 2030 can be regarded as the bare minimum necessary for Australia to be considered to be making an equitable contribution to the achievement of

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[48] Smith, P. et al. (2016) 'Biophysical and economic limits to negative emissions', *Nature Climate Change* 6: 42-50; Gasser, T., Guivarch, C., Tachiiri, K., Jones, C., Ciais, P. (2015) 'Negative emissions physically needed to keep global warming below 2 °C', *Nature Communications* 6: 7958; Fuss, S. et al. (2014), 'Betting on negative emissions', *Nature Climate Change* 4: 850-853; van Vuuren, D., Deetman, S., an Vliet, J., van den Berg, M., van Ruijven, B., Koelbl, B. (2013) 'The role of negative CO2 emissions for reaching 2°C—insights from integrated assessment modelling', *Climatic Change* 118: 15-27.

[49] Ibid.

the Paris Agreement's 2°C target, judged according to the main principle-based approaches to target setting.

One of the main reasons why the Australian Government's and Opposition's targets lie outside, and at the edge respectively, of what principle-based approaches suggest is reasonable is the small size of the remaining global emissions budget. With only roughly 950 $GtCO_2$-e remaining, any principle-based approach to target setting will result in highly developed, emissions-intensive nations like Australia having to pursue aggressive emissions reductions immediately and sustaining these reductions over the coming decades.

The small size of the remaining global emissions budget poses a significant challenge for the Paris Agreement's iterative structure, whereby nations are intended to progressively ramp-up mitigation efforts in 5-yearly cycles. If the global community is to succeed in keeping emissions within the 2°C budget, mitigation efforts in Australia and elsewhere need to be significantly accelerated on timescales shorter than those contained in the Paris Agreement.

# Harming farming

## The cost to agriculture from the **government's emissions reduction** plan

***A sector by sector proportional emissions reduction approach will mean agriculture will have to reduce emissions by 26 per cent by 2030. Agriculture lacks significant emissions reduction projects, so this emissions cut will come at a large cost.***

Discussion paper

**Matt Grudnoff**

**July 2018**

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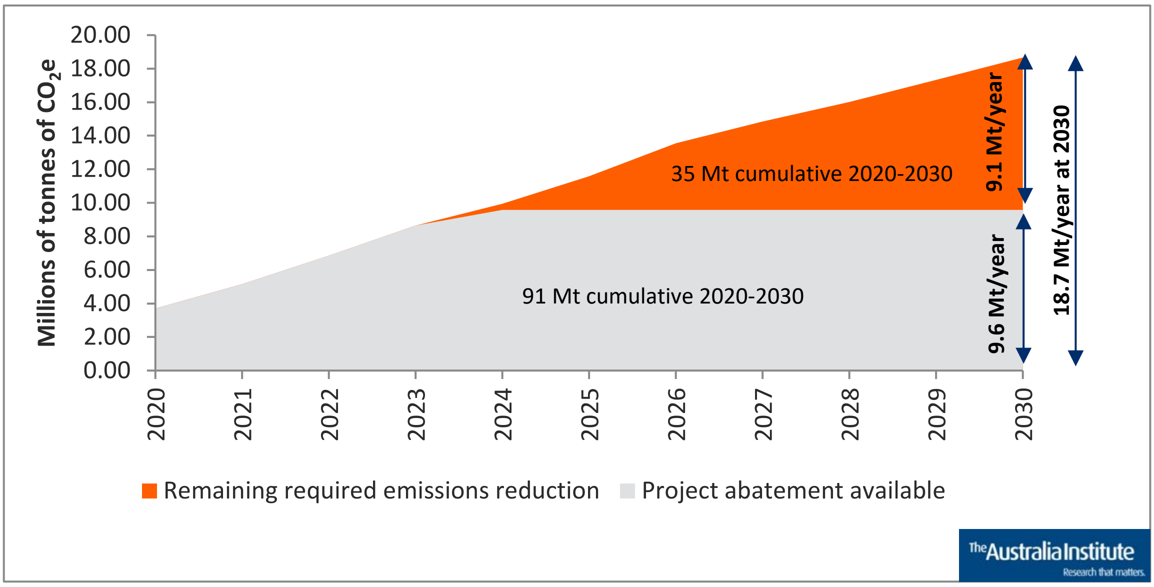
# Summary

Australia's commitment under the Paris climate agreement is to reduce carbon emissions by 26 to 28 per cent below 2005 levels by 2030. With the announcement of the National Energy Guarantee the government has required the electricity sector to reduce its emissions by 26 per cent. This implies other sectors such as agriculture will also need to reduce emissions by at least 26 per cent by 2030. This approach will impose significant costs on agriculture and other sectors that do not have the existing, commercially available technologies for emissions reduction that the electricity sector has.

We have calculated that the government's plan will require agriculture to reduce emissions per year by 18.7 million tonnes (Mt) of $CO_2$e by 2030. Between 2020 and 2030, this represents 126 Mt of $CO_2$e not emitted compared to business as usual, since the reduction in yearly emissions is expected to occur incrementally.

Emissions reduction projects identified by energy analytics firm RepuTex could reduce agriculture's emissions by a maximum of 9.6 Mt of $CO_2$e per year and from 2024 onwards the agriculture sector would be unable to abate emissions in line with a 26 per cent reduction trajectory. By 2030 there would be 9.1 Mt per year gap in emissions reductions which will have to come from reducing agricultural production, including significant reductions in livestock numbers. In 2030, this would include 2.9 million fewer beef cattle, 8 million fewer sheep, 290,000 fewer dairy cows and 270,000 fewer pigs.

**Figure - Total agricultural sector abatement and project abatement**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

This represents an emissions reduction through lower production of 11 per cent by 2030, roughly equivalent to the 15 per cent reduction in emissions through lower production caused by the major Millennium Drought in South East Australia (from 1996 to 2010).

This unnecessarily high cost is a product of the government's decision that every sector should reduce emissions by 26 per cent. If those sectors that are able to most cheaply reduce emissions are allowed to do so, then sectors like electricity generation would reduce emissions by far more than 26 per cent and sectors like agriculture would reduce emissions by less than 26 per cent.

This is particularly important as the government attempts to lock in a 26 per cent reduction target for electricity generation. If the government succeeds in doing this, it will increase the cost to sectors like agriculture.

# Introduction

Australia's commitment under the Paris climate agreement is to reduce carbon emissions by 26 to 28 per cent below 2005 levels by 2030.[1] The federal government plans to lock in a 26 per cent reduction in the electricity sector with its proposed National Energy Guarantee. This implies that it intends to reach the Paris target using a proportional sector by sector approach where each sector would need to reduce emissions by at least 26 per cent. The sectors are:[2]

- Electricity
- Stationary energy excluding electricity (also known as direct combustion)
- Transport
- Fugitive emissions
- Industrial processes and product use
- Agriculture
- Waste

This approach is likely to increase the cost of reducing emissions when compared to a sector neutral approach which would see emissions reduced in the sector that can do it most cheaply. This is because some sectors, such as electricity, have an abundance of relatively cheap, commercially proven technologies and techniques for reducing emissions. Other sectors, like agriculture, have fewer and more expensive emissions reduction options.

This paper looks at the potential for the agriculture sector to achieve a 26 per cent reduction by 2030 and the possible costs of doing so. Abatement cost estimates of emissions reduction projects in the agricultural sector have been provided by analysts, RepuTex. These projects reduce the emissions intensity of farming. That is, they reduce the emissions from agriculture without reducing agricultural output. Land use, land use change and forestry (LULUCF) projects have been excluded because a large portion of them would reduce agricultural output. Many of the projects involve reforesting farmland.

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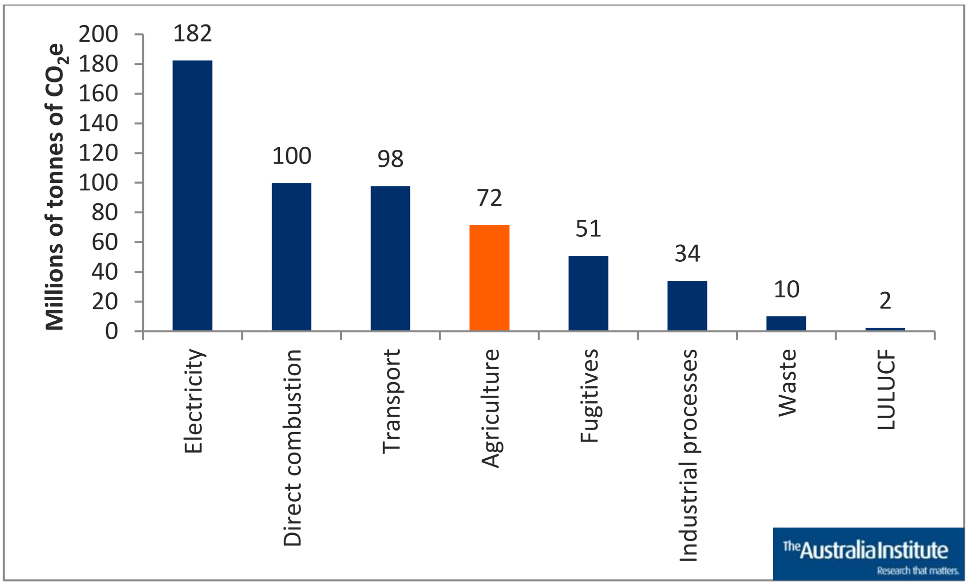
[1] Department of Foreign Affairs and Trade (2015) *Australia's intended Nationally Determined Contribution to a new climate change agreement*

[2] Land use, land use change and forestry (LULUCF) has been excluded from this analysis. LULUCF can be a carbon sink or a source of carbon. Currently it is a very small source of carbon (2 Mt $CO_2e$) and its exclusion does not make a meaningful difference out to 2030.

# Emissions reduction projects

Australia's emissions come from many sources. As shown in Figure 1 below, there are seven key sectors of the Australian economy in relation to greenhouse emissions:

**Figure 1 - Emissions by sector in 2018, projection**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Figure 1 shows that the electricity sector is responsible for a third of Australia's carbon emissions (33 per cent). By contrast, agriculture contributes just 13 per cent of Australia's emissions, expected to rise to 14 per cent by 2020.[3] Of the seven emissions producing sectors, it is the fourth highest.

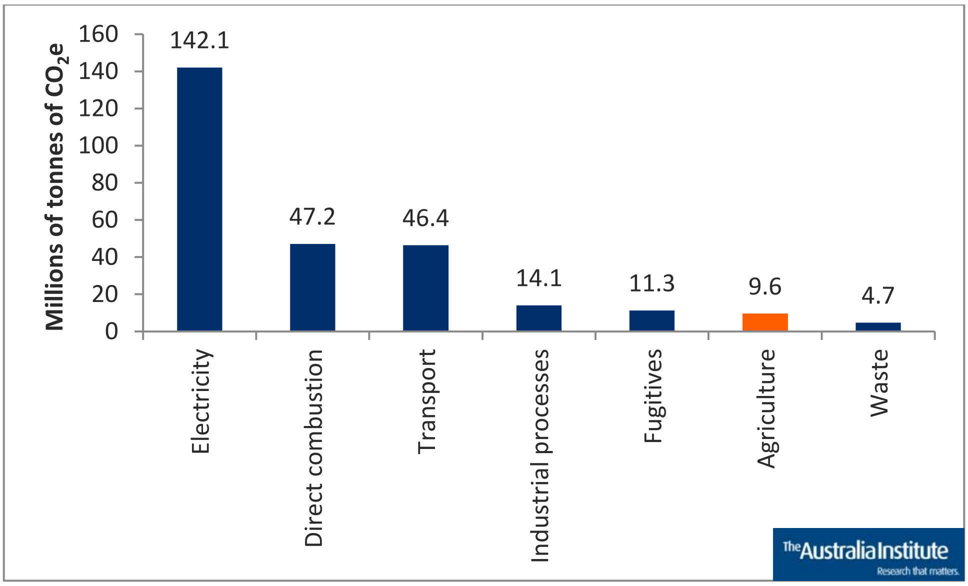
Energy analysts RepuTex have compiled a list of emissions reduction projects across all sectors of the economy, including estimates of the amount of emissions that each project can reduce and the cost of doing so.[4] The amount of emissions reduction available to each sector is shown in Figure 2, below. Just as it contributes the greatest share of emissions, the electricity sector also has the largest amount of potential

[3] All figures of Australia's emissions come from Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

[4] RepuTex (2018) *Marginal Abatement Cost Curve - 2030*, provided to The Australia Institute. Some details are available here: https://www.reputex.com/research-insights/report-meeting-a-2c-target-a-marginal-abatement-cost-mac-curve-for-australia/

emissions reduction projects. The agricultural sector has relatively few projects for its size.

**Figure 2 - Total amount of emissions reduction available from projects by sector**




Source: RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

Given the large amount of low-cost abatement options available to the electricity sector, most economists and emissions analysts suggest that it should shoulder more of Australia's abatement task.[5] This would reduce the burden on, and costs to, industries such as agriculture.

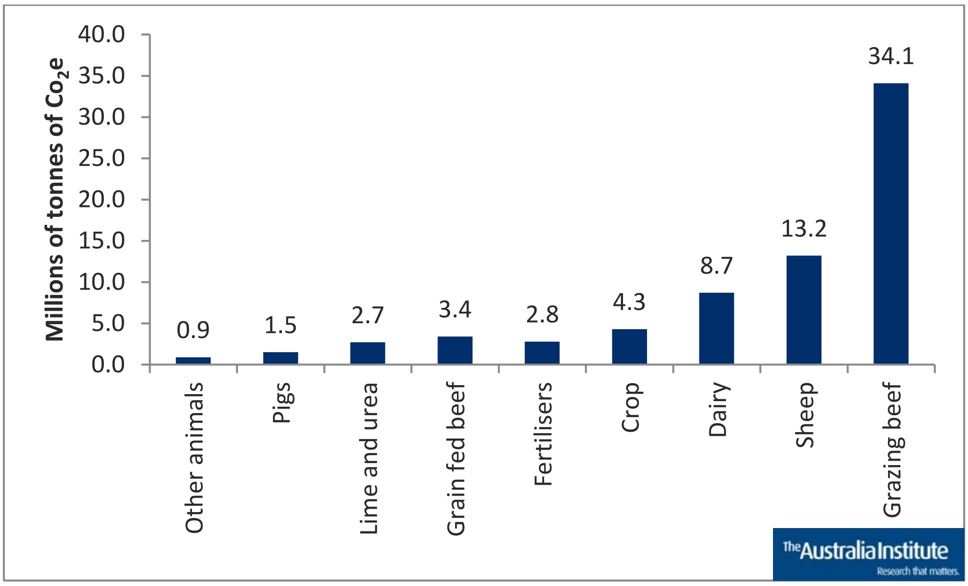
However, government policy appears not to be concerned with minimising cost or the potential of each sector to reduce emissions. This paper will take a close look at implications of this for the agricultural sector. It will look at how much emissions reduction the agriculture sector can achieve with the projects known to RepuTex and what the cost of that reduction would be.

[5] See for example Campbell (2017) *Meeting our Paris commitment,* http://www.tai.org.au/sites/defualt/files/P439%20Meeting%20our%20Paris%20Commitment%20-%20TAI%20Climate%20and%20Energy%20Program%20-%20September%202017.pdf

# Agricultural emissions

In agriculture, the top three emissions producing subsectors all involve livestock rearing. The largest is beef grazing, which makes up almost half of agricultural emissions (48 per cent). When grain-fed beef is included (5 per cent), beef makes up 52 per cent of agricultural emissions. This is followed by sheep (18 per cent) and dairy (12 per cent). Together the top three emitters make up over three quarters of carbon emissions in the agricultural sector (83 per cent), as shown in Figure 3 below:

**Figure 3 - Agricultural emissions by subsector in 2018**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Clearly, if the agriculture sector is to reduce its emissions by 26 per cent then these three subsectors are going to have to play a significant role.

The main source of $CO_2e$ from livestock is enteric methane emissions produced by the animal as it breaks down feed. This is done by microorganisms fermenting and breaking down ingested feed and producing methane, most of which is belched.[6] Emissions from pigs do not occur in this way, hence the lower emissions shown in Figure 3. Emissions from pigs mainly relate to the breakdown of manure in effluent ponds.[7]

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[6] Lines-Kelly (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

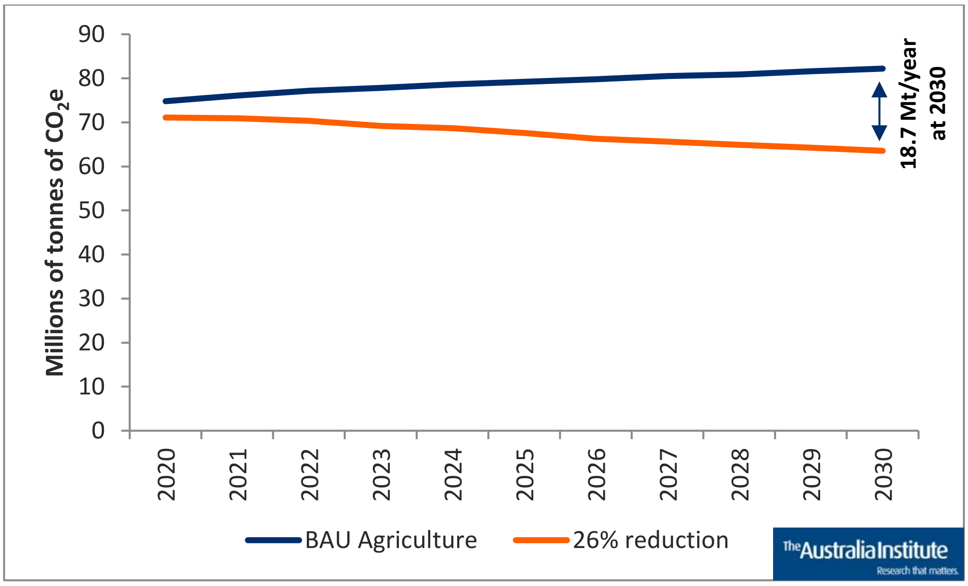
[7] Massey et al. (2013) *Pork Production and Greenhouse Gas Emissions*

Even with the current policies to reduce emissions, including the Carbon Farming Initiative and the Emissions Reduction Fund, agricultural emissions are expected to rise out to 2030 by 10 Mt $CO_2e$ per annum. Half of that increase will be in beef (including grain fed beef). Emissions from sheep will increase by about 2 Mt of $CO_2e$ while Dairy is projected to increase by about 1 Mt $CO_2e$.[8]

These increases in agricultural emissions include the impact of the Carbon Farming Initiative and the Emissions Reduction Fund. Agricultural emissions would rise even faster without these projects. The RepuTex emissions reduction projects are in addition to the emissions reduction work already underway. Work on reducing agriculture emissions is already underway but in order to reach a 26 per cent reduction target by 2030 a lot more would need to be done.

Agricultural emissions are currently 72 Mt $CO_2e$ per year, but they are expected to rise to 82.2 Mt $CO_2e$ by 2030 in the business as usual scenario (BAU). To reach the Paris target by 2030 agricultural emissions would instead need to fall to 63.5 Mt $CO_2e$. The difference between the increase in emissions if there is no change in policy and the reduction required to meet the Paris target is the size of the abatement task. This means the total abatement task for agriculture is for emissions to be 18.7 Mt $CO_2e$ per year lower in 2030 than they are currently. The total abatement task from 2020 to 2030 added together is 126 Mt $CO_2e$. This is shown in Figure 4 as the area between the two lines.

**Figure 4 - Agricultural sector emissions business as usual and 26% reduction task**

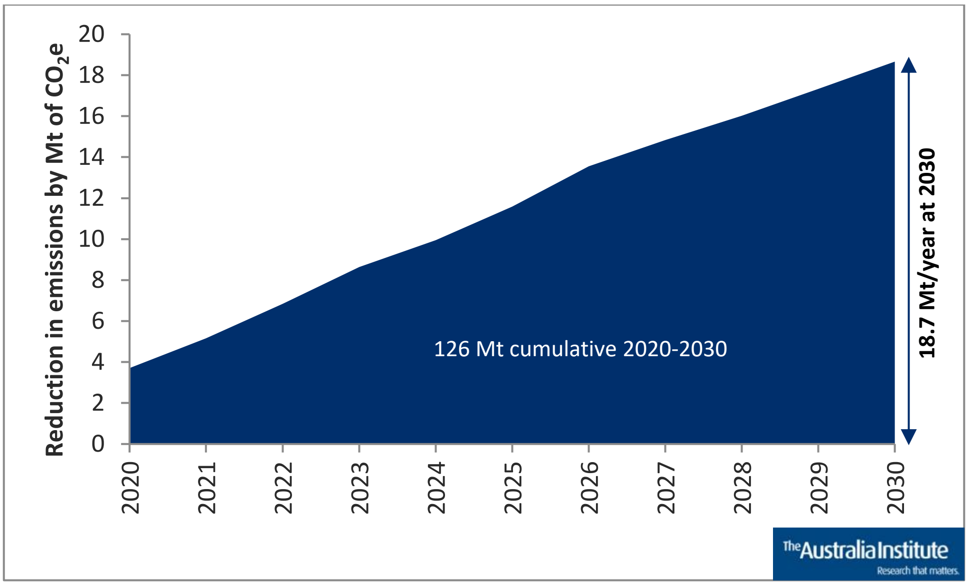



8 Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

As shown in Figure 5, the emissions abatement task in agriculture will rise steadily in line with a 26 per cent reduction in sectoral emissions.

### Figure 5 - Agricultural sector abatement task 2020 to 2030

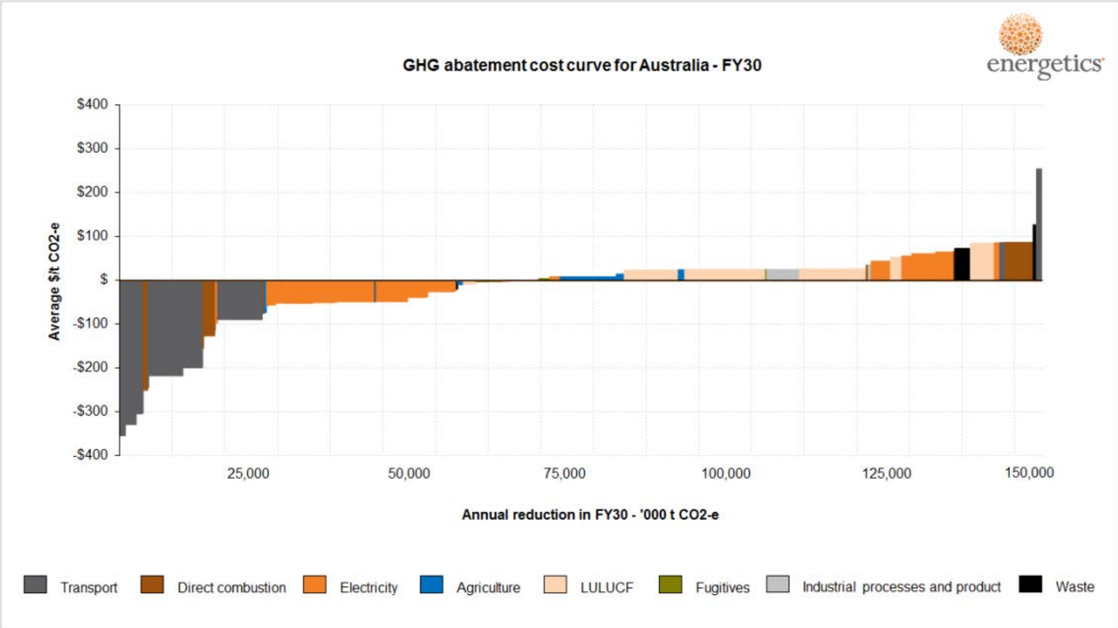



Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and Australia Institute calculations

Reducing emissions in the agriculture sector is costly when compared to other sectors in the Australian economy. There are proportionately more abatement projects at lower costs in other sectors. This can be seen in the Government's commissioned Abatement Cost Curve 2030 by Energetics, reproduced in Figure 6 which shows numerous available abatement opportunities in transport, electricity and direct combustion sectors.[9] Many of the available activities incur a negative cost (i.e. will ultimately save the activity undertaker money). The government's decision that each sector should contribute to emissions reduction in the same proportion will lead to an unnecessary increase in cost.

[9] Energetics (2016) *Australia's 2030 climate change emissions reduction target – abatement potential,* http://www.environment.gov.au/climate-change/publications/modelling-and-analysis-australias-abatement-opportunities

### Figure 6 - Energetics cost curve




Source: Energetics (2016) *Australia's 2030 climate change emissions reduction target – abatement potential*, http://www.environment.gov.au/climate-change/publications/modelling-and-analysis-australias-abatement-opportunities

That is not to say that the agriculture sector should be excluded from reducing emissions. There are some projects within the agriculture sector that have the potential to reduce emissions at a relatively cheap, or even negative, cost. These projects should be encouraged. Further research and development into other ways to reduce emissions in the agricultural sector should also be encouraged.

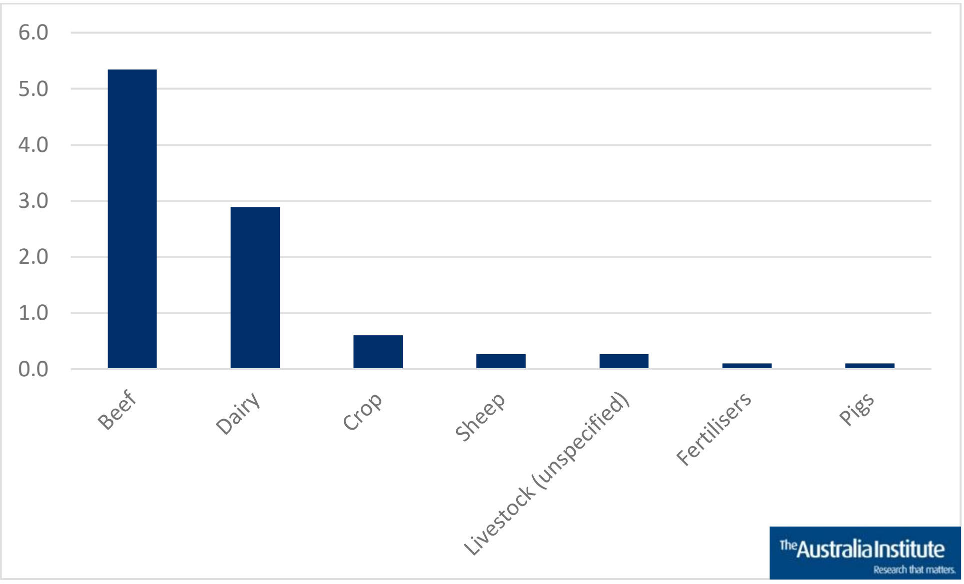
The selection of emissions reduction projects should be based on a comparison with all possible projects in Australia. Sector-specific targets should be based on good policy; assigning the same target for each sector will only increase the cost of reducing emissions.

# Agricultural emissions reduction projects

RepuTex has a large database of emissions reduction projects from all sectors. Each project provides for an ongoing reduction in emissions. The database identifies 11 emissions reduction projects, covering most of the agriculture subsectors. They are all considered technologically feasible, meaning they could be implemented at any time. If they were all implemented, they have the potential to reduce agriculture emissions by 9.6 million tonnes of $CO_2e$ each year.[10]

Figure 7 shows the abatement available from agriculture projects in RepuTex's database, sorted by The Australia Institute into subsectors. Our calculations combine the grazing beef and grain fed beef subsectors as it is not always clear which subsector a beef project would belong to.

**Figure 7 - Mt per year abatement available from agriculture projects**




Beef is the largest source of emissions and has projects that could reduce emissions by the largest amount. These projects include:

- Optimising grazing patterns so that more carbon is sequestered into the soil of grasslands. This includes converting land from crops to pasture, rejuvenating

[10] RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

pasture through seeding, changing stocking rates, changing the duration or intensity of grazing including resting pasture.[11]
- Active feeding programs that allow cows to gain weight more quickly with higher quality feed, which can reduce emissions per day and also reduce the time it takes to bring an animal to slaughter weight, thus reducing lifetime emissions.[12]

The dairy subsector has projects that could reduce emissions by the second largest amount, although it is the third largest source of emissions. The projects include:

- Capturing the methane from dairy waste in covered ponds. The methane is then burnt off and could be further used to generate electricity.[13]
- Reducing methane emissions by feeding dairy cows high fat feed supplements. This allows better digestion of lower quality feeds.[14]

There are also significant projects to reduce emissions from sheep including:

- A similar project to that of cattle that involves optimising grazing patterns so that more carbon is sequestered into the soil of grasslands. This includes converting land from crops to pasture, rejuvenating pasture through seeding, changing stocking rates, changing the duration or intensity of grazing including resting pasture.[15]
- Sheep can also use active feeding programs to allow the lambs and sheep to gain weight more quickly with higher quality feed, which can reduce emissions per day and also reduce the time it takes to bring an animal to slaughter weight, thus reducing lifetime emissions.[16]

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[11] Australian Government (2018) *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination, 2014,* https://www.legislation.gov.au/Details/F2014L00987

[12] Lines-Kelly (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

[13] Australian Government (2015) *Carbon Credits (Carbon Farming Initiative) (Destruction of Methane Generated from Dairy Manure in Covered Anaerobic Ponds) Methodology Determination 2012,* https://www.legislation.gov.au/Details/F2015C00573

[14] Department of the Environment and Energy (2014) *Feeding dairy additives to milking cows,* http://www.environment.gov.au/climate-change/government/emissions-reduction-fund/cfi/publications/factsheet-dairy-additives-milking-cows

[15] Australian Government (2018) *Carbon Credits (Carbon Farming Initiative) (Sequestering Carbon in Soils in Grazing Systems) Methodology Determination, 2014,* https://www.legislation.gov.au/Details/F2014L00987

[16] Lines-Kelly R (2014) *Enteric methane research: A summary of current knowledge and research*, NSW Department of Primary Industries

Crop emissions can also be reduced with a number of projects including:

- Soil conservation to improve nitrogen mineralisation and soil structure. This increases the amount of carbon captured in the soil. It is achieved through changing from annual cropping to pasture, retaining field stubble and increasing biomass yields through sustainable intensification (nutrient management, soil acidity management, new irrigation and pasture renovation).[17]

There are also projects to reduce piggery emissions including:

- Covering the lagoons that store effluent, collecting the biogas and combusting the gas. The biogas could also be used to generate electricity.[18]

Emissions reduction projects also target fertiliser use including:

- Efficiency improvements in the use of nitrogen fertilisers used by irrigated cotton farmers. Nitrogen fertiliser wastage is as high as 92 per cent, mainly through denitrification, leaching, runoff and volatilization.[19]

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[17] Federal Register of Legislation (2015) *Carbon Credits (Carbon Farming Initiative—Estimating Sequestration of Carbon in Soil Using Default Values) Methodology Determination 2015,* https://www.legislation.gov.au/Details/F2016C00263

[18] Australian Government (2015*) Carbon Credits (Carbon Farming Initiative) (Destruction of Methane Generated from Manure in Piggeries—1.1) Methodology Determination 2013,* https://www.legislation.gov.au/Details/F2013L00856

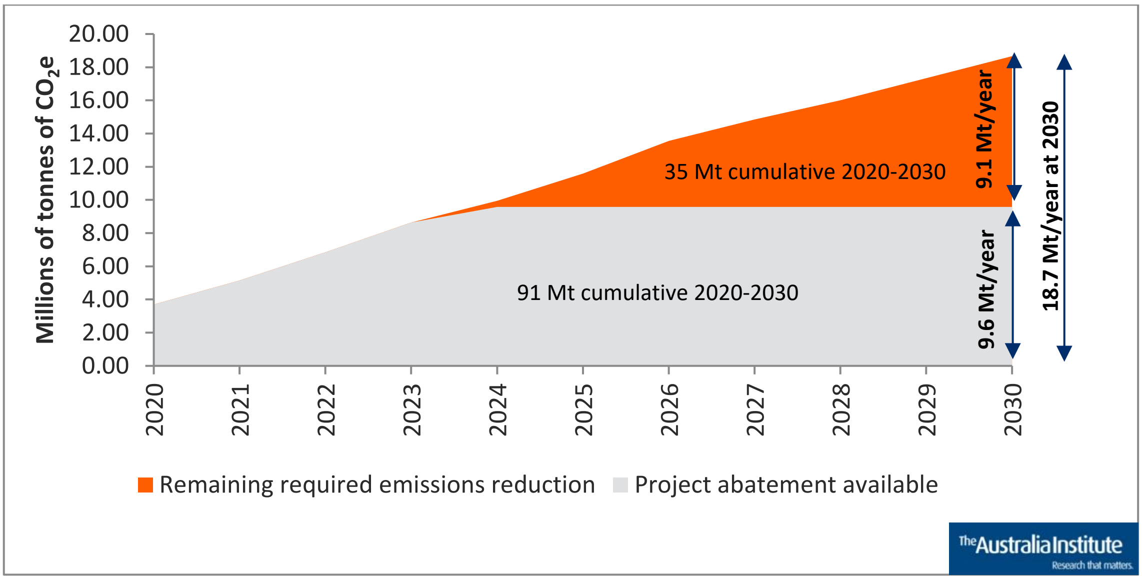
[19] Australian Government (2015) *Carbon Credits (Carbon Farming Initiative—Reducing Greenhouse Gas Emissions from Fertiliser in Irrigated Cotton) Methodology Determination 2015,* https://www.legislation.gov.au/Details/F2015L00584

# Emissions targets vs reduction potential

Assuming that all, but only, the existing agricultural emissions reduction projects can be implemented in full, the agriculture sector would still be unable to meet its emissions reduction target. This is because the maximum reduction available from the projects identified by RepuTex is 9.6 Mt $CO_2$e per year but the required abatement per year becomes larger than this from 2024.

Figure 8 shows the agriculture sector's abatement task, as calculated in Figures 4 and 5, as well as the emissions reduction available with projects identified in the RepuTex data. It assumes that agriculture follows the Australia-wide trajectory to the 26% reduction by 2030 outlined in *Australia's emissions projections 2017.* It does this by incrementally adopting the projects identified by RepuTex until all agriculture projects have been implemented. Figure 8 shows that after 2024 the required annual abatement becomes larger than the annual abatement available from abatement projects.

**Figure 8 - Total agricultural sector abatement and project abatement**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

Assuming this steady pace of project implementation, the cumulative shortfall in emissions reduction from 2024 to 2030 is almost 36 Mt of $CO_2$e – the area between the curves in Figure 8. If all projects were implemented earlier, the shortfall would be smaller; if projects were not all implemented by 2024, the shortfall would be larger. The year this shortfall is largest is 9.1 Mt of $CO_2e$ in 2030. This is the emissions reduction required in 2030 to meet the 26 per cent reduction target after all agricultural emissions reduction projects have been implemented.

Emissions reduction projects in the agricultural sector can reduce emissions without large cost to the sector. They are designed to change the way production happens so that less emissions are produced from the same amount of production. This is important because reduction projects should ideally allow the same amount of production with lower emissions.

# Abatement costs and projects from an economic perspective

If all agriculture emissions reduction projects identified are implemented, RepuTex estimate they would reduce emissions by a maximum of 9.6 million tonnes of $CO_2e$ per year at an estimated cost from 2020 to 2030 of $1.8 billion. However, while these estimates may be accurate from an engineering perspective, from an economic perspective there appear to be unstated assumptions that need to be explored.

Many of the projects are estimated to have a "negative cost", meaning that if farmers implement them they should actually save more money in energy efficiency than the project costs to implement. However, if a project truly is negative cost, economists would expect farmers to implement these projects without any form of policy intervention. The fact that these projects have not been implemented means either that there are hidden costs, risks, or that there is some aspect of market failure.

Examples of market failures that could affect emissions reduction projects are large upfront costs, a lack of information or expertise among farmers or the financial benefits are so uncertain that it is not worth the risk.

This paper assumes that the impediments to these projects occurring will be overcome without further cost. In practice, the government may have to pay incentives to farmers to convince them to adopt these projects or the government might have to fund some of these projects directly (the government might get some or all of its money back). None of this funding is included in the cost figures below, which should be seen as optimistic.

Furthermore, not all projects identified by RepuTex are at a commercial stage. If the agriculture sector is to reach at 26 per cent reduction by 2030 then many of these projects will need to come on line quickly. As explained below, all the projects will need to be up and running by 2024. This may not be possible with some of these projects.

To get the full emissions reduction of 9.6 Mt of $CO_2e$ all projects would need to be fully implemented with the full emissions reduction achieved. This seems optimistic as some projects would cover a large number of producers, many of whom are small scale farmers. Compliance will need to be closely monitored to ensure full emissions reduction is realised. Recent reporting of compliance and enforcement in the Emissions Reduction Fund suggests compliance can be problematic.[20]

On the other hand, it is likely that new emissions reduction methods and technologies will be devised over the coming years. While these calculations do not factor in any technology change, it should be noted that any new projects will be experimental and in an earlier stage of development. They might take time before they can be commercially rolled out and the activity methodologies achieve accreditation (by the Clean Energy Regulator in order to generate carbon credits). This means that it is unlikely in the short term that total amount of emissions reduction possible from agricultural projects will be significantly greater than what is included in the RepuTex data. This is particularly the case because, as we will show below, all the projects will need to be implemented by 2024.

[20] See for example Hasham (2018) *'Serious questions' over whether Australia's emissions cuts are real*, https://www.smh.com.au/politics/federal/serious-questions-over-whether-australia-s-emissions-cuts-are-real-20180710-p4zqln.html

# Direct emissions reduction

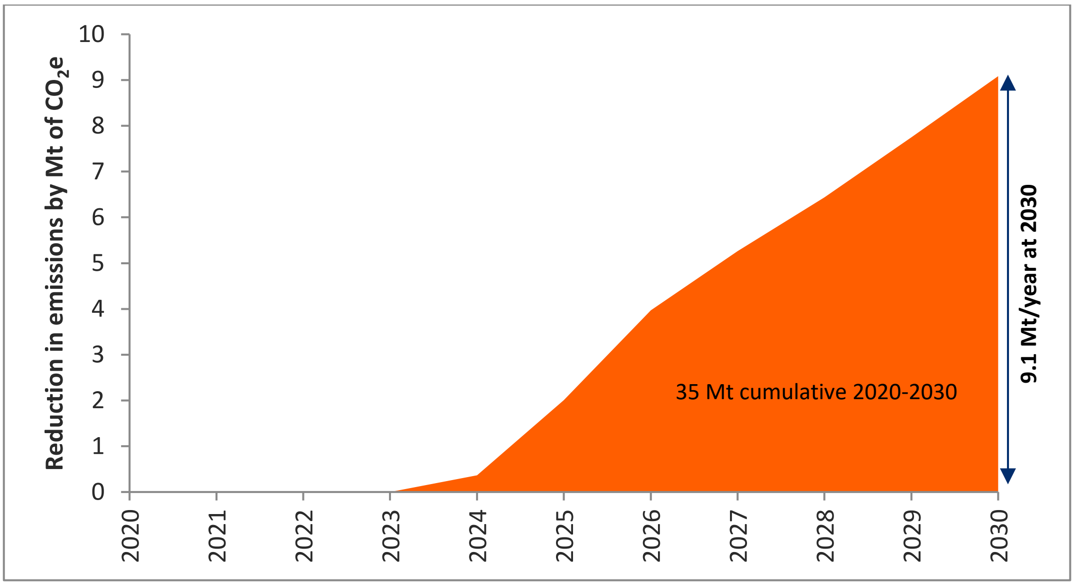
Emissions can also be reduced more directly by reducing production. In the agriculture sector emissions from production are mainly methane from animals. If the agricultural sector does not have enough emissions reduction projects then to meet its targets it will have to reduce its emissions by directly reducing production.

An important distinction is total emissions versus emissions intensity. The emissions reduction projects aim to improve emissions intensity. That is they aim to reduce the amount of emissions for each unit of output such as per kilogram carcass weight or fleece weight. This is a way of reducing emissions without reducing output.

While reducing emissions by reducing the emissions intensity of agriculture is the preferred way of reducing emissions, it is not the only way. Total emissions can be decreased by simply reducing overall production. This is a less desirable way of reducing emissions because the agricultural sector has a reduced income and consumers will have less agricultural produce to consume.

The agriculture sector would run out of emissions reduction projects by 2024, unless new abatement methods can be developed. This is the first year that the sector would have to start reducing production to reduce emissions. Figure 9 shows the emissions shortfall that would have to be made up by reductions in production.

**Figure 9 - Shortfall in emissions reduction after all projects fully implemented**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve – 2030*

# The cost of direct reductions

By 2030 the agriculture sector would have a shortfall of over 9 Mt of $CO_2e$ or about 11 per cent of total agricultural emissions. To reduce emissions in the agricultural sector by this amount would require a significant reduction in agricultural output. If the sector was to reduce emissions in proportion to output then beef production would require the largest reduction in output, 4.7 Mt of $CO_2e$ in 2030. This is the equivalent of 2.9 million fewer cattle from the current Australian herd of 23.6 million meat cattle – or, to put it another way, all the beef cattle in Victoria and South Australia put together.[21]

Sheep farming would require the second largest reduction in emissions, 1.7 Mt of $CO_2e$ in 2030. This is equivalent to eight million fewer sheep, from the current Australian flock of 72.1 million. This reduction in sheep is almost double the number of sheep in Tasmania and Queensland put together (4.2 million). Dairy would need to reduce emissions by 1.1 Mt $Co_2e$, the equivalent to 290,000 cows, or all the dairy cows in NSW. Pig farming would need to reduce emissions by 0.2 Mt $CO_2e$ (270,000 pigs).

The reduction in livestock is summarised in Table 1.

**Table 1 - Summary of emissions and livestock reduction by subsector**

| Livestock | Mt of $CO_2e$ reduced | Reduction in livestock |
|---|---|---:|
| **Beef (including grain fed beef)** | 4.7 | 2,900,000 |
| **Sheep** | 1.7 | 8,000,000 |
| **Dairy** | 1.1 | 290,000 |
| **Pig** | 0.2 | 270,000 |

Source: Australian Bureau of Statistics (2018) *7121.0 - Agricultural Commodities, Australia, 2016-17* and Department of the Environment and Energy (2017) *Australia's emissions projections 2017* and RepuTex (2018) *Marginal Abatement Cost Curve - 2030*

[21] Reductions in livestock have been calculated using Australian Bureau of Statistics (2018) *7121.0 - Agricultural Commodities, Australia, 2016-17* and reducing the numbers by the equivalent shortfall in emissions, which is 11.1 per cent. This should be considered the equivalent impact that would occur today. By 2030 livestock number would have increased and so the decrease in numbers would be larger.

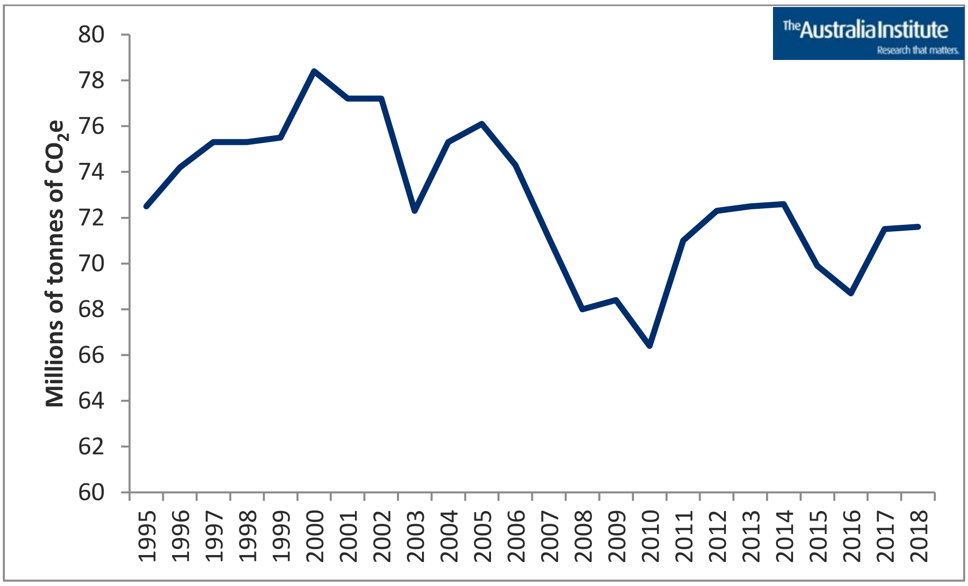
Livestock makes up about 85 per cent of emissions from agriculture. The remaining 15 per cent or 1.4 Mt of $CO_2e$ in 2030 would need to come from the other agriculture subsectors including crops, fertiliser and lime and urea. While reductions in these sectors are far smaller than those of the livestock sectors they will still cause significant reductions in output.

# Comparison to Millennium Drought fall in production

A good example of the agricultural sector reducing emissions because of a decrease in output occurred during the 2000s Millennium Drought. During the Millennium Drought total agriculture emissions fell because the drought conditions forced farmers to reduce the number of animals. Fewer animals meant fewer emissions.

The Millennium Drought was underway by the year 2000 and lasted, on and off until 2010. Agricultural emissions peaked in 2000 at 78 Mt of $Co_2e$ and fell 15 per cent to a low of 66 Mt of $CO_2e$ in 2010. The drop in agricultural emissions because of the Millennium Drought can be seen in Figure 10.

**Figure 10 - Agricultural emissions during the Millennium Drought (2000 to 2010)**




Source: Department of the Environment and Energy (2017) *Australia's emissions projections 2017*

Note: The axis has been shortened to better show the impact of the Millennium Drought

Looked at another way, the agricultural sector would need to reduce its emissions in excess of emissions reduction projects in 2030 by 11 per cent. This is roughly equivalent to the impact of the Millennium Drought, which reduced emissions by 15 per cent.

# Conclusion

A sector by sector approach to emissions reduction will harm sectors that have few cheap sources of abatement. Reducing emissions by 26 per cent in the agricultural sector would come at significant cost. This does not need to be the case.

Sectors like electricity generation have commercially available, relatively cheap abatement projects. Additional abatement in these sectors above the 26 per cent target means that sectors like agriculture would have to do less. The more that electricity generation reduces emissions the less the agricultural sector needs to do.

Those who are concerned about the cost to the agricultural sector need to be concerned with the government's plans to reduce emissions on a sector by sector basis. They should also be concerned by the government's National Energy Guarantee if it locks in a 26 per cent reduction in the electricity sector. If the electricity sector does not reduce emissions beyond 26 per cent then other sectors, including agriculture, will have to do more.

The cheapest method to reach the Paris target is to judge a sector on how cheaply it can reduce its emissions, not on arbitrary sector by sector targets. Building walls between sectors will only increase the cost of reaching the Paris target.

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change/submissions/Pages/australias-intended-nationally-determinedcontribution-to-a-new-climate-change-agreement-august-2015.aspx>

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# Gorgon-tuan Problem

***Chevron's Gorgon LNG project released millions of tonnes CO2 last year that were meant to be sequestered by its carbon capture and storage (CCS) project. This failure represents half of the national increase in emissions over the last year. If required to offset these emissions, Gorgon would need to pay more than $55m million a year. However, Gorgon will face no penalties and is in line to receive $60m in taxpayer subsidy. Under the safeguard mechanism, it has an emission limit that assumes CCS is not operating.***

**Tom Swann**
**November 2018**

Australia's greenhouse gas emissions have increased for three years in a row. The Department of Energy and Environment's *National Greenhouse Gas Inventory Quarterly Update* for March 2018 says:

> Emissions for the year to March 2018 increased 1.3 per cent or 6.8 Mt CO2-e. This increase was mainly driven by LNG production for export.[1]

LNG emissions come from stationary energy (gas used in LNG processing) and fugitives (release of CO2 and methane). LNG also increases emissions from electricity, which is used in the extraction and transport of gas.

[1] Department of Energy and Environment (2018) *Environment's National Greenhouse Gas Inventory Quarterly Update - March 2018,* https://www.environment.gov.au/system/files/resources/63391569-7ffa-4395-b245-e53893158566/files/nggi-quarterly-update-mar-2018.pdf

The single largest source of LNG emissions is the Gorgon LNG Project off the North West of Western Australia. The main stake in the project is held by Chevron.

The gas in the Gorgon reservoir is relatively high in CO2. The Gorgon Project intends to sequester this CO2 with carbon capture and storage (CCS). The Gorgon LNG Project is often lauded as the CCS flagship project. For example, on ABC RN the CEO of the Minerals Council Tania Constable pointed to Gorgon as the largest CCS project in the world, when it starts in 2019.[2] Ms Constable did not explain that the Gorgon Project's CCS has failed for the past two years emitting millions of tonnes of CO2 that it promised to sequester.

Fugitive emissions from Gorgon are included in the National Greenhouse Gas Inventory.[3] They therefore make it harder to reach our emissions targets. The Government's emissions projections for future years include Gorgon CCS coming on "as currently scheduled" – presumably meaning as rescheduled for 2019, after two years of failure.[4] These projections will need to be adjusted further if there are further failures.

The Gorgon CCS project has CCS capacity of 3.4 to 4Mt per year.[5] Chevron previously estimated the Gorgon CCS project was to sequester between 5.5 and 7.8Mt of CO2 over the first two years of operation.[6] It is likely the emissions from the second year of operation would be larger than the first, as production ramps up. There have also been some issues with production, but it is unclear whether and by how much this has reduced fugitive emissions.[7]

[2] ABC RN (2018) *RN Breakfast, Tania Constable, CEO of the MCA,* https://abcmedia.akamaized.net/rn/podcast/2018/10/bst_20181012_0816.mp3

[3] Senate Environment and Communications Committee (2018) *Question on Notice 162,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber162

[4] Senate Environment and Communications Committee (2018) *Question on Notice 164,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber164

[5] Global CCS Institute (2018) *Gorgon Carbon Dioxide Injection,* https://www.globalccsinstitute.com/projects/gorgon-carbon-dioxide-injection-project

[6] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant,* https://thewest.com.au/business/oil-gas/carbon-hiccup-for-chevron-with-5-million-tonne-greenhouse-gas-problem-at-gorgon-lng-plant-ng-b88694565z

[7] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant,*

In short, in a year when Australia's total emissions increased by 6.8Mt CO2, Chevron's failing Gorgon CCS project emitted up to 4Mt CO2. Gorgon's CCS failure so far represents a significant part, likely half or more, of Australia's emissions increase.

Chevron's fact sheet on the project not only ignores its failures to date, but further notes:

> The Australian Government has committed $60 million to the Gorgon Carbon Dioxide Injection Project as part of the Low Emissions Technology Demonstration Fund (LETDF).[8]

## Penalties for emitting millions of tonnes of CO2?

There is no federal requirement for Gorgon to sequester these emissions; it is not part of the federal approval.[9] As discussed below, Gorgon's emissions are subject to the safeguard mechanism, but Chevron has set itself an emissions limit that does not assume CCS operates successfully.

The WA Government approval for Gorgon requires it to sequester at least 80% of its fugitive emissions over a five year period. It is unclear how this is now possible and purchasing offsets to meet this target would cost tens of millions of dollars.

The WA Government has decided not to impose penalties, citing uncertainty about the meaning of "commencement of operations".

Failing to follow through on compliance through requiring offsets not only increases emissions sets a precedent that undermines the force of such obligations in the future.[10]

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[8] Chevron (2018) *Gorgon carbon dioxide injection project*, https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf

[9] Senate Environment and Communications Committee (2018) *Question on Notice 163,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId8-EstimatesRoundId3-PortfolioId10-QuestionNumber163

[10] Diss (2018) *How the Gorgon gas plant could wipe out a year's worth of Australia's solar emissions savings,* https://www.abc.net.au/news/2018-06-21/gorgon-gas-plant-wiping-out-a-year-of-solar-emission-savings/9890386

On 17 October 2018, the WA Government gave Chevron "the benefit of the doubt", saying they would revisit the question of offsets if the CCS was not working in "six months or a year's time".[11]

The Federal Government indemnified the Western Australian Government over long term risks from CO2 leaks from Gorgon. This appears in every federal budget as a 'contingent liability'.[12]

## Safeguard mechanism?

Gorgon is covered by the Commonwealth Government's safeguard mechanism. This policy is intended to limit emissions increases from large industrial and extractive facilities in Australia. Every facility has 'baseline', or emissions limit. Companies with facilities that breach their limit may need to buy offsets to cover the breach.

Gorgon's emissions limit is a 'calculated baseline' based on Chevron's projection of emissions from the project.[13] Specifically, the limit is set at the emissions projected by Chevron for the year of highest production (of LNG) in the first five years of operation.

The emissions limit for 'Gorgon Operations' is set at 8.3Mt CO2-e per year.[14] 'Gorgon Upstream' and 'Gorgon Downstream' are listed as separate facilities with their own much smaller limits, together bringing Gorgon's *total* emissions limit to 8.7Mt per year.

It is unclear when the projections used to set Gorgon's emission limit assume CCS will be operational. The Clean Energy Regulator says all details of the projection are confidential.[15] However it appears the Gorgon emissions limit does not include operational CCS.

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[11] Milne (2018) *Chevron Gets Lifeline on Delayed Gorgon Capture,* https://thewest.com.au/business/energy/chevron-gets-lifeline-on-delayed-gorgon-carbon-capture-ng-b88992451z

[12] Senate Environment and Communications Committee (2018) *Question on Notice 164,* https://www.aph.gov.au/api/qon/downloadestimatesquestions/EstimatesQuestion-CommitteeId3-EstimatesRoundId3-PortfolioId17-QuestionNumber164

[13] A calculated baseline is the projected emissions in the year of projected highest production (of LNG) in its first five years of operation:
CER (2018) *Calculated Baseline,* http://www.cleanenergyregulator.gov.au/NGER/The-safeguard-mechanism/Baselines/Calculated-baseline

[14] CER (2018) *Safeguard baselines table,* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Safeguard-baselines-table#Safeguard-baselines-table

[15] CER Personal communication.

Chevron says CCS will reduce the project's emissions by around 40%:

> The Project plans to inject between 3.4 and 4 million tonnes of reservoir CO2 each year. This will reduce greenhouse gas emissions from the Gorgon Project by approximately 40 percent. [16]

It is unclear whether this refers to peak production, or is averaged over the life of the project. At any rate, we can infer the (average or peak) total CO2 emissions *before* CCS are 8.5 to 10Mt per year, and the CO2 emissions *after* CCS are at 5.1 to 6Mt per year. Since the emissions limit for the project is 8.7Mt, or 8.3Mt just for Gorgon Operations, it appears Chevron's emissions limit is based on a year where CCS is not operating.

Despite Chevron's emphasis on CCS at Gorgon, it has set an emissions limit that does not include CCS being operational. Gorgon will face no penalty for this failure under the safeguard mechanism.

If Gorgon's CCS had been projected as operational from the beginning, the baseline would have been set at a level assuming CCS operates. It therefore would have imposed an obligation if CCS failed.

All details about Chevron's projection are confidential. We cannot even find out what date Chevron applied for the limit.[17] However it appears to be late 2017, after Gorgon had operated for a year without CCS and as production continued to ramp up.

Gorgon's emissions limit was as 'updated' in November 2017[18] and the Clean Energy Regulator advised this was Chevron's first emissions limit.[19] The last deadline to submit that limit was 31 October 2017.[20] In December 2017, Chevron reported to the WA Government that Gorgon's CCS would be delayed again.[21] If Chevron submitted its limit in late 2017, it likely knew at the time that CCS would not be operational soon.

[16] Chevron (2018) Gorgon carbon dioxide injection project, https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf

[17] CER Personal communication.

[18] Table updated in November for Gorgon Operations, projections lodged beforehand. CER (2018) *Safeguard baselines table* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/Safeguard-baselines-table#Safeguard-baselines-table

[19] Prior to this it had the default baseline of 100,000 tonnes CO2e.

[20] CER Personal communication

[21] Milne (2017) *Carbon hiccup for Chevron with 5 million-tonne greenhouse gas problem at Gorgon LNG plant* https://thewest.com.au/business/oil-gas/carbon-hiccup-for-chevron-with-5-million-tonne-greenhouse-gas-problem-at-gorgon-lng-plant-ng-b88694565z

Moreover, this was during the ramp up of production. LNG production started in March 2016, ramping up in October 2016 and again in March 2017.[22] The 2017-18 year would have been projected as having higher production and it appears it, or a later year, was projected assuming CCS was not operational.

If CCS does not become operational Chevron may still be at risk of breaching the safeguard mechanism. Chevron reports that 'Gorgon Operations' emitted 7.7Mt $CO_2$-e in 2016-17.[23] The emissions limit was 8.3Mt. So during the ramp-up of production, Gorgon came within 0.6Mt of hitting its limit under the safeguard mechanism. Emissions are likely to be higher in 2017-18, with increased production.

Facilities that breach their emissions limit may be required to purchase offsets. This can be avoided however if they can bring down emissions in future year to keep the three year average below the emissions limit.

## Cost of offsetting Gorgon's failing CCS

If Gorgon were required to offset the emissions it did not sequester, it might do this by purchasing Australian Carbon Credit Units (ACCUs).

The average price of ACCUs following the sixth government auction in December 2017 was $13.08. Offsetting 4Mt of $CO_2$ at this price would cost $52 million. It would likely cost Gorgon more as lower cost abatement options are generally exhausted first.

If CCS continues to fail while the world and Australia takes action in line with the Paris Agreement, the cost of offsetting could be ten times greater. This is according to the projected carbon price in such a scenario put forward by the Climate Change Authority.[24]

## Conclusion

Despite being widely lauded as a success story for CCS, the Gorgon LNG Project has failed to sequester $CO_2$ as promised over its first two years. This has led to millions of

[22] WA DJTSI (2018) *WA Liquefied Natural Gas Industry Profile* https://www.jtsi.wa.gov.au/docs/default-source/default-document-library/wa-lng-profile-0218.pdf?sfvrsn=8

[23] Gorgon Upstream and Downstream are listed as separate facilities with far smaller emissions limits. CER (2018) *2016-17 Safeguard facility reported emissions,* http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/safeguard-facility-reported-emissions/safeguard-facility-emissions-2016-17

[24] See Ogge (2018) *NT Options for the implementation of Recommendation 9.8 of NT Fracking Inquiry* http://www.tai.org.au/sites/default/files/P637%20NT%20offset%20paper%20%5BWEB%5D_0.pdf

tonnes of additional emissions, likely at least half as large as the increase in national emissions last year. Chevron will not however face a penalty for this. It does not face penalties for breaching its Western Australian approval, and the WA government remains ambiguous about when it would require Chevron to purchase offsets. It has set an emissions limit for itself under the safeguard mechanism that does not include operational CCS.

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# Offset Upset

## The WA EPA's climate offset requirements and the LNG backlash

***WA LNG projects are pushing up Australia's emissions. The EPA recommended offsets to stop emissions rising. Contrary to industry claims, FOI documents show the EPA consulted with industry who opposed offsets.***

***Gas companies can afford to buy offsets at very small shares of their profits. They already use internal carbon prices, which they should disclose.***

***A large expansion in gas exports is not consistent with solving climate change. If approved, new projects should offset exported emissions or ensure exported gas is burned under climate policies consistent with Paris Agreement goals.***

Submission

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# Summary

Australia's emissions are rising, not falling, because there is no credible national climate and energy policy. Western Australia (WA) is the only state where greenhouse gas emissions have increased over the past decade, largely due to large expansions in the emissions intensive production and export of Liquified Natural Gas (LNG).

In the absence of a climate policy, further increases in LNG exports will only further increase Australia's emissions and further damage the climate.

This was the situation confronting the WA Environmental Protection Authority (EPA) earlier this year.

On 7 March 2019, the EPA published comprehensive guidelines under which it would recommend that high emitting new project be required to purchase offsets (pay a price) for all direct emissions. The backlash from the gas industry resulted in the WA Premier taking heed of industry's concerns and soon after the EPA taking the unprecedented move of withdrawing the guidelines and putting them out for further consultation.

Gas companies and their industry groups claimed the guidelines were ad hoc, were not given due consultation, went far beyond requirements under the Paris Agreement, and would have severe negative economic impacts in particular on employment.

This report shows these are all inaccurate, and in the latter case irrelevant to EPA consideration.

One week before the EPA's consultation finished, the WA Government announced a new aspirational 2050 net-zero emissions target. This target is empty without policies to prevent new projects from increasing emissions. The timing of the new policy also raises further questions about how gas industry pressure on the government has lead the WA Government to pressure the EPA.

The EPA is an independent advisory body that must by law consider and make recommendations based on environmental science. Contrary to industry and government claims, its decisions are not to be based on economic factors. The pressure on the EPA threatens its independence and sets yet another alarming precedent threatening the future of science-based policy in WA and across Australia.

FOI documents released to The Australia Institute show the EPA did consult as required with industry groups via its stakeholder reference group. Months before finalising the guidelines, the EPA told the group it was concerned about rising emissions in the lack of policy, and that its offset expectations would be increased. Industry group submissions to the consultations objected to offsetting, in particular on the basis of cost. Conservation groups gave detailed environmental and legal evidence and arguments that projects must not be allowed to increase emissions – either through

offsetting, or rejection of approvals. The EPA then told the stakeholder reference group it was likely to require full offsetting for scope 1 emissions, one week in advance of releasing the policy.

Documents tabled in WA Parliament show the WA Department of Water and Energy Regulation (DWER) was also told of the offset requirements in advance of publication, as was the respective Minister at least two weeks in advance. The advice to the Minister was that the cost of offsetting was "likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment".

LNG companies are already planning to pay for their emissions by using 'shadow carbon prices' in their investment decisions. This includes Woodside, who use prices

> "that reflect our expectations of future carbon prices. These vary over time and jurisdiction. We also use include high and low sensitivities to test major decisions, with the high sensitivity reflecting our understanding of a 2°C scenario."

Carbon pricing is both widely used and widely understood. Even the Australian Petroleum Production & Exploration Association (APPEA), has suggested projects only be approved if they are assessed using a carbon price.

However while some companies do disclose these prices, WA LNG companies Woodside and Chevron do not. The EPA should ask them to do so as part of their assessment. Proponents should be required to demonstrate the role of the project in scenarios consistent with a 1.5-2°C warming under the Paris Agreement. Since Woodside already does this analysis, such disclosure should not be difficult.

While WA LNG projects are a major and increasing source of domestic emissions, the projects are by the company's own claims very profitable, and so well able to pay to offset those emissions. Offsets at current prices would cost Woodside 1.1% of 'gross margins' at Pluto and 1.5% of gross margins at North West Shelf. For Chevron's Gorgon and Wheatstone projects, current prices would see offsets cost 2.6% of 'cash margins'. These offset cost estimates were validated by the WA DWER. Even using Shell's shadow carbon price of US$40 per tonne of $CO_2e$, offsets would cost Woodside 4.6% of Pluto's margins and 6.2% of North-West Shelf's margins.

Woodside is currently proposing to extend, expand and link the Pluto and North West Shelf LNG projects to develop the Browse and Scarborough fields. The emissions from the projects will be larger than emissions from the existing operations at the LNG plants. Given the projects will use existing infrastructure is therefore reasonable to assume the margins enjoyed on these projects will be similar to if not lower than those enjoyed on the existing NWS LNG project, and the cost of offsetting is likely to be similarly small by comparison.

A key question raised by the EPA in its recent consultation is whether it should assess and put conditions on scope 3 exported emissions. After decades of fossil fuel companies trying to disown responsibility for exported emissions, it is surprising to see the gas industry seek to use scope 3 arguments to justify increased emissions in Australia.

The gas industry and government supporters are fond of saying that exporting more gas "can" reduce emissions by displacing coal. But the fact that gas power is cleaner than coal power has little bearing on whether extracting and exporting more gas results in less coal being burnt. On the contrary, more gas risks displacing zero carbon energy investment required to meet the goals of the Paris Agreement. More gas supply and gas infrastructure locks in more gas use for longer.

While the gas industry usually gives no evidence of its coal to gas claims, when it does it usually points to the International Energy Agency (IEA). A closer look at the IEA's reports and data shows global gas consumption expands only in scenarios where the Paris Agreement fails to meet its goal. The preferred scenario is the Sustainable Development Scenario (SDS), which delivers economic growth, universal energy access, and rapid decarbonisation. The SDS sees emissions from gas fall out to 2040. Current approved supply is sufficient to meet demand in the short term. Gas production globally increases by a small amount in the short term, then declines again to 2040.

The gas industry cites approvingly a recent IEA report on gas. That report shows coal to gas switching has played a very small role in abatement relative to baseline in China, the US, EU and India. More abatement was from renewables and "structural economic changes and efficiency" than displacement from gas. The IEA says there is abatement potential from more gas generation at existing power stations, but emphasises this needs regulation and does not support new gas generation.

As the IEA warns, new infrastructure locks in future emissions. New fossil fuel infrastructure now makes environmental outcomes more difficult and costly to achieve. Recent studies published in *Nature* examined the stock of fossil fuel infrastructure globally finding locked in emissions from existing infrastructure exhausts the 1.5C carbon budget and most of the 2C budget. As the Intergovernmental Panel on Climate Change recently showed, the peer reviewed literature requires gas consumption not to increase or to fall out to 2030 and then decline dramatically to 2050.

A simple way to prevent environmental damage from scope 3 emissions from LNG projects is to not allow them to be built. However scope 3 emissions could be managed through conditions on the approvals. The EPA could implement export management plans so that gas is only exported to countries with an emissions cap or price or other policies that ensure any gas does displace coal, does not lock in new long-term emissions, and is in line with the goals of the Paris Agreement. Alternatively, the EPA could require projects to fully offset their scope 3 emissions or pay a levy on exported emissions that could fund domestic mitigation. This could be adjusted so that it applies only where and to the extent that customer countries do not have appropriate mitigation policies in place.

There are risks and costs associated with offsetting that must be considered. If the offsets do not work, then Australia’s emissions will increase. The policy of allowing LNG expansion even if offset is still a risk to Australia’s emissions targets. The project proponents should be made responsible for this risk, not the government. Moreover, policies used to offset WA LNG emissions cannot also be used to reduce Australia’s emissions. If companies get access to lower cost abatement options to offset LNG emissions, this may increase the cost of reducing Australia’s emissions.

If, however, the EPA is to approve large increases in emissions in the absence of effective climate policy, the EPA it must ensure they are fully offset.

# Introduction

Australia's emissions are rising, not falling, because there is no credible national climate policy. Australia will not meet its current Paris Agreement targets, according to Australian Government projections, despite an essential objective of the Agreement being a commitment to increase national ambition.

In this context, state governments and authorities must act to reduce emissions. Acting now reduces both environmental damage and the economic costs of later action.

WA is the only state where emissions have increased over the past decade mainly due to increasing production and export of Liquified Natural Gas (LNG). WA accounts for most of Australia's LNG exports and most of the increase in recent years. LNG is very emissions intensive to produce, so as LNG exports from WA have increased so too have WA emissions. In the absence of a climate policy, further increases in LNG exports will further increase Australia's emissions and further damage the climate.

This was the situation confronting the West Australian Environmental Protection Authority (EPA) earlier this year. The EPA is responsible for independently assessing the environmental impacts of projects in WA and recommending measures to mitigate those impacts. The EPA considered the increasingly concerning climate science, WA's rising emissions and the lack of federal climate policy.

On 7 March 2019, the EPA published comprehensive guidelines for how it would assess projects, including the *Technical Guidance- Mitigating Greenhouse Gas Emissions* (the Technical Guidance).[1] New and expanding projects with direct emissions of more than 100,000 tonnes of CO2e a year would be required to fully offset all those emissions.

The backlash from the gas industry was immediate and fierce. Lobby groups and companies complained about lack of consultation and threats of job losses. They met with the WA Premier in Parliament House. They launched paid advertising campaigns. Swayed by this reaction, the Premier and the Federal Ministers also criticised the EPA. Just one week later, on March 14, the EPA took the Technical Guidance off its website and began a new public consultation. [2]

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[1] WA EPA (2019) *Technical Guidance- Mitigating Greenhouse Gas Emissions* (withdrawn 14 March).

[2] WA EPA (2019) *Greenhouse gas emissions assessment Technical Guidance- consultation* http://www.epa.wa.gov.au/pages/greenhouse-gas-emissions-assessment-Technical Guidance-consultation

This report examines the key claims put forward by the industry during its backlash, and the debate that has followed. Gas companies and their industry groups claimed the guidelines were ad hoc, were not given due consultation, went far beyond requirements under Paris, and would have severe negative economic impacts, in particular on employment.

As this report argues, the former claims are inaccurate, and the latter claim is both inaccurate and irrelevant to the EPA's statutory role.

Over the past year, and in response to the EPA's latest round of consultation, gas companies and federal government ministers have argued that increased LNG emissions are justified by the coal power being displaced overseas. The industry should therefore be comfortable with regulation on that basis. The report examines the evidence for their claims.

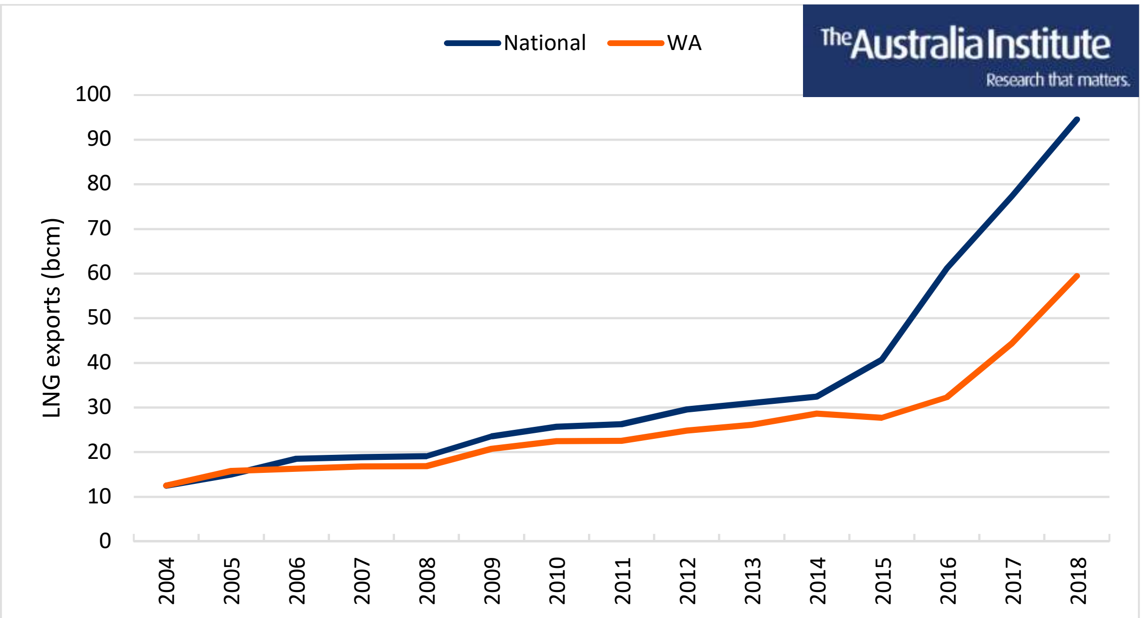
# WA LNG pushing up emissions

Australia is the world's largest exporter of LNG and WA is Australia's biggest producer of LNG.[3] While emissions in all other Australian states are declining, emissions in WA are increasing, due to the large increase in LNG production and export out of WA.

Extracting and exporting LNG is very emissions intensive, including gas leakage, vented CO2, flaring and energy-intensive processing. LNG also produces emissions when burnt overseas and while these emissions are not traditionally counted as Australian emissions, they are significant and cause damage.

Most Australian LNG exports are from Western Australia (WA) which has also been responsible for most of the national growth. Further WA LNG projects are under consideration.

**Figure 1: LNG Exports – National and WA**




Source: National year to December from DEE (2019) *National Greenhouse Gas Inventory Quarterly Update March 2019*, Figure 9; WA from WA DMIRS (2018) *2018 Major commodities resources file*, tonnes to bcm with BP conversion factors.

As large emitters (over 100,000 tCO2e per year), LNG facilities are subject to the national safeguard mechanism. This mechanism was ostensibly introduced to prevent

[3] Western Australian Department of Jobs, Tourism, Science and Innovation (2019) *Oil and Gas.* https://www.jtsi.wa.gov.au/invest-in-wa/sector/resource-services/oil-gas

emissions across the economy from increasing, despite government purchases of abatement through the Emission Reduction Fund (ERF), now rebranded the Climate Solutions Fund (CSF). However, the safeguard mechanism allows new high emitting facilities to be built and allowed existing high emitting facilities to increase their emissions.

The Gorgon LNG plant has been granted an emission limit that assumes its carbon capture and storage (CCS) project does not work; Gorgon's multi-year failure to meet the legal obligation to operate CCS has resulted in emissions equivalent to half of Australia's 2018 emissions growth.[4]

Without a credible emissions policy, new LNG projects will push Australia's emissions further up, rather than down, cause more environmental damage, and undermine future efforts to reduce that damage.

## NEW WA POLICY STATEMENT INADEQUATE

The WA Government recently announced an 'aspirational' target of net zero emissions by 2050.[5]

Meeting such targets is necessary to align with the global goals of the Paris Agreement. It is not however sufficient. The new target is empty without a credible policy to prevent emissions from increasing.

Greenhouse gases are a stock pollutant. What matters is accumulated emissions over time. A net zero target means little if emissions are allowed to increase.

In its new policy statement, the WA government says it will require new high emitting projects to set out plans to mitigate their emissions. This is already required under EPA assessment. The EPA has a long-established mitigation hierarchy including offsets. The new guidelines merely changed the level of mitigation expected.

The WA government document gives little information on what mitigation will be required. It does not say if the government will prevent new projects from increasing WA and Australia's emissions.

Approving new LNG projects without full emissions mitigation will push emissions up rather than down. Given the lack of credible policy, this is not environmentally sound.

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[4] Swann (2018) *Gorgon-tuan-problem.* http://www.tai.org.au/content/gorgon-tuan-problem

[5] Hon Bill Johnston (2019) Media Statements, *State Government details emissions policy for major projects*. https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/08/State-Government-details-emissions-policy-for-major-projects.aspx

# EPA independence undermined

The WA EPA provides independent, science-based advice to the West Australian government, in particular through principled assessment of development proposals.

That is precisely what the EPA was doing in drafting the GHG Technical Guidance.

The WA EPA is established under the *Environmental Protection Act 1986* (WA) (The EPA Act) as an independent body that assesses the environmental impacts of development proposals and provides advice and recommendations to the Minister for Environment.[6]

The WA EPA provides advice but has no approval power. That resides with the Minister for Environment who, in accordance with the EPA Act must consider the EPA's independent environmental advice and recommendations along with economic, commercial and social factors.

The WA EPA is required to consider only environmental factors. Its Act gives it no power to consider non-environmental factors, including economic considerations, in themselves. This was expressly stated by the Western Australian Supreme Court in the case of *Coastal Waters Alliance* (1996), where it held the EPA could not weigh environmental against economic and commercial considerations.[7] Justice Rowland stated:

> "An overview of the [EPA] Act would seem to confirm that there is some limit to the powers of the Environmental Protection Authority. There is nothing in s 17 which sets out the Environmental Protection Authority powers which would indicate a function that its advice is to be given on other than "environmental matters" in that s l7(3)(b), in particular, so limits the matter."[8]

As the detrimental effects of GHG emissions on WA's environment have been clearly established, under the EPA's governance framework it is proper and indeed necessary for the EPA to consider and seek to mitigate these emissions.

It is expressly *not* within their governance framework to balance environmental against economic impacts of requiring emissions to be offset.

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[6] EDO (WA), Media Release, 14 March 2019.http://www.edowa.org.au/2019/03/14/media-release-edowas-response-to-epa-Technical Guidance-on-greenhouse-gas-emissions/
[7] *Coastal Waters Alliance of Western Australia Incorporated* (1996) 90(2) LGRA 136.
[8] Rowland J, *Coastal Waters Alliance of Western Australia Incorporated* (1996) 90(2) LGRA 136, 151 p2.

The backlash to the GHG Technical Guidance demonstrated widespread misunderstanding of the EPA's statutory obligations. APPEA complained the EPA "has not considered the social or economic impact of its guidelines".[9] Even Premier Mark McGowan flagged threats to jobs as a major criticism of the Technical Guidance. [10]

The EPA may consider economic factors *in so far* as they relate to the environment and measures to protect the environment. But industry complaints went far beyond this and so were inconsistent with their legal role.

The removal of a WA EPA policy from the EPA website pending industry consultation is unprecedented.[11] EPA chair, Dr Hatton indicated this is the first time West Australian EPA guidelines have been published after consultation with the Stakeholder Reference Group, only to be withdrawn pending further consultation.[12]

It threatens the independence of the EPA and sets yet another alarming precedent threatening the future of science-based policy in WA and across Australia.

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[9] Dr Malcolm Roberts (APPEA Chief Executive) (2019) *Media Release: WA EPA Guidelines put investment at risk*. https://www.appea.com.au/media_release/wa-epa-guidelines-put-investment-at-risk/

[10] Elicia Kennedy et al (2019) *WA Premier Mark McGowan arracks EPA guidelines aimed at cutting carbon emissions* https://www.abc.net.au/news/2019-03-08/mark-mcgowan-attacks-epa-carbon-emissions-policy/10882946

[11] Tom Hatton (2019)*Greenhouse gas emissions- Where to from here in WA?* ABC https://www.abc.net.au/radio/perth/programs/focus/epa/10912410

[12] Ibid.

# FOI shows EPA consultation

Gas companies and lobby groups claim the Technical Guidance was produced without adequate consultation, warning or rationale. APPEA described the Guidance as "ad-hoc".[13] Premier Mark McGowan echoed their views:

> "They [industry] indicated they thought the consultation in relation to the Technical Guidance was not sufficient and they were not given sufficient opportunity to provide their views on the policy that was ultimately released."[14]

The WA EPA is required to consult with stakeholders over proposed changes to its policies and guidelines. For this purpose the EPA consults with an EPA 'Stakeholder Reference Group' (SRG).[15]

The SRG includes multiple industry groups representing the resource sector, including

- the Australian Petroleum Production and Exploration Association (APPEA),
- the Association of Mining and Exploration Companies (AMEC),
- and the Chamber of Minerals and Energy (CME).

The SRG also includes the West Australian Local Government Association (WALGA) and conservation organisations.

Given consultation is required and established practice for the EPA, it would have been unusual if the EPA had not consulted, as the gas companies claimed.

## CONSULTATION WITH STAKEHOLDERS

The Australia Institute requested the documents sent between the EPA and SRG members over this matter under Freedom of Information (FOI) laws. After delays, the Department processing the request released most of the requested documents.

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[13] APPEA (2019) WA EPA Technical Guidelines put investment at risk, https://www.appea.com.au/media_release/wa-epa-guidelines-put-investment-at-risk/

[14] Mercer and de Kruijff (2019) *Industry carbon emissions guidelines,* The West Australian. https://thewest.com.au/news/environment/epa-bows-to-pressure-withdraws-indsutry-carbon-emissions-guidelines-ng-b881135984z

[15] EPA (2019) *Stakeholder Reference Group- Terms of Reference.* http://www.epa.wa.gov.au/stakeholder-reference-group-terms-reference

APPEA objected to release of their submission, which was curious given industry complaints about alleged EPA secrecy. However APPEA later released this document, as part of their new public submission to the new EPA consultation.

The documents confirm that the EPA did indeed consult with SRG, including the industry groups for the gas and other resource companies. This is outlined in Table 1.

**Table 1: FOI documents: EPA Consultation over emissions guidance and offsets**

| Date | Events |
|---|---|
| **21 Nov 2018** | **EPA SRG Meeting No 47.** EPA tells SRG members they will soon receive a draft copy of the EPA's new *Technical Guidance on GHG Emissions.* EPA explains the elements of the new Technical Guidance will include offsetting provisions and the EPA's expectations will be higher than in previous versions.[16] |
| **21 Jan 2019** | **CME submission:** opposes state-based offset programs. |
| **1 Feb** | **AMEC submission:** offsets will be a major additional impost on proponents. **APPEA submission**: four sentences on offsets; should not be required "over and above any national emissions reduction approach". |
| **4 Feb** | **WALGA submission**: if offsetting cannot be implemented to prevent emissions from rising, projects should *not* be approved. |
| **6 Feb** | **Conservation NGOs submission:** includes detailed legal and environmental argument supporting rejecting proposals or requiring full emissions offsetting. |
| **27 Feb** | **SRG Meeting No 48.** The EPA updates the SRG that, as a result of submissions, the EPA has clarified offset requirements: the EPA will recommend offsets for all residual scope 1 emissions. |
| **7 Mar** | **EPA publishes** *Draft Technical Guidance* on their website. They require offsets for all residual scope 1 emissions. |
| **7-13 March** | **Industry backlash**, including advertising campaigns and industry meetings with the Premier, who criticises the EPA. |
| **14 Mar** | **EPA withdraws** *Draft Technical Guidance*, pending further consultation. |

Source: documents from WA EPA released under FOI to The Australia Institute, media reports.

[16] FOI (2019) DN 2_SRG meeting, p7.

In November 2018 the EPA Chairman met with the SRG. The minutes record the following:

**Figure 2: Minutes of EPA meeting with stakeholder reference group November 2018**

7. **Air Quality Environmental Factor Guideline and Technical Guidance – Greenhouse Gas (GHG) Emissions**

The EPA Chairman noted that:

- SRG members will soon receive a draft copy of the EPA's Air Quality Environmental Factor Guideline (revised) and Technical Guidance on GHG Emissions (new) which set out how GHG emissions will be considered by the EPA;
- In its preparation, the EPA has considered advice from the Climate Change Unit of the Department of Water and Environmental Regulation, and has also taken into account that Australia appears unlikely to meet its GHG emissions commitments in 2030, particularly given the projects in WA;
- The elements of the new technical guidance will be familiar to members (benchmarking, continuous improvement, offsetting), but the EPA's expectations will be better defined and will be higher;
- SRG members are asked to provide comments on the draft documents, prior to finalisation by the EPA early in 2019;
- SRG Members were also asked to consider the draft documents under embargo until finalised and published by the EPA.

Source: FOI, SN 2_SRF meeting 21 Nov, highlight added

The minutes show the EPA told the SRG it was acting on WA projects pushing up emissions, that there would be new guidance, it would include offsetting and that the expectations would be better defined and higher than previous. AMEC was present, CME was an apology and APPEA is not listed. All members of the SRG were sent the minutes.

January 2019, SRG members were provided with Draft Technical Guidance.[17] It said;

> "The EPA will consider carbon offset proposals with the capacity to make very large contributions to the State's emissions. In particular, offsets will be considered for those emissions not likely to be addressed by adoption of best practice technologies. …
>
> The EPA notes that offset requirements are prescriptive, and likely to be non-complementary to a broad-based market mechanism such as a carbon price or 'cap and trade' emissions trading scheme. Until emissions from proposals are covered in this manner, offsets will continue to be considered where relevant and appropriate."[18]

[17] FOI (2019) D4_CME feedback.
[18] FOI (2019) D10_Draft Guidelines, p 7-8.

From February 2019, SRG members provided the EPA with their submissions on the Draft Technical Guidance, including feedback on GHG offsetting.

APPEA, CME and AMEC all commented directly on the offsetting provisions of the Draft Technical Guidance. All raised concerns about offsets although with limited argument.

APPEA for example provides only four sentences on offsets almost as an afterthought at the end of its submission. While offsets "provide a potentially important way to reduce emissions", they should not be required "over and above any national emissions reduction approach".[19]

But this is consistent with what the EPA proposed. The EPA proposed offsets because there is no national or indeed state emissions reduction approach. The EPA's proposal, to which APPEA was responding, made explicit offsets were not complementary to a carbon price or cap and would only be required "Until emissions from proposals are covered in this manner".

Bizarrely, the APPEA submission also pleads that "the level of emissions from a facility may be influenced by many factors outside of the control of facility proponent".[20] Plainly, a proponent is primarily responsible for the existence of the facility. Under the EPA Act, the EPA must pursue "the polluter pays principle — those who generate pollution and waste should bear the cost of containment, avoidance or abatement."[21]

A range of more detailed submissions from conservation groups provides extensive environmental and legal arguments in support of offsets. Submissions from the WA EDO point to the *Gloucester Resources (2019)* judgement in which the Chief Justice of the NSW Land and Environment Court rejected a mine proposal on grounds that emissions from the exported coal would cause climate change by undermining the Paris goal of 'net zero emissions'.

On 20 February 2018, SRG members were told they would soon receive a draft of the new Technical Guidance. They were again told the elements would:

> "be familiar to members (benchmarking, continuous improvement, offsetting), but the EPA's expectations will be better defined and will be higher."[22]

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[19] APPEA (2019) *SRG Submission to WA EPA*. https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-–-CONSULTATION-APPEA-Submission.pdf p 16.

[20] Ibid.

[21] *Environmental Protection Act* 1986 (WA) s 4A- Objects and principles of Act

[22] FOI (2019) DN 16_Email EPA to SRG, SRG Agenda notes, p6.

At a meeting on 27 February, the EPA provided the SRG with an account of the Draft Technical Guidelines. The minutes show the EPA made clear they will "likely recommend offsets for all residual (after avoid/reduce) scope 1 emissions from a facility".[23]

**Figure 3: Minutes from EPA stakeholder meeting, 27 Feb 2019**

- Provided clarity on the degree to which the EPA will advise on offsets; specifically, the EPA will likely recommend offsets for all residual (after avoid/reduce) scope 1 emissions from a facility; the EPA will expect the offsets to be legitimate and will encourage the development to achieve those offsets in WA, recognising that because these emissions affect us through a global process, they could be achieved anywhere on the planet and have the same effect in terms of climate. The EPA understands the significant impost that this advice places on industry, but the objective of the Authority is to use its best endeavours to protect the environment and it is the Government's role to consider social and economic factors. The EPA advice will apply to all new projects and changed projects, recognising the need for a transition phase to give proponents time to develop plans.

Source: FOI DN 1_SRG meeting 27 Feb

The documents released under FOI clearly show the EPA consulted with LNG industry representative groups and told them about potential offsetting requirements months before the Technical Guidance was published. The industry groups were made aware that the requirements would apply to the whole of a project's emissions more than a week prior to the Technical Guidance being published.

The EPA was persuaded by environmental evidence and performed its legal duty.

The gas companies that criticised the EPA appear not to have criticised their own industry groups for their performance in the consultation process.

# INFORMING GOVERNMENT

Documents tabled in WA Parliament show the EPA also informed the Department and Minister about the Guidelines.[24]

Advice to the Minister on 20 February regarding the EPA offset requirements, noted that there would be costs "broadly consistent with the internal carbon price such

[23] FOI (2019) DN_SRG meeting 27 feb, p5.
[24] WA DWER (2019) *Tabled Paper No. 2783* http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

organisations are using for business risk assessment purposes" and would include potential "environmental and economic co-benefits for the State".[25]

**Figure 4: Advice to WA Environment Minister, 20 February 2019**

The EPA's revised approach to offsets may place significant burden on proponents, with proposed requirements to offset all residual direct (scope 1) emissions. In addition, the threshold for consideration of offsets has been lowered from very large proposals to all proposals with emissions (scope 1 and scope 2) above 100,000 tonnes of carbon dioxide equivalent, noting that only scope 1 emissions will be subject to offset requirements.

Compliance costs for large liquefied natural gas projects are likely to be substantial, although these are likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment purposes. As different offsets have significantly different cost profiles, compliance costs associated with offsetting scope 1 emissions from the Wheatstone project may be between $30 and $130 million per annum at full production. As the EPA guidance acknowledges, offsets are not complementary to some national emissions policies and, if applied, should be removed if national market-based measures are in place.

In terms of economic co-benefits for the State, offsets applied under Part IV of the EP Act have the potential to be a significant source of demand for the local offset market. This would include potential environmental and economic co-benefits for the State.

Source: WA DWER (2019) *Tabled Paper No. 2783*

The advice to the Minister also suggested that the government might instead pay companies to pollute less, and the Department would consider alternative policies.

A further Ministerial briefing dated 27 February responds to the 21 February advice. It notes "the EPA's new guidance … adds requirements for offsets for scope 1 emissions."

It further notes the benefits of requiring local offsets "have the potential to be a strong demand source for State offsets, with associated benefits for regional economies, diversification and jobs."

Rather than look at ways of maximising benefits to the state, the Department note they were "evaluating options, including the establishment of a carbon abatement fund underpinned by industry contributions." [26]

Such a fund could be an adequate alternative only if it is mandatory and delivers revenue sufficient to offset the increase in emissions.

[25] Ibid.

[26] WA DWER (2019) Tabled Paper No. 2783 http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

# LNG companies are planning to pay

Despite claims the EPA proposal was 'out of the blue', most LNG companies have been planning to pay for their pollution for some time. All of the major WA gas companies are preparing to pay for carbon, and disclose these risks to their shareholders.

## DISCLOSURES TO SHAREHOLDERS

Annual reports show that both Chevron and Woodside consider GHG emissions policy to represent a material risk. Woodside's 2018 Annual report states:

> Woodside faces climate change related risks including changes in product demand, carbon pricing, uncertainty surrounding future regulatory frameworks and increased stakeholder expectations."[27]

Chevron's 2018 Annual report notes:

> the potential liability for remedial actions or assessments under existing or future environmental regulations and litigation; significant operational, investment or product changes required by existing or future environmental statutes and regulations, including international agreements and national or regional legislation and regulatory measures to limit or reduce greenhouse gas emission[28]

The companies and their shareholders are not blind to the risks of future climate policy.

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[27] Woodside (2018) *Annual Report 2018*, https://www.woodside.com.au/investors/reports-publications/report/annual-report-2018, p 62.

[28] Chevron (2018) *Annual Report 2018,* https://australia.chevron.com/-/media/shared-media/documents/annual-report-supplement-2018.pdf, p 56.

# SHADOW CARBON PRICES

It is common for major corporations to assess investment decisions against an internal or 'shadow carbon price'. For example, Woodside's disclosure to CDP (a voluntary but widely used climate disclosure platform) makes clear that Woodside uses

> carbon prices that reflect our expectations of future carbon prices. These vary over time and jurisdiction. We also use include high and low sensitivities to test major decisions, with the high sensitivity reflecting our understanding of a 2°C scenario.

Woodside says the "Type of internal carbon price" includes "Implicit" prices as well as "Offsets". As rationale Woodside states:

> By including carbon prices in our commercial and operational decisions, we ensure that the actual regulatory costs associated with these decisions are considered and results in more efficient design and operation than would be the case if we did not apply carbon prices.

Woodside does not however disclose its shadow carbon prices. This contrasts with other major oil and gas companies, and indeed other major Australian corporations.

Shell for example has applied internal carbon prices of US$40-$80 per tonne since 2000, while BHP has applied prices of US$24-$80 per tonne since 2004.[29] Wesfarmers discloses a shadow carbon price starting low but reaching A$26 per tonne by year 8 and $53 per tonne by year 16.[30]

Such actions have not of course prevented these companies from obstructing policy progress to implement such policies over many decades. They do however leave little doubt that the companies are prepared to pay for the cost of their emissions.

This is widely understood, including by the WA government. Documents tabled in Parliament show the Departmental officials advising that the cost of purchasing offsets are "likely to be broadly consistent with the internal carbon price such organisations are using for business risk assessment".[31]

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[29] Centre for Climate and Energy Solutions (2019) *Companies set their own price on carbon* https://www.c2es.org/2017/09/companies-set-their-own-price-on-carbon/

[30] Wesfarmers (2018) *Wesfarmers sustainability report 2018* https://sustainability.wesfarmers.com.au/our-principles/environment/climate-change-resilience/shadow-carbon-price/

[31] WA DWER (2019) Tabled Paper No. 2783, p 2. http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

Similarly, in APPEA's February 2019 submission to the SRG consultation APPEA argues that assessment of major projects should be based on "leading indicators" of how well project design mitigates emissions. As an example, APPEA cited "has the proponent applied an international carbon price in assessing design options?"[32]

While this proposal is not repeated in APPEA's subsequent submission, it is worth supporting, but only if substantially strengthened. For such considerations to be effective, proponents should be required to disclose the carbon prices applied and what climate scenarios they consider this consistent with.

Such disclosure would implement the key recommendations of the G20 financial Stability Board's *Taskforce on Climate Related Financial Disclosures*. The disclosure could be made through existing platforms, such as CDP. Such disclosures would also enable scrutiny of gas industry claims that their projects are necessary for tackling climate change.

Requiring full offsetting would impose the same incentives to design for abatement as a rigorously applied shadow carbon price.

[32] APPEA (2019) *SRG Submission to WA EPA*. https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-–-CONSULTATION-APPEA-Submission.pdf p 16.

# Cost of offsetting LNG emissions

While WA LNG projects are a major and increasing source of domestic emissions, the projects are so profitable they are well able to pay to offset those emissions.

As noted above, the EPA is required not to assess economic factors themselves. If a project cannot afford to fully mitigate its emissions, in the absence of credible climate policy conditions the EPA would be justified in recommending conditions that would prevent the project from going ahead.

However it is necessary to correct misleading industry claims about the impacts of offsetting. The gas industry claimed fully offsetting scope 1 emissions would put jobs at risk.

The Australia Institute's calculations show the cost of offsetting emissions, in line with the EPA's Technical Guidance would represent a very small share of the project's profits, as outlined below (detailed calculations and all references in Appendix).

The offset cost estimates have been validated by the WA Department of Environment Water and Resources (DWER), in documents tabled to the WA Parliament.

The offsetting requirements of the Technical Guidance would only affect new projects. However calculations for current projects can be used as a proxy for future projects.

There are four operational LNG projects in WA (excluding the floating Prelude):

- Woodside's Pluto and North West Shelf projects, and
- Chevron's Wheatstone and Gorgon projects.[33]

The calculations use scope 1 project emissions.  Multiplying these by offset prices per tonne gives the total offset cost by project. The companies disclosed figures for revenue less key production costs. This allows comparison of offset costs compared with profits.

## EMISSIONS AND OFFSET COSTS

For Woodside, data is from disclosures under the safeguard mechanism. For Chevron, as Gorgon has faced problems during ramp up, especially with its carbon capture and

[33] APPEA (2019) *Australia LNG Projects* https://www.appea.com.au/oil-gas-explained/operation/australian-lng-projects/

storage (CCS) commitment, the data are full capacity expected emissions, with and without CCS.

The base offset cost is the average per Australian Carbon Credit Unit (ACCU) in the eighth Emissions Reduction Fund held in December 2018 ($13.87 per tonne CO2e).[34] For sensitivity we also use the Shell shadow carbon price of US$40 (A$58) and a much higher price of A$150 / tonne.

On 13 June 2019, the WA Department of Environment Water and Resources (DWER) tabled documents in the WA Parliament estimating the cost to large Liquified Natural Gas (LNG) projects of offsetting greenhouse gas emissions.[35]

**Table 2: Cost estimates for offsetting emissions from WA LNG projects**

| LNG Projects | WA Government estimate ($m) | The Australia Institute estimate ($m) |
|---|---|---|
| **Wheatstone + Gorgon (Chevron)** | $242m | $228m |
| **North West Shelf (Woodside)** | $100m | $106m |

DWER's figures validate The Australia Institute earlier estimates using the ACCU costs. Indeed, the Department provides even lower estimates using far cheaper, less rigorous units.

# WOODSIDE - NORTH WEST SHELF, PLUTO

Woodside's annual report discloses the "gross margin" for their interest in Pluto and North West Shelf projects.[36] This is revenue less production costs, depreciation and amortisation, and "other". The gross margins in 2018 were 55%-56% respectively.

At current ACCU prices, fully offsetting scope 1 emissions would cost Woodside 1.1-1.5% of gross margins for Pluto and the North-West Shelf respectively.

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[34] CER (2018) *ERF Auction Results, December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018

[35] WA DWER (2019) Tabled Paper No. 2783 http://www.parliament.wa.gov.au/publications/tabledpapers.nsf/displaypaper/4012783c201a3c779f812573482584180035d7b8/$file/tp-2783.pdf

[36] Woodside (2018) *Annual Report 2018* https://files.woodside/docs/default-source/investor-documents/major-reports-(static-pdfs)/annual-report-2018.pdf?sfvrsn=c9a46145_6, page 28-30

At the Shell shadow carbon price, it would cost Woodside 4.6%-6.2% of gross margins.

Even up to $150 per tonne of CO2, Woodside would be paying only 12%-16% of gross margins for these projects.

Woodside boasts "Our high margin, low cost operations will generate cash flow" in a range of scenarios.[37] These calculations support Woodside's self-assessment.

## CHEVRON - GORGON, WHEATSTONE

Last year Chevron boasted to media and investors that the Wheatstone and Gorgon projects were "becoming strong cash generators with cash margins of more than $US30 per barrel at a $US50 Brent price". The reporter noted this would have been delivering margins of $32 million per day.[38] The offset costs would take around a week to pay off.

At the time (February 2018) Brent prices were at US$68 per barrel. At the time of The Australia Institute's earlier analysis (March 2019) they were at US$66 per barrel; presently (September 2019) they are at US$58 per barrel.

At current ACCU prices and Brent prices of between $58-$68 per barrel, offsetting these emissions would amount to just 2.1%-2.6% of Chevron's cash margins.

While Chevron's development approval for Gorgon requires it to sequester most of the CO2 fugitives it produces, this did not occur for the first years of its operations. Chevron has now announced its carbon capture and storage (CCS) facility is ramping up, but it is unclear at what rate and given previous problems ongoing operation is uncertain. Chevron's failed CCS project led Gorgon to emit the equivalent of half of Australia's annual 2018 increase in emissions.[39]

The cost of offsetting Chevron's two major projects would drop to only 1.6-2.0% if the long-awaited carbon capture and storage (CCS) facility becomes fully operational.

The Shell shadow carbon price would see Chevron paying between 6.9% of its margins, at the higher oil price and assuming CCS operates, and 10.8% if CCS fails and at the lower oil price.

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[37] Woodside (2018) *Annual Report 2018*, p 20. https://www.woodside.com.au/investors/reports-publications/report/annual-report-2018

[38] Peter Milne (2018) *Chevron LNG projects Gorgon and Wheatstone earning $32 million a day* https://thewest.com.au/business/oil-gas/chevron-lng-projects-gorgon-and-wheatstone-earning-32-million-a-day-ng-b88734044z

[39] Swann (2018) *Gorgon-tuan-problem.* http://www.tai.org.au/content/gorgon-tuan-problem

# WOODSIDE – BROWSE, BURRUP, SCARBOROUGH

Woodside is currently proposing to extend, expand and link the Pluto and North West Shelf LNG projects. It plans to develop Browse and connect it to the NWS LNG project via a long sea pipeline, to replace input gas from fields due to phase down, extending the NWS LNG terminal's operations by many decades. Woodside also has plans to develop the Scarborough field, with gas piped for export from Pluto, expanding Pluto, and connecting Pluto to NSW.

These are all separate development applications. From an environmental perspective they should be considered in terms of the emissions they enable, not simply emissions from point sources under each proposal.

The Browse gas field is far offshore. Parts of Browse are in state waters surrounding a reef far from the coast. Most proposed wells are in Commonwealth waters. However, the EPA should consider all emissions from extracting and processing gas that would be exported from NWS, including gas extracted from Commonwealth waters.

These projects will require some new capital expenditure, especially the very long sea pipeline from Browse. However much of the plant already exists, especially the capital-intensive LNG processing and export facilities.

It is therefore reasonable to assume the margins enjoyed on these projects will be similar to those enjoyed on the existing NWS LNG project, and the cost of offsetting is likely to be similarly small by comparison.

# EPA should consider scope 3

A key question raised in the EPA background paper is whether the EPA should consider scope 3 emissions. These are emissions not directly emitted from projects (scope 1) or their electricity supply (scope 2). For fossil fuel extraction, scope 3 emissions are primarily emissions from burning the fuel; exported scope 3 emissions occur overseas.

Exported emissions are beyond the scope of greenhouse accounting under the UN Framework Convention on Climate Change. This approach is, however only one half of the picture. This is clear when considering countries like Australia that export most of what they extract. Australia is the 14th largest direct emitter but fifth largest miner and third largest exporter of fossil fuel CO2.[40]

The Australia Institute has argued for many years that climate policy should address both fossil fuel demand *and* supply. The arguments for supply policy are well elaborated elsewhere. In short, attempting to reduce demand without reducing supply is like trying to cut emissions with one arm of a pair of scissors; both must work together.

For decades fossil fuel companies in Australia, their lobby groups and governments have all argued that climate policy should not try to constrain supply, and that exported emissions are another country's responsibility.

It is therefore surprising to see gas companies, lobby groups and governments now appeal to scope 3 emissions as justification for increased domestic emissions from increased LNG supply. At least it is now agreed that Australian environmental policy should consider scope 3 emissions.

APPEA argues such 'displacement' emission reductions should be disclosed and considered as part of the approval process. APPEA then caveats (in bold) "this disclosure should not be confused with a requirement for regulation."[41]

If gas companies want to claim reductions in emissions overseas to justify increased emissions in Australia, they cannot expect to avoid regulation on exported emissions.

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[40] Swann (2019) *High Carbon from a Land Down Under* https://www.tai.org.au/sites/default/files/P667%20High%20Carbon%20from%20a%20Land%20Down%20Under%20%5BWEB%5D_0.pdf

[41] APPEA (2019) *Background Paper on Greenhouse Gas Assessment Guidance: APPEA Comments,* p10 https://www.appea.com.au/wp-content/uploads/2019/09/WA-EPA-GREENHOUSE-GAS-EMISSIONS-ASSESSMENT-GUIDANCE-%E2%80%93-CONSULTATION-APPEA-Submission.pdf

## COAL TO GAS CLAIMS

Surprisingly, gas proponents rarely provide evidence for their claims that gas exports reduce emissions.

Woodside claims “LNG can displace higher emissions energy sources in transport and power generation”.[42] The key word here is ‘can’. They give no evidence it *is* happening.

Recently the federal Minister for Energy and Emission Reduction Angus Taylor made a stronger claim:

> "In the last year there is a 0.6 per cent increase but it was more than accounted for by the very strong growth in LNG exports that are reducing global emissions. We're seeing a reduction in emissions as a result of Australia's gas exports, but we have to wear a small increase as a result of that. While that is not great for carbon accounting it is a good outcome for the world."[43]

Yet again no evidence is provided.

The fact that gas power is cleaner than coal power has little bearing on whether extracting and exporting more gas results in less coal being burnt.

On the contrary, more gas risks displacing zero carbon energy investment required to meet the goals of the Paris Agreement. More gas supply and gas infrastructure locks in more gas use for longer.

## WHAT THE IEA SAYS ABOUT GAS

On the rare occasions gas proponents do give evidence, they usually point to the International Energy Agency’s New Policies Scenario (NPS).

The NPS sees gas consumption increasing to 2040. It assumes failure on climate change with global warming of 3-4 degrees.

The preferred scenario is the Sustainable Development Scenario (SDS), which delivers economic growth, universal energy access, and rapid decarbonisation. The SDS sees

[42] Woodside (2019) *Climate Change* https://www.woodside.com.au/sustainability/climate-change

[43] Taylor quoted in Long (2019) *Australia’s carbon emissions continue to rise despite Government assurances about climate change policy,* ABC Online, https://www.abc.net.au/news/2019-08-30/emissions-drop-but-year-long-trend-on-the-rise/11464816

emissions from gas fall out to 2040.[44] Under the SDS, gas production globally increases by a small amount then declines again to 2040.[45]

Current LNG proposals "approved for investment" would exceed even the NPS in the short term.[46] While the IEA does not compare the infrastructure 'pipeline' with the SDS, it is clear that increased supply to meet the NPS would breach the SDS and the climate goals of Paris.

The IEA has set out short term actions to enable mitigation in line with SDS. Reviewing the first two years of progress, the IEA finds the world is going backwards on oil and gas methane leakage, and is far behind on reducing inefficient coal power generation. Only renewable energy installation is 'on track'.[47]

The increase in gas is not delivering the result the gas companies claim.

In a recent report on gas, the IEA examines historical coal to gas switching and potential for further switching. APPEA cites this approvingly, in their submission to the most recent EPA consultation. However, the IEA gas report is in fact highly circumspect:

> [Gas] can bring environmental benefits, but it remains a source of emissions in its own right and new gas infrastructure can lock in these emissions for the future. … the benefits provided by gas need to be weighed against the risks of locking in future gas-related emissions
>
> … beating the most carbon-intensive fuel is not in itself a persuasive case for gas if there are lower emissions and lower-cost alternatives to both fuels. The falling cost of renewable technologies in the power sector is the clearest case in point. In many markets, wind and solar PV are already among the cheapest options for new generation.[48]

The IEA finds coal power has fallen and gas power has increased in some countries (relative to baseline). They call this 'switching'. However in every case study – US, EU, China, India – coal to gas switching has played a very small role in abatement, smaller than renewable energy and far smaller than "structural economic changes and efficiency". For example, Figure 5 shows the tiny role of gas in abatement in China.

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[44] IEA (2018) *WEO*, page 88

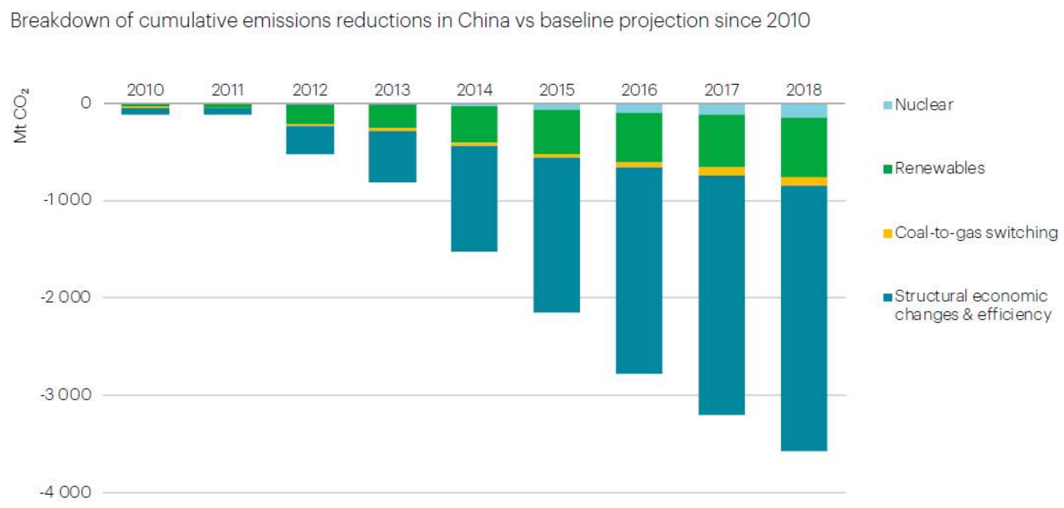
[45] IEA (2018) *WEO*,

[46] IEA (2018) *WEO*, Annex A, Current Policies and Sustainable Development Scenarios, page 521

[47] IEA (2018) *WEO,* page 109

[48] IEA (2019) *Role of Gas in Today's Energy Transitions,* p42

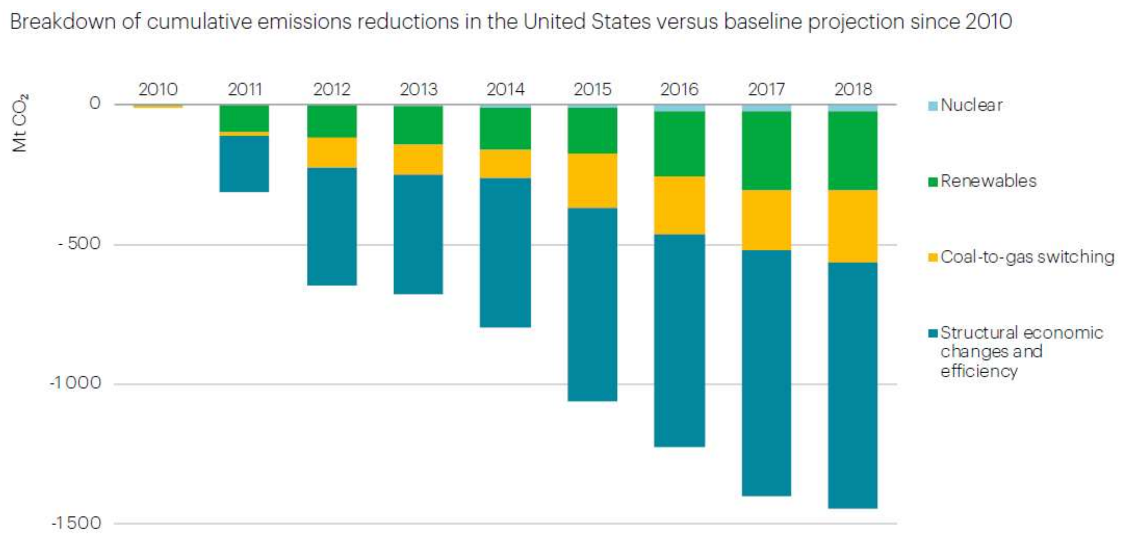
## Figure 5: IEA estimate of source of abatement in China




Source: IEA (2019) *Role of Gas in Today's Energy Transitions,* page 73

Figure 6 shows somewhat more switching has occurred in the US, however even there it is smaller than from renewables and most abatement has occurred from structural and efficiency changes.

## Figure 6: IEA estimate of source of abatement in USA




Source: IEA (2019) *Role of Gas in Today's Energy Transitions* page 47

The IEA gas report finds "We estimate that up to 1.2 gigatonnes of CO2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive."[49] APPEA quotes this directly in their submission

[49] IEA (2019) *Role of Gas in Today's Energy Transitions* page 4

to the EPA consultation but ignores the IEA's following sentence is that "The vast majority of this potential lies in the United States and in Europe." These are not major customer countries for Australia's LNG. APPEA also ignores IEA focus on *regulation* for increased use of *existing* generators, due to concerns about lock in. Even then, the IEA sees gas switching accounting for only 8% of required abatement under SDS, far smaller than energy efficiency and renewable energy.

Taken together, IEA data and the projections undermine rather than support gas company claims about the environmental benefits of large increases in gas production.

# NO NEW FOSSIL FUEL INFRASTRUCTURE

Just as climate change is caused by the accumulated stock of greenhouse gas emissions, carbon emissions are caused by the stock of infrastructure. Building new supply and generation infrastructure means both supply and demand are possible a lower short-run marginal cost. New fossil fuel infrastructure now makes environmental outcomes more difficult and costly to achieve, requiring 'stranded assets' and conflict with established facilities.

Recent studies published in *Nature* examined the stock of fossil fuel infrastructure globally, comparing the extent of greenhouse gas emissions 'locked in' to the carbon budget required for a given probability of meeting climate targets.

One study in *Nature* finds current fossil fuel infrastructure, if simply retired at the end of expected lifetimes, would deliver a 64% chance of meeting the Paris goal of limiting warming to 1.5°C. Allowing new infrastructure out to 2030 makes this unfeasible without early retirement ('stranded assets').[50]

A later study in *Nature* finds existing fossil fuel infrastructure already exceeds the 1.5 target and exhausts most of the 2C upper limit:

> "our estimates suggest that little or no new $CO_2$-emitting infrastructure can be commissioned, and that existing infrastructure may need to be retired early (or be retrofitted with carbon capture and storage technology) in order to meet the Paris Agreement climate goals."[51]

The Intergovernmental Panel on Climate Change recently examined the costs of global temperature increases above 1.5°C, as targeted in the Agreement, and what is

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[50] Smith et al. (2019) *Current fossil fuel infrastructure does not yet commit us to 1.5°C warming,* Nature Communications 10 (101). https://www.nature.com/articles/s41467-018-07999-w

[51] Tong et al. (2019) *Committed emissions from existing energy infrastructure jeopardize 1.5°C,* Nature 572. https://www.nature.com/articles/s41586-019-1364-3

required to prevent that from happening. It found very significant environmental costs associated with breaching that limit. The IPCC assessed peer-reviewed literature and concluded there is unlikely to be a greater role for gas in meeting the Paris 1.5°C goal. Gas power generation must stay flat or reduce out to 2030 and then decline dramatically out to 2050.[52]

These scenarios are more stringent than the IEA's SDS, however even the IEA's SDS gives little to no role for large new gas expansions.

# CONDITIONS ON SCOPE 3 EMISSIONS

There are many ways environmental approvals could seek to prevent gas exports from increasing global emissions.

The EPA could mandate export management plans to be conditional on exports only to certain countries. This approach was taken recently by the NSW Independent Planning Commission in conditions on a coal mine approval.[53] However, stronger specification of export conditions is needed for meaningful environmental protection aligned with the environmental goals of the Paris Agreement.

Export management plans could be constrained to countries and in contexts where "relative prices and regulation" support or mandate levels of mitigation aligned with the Paris Agreement. Conditions could include restricting exports to customer countries with economy wide or electricity sector carbon caps or prices, as urged by gas companies themselves. To ensure gas helps reduce rather than lock in excess emissions, customer countries could be constrained to those whose Paris targets and policies align with the global goals of the Paris Agreement.

Alternatively, the EPA could require projects to fully offset their scope 3 emissions or pay a levy on exported emissions that could fund domestic mitigation. This could be implemented where and to the extent that customer countries do not have appropriate mitigation policies in place. Concerns about complementarity could be addressed by setting obligations net of explicit or implicit emissions prices in the customer countries. If difficulties implementing such arrangements a major concern this should weigh against approving such exported emissions.

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[52] IPCC (2019) *Special Report: Global Warming of 1.5°C, Mitigation pathways compatible with 1.5°C in the context of sustainable development,* Table 2.7. https://www.ipcc.ch/sr15/chapter/chapter-2/

[53] NSW Government IPC (2019) *Statement of reasons for decision: United Wambo Open Cut Coal Mine Project*. https://www.ipcn.nsw.gov.au/resources/pac/media/files/pac/projects/2018/11/united-wambo-open-cut-coal-mine-project-ssd-7142/determination/uwjv--sor--final.pdf par 309 onwards

# Offsets undermine emissions reductions

There are many environmental issues with emissions offsets, including ensuring additionality and integrity. These are alleviated somewhat by requiring the National Carbon Offsets Standards, or surrender of Australian Carbon Credit Units. However, issues arise here as well, with projects granted ACCUs under the Emissions Reduction Fund (ERF) facing allegations or even admitting they are not additional (i.e. would have happened anyway).

If the offsets do not work, then Australia's emissions will increase. The policy of allowing LNG expansion when offset is still a risk to Australia's emissions targets. The project proponents should be made responsible for this risk, not the government.

A further, more fundamental point is rarely made;

Offsetting WA LNG emissions will not reduce emissions. It will only stop emissions from increasing. Moreover, given that Australia must reduce its emissions, any offsets must also be additional to what we need to do to reduce emissions.

Put differently, policies used to offset WA LNG emissions cannot also be used to reduce emissions. If companies get access to lower cost abatement options to offset LNG emissions, this may increase the cost of reducing Australia's emissions.

If the lower cost options go towards reducing Australia's emissions, this may increase the cost of offsetting WA emissions.

It is therefore doubtful that requiring offsets for increased emissions is cost effective environmental policy.

However, if however the EPA is to approve large increases in emissions in the absence of effective climate policy, the EPA it must ensure they are fully offset. The need for state agencies like the EPA to take such action again reflects the need for federal action and the costs created by failing to have an effective carbon price or other policy.

# Appendix - Estimated offset costs

## WOODSIDE

| | | NWS LNG | Pluto LNG |
|---|---|---|---|
| **Gross profit**[54] | US$m | 826 | 1,546 |
| **Gross profit**[55] | A$m | 1,165 | 2,180 |
| **Emissions** | | | |
| **2016-17 project emissions**[56] | mtCO2e | 7.66 | 1.97 |
| **Woodside interest in project**[57] | % | 17% | 90% |
| **Woodside emissions** | tCO2e | 1.28 | 1.78 |
| **Offset costs** | | | |
| **ACCU offset price**[58] | A$/tCO2e | 13.87 | 13.87 |
| **Total offset cost** | $m | 18 | 25 |
| ***/ gross profit*** | % | 1.5% | 1.1% |
| **BP / Shell shadow carbon price**[59] | US$/t | 40 | 40 |
| | A$/t[60] | 58 | 58 |
| **Total offset cost** | A$m | 74 | 103 |
| ***/ gross profit*** | % | 6.2% | 4.6% |
| **higher offset / carbon price** | A$/t | 150 | 150 |
| **total offset cost** | A$m | 192 | 266 |
| ***/ gross profit*** | % | 16% | 12% |

[54] Woodside (2018) *Annual Report* https://files.woodside/docs/default-source/investor-documents/major-reports-(static-pdfs)/annual-report-2018.pdf?sfvrsn=c9a46145_6, page 28-30
[55] At $1.45
[56] CER (2019) Safeguard Facilities Reported Emissions http://www.cleanenergyregulator.gov.au/NGER/National%20greenhouse%20and%20energy%20reporting%20data/safeguard-facility-reported-
[57] Woodside (2018) *Annual Report*
[58] CER (2018) *ERF Auction Results December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018
[59] Macdonald-Smith (2019) *WA Slaps Down EPA Amid Calls for Reckless Carbon Rule to Be Rescinded* https://www.afr.com/business/energy/gas/wa-slaps-down-epa-amid-calls-for-reckless-carbon-rule-to-be-rescinded-20190313-h1cc33
[60] At $1.45

## CHEVRON

| Emissions at capacity production | | | | | |
|---|---|---|---|---|---|
| **Wheatstone**[61] | Mt CO2e | 10.4 | | | |
| **Gorgon (w CCS)**[62] | Mt CO2e | 6 | | | |
| **Gorgon (no CCS)** | Mt CO2e | 10 | | | |
| **Total w CCS** | Mt CO2e | 16.4 | | | |
| **Total no CCS** | Mt CO2e | 20.4 | | | |
| **Offset costs** | | | | | |
| **Offset price**[63] | A$/t | **$13.87** | | **$50** | |
| **Offset cost (w CCS)** | A$m | $282.9 | | $1,183 | |
| **Offset cost (no CCS)** | A$m | $227.5 | | $951 | |
| **Surplus** | | | | | |
| **Cash costs per barrel**[64] | US$ | 20 | | | |
| **Production capacity**[65] | Barrels /day | 545,000 | | | |
| **Brent crude oil price**[66] | US$ /Barrel | **68** | **58** | **68** | **58** |
| **Margin per barrel** | US$/Barrel | 48 | 38 | 48 | 48 |
| **Total margin** | US$m | $9,548 | $7,559 | $9,548 | $9,548 |
| | A$:US$ | 1.45 | 1.45 | 1.45 | 1.45 |
| | A$m | $13,845 | $10,961 | $13,845 | $10,961 |
| **Offset cost as % of cash surplus** | | | | | |
| **max, no CCS** | % | 2.04% | 2.58% | 8.55% | 10.79% |
| **max, w CCS** | % | 1.64% | 2.08% | 6.87% | 8.68% |

61 SBS (2018) *Chevron LNG project facing emissions row* https://www.sbs.com.au/news/chevron-lng-project-facing-emissions-row
62 Chevron (2018) Fact sheet: *Gorgon carbon dioxide injection project* https://australia.chevron.com/-/media/australia/publications/documents/gorgon-co2-injection-project.pdf
63 CER (2018) *ERF Auction Results December 2018* http://www.cleanenergyregulator.gov.au/ERF/Auctions-results/december-2018
64 Peter Milne (2018) *Chevron LNG projects Gorgon and Wheatstone earning $32 million a day* https://thewest.com.au/business/oil-gas/chevron-lng-projects-gorgon-and-wheatstone-earning-32-million-a-day-ng-b88734044z
65 Ibid.
66 Prices as at time of cash margin claim, and presently from Oil Price (2019) https://oilprice.com/

# Driving Norse: Electric Vehicle policies in Norway

***Norway has implemented a suite of policies to boost electric vehicle uptake. These policies should be considered in Australia's electric vehicle debate.***

**Audrey Quicke**
**April 2019**

## Norwegian leadership in electric vehicles

The Nordic countries (defined in this briefing note as Norway, Denmark, Sweden, Finland and Iceland) represent the world's third-largest electric vehicle market by share of sales, despite being far smaller in population than the top two markets, China and the United States of America. Norway is a prominent leader in electric vehicle (EV) policy amongst the Nordic countries and the world. In Norway, the number of new car registrations that are EVs is now over 50%.[1]

Norway's success has been driven by government leadership, creating a policy environment to drive a large-scale and sustainable shift to EV use. Norway's policy

[1] Norsk Ebilforening (2019) *Norway reaches historical electric car market share* https://elbil.no/norway-reaches-historic-electric-car-market-share/

framework to boost uptake of EVs has been in place since 1990.[2] The country has the highest share of EVs per-capita in the world[3][4] and is aiming for all new cars sold to be EVs by 2050.[5]

By contrast, in Australian EV sales last year were only about 0.2 per cent of the total compared with just under 2 per cent globally.[6]

Norwegian policies serve as a useful roadmap for OECD members suffering from low-uptake, such as Australia. A useful English language source on Norwegian EV policies is the recent International Energy Agency report, *Nordic EV Outlook 2018 Insights from leaders in electric mobility.*

## Policy levers at play

Norwegian EV policies can be roughly divided into three categories:

- **Purchase incentives**: Aim to reduce the upfront cost of EVs as compared to ICE vehicles. These policies tend to have the most influence, as consumers appear to be more influenced by short-term expenditure than longer-term savings.[7]
- **Use incentives**: Aim to reduce the cost of using EVs as compared to ICE vehicles.
- **Access incentives**: Incentivise EVs by allowing them access to bus lanes and designated parking.

The following table (Table 1) outlines the EV policies for five Nordic countries. The policies are explained in more depth below, with specific reference to Norway.

[2] International Energy Agency (2018) *Nordic EV Outlook 2018 Insights from leaders in electric mobility*, https://webstore.iea.org/nordic-ev-outlook-2018 p 8.

[3] The International Council on Clean Transportation (2018) *Using vehicle taxation policy to lower transport emissions: An overview*, p ii https://www.theicct.org/sites/default/files/publications/EU_vehicle_taxation_Report_20181214_0.pdf

[4] IEA(2018) p8

[5] https://elbil.no/english/norwegian-ev-policy/

[6] Bloomberg New Energy Finance (2018) *Cumulative Global EV Sales Hit 4 Million* https://about.bnef.com/blog/cumulative-global-ev-sales-hit-4-million/

[7] Ibid, p 25

**Table 1: Nordic Policies to Encourage Uptake of Electric Vehicles**

| | Denmark | Finland | Iceland | Norway | Sweden |
|---|---|---|---|---|---|
| Purchase Incentives | Registration tax rebate | Registration tax rebate | | Registration tax rebate | Registration tax rebate |
| | | | Registration tax exemption | Registration tax exemption | |
| | | | GST exemption | GST exemption | |
| | | | | | Tax Credits |
| Use Incentives | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions | Circulation tax rebates/ exemptions |
| | Waived fees for tolls, parking, ferries at the local level | | | Waived fees for tolls, parking, ferries | Waived fees for tolls, parking, ferries at the local level |
| | | | | | Tax credits for company cars |
| Access Incentives | Free/dedicated parking | | Free/dedicated parking | Free/dedicated parking | |
| | | | | Access to bus lanes | |

*Source: International Energy Agency (2018)*

## Purchase Incentives

### *Registration tax rebates and exemptions*

In all Nordic countries, car registration is a one-off ‘registration tax’ (though it is more similar to a fee in Australia). In Norway, this registration fee is 30% for an average ICE car.[8] In Norway, the registration fee is differentiated between vehicles based on their weight, carbon dioxide ($CO_2$) emissions and nitrogen oxide (NOx) emissions. Norway’s registration tax keeps up to date with the latest technological advancements too, changing how $CO_2$ and NOx emission levels are taken into account to incentivise models with the highest environmental standards.

[8] IEA (2018) p 20.

A registration fee rebate returns some of the money charged as registration fee, whilst registration fee exemptions means that certain vehicles pay no registration fee at all. By reducing the amount of registration tax paid on EVs, customers are incentivised to choose EVs over ICE vehicles, due to the lower upfront costs. An example is provided in Figure 1 comparing standard European car in both ICE and EV models. [9]

### *GST exemption*

Goods and services tax (GST or value-added tax, VAT) exemptions have a similar effect as registration tax rebates/exemptions. In Norway, zero-emissions vehicles have been exempt from a 25% GST on purchase since 2001.[10] This reduces the upfront cost of EVs, encouraging consumers to purchase them over ICE vehicles.[11]

For example, the following table shows the difference in drive away price between an ICE Volkswagen Golf and an electric Volkswagen Golf in Norway. Although the import price is higher for the electric Golf, once registration and GST exemptions have been applied, the electric Golf retails at a comparatively lower price.

**Table 2: Import and retail price for electric and non-electric VW Golf in Norway**

| (AUD) | Volkswagen Golf (VW golf TSI 110 hk) | Volkswagen e-Golf (Electric) |
|---|---|---|
| **Import Price:** | $31,377 | $45,148 |
| **$CO_2$ tax:** | $5,528 | 0 |
| **NOx tax:** | $393 | 0 |
| **Weight tax:** | $3,739 | 0 |
| **Scrapping fee:** | $417 | $417 |
| **GST:** | $10,364 | 0 |
| **Retail Price:** | $51,818 | $45,565 |
| **Comparative Saving** | **13% more** | **13% less** |

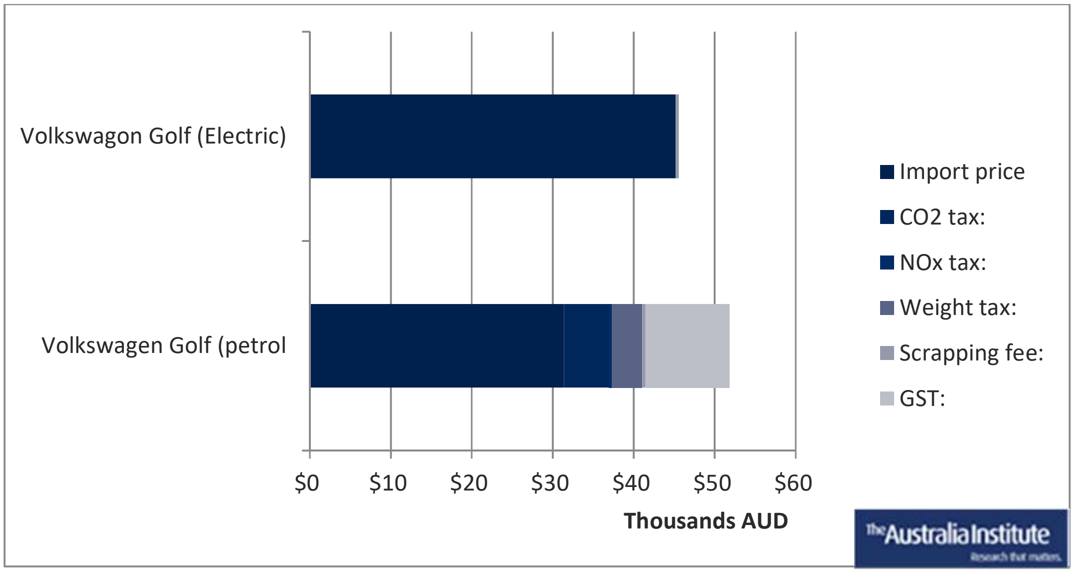
*Source: 'Norwegian EV policy',* https://elbil.no/english/norwegian-ev-policy/
*Note: prices converted to $AUD at the rate of 1AUD = 5.75660 NOK current at 12/04/2019*

[9] Ibid.

[10] IEA (2018) p 21

[11] The International Council on Clean Transportation (2018) *Using vehicle taxation policy to lower transport emissions: An overview,* p ii https://www.theicct.org/sites/default/files/publications/EU_vehicle_taxation_Report_20181214_0.pdf

**Figure 1: VW Golf - Petrol vs Electric**




*Source: 'Norwegian EV policy', [https://elbil.no/english/norwegian-ev-policy/](https://elbil.no/english/norwegian-ev-policy/)*
*Note: prices converted to $AUD at the rate of 1AUD = 5.75660 NOK current at 12/04/2019*

## Use Incentives

### *Circulation tax rebates/exemptions*

Circulation tax requires an annual fee to allow the vehicle to operate on public roads. In most Nordic countries, circulation taxes are differentiated based on fuel consumption, weight, and/or $CO_2$ per km rating. In Norway, it is based just on the type of fuel and full electric vehicles will pay the minimum amount, NOK 455 (AUD 75).[12]

### *Waivers on fees (tolls, parking, ferries)*

Nordic countries have toll roads, similar to most Australian capital cities. Tolled ferries also connect parts of the national road network. Norway waives or lower these fees for EVs, incentivising their uptake.

## Access Incentives

Some Nordic Countries offer free or discounted parking for EVs. This policy can be used at multiple levels of governance, and is the most widely applied policy instrument at the local level. Norway also allows EVs to access bus lanes. These incentives encourage

[12] IEA (2018) p 25.

the use of EVs on Norwegian roads by making driving and parking easier and more accessible to EVs.[13]

## Charging Infrastructure

The availability of publicly accessible charging stations encourages consumers to purchase EVs and enables longer distance trips for EV drivers. The Norwegian government has established a program to finance a minimum of two fast charging stations per every 50km of main road.[14] In addition, the European Union has funded fast-charge networks across Europe to enable long-distance cross-border EV journeys.[15]

## Conclusion

Australia has a long way to go before it can catch-up to the impressive uptake of EVs in Norway and other Nordic countries. However it is all well within reach through targeted government policies. Equally important, many of these policies are popular with Australians. Recent Australia Institute's research has found three in five Australian's support a national program to switch to an electrically charged transport system (62%).

When it comes to specific policies there is an overwhelming majority of Australians (79%) who support the Government building a network of EV charging stations across the country. The majority of Australians support for governments to procure electric vehicle fleets (76%) and providing loans for electric vehicle uptake (55%).[16] While some policies are not very popular in Australia, including allowing EVs to use dedicated bus lanes, there remains a menu of choices the government can choose from and implement in the next year. All that is missing is the leadership to drive the change.

[13] Ibid, p 26.

[14] Fleetcarma (2019) *How Norway became the leading EV market* https://www.fleetcarma.com/norway-became-leading-ev-market/

[15] Rapid Charge Network (2019) *EU-funded fast-charge network opens up pan-european travel* http://rapidchargenetwork.com/news_post.php?id=34

[16] Merzian (2019) *Poll: Overwhelming Support for Electric Vehicle Incentives* http://www.tai.org.au/content/poll-overwhelming-support-electric-vehicle-incentives

The Australia Institute
Research that matters.

# Submission: Interim Report on the Liquid Fuel Security Review

***The Interim Report outlines significant risks to Australia's transport energy security. Addressing these security risks requires reducing oil consumption and accelerating the transition to electric vehicles***

**Tom Swann**
**July 2019**

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The Australia Institute is an independent public policy think tank based in Canberra. It is funded by donations from philanthropic trusts and individuals and commissioned research. We barrack for ideas, not political parties or candidates. Since its launch in 1994, the Institute has carried out highly influential research on a broad range of economic, social and environmental issues.

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As we begin the 21st century, new dilemmas confront our society and our planet. Unprecedented levels of consumption co-exist with extreme poverty. Through new technology we are more connected than we have ever been, yet civic engagement is declining. Environmental neglect continues despite heightened ecological awareness. A better balance is urgently needed.

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# Summary

The Department of the Environment and Energy is conducting a Liquid Fuel Security review and public consultations on the Interim Report. This report is an edited version of The Australia Institute's submission to that consultation.

The *Interim Report on Liquid Fuel Security* shows Australia is ill-equipped to deal with a liquid fuel security crisis. In FY2018 Australia had on average access to liquid fuel that would cover only 20 days of consumption. Alarmingly, the Interim Report reveals the emergency powers to ration fuel stocks would take up to three weeks to be implemented in the event of a fuel emergency.

The Interim Report makes it clear that producing more oil in Australia is a dubious response to the issue of fuel security. Australia's oil production has already peaked and is likely to continue to decline. There is great uncertainty surrounding the scale, quality and viability of oil production in prospective resources like the Great Australian Bight and Beetaloo Basin.

Reducing oil use requires both increased fuel efficiency and substitution to non-oil based transport, including active transport, public transport, and electric passenger vehicles.

The Australia Institute strongly supports a review of the *LFE Act*, as announced by the Minister for Energy. The Review should refocus away from liquid fuel and towards transport, and ensure its scenarios integrate Paris-consistent emissions targets. The Department's ongoing work in this area should include scenarios consistent with Australia's commitment under the Paris Agreement to consider increasing targets consistent with a 2 degree budget.

In developing the final Review and relevant scenarios, the Department should ensure it consults with industries required to drive this transition and includes policies with specific electric vehicle targets and fuel efficiency standards.

# Introduction

The Australia Institute is a public policy research organisation based in Canberra. Our dedicated Climate and Energy program conducts a range of research into issues, including energy and emissions relating to transport. The Australia Institute welcomed the opportunity to respond to the *Interim Report on the Liquid Fuel Security Review* ("Interim Report").[1]

The Review is framed in terms of security of *liquid fuel*. This framing is misplaced and inconsistent with much of the content of the Interim Report. The Department's concern should not be security of fuel for its own sake, but security of energy services. Liquid fuel consumption in Australia is dominated by transport, with smaller roles for peaking electricity and non-energy uses. It would be more appropriate to approach the issue from a broader perspective of energy security, and specifically for transport. As the Interim Report itself emphasises, there is a great need to increase fuel efficiency and transition to non-oil energy sources.

The Interim Report outlines significant risks to Australia's transport energy security, due to reliance on imported oil and access to only a limited number of days of consumption at any one time. The Interim Report shows that in a major security situation fuel stocks could be greatly eroded before emergency powers come into force. Importantly, the Interim Report doubts new domestic oil supply will ameliorate those risks. Rather, it emphasises the need to reduce consumption and diversify sources of energy.

These significant findings are strongly endorsed and extended in this report. Reducing oil dependency is imperative for energy security, national security and climate change mitigation.

[1] Department of Energy (2019) *Liquid Fuel Security Review* https://www.energy.gov.au/government-priorities/energy-security/energy-security-assessments/liquid-fuel-security-review ("Interim Report")

# Strategic risk

As highlighted by the Interim Report, the Australian economy is currently highly dependent on imported liquid fuel:[2]

- 90 per cent of the fuel consumed in Australia is derived from oil sourced outside of Australia.
- Australia imports 60 per cent of its refined oil.
- Of the crude oil refined in Australia, 80 per cent is imported.

Further, Australia is in breach of international obligations regarding fuel stocks. Even more concerning is that these stocks leave Australia with access at any one time to only a limited number of days' worth of consumption.

In 2017-2018 Australia had an average of only 20 days of consumption cover of refined fuel.[3] This means if all oil supply into Australia's supply chains were to cease immediately, consumption at current rates would continue for only 20 days on average across fuel types.

Of course consumption cover figures are only a guide for risks of more complex system disruptions.[4] It is nonetheless clear that the consequences of any significant impact on oil supply could be substantial to both the Australian economy and security.

Such disruptions could have many causes, which could be concurrent and interacting, and the risk is fuelled by increasing climate extremes. There could be a range of strategic implications, for example, on supply chains for all essential goods, like food.

In this context it is useful to highlight recent regional supply disruptions.

- In late 2012, Shell's Geelong oil refinery suffered system failures, stopping production of 50 percent of Victoria's diesel supply. Diesel supplies ran out for two days in North West Victoria, in the middle of harvest period for farmers.[5]
- In May 2014, issues with imported diesel led to a shortage across the Perth Metropolitan area. BP confirmed an acute supply shortage, diesel was unavailable at more than 100 service stations across Perth and regions, and the WA Department of

[2] Interim Report, p 3.

[3] Ibid p 47.

[4] Such a disruption would likely impact demand, and supply is more likely limited than completely cut off. Conversely, there could be panic buying, hoarding, increased demand from addressing the disruption itself (e.g. natural disaster, defence requirements), or other countervailing factors.

[5] NRMA (Prepared by John Blackburn AO) (2013) *Australia's Liquid Fuel Security Part 2,* https://www.aph.gov.au/DocumentStore.ashx?id=677ff8dd-ce35-40ee-9af8-bfec1e43d125&subId=301736 p 12

Mines Industry Regulation and Safety advised drivers not to drive without checking ahead of a trip to see if fuel was available. [6]

These events occurred even with the availability of the broader supply chain. While short term, they are likely to have had significant economic impacts.

## EMERGENCY POWERS INADEQUATE

Given the strategic risks outlined above, it is highly concerning to learn from the Interim Report that emergency powers to ration fuel stocks, under the *Liquid Fuel Emergency Act 1984* ("the *LFE Act*"), would take up to three weeks to be implemented.

The long time period for implementing the rationing and direction powers exhausts much of and potentially all of the total consumption coverage.

There are also risks of panic buying and hoarding in the intervening period, reducing stocks available for rationing.

During Senate Estimates, a Departmental official stated that such a disruption could be viewed in advance, giving increased lead time. This seems a poor basis for strategic planning, given the uncertain nature of disruptions.

Clearly, the current arrangements are leaving Australia ill-equipped to deal with a liquid fuel security crisis.

This economic and strategic risk is emblematic of how poorly successive governments have managed the issue of transport energy security in Australia.

The Australia Institute strongly support a review of the *LFE Act*, as announced by the Minister for Energy. The review of the emergency response should be informed by longer-term changes needed to increase energy security.

[6] BP (2014) *BP confirms WA diesel supply,* https://www.bp.com/en_au/australia/media/media-releases/bp-confirms-wa-diesel-supply.html
WA Department of Mines Industry Regulation and Safety (2014) *Diesel buying advice for WA drivers,* https://www.commerce.wa.gov.au/announcements/diesel-buying-advice-wa-drivers

# New domestic supply a dubious response

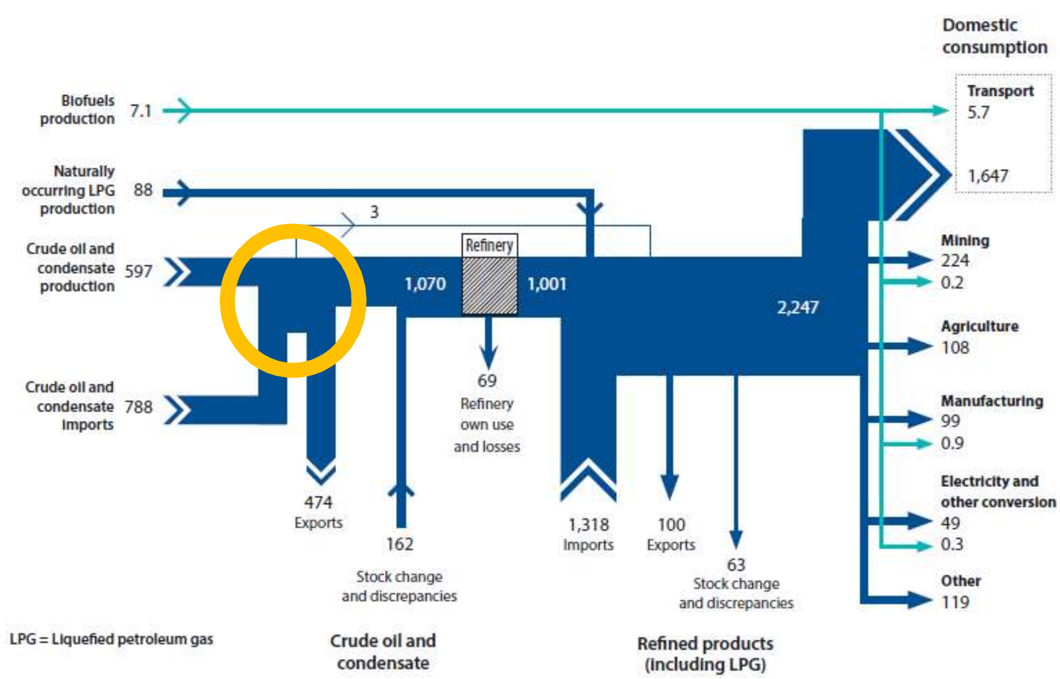
If Australia's transport energy security is threatened by reliance on imported oil, the question arises as to whether it is possible to increase Australia's consumption of domestic oil.

The Interim Report makes it clear that producing more oil in Australia is a dubious response to this issue.

Australia produces some oil domestically, but most of this is exported, while most refinery feedstocks are imported. This is because of a mismatch between the type of product extracted, the design of Australian refineries and Australian demand.

This fact should be made more clearly in the final report. Figure 1 (reproduced below) shows annual flow of Australian liquid fuel. However, as highlighted with an orange circle, the figure fails to show that most primary production is exported, and most input into Australian refineries is imported.

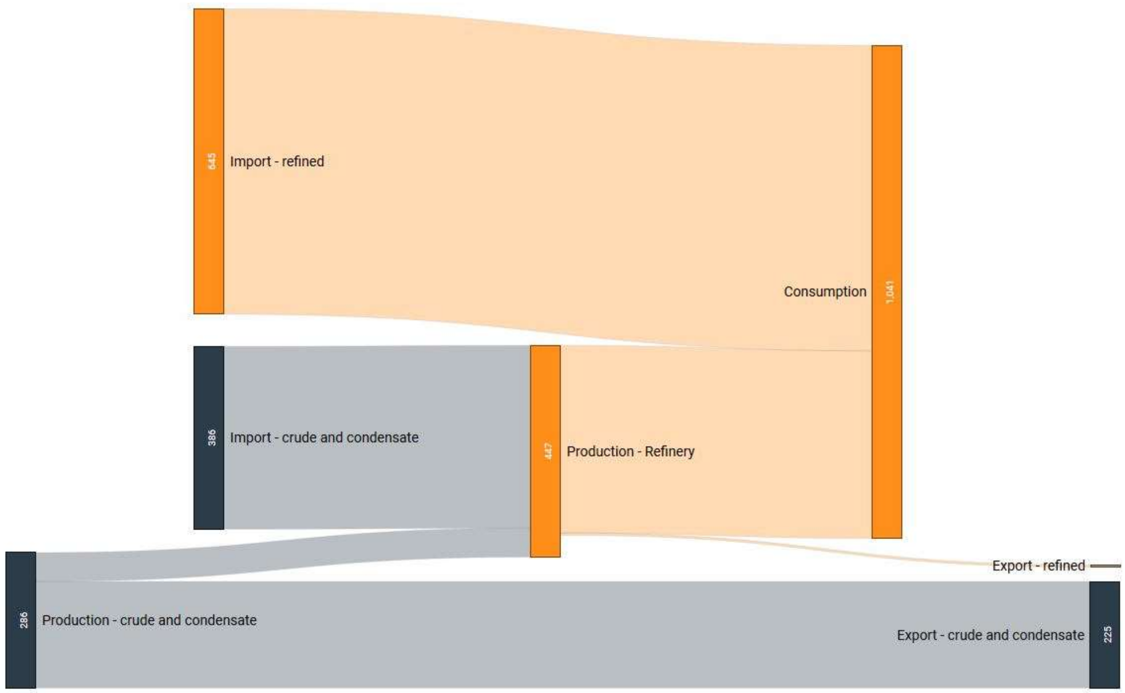
**Figure 1: Australian liquid fuel flows, petajoules, 2016-7**




Source: Liquid Fuel Security Review, p 6, figure 1, amended by TAI

Figure 1 obscures the extent of Australia's dependency on imports by hiding the tiny share of domestic demand met by domestic production. Figure 2 (below) presents liquid fuel flows using data from the Office of the Chief Economist's *Resource and Energy Quarterly.* Domestic primary oil production is a very small share of consumption, even if all non-exported primary oil production is refined and consumed domestically, as assumed in the diagram.[7]

**Figure 2: Australian liquid fuel flows, kb/d, 2017-8**




Source: The Australia Institute's figure using data from Office of the Chief Economist (2019) *Resource and Energy Quarterly March 2018*

The Interim Report gives many further reasons to think domestic supply is a dubious response to transport energy security risks.

- Australia's oil production is likely to continue to decline. It is already far below its 2000 peak, which was 59% higher than current production.
- There is great uncertainty surrounding the viability of oil production in prospective resources like the Great Australian Bight and Beetaloo Basin. Such projects may not be commercial. They may rely on significant subsidies, which would be better directed to other energy security measures.
- The Interim Report notes the scale and viability of oil production in the Bight is largely unknown. It cites industry consultants who put it at "between 15 and 40 per cent of [Australian] demand for 20 years", not coming into full production "until

[7] Assumptions include that production of primary oil is either

after 2030 given the complexity of infrastructure installation."[8] The Interim Report also states global oil demand is expected to peak in the 2030s.[9]

It is also important to point out:

- Oil produced in these projects may not be compatible with Australian refineries and demand requirements. Oil industry representatives, in whose interests it is to justify such claims, have been unable to provide evidence that new Australian oil production will be refined, or refinable, in Australia. The Minister for Resources has also been unable to provide such evidence.
- The social license for fracked shale oil in the Northern Territory or for drilling in the Great Australian Bight is at best contentious, and likely to erode further. Public opinion research has found strong opposition across the country to allowing drilling for oil in the Bight,[10] and strong opposition in the NT for fracking for gas.[11]

Even if domestic supply is increased, declining refinery capacity and resilience increases reliance on imports. The Report casts doubts on the viability of Australian oil refineries:

- Remaining Australian oil refineries are shutting down. The Port Stanvac refinery closed in 2003. The Clyde refinery closed its doors in 2012, followed by Kurnell in 2014, and Bulwer in 2015.[12]
- New Australian refineries are uneconomical, due to competition with Asian mega-refineries, and transition risks are also a major consideration for investors.[13]
- Ageing refineries are also less resilient to the effects of climate change. They are likely impacted by increasing average and extreme temperatures, extreme weather, and as coastal infrastructure, rising sea levels and increased storm surges.

[8] Interim Report, p 26.

[9] Interim Report, p 4.

[10] The Australia Institute (2019) *National Poll: Australians Opposed to Drilling in the Great Australian Bight,* http://tai.org.au/content/national-poll-australians-opposed-drilling-great-australian-bight

[11] ReachTEL (2018) *Solomon – Final Results,* http://www.tai.org.au/sites/defualt/files/TAI-28March18-Solomon%20-%20Fracking%20Poll%20ReachTEL.pdf

[12] Sydney Moring Herald (2014) *BP refinery closure leaves Australia more reliant on fuel imports,* https://www.smh.com.au/business/companies/bp-refinery-closure-leaves-australia-more-reliant-on-fuel-imports-20140402-35y4p.html

[13] Ibid.

# Reducing oil use

Currently Australia's oil use is increasing. It is argued throughout the Interim Report that transport energy security requires reducing oil use.

This requires both increased fuel efficiency and substitution to non-oil based transport, including active transport, public transport, and electric passenger vehicles. In this respect Australia is a long way behind where it should be.

## FUEL STANDARDS

Australia's weak fuel standards leave us among the least fuel-efficient fleets in the OECD. This is clearly not in Australia's economic and security interests.

Even the Business Council of Australia, which counts many oil companies amongst its members, has long called for increased fuel efficiency standards, arguing it would save Australia money and reduce emissions.[14]

Government refusal to take even this modest step is making our transport systems more expensive, less secure and more emissions intensive.

Australia is currently entirely reliant on imported passenger vehicles. This makes it hard to understand why governments will not impose requirements on these imports to bring them at least in line with comparable markets.

Given the timescales involved in vehicle stock turn over, increasing fuel standards for the flow of all imported cars should be an urgent priority.

## ELECTRIC VEHICLES

Rapid cost reductions in electric vehicles (EVs) are creating enormous opportunities for increased transport energy security. Replacing imported fuel with domestically produced electricity will have benefits for energy security.

Most obviously, it will increase the domestic supply of transport energy. The decentralisation and diversification possible in renewable energy systems can also create further resilience in energy supply.

[14] See for example: BCA (2016) *Vehicle Emissions Discussion Paper,* https://d3n8a8pro7vhmx.cloudfront.net/bca/pages/4038/attachments/original/1528953385/Submission_to_Vehicle_Emissions_Discussion_Paper_FINAL_April_22.pdf?1528953385

Moreover, CSIRO modelling shows that policy to better integrate EVs into Australia's grid can reduce both emissions and power prices, by making better use of grid infrastructure.[15]

As the Report notes, Australia is lagging far behind the rest of the world when it comes to electric vehicle uptake.[16] This is largely because there is no national policy to promote EVs.

By contrast, policies in Norway, a major exporter of oil, have seen electric vehicles make up the majority of new car sale in the past year.[17] Jurisdictions with end-dates for the last sale of oil-based cars include the UK, France, California, India and China.

Even without policy, Australia will be affected by the shift by most major manufacturers to electric vehicles and away from internal combustion engine vehicles. Failing to plan for this shift is itself an energy security risk.

Policy to shift to EVs is therefore a crucial component of any transport energy security framework.

Beyond increasing uptake of electric vehicles, Australia could further improve its transport energy security by embracing associated manufacturing opportunities.

Despite the much publicised exit of the Australian car manufacturing industry, ABS data show that 30,000 Australians are employed in motor vehicle and motor vehicle part manufacturing, including a number of factories producing EVs, with more planned. Currently there are battery factories announced and planned at various regional cities, and proposals in Western Australia to increase the value of Australia's dominant position in global battery minerals markets.

Enhancing these economic opportunities would further increase Australia's transport energy security.

# POLICY WINDOW OPEN

Policy implementation in complex areas often requires a 'window' of opportunity.

The Australia Institute's research shows the window is wide open, with strong public support for measures that would increase transport energy security.

[15] CSIRO and ENA (2017) *Electric Network Transformation Roadmap,* https://www.energynetworks.com.au/electricity-network-transformation-roadmap

[16] Interim Report, p81

[17] Quicke (2019) *Driving Norse: Electric Vehicle Policies in Norway,* http://www.tai.org.au/sites/default/files/P718%20NPC%20Driving%20Norse%20-%20EV%20Policy_0.pdf

Nearly four in five Australians support requiring new cars sold in Australia to be more efficient, even if they cost a bit more up front. There is also strong public support for a range of policies to support electric vehicle uptake, including

- government built charging stations (79% support),
- government procurement of EVs for its own fleet (76%),
- requiring new apartment blocks to include EV charging stations (73%), and
- government loans for EVs (55%).[18]

Notably, respondents were responding to policies without any explanation of energy security benefits. Awareness of such benefits are likely to increase support further.

# HYDROGEN AND BIO FUELS

While EVs with batteries have been the focus here, we note that a range of other alternatives exist, including both biofuels and hydrogen. Notwithstanding the rapid commercialisation and scale of EVs, there is a role for appropriate research, development and deployment support to other energy sources.

One issue with these approaches to transport energy security is ensuring their production is not itself linked to liquid fuels. Fossil fuel based hydrogen would be heavily reliant on fossil liquid fuels, especially when produced from coal. Biofuels produced in reliance on the agriculture sector would also be reliant on fossil fuel.

Such approaches are unlikely to support transport energy security.

# PUBLIC AND ACTIVE TRANSPORT

The Interim Report appears to pass over the opportunities and need to increase public and active transport (e.g. bicycle and walking).

Australia has high rates of car use, even in our metropolitan cities. Policies to encourage public and active transport would reduce energy insecurity, especially where public transport is electricity based. Policies could include behavioural nudges, financial incentives, changes to planning zones and infrastructure financing. Electrification of public transport (e.g. electric buses) can further decrease emissions and increase security.

[18] The Australia Institute (2019) *Polling – Policies for low emissions and electric cars,* http://www.tai.org.au/sites/default/files/Electric%20Vehicle%20Polling%20-%20Aus%20Institute%20%5BWEB%5D.pdf

While these issues span jurisdictional levels, the Commonwealth can play a strong role in promoting and coordinating progress. These issues should be central to consideration of reducing reliance on imported oil.

# Commitment to decarbonise transport

The discussion above illustrates how increasing transport energy security could at the same time address Australia's commitment to decarbonise its transport sector. The lack of policy on transport energy security is also increasing Australia's emissions. Conversely, decarbonising transport may be easier when supported by the strong policy arguments arising from energy security.

The goal of the Paris Agreement, to limit warming to well below two degrees, should be central to all policy discussion of energy security. In the Paris Agreement, Australia noted that current pledges to cut emissions by 2030 are not enough and committed to increase these pledges in the future. Australia also committed to phase out fossil fuel use in the second half of the century.

The transport sector is the third highest polluting sector in the Australian economy, making up 18% of current emissions, having increased by 57% on 1990 levels.[19] Cars currently represent the largest source of emissions within the transport sector. Car emissions have grown by 25% since 1990.[20]

## ELECTRIC VEHICLES CHARGER WITH CLEAN ENERGY

A common argument against electric vehicles in Australia is that they substitute oil for a largely coal based energy system, increasing emissions.

This argument is misguided for three reasons.

First, the energy system is already decarbonising and can decarbonise much quicker, as the cost of renewables and storage comes down quickly. Second, many EVs owners are likely to capture benefits from their EV 'behind the meter', linking it up with a solar PV array and household storage.

Third, increased grid demand from EVs would induce new supply, which given the economics of new generation would be renewable. The CSIRO has shown that solar and wind, backed up with six hours of storage, is now the lowest cost form of new generation.

[19] Commonwealth of Australia (2016) *National Greenhouse Gas Inventory,* http://ageis.climatechange.gov.au/NGGI.aspx

[20] Climate Analytics (2019), *Australia's Vehicle Fleet- Dirty and falling further behind,* https://climateanalytics.org/publications/2019/australia-climate-factsheets-vehicle-emissions/

Even while the *average* generation on the grid is largely coal power, the *marginal* generation on the grid -- that is, from new investment -- is likely to be renewable.[21]

Additionally, increased demand from EVs will not only save consumers on reduced petrol consumption with the right policy can also downwards pressure on power prices for everyone. CSIRO and ENA find that flexible use of existing grid assets, planning and coordinating EV demand profiles and responses to market prices will help reduce both power prices and emissions.[22] Changes to market rules to increase competition, such as demand response aggregation and 'the five minute' bidding rule, will favour EVs and enable them to make greater value use of the grid.

Similar points apply to energy peaking or remote electricity requirements. While liquid fuel is currently used in these contexts, it is relatively expensive and increasingly replaced by solar, wind, batteries, pumped hydro and demand response. Increased requirements for grid flexibility and falling costs of meeting those requirements create needs and opportunities for reducing liquid fuel reliance.

# NEED FOR A PARIS-CONSISTENT SCENARIO ANALYSIS

Failing to take action on climate change is itself an energy security risk. Climate change will impact on transport energy security directly, but energy transition risks also create threats to energy security, through uncertainty, disruption and risks of stranded assets. 'Transition risks' are only exacerbated by ongoing delay in action.

In a best-practice approach, an energy security framework would integrate Paris-consistent emissions targets.

As a minimum, the Department should *consider* a transport energy system under a Paris-consistent scenario.

'Scenario analysis' is used by energy analysts and increasingly in the corporate world under the recommendations of the G20's *Taskforce on Climate-related Financial Disclosures* (TCFD), to explore risks and opportunities of success under the Paris Agreement. As the International Energy Agency's *Sustainable Development Scenario* shows, mitigating climate change, reducing air pollution and sustaining economic growth are all possible together. However, for this to happen there must be greatly increased policy ambition, including tighter fuel standards and increased EV uptake.

[21] Richardson (2018) *Submission to the Senate Inquiry into electric vehicles* http://www.tai.org.au/content/submission-senate-inquiry-electric-vehicles

[22] CSIRO and ENA (2017) *Electric Network Transformation Roadmap* https://www.energynetworks.com.au/electricity-network-transformation-roadmap

The Department’s ongoing work in this area should use and emphasise scenarios relating to alternative uptake scenarios, including scenarios consistent with Australia’s commitment under Paris to consider increasing targets consistent with a 2 degree budget.

## CONSULTATION WITH NEW TRANSPORT INDUSTRIES

In developing the final Review and relevant scenarios, the Department should ensure it increases the consultation with industries required to drive this transition, including electric vehicle companies, renewables and smart energy companies, and the financial sector. Historically the debate has been dominated by fossil fuel company interests, reflected in the very framing of the issue as “liquid fuel security”. It is important that non-oil and non-liquid fuel industry perspectives are considered fully, as they are central to reducing transport energy security risks.

# Conclusion

To meet our obligations under the Paris Agreement and address risks to transport energy security, Australia must reduce its reliance on imported fuel and shift towards locally generated power, a more decentralised energy system, and higher uptake of electric vehicles. This requires government policies with specific electric vehicle targets and fuel efficiency standards, and government incentives for low and zero emissions vehicles. By contrast, domestic supplies of oil and failing to change the vehicle fleet will both increase emissions and do little to improve energy security.

In conjunction, the review of the *LFE Act* announced by the Minister is clearly pressing. Focus is needed on the provisions of the *LFE Act* which currently hamper effective Government responses to a fuel emergency.