The Clean Energy Target: Policy Implications for Meeting Australia’s 2030 Emissions Reduction Target

MARKET STUDY
THE CLEAN ENERGY TARGET: POLICY IMPLICATIONS FOR MEETING AUSTRALIA’S 2030 EMISSIONS REDUCTION TARGET

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The recent “Independent Review into the Future Security of the National Electricity Market” (Finkel Review) recommends a Clean Energy Target (CET) as the credible and durable mechanism for the electricity sector to drive clean energy investments to support a reliable electricity supply.

The Finkel Review acknowledges that the specific emissions reduction trajectory for the electricity sector is a question for governments, but at a minimum, the electricity sector should apply a trajectory consistent with a direct application of the national target of 26 to 28 per cent reduction on 2005 levels by 2030 - Australia’s initial contribution to assist in limiting warming to below 2 °Celsius (°C) relative to pre-industrial levels (Paris Agreement).

To inform the setting of electricity sector emissions reduction target the Australian Conservation Foundation (ACF) commissioned RepuTex to examine the abatement contribution of a CET in the context of Australia’s 2030 target.

We outline three policy scenarios, measured against a reference case. Our reference case presents emissions growth in line with the government’s December 2016 projections. Policy scenarios investigate electricity sector abatement under the Finkel Review’s minimum CET of 28 per cent, extend this target to non-electricity sectors, and examine what the CET should be to align with future targets under the Paris Agreement.

Analysis indicates that a 28 per cent CET would reduce Australia’s emissions by 44 million tonnes of carbon dioxide equivalent (Mt) in 2030. This would be equivalent to an 8 per cent reduction in national emissions (below 2005 levels), a shortfall of 119 Mt to meet the 2030 target.

Notably, continuing such a trajectory would result in electricity emissions being phased out by as late as 2101, inconsistent with the action of developed nations to reach net zero emissions across the whole economy by around 2050.

Should a direct application of the 28 per cent cut be applied in a uniform way across all sectors of the economy, a greater emissions reduction obligation would be imposed on Australia’s growth sectors, such as the direct combustion of oil and gas, predominantly in the manufacturing, mining, residential, and commercial sectors, rather than sectors with the largest total emissions.

Under such a scenario, the industries that rely upon direct combustion of oil and gas and the transport sectors would be accountable for reductions of 51 to 52 Mt of abatement in 2030. This is equivalent to 31 and 32 per cent of the national abatement task, despite making up only 17 to 18 per cent of total emissions. Comparably, the electricity sector, in delivering a 44 Mt reduction, would contribute only 20 per cent of the national abatement task, despite being the largest emitting sector.

The land sector - critical to meeting Australia’s long-term emissions reduction obligations - would not be encompassed by a uniform national target on all sectors. This is because land sector emissions are currently over 100 per cent below 2005 levels - i.e. the sector is currently sequestering more emissions than it creates. As such a uniform target of 28 per cent below 2005 levels could result in an increase in emissions.
• An alternative CET of 45 per cent – equivalent to an annual reduction of around 7 Mt – would achieve zero emissions by approximately 2045. Under this scenario, a 45 per cent CET would contribute a cumulative 424 Mt of abatement – or 41 per cent of Australia’s abatement task to meet a national 28 per cent reduction target by 2030.

• A 63 per cent CET target – equivalent to a reduction of around 10 Mt annually – would phase out electricity sector emissions a decade earlier, by 2035, contributing 619 Mt of cumulative abatement – or 60 per cent of Australia’s abatement task to meet a national 28 per cent target.

• In both the 45 and 63 per cent CET scenarios, we project downward pressure on wholesale electricity prices, with greater volumes of renewables to cause electricity supply to become more competitive and less influenced by high gas prices. In such scenarios, we estimate that wholesale electricity prices could fall towards $60/MWh within the first year of a CET mechanism.

• Decarbonising the electric power sector is therefore the most important, fastest, and cheapest of the major abatement policies that will be needed to meet Australia’s 2030 target.

BACKGROUND

Australia reports greenhouse gas (GHG) emissions in eight categories:

• Electricity,
• Direct Combustion,
• Transport,
• Fugitive,
• Agriculture,
• Industrial Processes,
• Waste, and
• Land-use, Land-use Change and Forestry (LULUCF).

The Electricity sector is Australia’s largest emitting sector and is the key sector to decarbonise the entire economy given most of Australia’s emissions – whether from businesses, government, or individuals – are a direct result of the carbon-intensive electricity from the grid.

The National Electricity Market (NEM) has traditionally relied on the development of capital-intensive, centralised, and long-lived assets to provide adequate power capacity. Investing in these facilities – at reasonable borrowing rates – requires a high degree of policy certainty, which has not characterised the Australian electricity sector in the last five years. Uncertainty about the reduction of the Renewable Energy Target (RET) has stymied investment in both new renewable and traditional generators as Australia’s aging fossil fuel fleet of plants close.
To address this imbalance the Council of Australian Governments (COAG) Energy Ministers agreed to an independent review of the NEM to provide advice to governments on a coordinated, national reform blueprint to ensure affordable, reliable, low carbon energy supply. The subsequent Finkel Review recommended a way forward that focuses on four key outcomes for the NEM: increased security, future reliability, rewarding consumers, and lower emissions.

Addressing reliability and low emissions, the Review recommended that the Commonwealth and State and Territory governments agree to an emissions reduction trajectory for the NEM, but acknowledged that what specific emissions reduction trajectory should be set for the electricity sector is a question for governments. The Review stated:

“At a minimum, the electricity sector should have a trajectory consistent with the direct application of the national target for 26 to 28 per cent reduction on 2005 levels by 2030, and per Australia’s international obligation under the Paris Agreement.”

To inform the policy design process the Australian Conservation Foundation (ACF) commissioned RepuTex to examine the necessary ambition of a CET to meet Australia’s 2030 target. The objective of the report is to analyse the role that the CET policy may play in reducing Australia’s GHG emissions in line with the Paris Agreement, the adequacy of that role under several scenarios, and understand the climate change policy implications for other sectors.

To support this analysis, we outline three policy scenarios, measured against a reference case. Our reference case presents emissions growth in line with the government’s December 2016 projections. Our policy scenarios investigate not only the abatement of the Finkel Review’s minimum CET of 28 per cent on the electricity sector, but also extend this to implications for non-electricity sectors, and what the CET should be to align with future targets that are more consistent with Australia’s commitments under the Paris Agreement.

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Australian GHG emissions have increased steadily since 2013, causing emissions to increase from about 528 Mt to approximately 544 Mt in 2016. Current government projections indicate national emissions will continue to grow to 2030, reaching around 592 Mt, an increase of almost 9 per cent from 2016 levels.

National emissions growth driven by “covered sectors”

As shown in Figure 1, near-term emissions growth over 2017-19 is projected to be driven by three key factors:

- an expected return to 2010 levels of forest clearing,
- the expansion of Australia’s liquefied natural gas (LNG) industry, and
- growth in transport activity.

These activates fall into the emissions categories of LULUCF, Direct combustion, and Transport, respectively.

Figure 1: Australia 2030 projected emissions growth by sector from 2016
Beyond 2020, government projections indicate emissions growth will be driven by a different combination of Electricity, Transport, Agriculture, LULUCF, and Direct combustion categories. The key drivers of emissions from 2020-30 are projected to be:

- increased electricity demand linked to rising economic activity,
- increases in transport activity linked to population growth,
- increased cattle herd numbers in agriculture linked to international demand.

Notably emissions growth is projected to come from the electricity, industrial, and land sectors despite the government’s current climate change policy framework, including the Emissions Reduction Fund (ERF) and “safeguard mechanism.”

The ERF is the centrepiece of the government’s Direct Action Plan climate policy framework, operating as a competitive reverse auction process to tender contracts for Australian Carbon Credit Units (ACCUs) at the lowest available cost. Most of this abatement is contracted from the land sector where native vegetation can regenerate by avoiding further clearing. While the ERF has been successful in contracting ACCUs, the low-quality of abatement associated with these ACCUs means land sector’s net-emission are projected to rise rather than fall for the duration of fund.

The ERF is also supposed to be supported by a “safeguard mechanism” to ensure that emissions reductions paid for through the ERF are not offset by significant increases in emissions elsewhere in the economy. The safeguard mechanism specifically covers high-emitting facilities that produce over 100,000 tonnes of carbon dioxide in a year. Of these ‘covered facilities,’ electricity generators, almost entirely coal-fired, are the largest contributor accounting for more than half of all covered emissions. Large industry manufacturing facilities, such as steelworks and LNG projects, account for the bulk of the remaining covered emissions.

Although the safeguard mechanism commenced at the beginning of the 2016-17 financial year, it is not projected to reduce any emissions from current or new covered facilities. As such, growth in covered emissions represents a key roadblock for policymakers – whereby Australia’s 2030 target will not be met unless all covered facilities become accountable for their emission increases.

Stopping emissions growth is the first step for Australia to reduce GHG emissions and achieve its initial contribution to the Paris Agreement.

**Australia’s 2030 emissions reduction target**

In becoming a signatory to the Paris Agreement, the Australian Government has pledged to an emissions reduction target of at least 26-28 per cent on 2005 levels by 2030. In 2018, Parties to the Paris Agreement will take stock of the collective efforts in relation to progress towards the goal set in the Paris Agreement and to inform the preparation of “nationally determined contributions (NDCs). So far the United National Framework Convention on Climate Change (UNFCCC) secretariat estimates the sum of all current national targets under the Paris Agreement is likely to limit warming to only around 3-degrees Celsius (°C). This implies a high likelihood of the scale-up of national emissions targets, including Australia’s, at future reviews to restrict global temperature increases to less than 2 °C.
The Climate Change Authority (CCA) suggests that a target range of 45-63 per cent on 2005 levels by 2030 would be more consistent with a 2 °C pathway. Australia’s emissions reduction target under the Paris Agreement is therefore likely to evolve over time towards this target range.

**Abatement task to meet the current 2030 target**

Applying the government’s reference emissions trajectory, Australian emissions are projected to return to 2005 levels by 2030, around 160 Mt above a 28 per cent reduction target in 2030. To meet its 28 per cent emissions reduction target in cumulative terms, this means Australia will be required to reduce emissions by approximately 1,032 Mt between 2021-30.

Australia’s cumulative abatement task could grow from around 1,032 Mt to 1,600 -2,200 Mt to meet a scaled-up emission target more consistent with limiting global warming to 1.5 to 2 °C.

**Figure 2:** Government emissions projections to 2030 (December 2016)

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2. “If the Authority’s recommendations were converted to a 2005 base they would imply a 2025 target reduction of 36 per cent, and a 2030 range of 45 to 63 per cent.” Australian Commonwealth: Climate Change Authority, 14 August 2015 - Some Observations on Australia’s Post-2020 Emissions Reduction Target (Statement by the Chair, Mr Bernie Fraser).

3. Australia became a party to this Agreement on 9 November 2016 when it ratified this treaty.
A 2 °C target - effectively a goal of carbon-neutrality by the middle of the century - would likely drive more aggressive national policies to reduce carbon emissions. Therefore, while debate continues over the design of policy to meet that initial 2030 target, options to accelerate the transition to a 1.5 to 2 °C emissions trajectory should also be considered.

**Electricity sector**

Australia’s largest single category for emissions is the electricity generation sector. Electricity contributes around 35 per cent of national emissions. The next largest sectors are Direct combustion and Transport at 18 per cent each.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Total percentage (2016)</th>
<th>Growth to 2030</th>
<th>Percentage growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>35%</td>
<td>-6 Mt</td>
<td>-3%</td>
</tr>
<tr>
<td>Direct combustion</td>
<td>18%</td>
<td>+12 Mt</td>
<td>9%</td>
</tr>
<tr>
<td>Transport</td>
<td>18%</td>
<td>+17 Mt</td>
<td>16%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>13%</td>
<td>+10 Mt</td>
<td>13%</td>
</tr>
<tr>
<td>Fugitive</td>
<td>8%</td>
<td>+5 Mt</td>
<td>5%</td>
</tr>
<tr>
<td>Industrial processes</td>
<td>6%</td>
<td>+2 Mt</td>
<td>5%</td>
</tr>
<tr>
<td>Waste</td>
<td>2%</td>
<td>-1 Mt</td>
<td>-1%</td>
</tr>
<tr>
<td>LULUCF</td>
<td>0%</td>
<td>+12 Mt</td>
<td>77%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>54 Mt</td>
<td>7%</td>
</tr>
</tbody>
</table>


By 2030 Electricity emissions are projected to decrease 3 per cent below 2016 levels, however, as shown in Figure 1, this is the net-result of an emissions rebound from a low-point projected in 2020. Emissions are projected to continue declining to 2020 due to the build-out of the Large-scale Renewable Energy Target (LRET). Electricity emissions are projected to decrease by seven per cent through 2020 owing to new renewable facilities built to achieve the 33,000 GWh LRET.

After 2020, following the conclusion of the LRET policy, electricity emissions are projected to grow as a rise in electricity consumption is met with existing coal-fired capacity.
MODELLING SCENARIOS: A CLEAN ENERGY TARGET (CET)

All governments will need to agree to an emissions reduction trajectory to give the electricity sector certainty about how we will meet our international commitments. This requires a credible and durable mechanism for driving clean energy investments to support a reliable electricity supply. The Finkel Review recommends a CET as the mechanism for the electricity sector.

A CET would be designed to reduce electricity sector emissions, operating in a similar way as the current LRET, whereby facilities would earn a clean energy credit or a portion of a credit for being under an established threshold. Eligibility is expected to be extended to new generation defined below a threshold level of emissions intensity (kg CO2-e/MWh). Carbon capture and storage (CCS) retrofits to existing plants may also be eligible.

**Intensity threshold**

Under a CET, eligible generators receive certificates adjusted by how much the generation outperforms the threshold intensity, such that a zero emissions generator would receive one certificate for every MWh of output, while a generator with half the threshold intensity would receive half a certificate.

Given the size of the certificate would be proportionate to the amount of emissions below the baseline, generators with an emissions intensity just below the threshold would earn only a fraction of a certificate for each MWh and would therefore receive only a fraction of the clean energy subsidy. This is a key difference from an emissions intensity scheme (EIS) where the baseline intensity is critical to determining the ambition of the scheme. Importantly, with a CET there are no penalties or prohibitions to prevent high emissions plants entering the market.

For the purposes of our modelling the CET threshold is set at 0.7 tonnes of carbon dioxide equivalent per megawatt-hour (t CO2-e/MWh). This would theoretically allow emerging High Efficiency Low Emissions (HELE) technologies to generate Low Emissions Certificates, however, in practice such a facility would earn only a fraction of a certificate for each MWh under the baseline. Assuming a party agrees to purchase the power, a hypothetical emissions intensity of 0.67 t CO2-e/MWh would result in three one hundredths of a certificate per MWh (0.03), or 1 certificate for every 23 MWh generated.

Subsequently, any adjustment to the CET benchmark mechanism is largely inconsequential in its support for HELE coal. As noted in earlier research, we continue to believe that the economics of the NEM are fundamentally working against baseload generation, with ‘baseload’ sources of power considered too inflexible to compete in Australia’s future electricity system. We therefore do not envisage any appetite for HELE coal or other ‘baseload only’ facilities, even should it be included in a CET, unless there is a major government intervention in the market.
Modelled target scenarios

Rather than the emissions intensity threshold, the defining element of a CET framework is the emissions reduction target - the targeted amount of electricity emissions reductions in a specific year. The CET is set to achieve annualised emission reduction targets rather than a fixed low emissions generation target in a specific year (different to the LRET), with its trajectory adjusted each year to reflect changes in the emissions target, electricity demand, and the generation mix. Although this provides less long-term certainty for project developers, such an approach would be more politically stable in the event electricity demand or technology costs are very different than anticipated by today’s modelling.

For the purposes of our modelling, we initially apply a “minimum” 2030 emissions reduction target corresponding to 28 per cent below 2005 levels as modelled by the Finkel Review.

Analysis also considers a scenario aligned with developed countries’ climate mission to eliminate all carbon dioxide emission by the middle of this century. We use the equivalent of a 45 per cent reduction on 2005 levels by 2030 - in line with Climate Change Authority recommendations for national emissions – to model a Paris aligned scenario. This suggests electricity emissions would need to be around 7 Mt lower each year, giving Australia a reasonable chance of phasing out all electricity GHG emissions by around 2050.

Historic baseline

To avoid windfall gains for pre-existing generation, “clean energy” generators existing at the beginning of the scheme (e.g. 2020) would be eligible to produce CET certificates only for generation above pre-specified historic baselines (like pre-existing renewable generation under the current LRET). For the purposes of our modelling this baseline is derived from the average amount of electricity each generator produces from 2018 to 2020 (or whichever years the generator operates in that period).
SCENARIO 1: THE FINKEL REVIEW CET (28 PER CENT TARGET)

The Finkel Review did not endorse a specific recommendation for the ambition of the proposed CET. In the absence of guidance on what target to consider, the Review commissioned modelling for a 28 per cent emissions reduction on 2005 levels as a direct application of Australia’s national target.

Impact of a 28 per cent CET on national emissions

Analysis indicates that a 28 per cent CET would reduce GHG emissions by around 44 Mt in 2030, with annual electricity emissions falling to 142 Mt, down from 186 Mt currently projected. In national terms, this would result in an 8 per cent reduction in Australian emissions (below 2005 levels) by 2030, with emissions falling to 548 Mt, largely in line with 2016-17 levels.

Subsequently a CET as modelled by the Finkel Review would curb Australia’s emissions growth from today’s levels, but would leave shortfall of around 119 Mt to meet the 2030 target. This is due to the contribution of the electricity sector to Australia’s national emissions. Because electricity is not projected to be a high growth sector (Figure 1) and electricity emissions make up 35 per cent of total emissions (Table 1), a 28 per cent CET would not fulfil a national 26 to 28 per cent goal.

This indicates that a more ambitious CET will be required for Australia to meet its current national emission target, or policy in other sectors will also need to contribute emissions reductions - or a combination of these outcomes.
Figure 3: National Emissions Abatement with 28% CET

Sources: RepuTex Carbon, Australia’s emissions projections 2016 and the Quarterly Update of Australia’s National Greenhouse Gas Inventory.

Electricity emissions phased out by 2095-2101 under Finkel CET

As shown in Figure 4, in applying a 26 to 28 per cent target trajectory to the generation sector, analysis indicates that a linear decline in annual emissions would result in electricity sector emissions being phased out between 2095 and 2101. This is not consistent with Australia’s commitment to global action to limit global warming to well below 2 °C, which as a developed nation means reaching net zero emissions across the whole economy by about 2050.
Figure 4: Electricity sector emissions and a 28% CET trajectory.

A 28 per cent CET therefore implies a considerable shortfall to Australia’s commitment under the Paris Agreement, with such a target falling short of Australia’s national target under the Paris Agreement, and incompatible with the broader timeline to achieve zero emissions by 2050.
SCENARIO 2: IMPLICATIONS FOR NON-ELECTRICITY SECTORS

The Finkel Review modelling implies that all sectors of the Australian economy could be required to reduce emissions by the same amount – 28 per cent below 2005 levels. In this context, the percentage contribution of each sector to the national abatement task would reflect the emissions growth profile of each sector to 2030.

As shown in Figure 5, most emissions categories have not changed dramatically since 2005. As a result, almost all sectors would be required to reduce emissions by around 2 to 4 per cent annually if they are all accountable for a 28 per cent reduction on 2005 levels.

Such an approach would impose greater emissions reduction obligations on sectors that have increased their emissions since 2005, irrespective of their overall contribution to Australia’s total emissions. For example, the Direct Combustion (Oil and Gas) and Transport sectors would be accountable for reductions of 51 to 52 Mt of abatement in 2030, equivalent to 31 and 32 per cent of the national abatement task, despite making up only 17 to 18 per cent of total emissions.

Figure 5: Decay rates based on a 28% reduction on 2005 level by 2030 to all sectors.
Comparably, the electricity sector, in delivering only a 44 Mt reduction, would contribute only 20 per cent of the national abatement task, despite being the largest emitting sector. Therefore, a uniform 28 per cent reduction target for all sectors would mean the largest reductions would fall on high emissions growth sectors, rather than the sectors with the largest share of total national emissions.

Table 2: Contribution of all sectors under uniform 28 per cent reduction target

<table>
<thead>
<tr>
<th>Sector</th>
<th>Total percentage of emissions</th>
<th>Annual Abatement in 2030</th>
<th>Percentage of Cumulative Abatement Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>35%</td>
<td>44 Mt</td>
<td>20%</td>
</tr>
<tr>
<td>Direct combustion</td>
<td>18%</td>
<td>51 Mt</td>
<td>31%</td>
</tr>
<tr>
<td>Transport</td>
<td>17%</td>
<td>52 Mt</td>
<td>32%</td>
</tr>
<tr>
<td>Agriculture</td>
<td>13%</td>
<td>23 Mt</td>
<td>11%</td>
</tr>
<tr>
<td>Fugitive</td>
<td>8%</td>
<td>20 Mt</td>
<td>14%</td>
</tr>
<tr>
<td>Industrial processes</td>
<td>6%</td>
<td>13 Mt</td>
<td>8%</td>
</tr>
<tr>
<td>Waste</td>
<td>2%</td>
<td>1 Mt</td>
<td>0%</td>
</tr>
<tr>
<td>LULUCF</td>
<td>0%</td>
<td>-42 Mt</td>
<td>-16%</td>
</tr>
</tbody>
</table>

**Land sector abatement would be overlooked**

A key drawback of directly imposing a uniform national target on all sectors is that land sector emissions are currently well under 2005 levels, due to much lower clearing rates of old-growth forests. As of 2016, land-sector emissions are 101 per cent below 2005 levels. A 28 per cent cut applied to all sectors would therefore not trigger further abatement from LULUCF, while potentially creating headroom for emissions to increase from this sector.

Exempting LULUCF emissions from further cuts would be unwise given this sector is made up of both direct emissions – e.g. forest clearing - as well as “negative emissions” in the form of atmospheric carbon sequestration – e.g. reforestation. Unlike other sectors, the land sector has enormous potential to contribute “negative emissions” to the national GHG accounting. In the long-term this will be critical to maintaining the net-zero emissions necessary for limiting warming to 1.5°C to 2°C.

This abatement potential could take decades to be realised given the time required for forests to grow and sequester significant amounts of carbon. As a result, investment in land sector sequestration will be critical to ensuring Australia can meet any future scaled up emissions target.
AN ALTERNATIVE APPROACH: TARGETING ABATEMENT FROM AUSTRALIA’S ‘BIG 3’

Although it is possible achieve a 28 per cent national target by imposing a uniform reduction on all sectors, an alternative approach may be to design policy to unlock abatement from Australia’s largest abatement sources - the electricity, industrial and land-use sectors - which account for over 586 Mt of potential abatement in 2030. These sectors are referred to as Australia’s “big 3” sources of abatement.

In designing a more balanced policy framework to unlock abatement in these sectors and meet the national 28 per cent target, Australia would be well positioned to unlock low-cost abatement, and ensure the contribution of critical sectors that will be required to play a role to meet Australia’s longer-term emissions reduction objectives under the Paris Agreement.

Illustrative policy framework to meet 28 per cent target with “big 3” sectors

- Annual average of 10 per cent increase in distributed solar PV,
- 28 per cent CET by 2030,
- Doubling energy productivity by 2030,
- Light vehicle efficiency standards of 105 g/km fleet average target in 2025,
- 10 per cent of passenger vehicle kilometre travelled (VKT) are electric by 2030,
- 25 per cent of passenger VKT are hybrid (or other low emissions) vehicles by 2030,
- Fugitive emissions capped at no more than 15 per cent above 2000 levels,
- An additional $1 billion of abatement is contracted thought the ERF,
- 2013 Newman government land-clearing laws are repealed in Queensland,
- 85 per cent phase-down of high global warming potential gases by 2030
- A safeguard mechanism baseline decay rate of 1.7 per cent annually.

As shown in Figure 7, in this example, the ‘Big 3’ sectors of Electricity, Land-Sector, and the industrial emissions covered by the Safeguard Mechanism would contribute approximately 85 per cent of all abatement. Other important polices like the Hydrofluorocarbon (HFC) phase-down and vehicle emission standards can also make important contributions but are ultimately limited by their smaller influence on emissions.
Figure 7: Cumulative abatement by sector between 2021 and 2030.

The need for policy to be ‘future proof’ to a 2 °C target

Although this combination of polices could achieve Australia’s current 28 per cent target, it is still a “minimum” policy framework given it does not consider the requirement to scale up policy under Paris Agreement. For example, should Australia’s national target be scaled up to 45-63 per cent to align with a 2 °C target under the Paris Agreement, as expected, the energy sector would be required to contribute larger emissions reductions over a much shorter timeframe.

Subsequently, policy designed now must be future proof to the likely scale up of policy later, and better consider strategic sectors that can practically reach zero-emissions without reducing economic growth.
SCENARIO 3: ALIGNING THE CET WITH A 2 °C TARGET UNDER THE PARIS AGREEMENT

Considering the high likelihood of the future scale up of Australia’s emissions reduction contribution, we apply the Climate Change Authority’s 45-63 per cent reduction on 2005 levels by 2030 as upper and lower bounds for a national 2 °C target.

Applied to the CET, a 45 per cent target – equivalent to an annual reduction of around 7 Mt - would achieve zero emissions in the electricity sector by approximately 2045. Under this scenario, the CET would contribute a cumulative 424 Mt of abatement – or 41 per cent of Australia’s abatement task to meet a 28 per cent reduction target by 2030.

Figure 8: Scale-up of CET for the generation sector (28%, 45% and 63% targets).

A 63 per cent target – equivalent to a reduction of around 10 Mt annually – would phase out electricity sector emissions a decade earlier, by 2035. This would represent a cumulative abatement contribution of 619 Mt – or 60 per cent of Australia’s abatement task to meet a 28 per cent reduction target.
WHOLESALE ELECTRICITY PRICES LOWER UNDER A MORE AMBITIOUS CET

As noted in earlier research, in the absence of new energy policy, wholesale electricity prices will continue to be heavily influenced by gas-fired generators due to a tighter supply-demand balance across the NEM. This will lead to wholesale price rises partially mitigated by large wind and solar investments subsided by the LRET though 2020, with significant price premiums for green electricity driving a significant amount of wind and solar investment over the period to 2020-21.

Should a “minimum” 28 per cent CET be implemented, modelling indicates that greater volumes of renewables will be added to the grid, causing electricity supply to become more competitive and less influenced by high gas prices. In such a scenario, we estimate that wholesale electricity prices will fall towards $60/MWh in 2020.

Scaling up a linear emission target under the CET to align with the Paris Agreement would further enhance this outcome, with an aggressive build-out of clean energy leading to more competition and a lower influence of high priced gas. In such a scenario, we estimate wholesale electricity prices falling below $40/MWh by 2023.

**Figure 9:** Annual average NEM wholesale electricity prices with and without a 45% CET.

Source: RepuTex Carbon, July Market Update, “It’s the economics, stupid... Scenarios for the NEM wholesale price to 2030”.

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Market study | Undertaken for the Australian Conservation Foundation
CONCLUSION

Decarbonising the electric power sector is the most important, fastest, and cheapest step toward achieving Australia’s 2030 target

To date, Australia’s largest source of fossil fuel emissions reductions have come from the electricity generation sector as aging carbon intensive generation assets close. With generation capacity falling faster than demand, this has led to a tightening of market balance, reflected by elevated prices. Investment in new facilities is therefore needed to provide new competition as aging facilities are withdrawn from the market.

As noted, coal-fired capacity is too inflexible to capture value in being available to ramp-up or down at short notice, with the market now favouring dispatchable, low-cost plants that can take advantage of the increasing incidence of high demand and low supply situations. This will favour Solar and Wind powered facilities – with storage as necessary – to provide the most cost-effective investment for the electricity sector.

As more generation is added, this will continue to trigger the withdrawal of aging fossil fuel generation, leading to large scale, cost-effective national abatement. This is not projected to affect energy reliability, with cost reductions and technological improvements in controls and energy storage meaning that new renewable plants can provide firm supply when needed.

A 28 per cent CET will not meet the national emissions target

A 28 per cent CET will be insufficient in meeting Australia’s national 28 per cent target, leaving a notable shortfall to 2030. In addition, such a trajectory would result in electricity emissions being phased out between 2095-2101, inconsistent with the objective of the Paris Agreement to limit warming to 2 °C, and achieve carbon-neutrality by the middle of the century.

In applying a goal of becoming carbon-neutral by mid-century, analysis indicates that a 45 per cent CET could be extended to reach zero electricity emissions by around 2045, a timeline more compatible with the Paris Agreement. An advanced target of 63 per cent would phase out electricity emissions earlier – by around 2035 – and assist with reducing emission in other sectors through greater electrification options to take advantage of the clean energy available from the electricity grid. Either way, a greater target to phase out electricity emissions before 2050 in needed to future proof the electricity sector from the expected scale up of the target later. Announcing this target as soon as possible could provide more time to achieve Australia’s emissions reduction obligations that are expected to be imposed in the upcoming years.

In applying a more aggressive CET of 45 per cent, modelling also indicates that this would place downward pressure on wholesale electricity prices by bringing new competition, in the form of clean energy into the market.
Electricity climate policy is one of Australia’s ‘Big 3’ abatement pillars

While GHG abatement may come from all emissions categories, aiming for deep decarbonisation under the Paris Agreement must necessarily involve Australia’s “big 3” abatement pillars: The Electricity, Industrial, and Land sectors.

Of these, the electricity sector has the technology flexibility to reach zero emissions at least cost, and is the key sector to achieving a strong clean energy economy. In addition, the Australian economy could be strengthened by

- access to low-cost, reliable sources of electricity;
- being able to compete and grow in a decarbonised global economy; and
- benefiting from early and large investments in Australian energy infrastructure.

Projected growth in emissions from industrial sectors covered by the government’s safeguard mechanism (such as oil and gas) continue to represent a key roadblock for policymakers. These sectors will continue to contribute to national emissions growth unless they are made accountable for emissions increases under the “safeguard mechanism” or similar baseline and credit/baseline and offset scheme.

This may have the benefit of curbing emissions growth from all sectors of the economy, while potentially providing a framework for high emitting companies to support investment in land sector sequestration through the acquisition of Australian Carbon Credit Unit (ACCUs) offsets. The land sector – especially sequestration – will be key to meeting a long-term mid-century target of net-zero emissions due to the enormous potential for the land sector to offset any remaining emissions. This abatement will take time to mature, however, suggesting that taking a long-term view of challenges associated with deep decarbonisation is essential to setting targets.
APPENDIX: MODELLING APPROACH

OUR NEMRES GENERATION MODEL

RepuTex’s proprietary NEMRES model is our flagship electricity market simulation tool, replicating the operation of AEMO’s dispatch engine by simulating market behaviour and supply-demand conditions across the National Electricity Market (NEM). Various rules, laws and policies govern the operation of the NEM, with the key elements being supply and demand, connected by the electricity network. The supply side is comprised of fossil fuel and renewable generators which offer generation capacity based on their own economic decisions, dispatched by AEMO from the cheapest to more costly generator, subject to system conditions, to meet demand.

Demand is affected by a number of factors such as weather, economic activities, population, etc. Although demand for power has patterns, it remains mostly unplanned and highly inelastic over the short term. System operators rely on demand forecasting for the daily market operation and long term planning. As such AEMO publishes forecasted demand on a number of time frames. The RepuTex NEMRES model simulates the NEM least cost dispatch process and supply and demand conditions in the forecast periods, modelling the resulting generation and emissions from each of the scheduled generation plants. Contracts between generators and retailers/large users impact the percentage of electricity subject to bidding behaviours and spot price revenue.

The RepuTex NEMRES model explicitly models all scheduled power plants, while also allowing for non-market and non-scheduled plants. Figure 10 outlines the main model components and model process flows. The central component of the RepuTex NEMRES model is the least cost dispatch model, which dispatches the generation of plants based on default bids adjusted to each generators most recently observed patterns. For each dispatch interval, fossil fuel generators bids are optimised for individual facility profitability. Hydro generation is allocated by model based on historical inflow and the proportion of run-of-river generation and storable hydro energy.
As shown, the input data preparation and model calibration are important blocks, supported by a number of criteria in checking the validity of model outputs including cross checks against the closing facilities projected to be the least profitable and the feasibility of new entrants in a region.

**Merit Order Model**

A merit order is constructed via the bids offered by all fossil fuel plants. The algorithm orders the price bands offered by plants from the least to highest and accumulates the quantities of corresponding price bands accordingly. When network constraints or inter-temporal constraints are present, an optimisation solver is needed to achieve the role of the algorithm developed.

**Bidding Model**

The bidding model constructs the default four price and quantity pairs. All price and quantity pairs are in percentage of the cost and available capacity of each plant except the price in the first band, which is fixed at $0 per megawatt-hour (MWh). The first band of a bid applies to plant-level minimum generation. The second band applies to short-run marginal cost (SRMC) and the third to long-run marginal cost (LRMC). The last band is related to the value of lost load (VOLL).
The quantity is the percentage that a plant is willing to offer to the market at above given prices. The quantity is incremental, in that the sum of the four quantity components must be 100 per cent. The quantity at the SRMC cost is related to the contract level, while the quantity at the LRMC may be allocated to the normal design level less the amount that has already been allocated in the previous price bands. The last band can be thought as opportunity or gaming bids. There are two default formats. Long-term forecasting calculates dispatch on annual demand duration curve with 200 dispatch intervals per year. High precision forecasting uses the bidding format for half-hourly dispatch against half-hourly load curves.

**Cost Model**

The cost of a generator depends on a number of factors: plant characteristics such as plant efficiency/heat rate, plant auxiliary usage, fuel cost, fuel combustion emission factor, variable operating & maintenance (VOM), fixed operating & maintenance cost (FOM), etc. The short-run marginal cost (SRMC) and long-run marginal cost (LRMC) are calculated by summing each cost component as shown in Figure 11, which also shows the contributing factors of each.

To calculate per MWh cost of the fixed cost, a capacity factor is assumed for each plant. This may have impacts on dispatch outcomes. Normally, the impact should be minimal. However, this side-effect can be voided by adjusting bids based on plant profitability because the annual profit of each plant will not use the assumed capacity factors. The annual profit is calculated as total revenue from the sent-out energy + fixed subsidies less the variable cost associated with per MWh generation and less the annual fixed cost.

**Figure 11:** Plant level generation cost

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**Demand Trace Model**
Annual forecast demand comes with three numbers for the NEM. One is for annual energy and the other two are for maximum load in the winter and summer seasons. An annual load shape is chosen to allocate forecast demand into finer time scales. RepuTex aims to mimic the operation of the NEM over 200 periods per year, equivalent to averaging demand over 1.8 days. Once the load shape in a particular historical period is chosen, the Demand Trace Generator can produce a demand trace matching the historical shape and forecasted energy target and the maximum load in the winter and summer season.

Weekends and public holidays load profiles are to be checked and matched as required. Forecasted demand for scheduled and semi-scheduled generation is used only at the stage as only scheduled and semi-scheduled plants are modelled.

Wind Trace Model

Wind generation is of high randomness and it is classified as semi-scheduled by AEMO. In addition, new wind farms do not have historical generation data to use. As such a comprised method, which is widely used in simulating power market operation, is used to model the wind generation.

For new wind farms, assumptions are made for their capacity factors based on availability of wind resources or similar wind farms located nearby. Once annual energy and potential maximum output for the wind farms is available, it is disaggregated into the wind traces in shape.