CLIMATE COUNCIL

WORKING PAPER:

AUSTRALIA'S RISING GREENHOUSE GAS EMISSIONS

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Working paper: Australia's rising greenhouse gas emissions.
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Key Findings

1

Australia's emissions are rising and projected to continue increasing without credible and comprehensive climate and energy policy.

- Australia's greenhouse gas emissions have increased for the past three years, reaching 556.4 $MtCO_2e$ in the year to December 2017.
- Australia's greenhouse gas emission levels are very close to all-time highs (excluding land use emissions).
- Eight of Australia's major sectors are responsible for Australia's rising emissions. These sectors are electricity, transport, stationary energy, agriculture, fugitive emissions, industrial processes, waste and land use.
- The electricity sector is the biggest polluter accounting for 33% of our emissions.

2

Australia's emissions reduction target is woefully inadequate to protect Australians from intensifying climate change.

- Australia's 26-28% emissions reduction target for 2030 on a 2005 baseline is not adequate to meet the Paris Climate Agreement targets.
- Australia's share of the remaining global carbon budget is about 5,500 Mt CO_2e.
- If Australia's emissions continue at current rates we have only 10 years remaining before we will completely exhaust our carbon budget before 2030.
- If other countries were to adopt climate policies similar to Australia's then global average temperature rise could reach over 3°C and up to 4°C. A four degree world would present serious challenges for human survival, placing billions of lives at risk.
- A more appropriate target for Australia in line with the science would be a 45-65% emissions reduction target by 2030, as recommended by the Climate Change Authority and zero net emissions well before 2050.

3

Applying a pro-rata emissions reduction target of 26-28% by 2030 to each sector is not the most cost-effective way to reduce emissions.

- The Federal Government's National Energy Guarantee proposes to lock in a 26% emissions reduction target for the electricity sector. This approach implies other sectors would also be expected to reduce their emissions by 26% by 2030 (on 2005 levels).
- Applying a pro-rata reduction target to each sector would mean significant new policies and emissions reductions are required for every sector between now and 2030.
- The electricity sector is better placed to reduce emissions at lower cost than other sectors, such as agriculture and fugitive emissions. Reducing emissions in these sectors will potentially be very costly and challenging, whereas options to reduce electricity sector emissions are readily available and cost effective (e.g. renewable energy and storage technologies).

4

Australia is currently not even on track to meet its current inadequate emissions reduction target for 2030.

- The electricity sector would be required to reduce cumulative emissions by only 8% compared to business as usual from 2018 and 2030 in order to achieve a pro rata reduction.
- Other than waste, all sectors will be required to proportionally reduce emissions by far more than the electricity sector (compared to business as usual).
- Transport emissions and fugitive emissions would need to be cut by around a third.
- Stationary energy (excluding electricity) emissions would need to be cut by 31%.
- Agriculture emissions would need to be reduced by 23% and emissions from industrial processes, which includes chemical and metal production, by 22%. Waste emissions would only need to be cut by 5%.

5

The electricity sector can and should do more to reduce emissions.

- Cost-effective technologies such as energy efficiency, renewable energy and storage are readily available and can be rapidly deployed to reduce electricity emissions, creating the time for policies in other sectors to be established and implemented.
- Several studies have consistently found that there are no technical barriers to Australia achieving secure, reliable power from a very high proportion of renewable electricity.
- In contrast, there are far fewer opportunities to rapidly reduce emissions from other sectors, especially agriculture and fugitive emissions.

1. Introduction

In 2017, Australia's greenhouse gas emissions increased for the third consecutive year, approaching all-time highs (excluding the land use - LULUCF - sector) (Australian Government 2018). In order to limit global temperature rise and tackle increasing extreme weather fuelled by climate change, the Federal Government has committed to the near-universally agreed Paris Climate Agreement. As part of this agreement, the Federal Government has set in place an initial target to reduce Australia's greenhouse gas emissions by 26-28% below 2005 levels by 2030 (Department of the Environment and Energy 2015).

Australia's 2030 emissions reduction target of 26-28% falls significantly short of what is required to effectively tackle climate change. The Climate Change Authority recommended a 45-65% emissions reduction target for 2030 below 2005 levels, based on scientific evidence, what comparable countries are doing and what is in the best interests of Australia (Climate Change Authority 2015). Recent analysis implies that Australia will not meet its woefully inadequate 26-28% emissions reduction target (UNEP 2017).

If all other countries were to have similar climate policies to Australia's, then global average temperature could reach over 3°C and up to 4°C above pre-industrial levels (Climate Action Tracker 2018). A four degree world would make it very difficult for human civilisation to cope, putting billions of lives in danger (New et al. 2011).

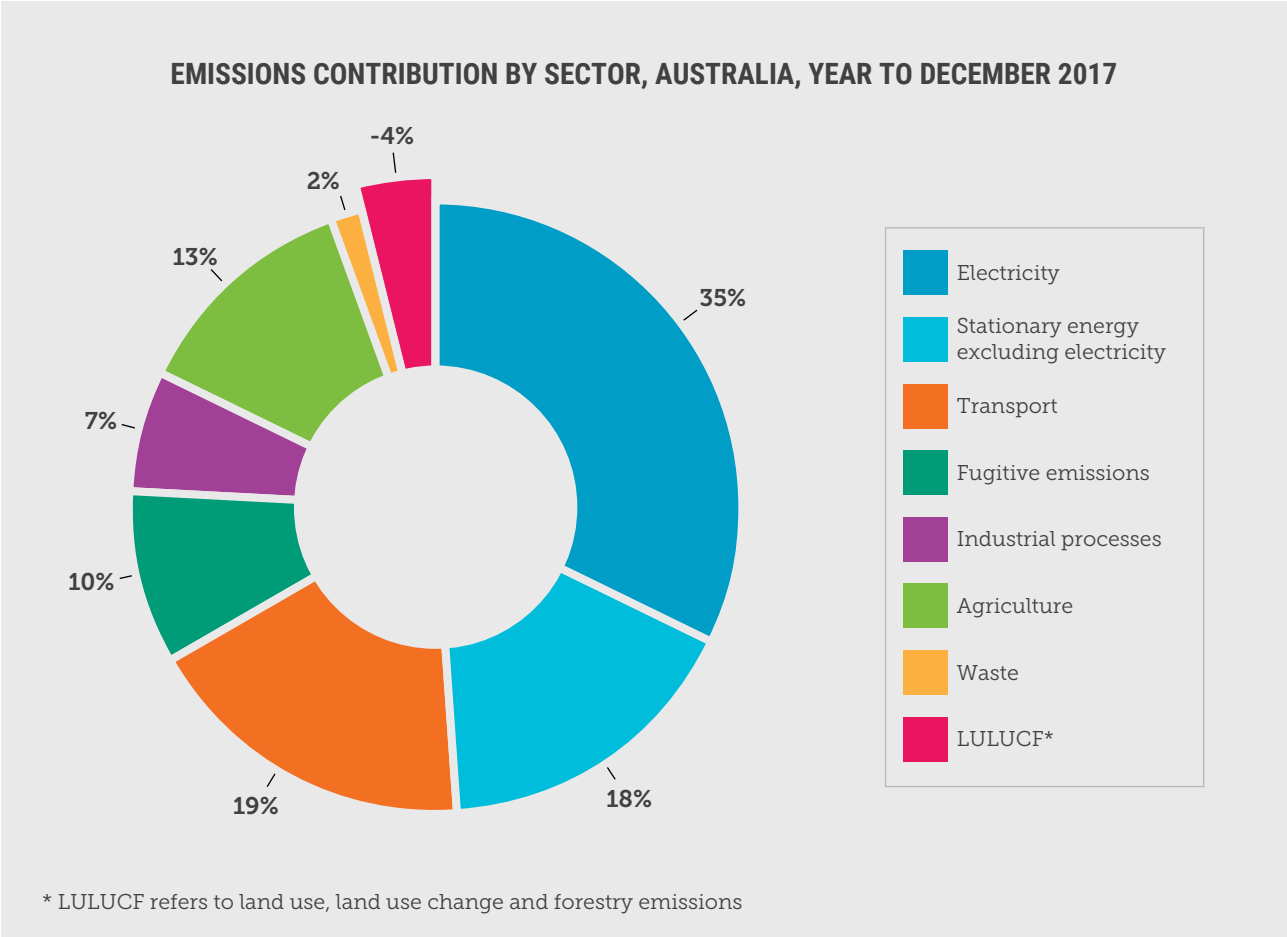
Australia is already experiencing the impacts of climate change. The world has just experienced the hottest five-year period (2013-2017) ever recorded. This record is part of a sharp, long-term upswing in global temperatures, with 17 of the 18 hottest years on record all occurring in this century. Increasing global temperatures, driven primarily by higher carbon dioxide levels from the burning of fossil fuels, is exacerbating extreme weather events around the globe and in Australia. Heatwaves are now hotter, lasting longer and occurring more often. Rising ocean temperatures are triggering coral bleaching events on the Great Barrier Reef.

Australia's greenhouse gas emissions have increased for a third consecutive year.

Climate change is also increasing extreme bushfire weather in southern and eastern Australia, while climate change is likely worsening drought conditions in southwest and southeast Australia. Across Australia, extreme weather events are projected to worsen as the climate warms further, increasing the vulnerability of Australia's ageing energy infrastructure to blackouts.

Australia has eight major sectors responsible for the majority of our greenhouse gas emissions. These sectors are electricity, transport, stationary energy (fuels like gas consumed directly rather than used for electricity), agriculture, fugitive emissions (gases leaked or vented from fossil fuel extraction and use), industrial processes, waste, and land use, land use change and forestry (LULUCF).

Figure 1: There are eight sectors that are responsible for Australia's greenhouse gas emissions. Note that the land use (LULUCF) sector was classified as a carbon sink in 2017. Due to uncertainties around the calculation of LULUCF emissions, it is not certain that the LULUCF sector actually constituted a carbon sink.



Source: Adapted from Australian Government (2018).

Australia will not meet its woefully inadequate 2030 emissions reduction target under current policies.

There are only a handful of Federal Government policies designed to achieve emissions reductions.

In electricity, the Federal Government's National Energy Guarantee proposes emissions reductions of 26% from the National Electricity Market (which covers all states and territories except Western Australia and the Northern Territory) (Energy Security Board 2017).

Figure 2: Climate change is worsening extreme weather events, posing a threat to energy infrastructure, such as these transmission lines near Churchill Park in 2009.

The Federal Government's Emissions Reduction Fund has helped fund a number of emissions reduction projects across several sectors, including agriculture and waste. However, most of these projects are yet to deliver any emissions reductions (Clean Energy Regulator 2017; Climate Council 2016). Only 30.5 million tonnes of carbon abatement have so far been delivered out of the total 191.7 million tonnes that were contracted under the fund (The Guardian 2018).

The National Energy Productivity Plan aims to improve Australia's energy productivity – calculated by dividing Australia's Gross Domestic Product by energy use – by 40% between 2015 and 2030 (COAG Energy Council 2015).

Australia has also begun restricting the amount of hydrofluorocarbons permitted to be imported into Australia between now and 2036. This policy is expected to lead to an 85% reduction in these emissions by 2036 (Department of the Environment and Energy 2018a).

There has also been proposals from the Federal Government to improve vehicle emissions and fuel efficiency standards that may help reduce car and light vehicle emissions (Australian Government 2017). These policies are at an early stage of development. Current and proposed federal policies to reduce emissions from other sectors - stationary energy, fugitive emissions, industrial processes or waste – are lacking.

Under current policy settings, Australia will not meet its 26-28% emissions reduction target (UNEP 2017). Australia lacks an overarching credible plan to reach its emissions reduction targets across the economy. In fact, Australia's emissions are projected to be higher in 2030 than they were in 2017 (Australian Government 2017). The Australian Government's emissions projections which take into account the National Energy Productivity Plan, the Emissions Reduction Fund and the phase-down of hydrofluorocarbons still see Australia's emissions rising from 556.4 $MtCO_2e$ in 2017 to 566 $MtCO_2e$ in 2030 (excluding LULUCF) (Australian Government 2017). This is 8-9% above 2005 levels (excluding LULUCF).

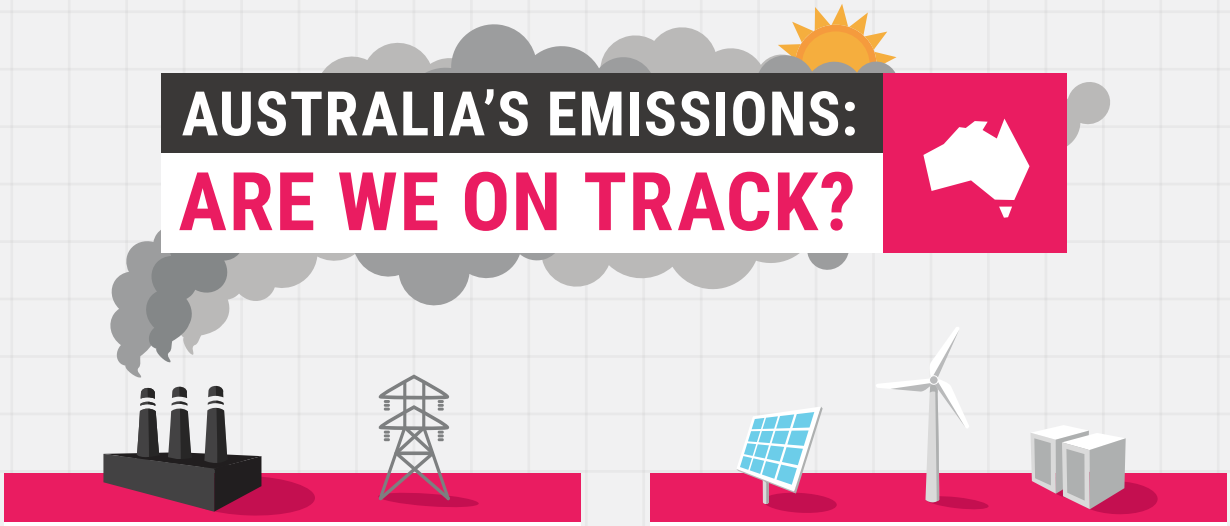
The Federal Government's emissions reduction target included in the National Energy Guarantee is designed to reduce emissions in the National Electricity Market by 26%. This implies that all other sectors of the economy will also have to reduce emissions by 26-28%. Cutting emissions from these sectors will be far more expensive and difficult (ClimateWorks 2017). Emissions are growing strongly in each of these other sectors (other than waste). However, by quickly transitioning to renewable energy and storage, the electricity sector can and should be responsible for a far larger amount of emissions reductions, reducing the burden on other sectors such as agriculture and stationary energy.

This working paper profiles seven of Australia's largest emitting sectors, focusing on whether emissions are going up or down in each sector and the reasons for the observed trends. It also assesses what opportunities and policies each sector has to reduce emissions. This working paper also analyses the magnitude of the emissions reductions required between now and 2030 if each sector were to reduce emissions by 26-28% below 2005 levels. The working paper concludes that Australia's emissions reduction target is far too weak to meet our commitments under the Paris Climate Agreement and we are not on track to meet even this weak target.

Although land use emissions are an important source of greenhouse gas emissions, they are not explored in detail in this working paper due to significant variability and unreliability in data and methodologies (Climate Council 2016).

The National Energy Guarantee places a greater burden on sectors of the economy where emissions reductions will be more challenging and more expensive.

Figure 3: The electricity sector is responsible for 33% of Australia's greenhouse gas emissions and emissions in the sector fell in 2017. Emissions increased in every other sector. The electricity sector has the best prospects for further emissions reductions.



EMISSIONS

Sector	Proportion of greenhouse gas emissions in 2017	Emissions trajectory in 2017	Prospects for further emissions cuts	On track for 26-28% emissions reduction by 2030 under current policies?
Electricity	33%	Down	Very good	No
Transport	18%	Up	Moderate/ Difficult	No
Stationary energy (excluding electricity)	17%	Up	Moderate	No
Agriculture	13%	Up	Difficult	No
Fugitive emissions	10%	Up	Difficult	No
Industrial processes	6%	Up	Moderate	No
Waste	2%	Up	Good	Yes

* LULUCF refers to land use, land use change and forestry emissions

2. Australia's rising emissions

Australia's greenhouse gas emissions are rising. 2017 was the third consecutive year that Australia's emissions have risen, reaching 556.4 $MtCO_2e$ (excluding LULUCF emissions)[1]. This is approaching all time highs.

Australia's greenhouse gas emissions increased by 1.5% in 2017 from 2016, largely driven up by increasing liquefied natural gas (LNG) exports, which caused increases in stationary energy emissions and fugitive emissions. The coal seam gas LNG industry also kept electricity emissions higher than they otherwise would have been, as gas production consumes significant quantities of electricity.

There are eight major sectors responsible for Australia's greenhouse gas emissions: electricity, transport, stationary energy, agriculture, fugitive emissions, industrial processes, waste and land use, land use change and forestry (LULUCF).

Emissions from most sectors have been increasing since 1990, the year the first United Nations Intergovernmental Panel on Climate Change report was published. Since 1990, electricity emissions have increased by 42%, transport emissions by 63%, stationary energy emissions by 47%, fugitive emissions by 49% and industrial processes by 37%. In contrast agricultural emissions declined by 11% and waste emissions declined by 37% (Australian Government 2018).

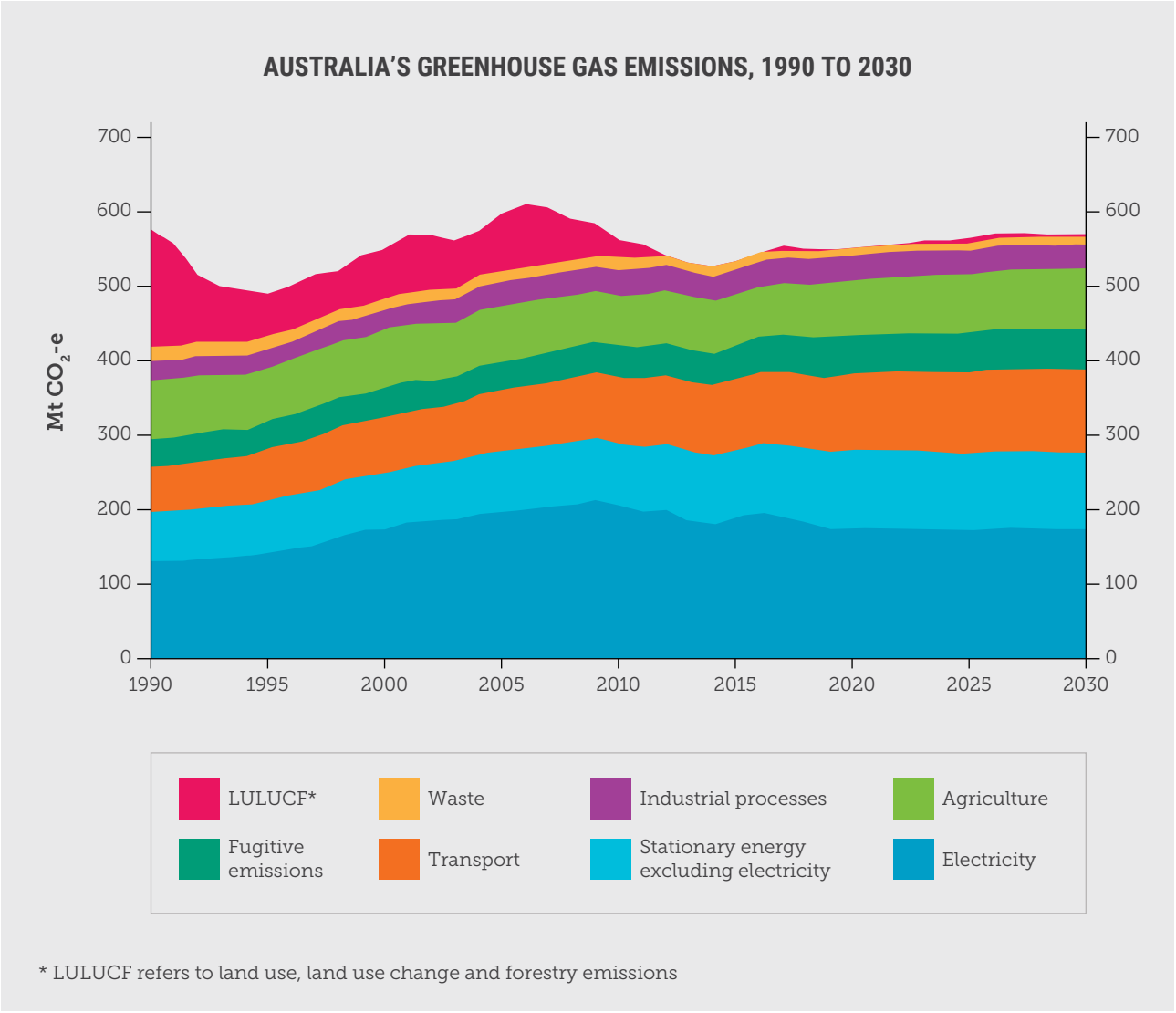
Federal Government projections show that emissions in all sectors except electricity, industrial processes and waste are expected to increase to 2030 without further policies or action (Australian Government 2017). These projections incorporate the effects of existing policies such as the National Energy Productivity Plan, the Emissions Reduction Fund and the legislated phase down of hydrofluorocarbons. The projections do not include the proposed National Energy Guarantee which only applies to the electricity sector.

Changing Australia's worrying trajectory will require credible and comprehensive emissions reduction policies that cover all sectors of the economy.

Australia's greenhouse gas emissions are approaching all time highs.

1 Data on Australia's total emissions in 2017 is from Australian Government (2018) Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2017. 18 May 2018. Accessed at: http://www.environment.gov.au/system/files/resources/7b9824b8-49cc-4c96-b5d6-f03911e9a01d/files/nggi-quarterly-update-dec-2017-revised.pdf

Figure 4: Australia's greenhouse gas emissions are projected to be similar to 2017 levels in 2030 under current policies.



* LULUCF refers to land use, land use change and forestry emissions

Source: Adapted from Australian Government (2017).

Table 1: Australia's greenhouse gas emissions rose for the third consecutive year in 2017, driven by significant increases in emissions from transport, stationary energy and fugitive emissions.

Sector	Annual emissions excluding LULUCF (Year to Dec 2017) ($MtCO_2e$)	% of Australia's emissions (Year to Dec 2017)	% increase (Year to Dec 2017)	Prospects for emissions reductions to 2030:
Total	556.4	100	+ 1.5	
Electricity	184.5	33	- 3.1	Very good
Transport	100.0	18	+ 3.4	Moderate/Difficult
Stationary energy (excluding electricity)	96.9	17	+ 3.8	Moderate
Agriculture	71.2	13	+ 1.0	Difficult
Fugitive emissions	55.4	10	+ 10.5	Difficult
Industrial processes	35.8	6	+ 2.9	Moderate
Waste	12.6	2	+ 1.0	Good

Source: Australian Government 2017; 2018.

Figure 5: Renewable energy and storage projects, such as the Kidston solar and pumped hydro project in Queensland (below), can drive significant reductions in greenhouse gas emissions from the electricity sector.

3. Assessing Australia's 2030 emissions reduction target

What is Australia's fair share?

The higher the amount of greenhouse gases like carbon dioxide (CO_2) in the atmosphere, the higher global temperature will rise. Fossil fuels, like coal, oil and gas, are the primary driver of the increasing amount of CO_2 in the atmosphere. It is widely accepted that keeping an increase in global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C above pre-industrial levels is critical if we are to limit devastating climate impacts on our health, our economy and on natural ecosystems. This is reflected in the Paris Climate Agreement which Australia has ratified. Just over half this level of temperature rise (1°C) has already occurred, resulting in accelerated climate impacts like worsening heatwaves, bushfires, intense rainfall and and rising sea levels.

The carbon budget is an approach that can tell us how much additional CO_2 can be "spent" over coming years while still having a strong chance of staying below a certain rise in global temperature. It is calculated using probabilities: the less CO_2 emitted, the greater the chance of limiting temperature rise.

Globally, cumulative emissions since the beginning of the industrial revolution through 2017 are estimated to have been 575 billion tonnes of carbon dioxide (measured as gigatonnes of carbon as CO_2, or Gt C). This leaves a remaining global carbon budget of 425 Gt C before the world needs to reach net zero emissions. These calculations are based on the Intergovernmental Panel on Climate Change AR5 (2013) global carbon budget of 1,000 Gt C (emitted as CO_2), which reflects a 66% chance of limiting warming to 2°C. Non-CO_2 greenhouse gases are assumed to be reduced at the same rate as CO_2 is reduced to meet the overall carbon budget.

Australia's share of the remaining global carbon budget is around 5,500 Mt CO_2e. This share is calculated based on Australia's share of the global population. If Australia's emissions continue at current rates (556 Mt CO_2e in 2017) we have barely 10 years remaining of our carbon budget and will completely exhaust it before 2030.

For more information about the carbon budget, please refer to the Climate Council report:

"Unburnable Carbon: Why we need to leave fossil fuels in the ground".

The Australian Government's 2030 emissions reduction target

The Australian Government has committed to a 26-28% emissions reduction target for 2030 (below 2005 levels).

Under the National Energy Guarantee the Federal Government has proposed that the electricity sector would reduce its emissions by a 'pro-rata' share of 26% below 2005 electricity sector levels by 2030. This approach implies that other sectors would also be required to reduce emissions to 26% below 2005 levels by 2030.

The Federal Government has yet to confirm its methodology and approach for how the national emissions reduction target and the cumulative emissions budget for the nation, and each sector, will be calculated. International negotiations may also have an impact on these methodologies.

In Table 2 we have calculated the emissions reductions required for other sectors of the economy if these sectors were required to meet their equivalent 26% pro-rata share. For many sectors such as fugitive emissions and transport, significant reductions are required before 2030. Land use, land use change and forestry emissions are excluded. These calculations are based on the limited information available from the Federal Government, and assume each sector reduces its emissions to 26% below the sector's emissions in 2005. The calculations are intended to give an indication of the emissions reductions required for other sectors. These numbers are approximations due to the lack of detailed methodology from the Federal Government regarding how its 2030 target would be calculated.

Table 2: The cumulative emissions reduction burden on different sectors if Australia is to achieve a 26% emissions reduction across every sector, as is implied under the Federal Government's proposed National Energy Guarantee.

Sector	2018 - 2030 cumulative emissions reduction required (compared to BAU projections) to achieve 26% below 2005 levels by 2030	Annual emissions reduction required between 2021 - 2030	Actual: current annual emissions growth year to December 2017 (Australian Government 2018)
Total	15%	- 2.2%	+ 1.5%
Electricity	8%	- 1.8%	- 3.1%
Transport	33%	- 5.0%	+ 3.4%
Stationary energy (excluding electricity)	31%	- 5.3%	+ 3.8%
Agriculture	23%	- 2.9%	+1.0%
Fugitive emissions	33%	- 5.5%	+10.5%
Industrial processes	22%	- 3.5%	+2.9%
Waste	5%	- 0.5%	+1.0%

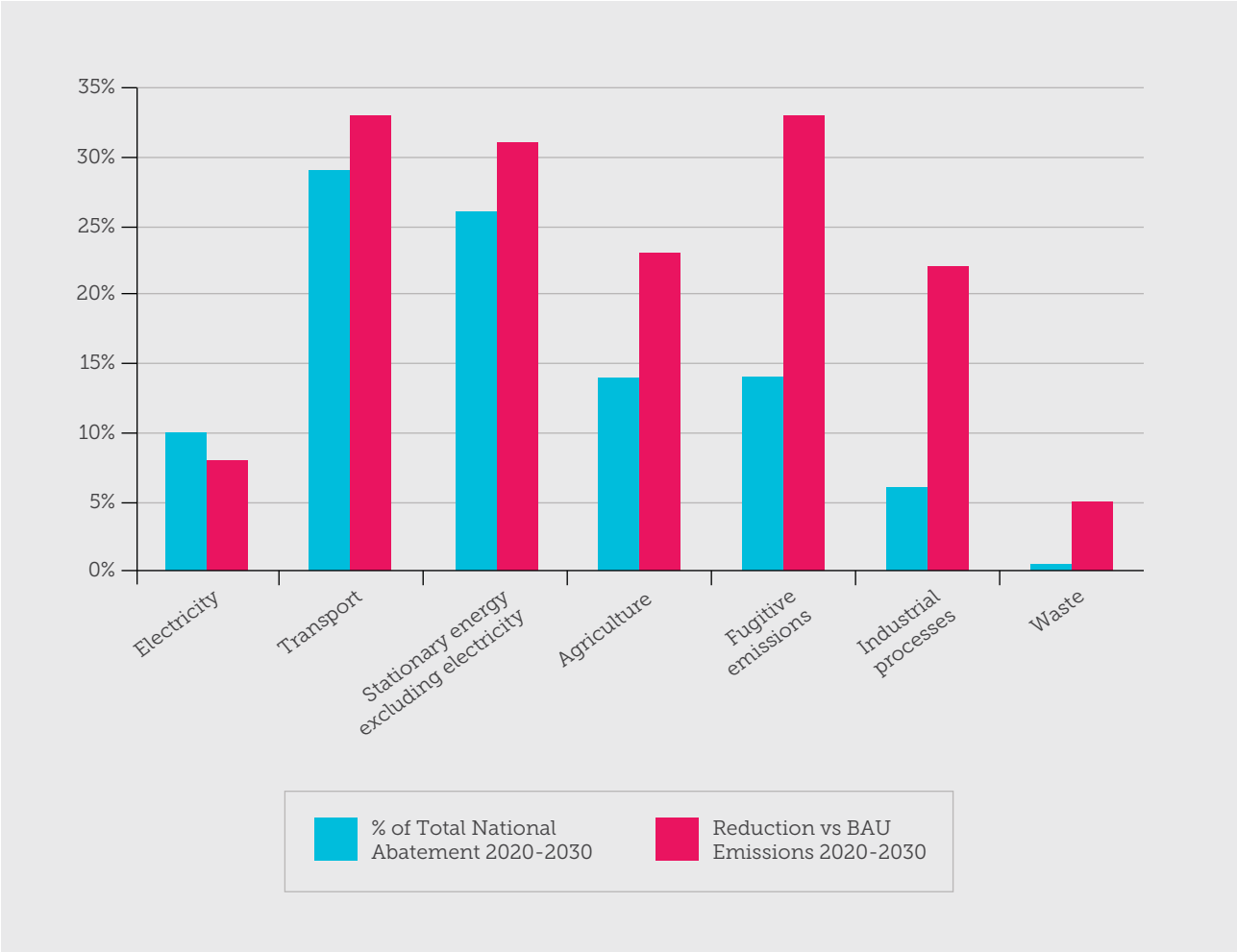
Note: Calculations in columns 2 and 3 are based on a 26% reduction on 2005 levels by 2030, achieved via a linear trajectory from 2020 to 2030. Business as usual is based on Australian Government projections (Australian Government 2017).

Table 2 assumes the Australian Government's emissions projections contained within its most recent update "Australia's Emissions projections 2017", to be 'business as usual' (BAU) (Australian Government 2017).

From 2018 the projected cumulative emissions through 2030 will exceed 6,000 Mt CO_2e if emissions are reduced on a linear trajectory from 2018 to 2030 (assuming that Australia meets the weaker end of its emission reduction target range – 26% on a 2005 baseline). This amount far exceeds Australia's remaining share of the global carbon budget.

Furthermore, reducing emissions by 26% on a 2005 baseline would still leave Australia with a significant task of reaching net zero emissions well before 2050.

Figure 6: This graph shows the national abatement challenge to 2030 (to attain a 26% reduction nationally compared to 2005) cumulatively by sector (between 2020 and 2030) and the % reduction in each sector versus BAU. This demonstrates how little the electricity sector is being asked to do over the next decade. By contrast, transport and stationary energy sectors have far greater burdens.



4. Sector Profiles:

Electricity

Emissions trajectory since 2005: Down

Emissions projections to 2030: Down

Prospects for emissions reduction: Very good

Electricity emissions are produced by burning fossil fuels to produce electricity. Fossil fuels include coal, gas and oil (diesel).

Changes in emissions:

Electricity is the largest source of greenhouse gas emissions in Australia, responsible for 33% of emissions. The sector produced 184.5 $MtCO_2e$ in 2017, which was 3.1% lower than 2016 levels (Australian Government 2018).

Electricity emissions have decreased by 6.4% since 2005, when the sector was responsible for 197 $MtCO_2e$.

Why are emissions changing?

Increasing electricity demand drove up electricity emissions until 2009, when emissions began to fall as higher levels of renewable energy displaced less competitive old coal fired power stations. The introduction of the Carbon Pricing Mechanism in 2012 also drove emissions reductions. Electricity demand also fell over this period due to increased uptake of rooftop solar, greater energy efficiency and the closure of some large industrial facilities. Once the Carbon Pricing Mechanism was repealed in 2014, electricity emissions began to increase again until the Hazelwood brown coal fired power station closed, causing a fall in electricity emissions in 2017 (Australian Government 2018).

Electricity emissions can be reduced further with energy efficiency, renewable energy and storage technologies.

What level do emissions need to be in 2030 for a 26% reduction?

Reducing electricity emissions by 26% below 2005 levels only requires the sector to reduce cumulative emissions to 2030 by 8% from current levels compared to business as usual.

Electricity emissions are currently projected to fall before 2020 as new renewable energy projects are built to fill the Renewable Energy Target (RET) and then flat-line between 2020 and 2030 (Australian Government 2017). These projections do not take into account the effect of the proposed National Energy Guarantee.

Are there any federal or state government policies? Are these policies working?

At the national level, the RET, complemented by investments from the Clean Energy Finance Corporation and grants from the Australian Renewable Energy Agency, have driven increased investment in renewable energy such as wind and solar. These policies, along with the now abolished Carbon Pricing Mechanism, have driven significant growth in renewable energy and reduced reliance on brown coal over the last decade and have helped to reduce emissions from the electricity sector. The cost of renewable energy technologies has fallen significantly over a similar timeframe, driven by economies of scale, global cost reductions and greater experience in installations (IRENA 2017).

The Renewable Energy Target will be fulfilled by new capacity by 2020. After 2020, the Federal Government is proposing to introduce the National Energy Guarantee (Energy Security Board 2017). In its current form, the National Energy Guarantee will lock in an inadequate emissions reduction target of 26% by 2030 (Climate Council 2018). The National Energy Guarantee may not even achieve 26% emissions reductions across the whole electricity sector as the proposed policy would not apply to Western Australia and the Northern Territory, emissions intensive trade exposed companies would be exempt and offsets could be included (Climate Council 2018).

State and territory governments in the ACT, Tasmania, Queensland, Victoria, New South Wales and South Australia have all set emissions reduction targets of at least 100% (or, 'net zero' emissions) by 2050. Several states and territories have also set renewable energy targets including the ACT (100% by 2020), Tasmania (100% by 2022), Victoria (40% by 2025), Queensland (50% by 2030) and the Northern Territory (50% by 2030) (Climate Council 2018). Along with projects already contracted, renewable energy to be built through reverse auctions conducted in Victoria and Queensland this year may go most of the way towards ensuring the sector achieves its 2030 target. If the first round of these two states' initiatives are subsumed by the National Energy Guarantee in its current form, these states would account for much of new renewable energy growth over the decade to 2030 (Green Energy Markets 2018).

There are opportunities to significantly reduce emissions from the electricity sector.

What are the opportunities to reduce emissions in this sector?

There are opportunities to significantly reduce emissions from the electricity sector. Fossil fuels can be replaced overtime by renewable energy like wind and solar, together with other technologies such as energy efficiency, demand management and energy storage (like batteries and pumped hydro) (ClimateWorks 2017). These technologies could reduce electricity emissions significantly over the next decade. Numerous studies have consistently found there are no technical barriers to Australia achieving secure, reliable power from a very high proportion of renewable electricity (AECOM 2012; AEMO 2013; CSIRO 2017; Elliston et al 2013; Finkel 2017; Lenzen et al 2016; Stocks et al 2017; Teske et al 2016).

If the electricity sector were to deliver higher emissions abatement to reduce emissions at least 60% below 2005 levels by 2030, it would lower the emissions reduction task for other sectors significantly. Given the current rate of renewable energy construction and industry momentum, along with the challenges to reducing emissions in the other sectors, the electricity sector can and should carry more of the nation's emissions reduction burden.

Figure 7: Coal and gas power stations, such as South Australia's Torrens Island gas power station (pictured), are responsible for most of Australia's electricity sector emissions.

Transport

Emissions trajectory since 2005: Up

Emissions projections to 2030: Up

Prospects for emissions reduction: Moderate/Difficult

Transport emissions are produced from the combustion of fuels (like petrol, diesel, aviation and bunker fuel) for transportation, including road, rail, domestic aviation, domestic shipping, off-road recreational vehicles and gas pipeline transport.

Emissions from the production and refining of oil-based fuels and electricity for vehicles and rail are not included in this sector's emissions, nor are emissions from international flights.

Changes in emissions:

Transport is currently the second largest source of emissions in Australia, responsible for 18% of the country's emissions. The sector emitted 100 $MtCO_2e$ in 2017, 3.4% above 2016 levels (Australian Government 2018). Cars are responsible for almost half (44$MtCO_2e$) of transport emissions (Australian Government 2017).

Emissions have increased by 22% since 2005, when the sector was responsible for just 82 $MtCO_2e$ (Australian Government 2017).

Why are emissions going up?

Transport emissions have been steadily rising as population growth has led to a higher number of cars on the road, while increased demand for freight is driving up truck emissions. Domestic air travel continues to increase, leading to an increase in aviation emissions (Australian Government 2017).

What level do emissions need to be in 2030 for a 26% reduction?

Reducing transport emissions by 26% below 2005 levels requires the sector to cut its emissions by a third by 2030 compared to business as usual.

Transport emissions are expected to continue increasing until 2030, largely driven by the forecast increase in domestic aviation and heavy vehicle, passenger and freight emissions. Improvements in vehicle efficiency and greater uptake of electric vehicles are projected to reduce car and light commercial vehicles' share of transport emissions between 2025 and 2030 (Australian Government 2017). Under current policy settings and projections, Australia will not achieve a 26% reduction in emissions below 2005 levels in the transport sector by 2030 (Australian Government 2017).

Are there any federal or state government policies? Are these policies working?

The Federal Government is currently considering new fuel efficiency, fuel quality and vehicle emissions standards, which would help to reduce emissions from the transport sector if implemented (Department of Infrastructure, Regional Development and Cities 2018). Australia remains one of a minority of countries without such standards and the only OECD country without an official fuel efficiency target (ICCT 2015).

Public transport investment and moving towards electric cars, bikes, trucks and buses can help reduce transport emissions.

What are the opportunities to reduce emissions in this sector?

There are some opportunities to reduce transport emissions through mode shift to public and active transport alternatives, and moving towards electric cars, bikes, trucks and buses. The cost of electric vehicles continues to drop and with strong policies, current technologies could lead to a significant reduction in emissions from road-based transport (IEA 2017). However, the turnover of vehicles is slow, restricting the speed at which electric vehicles can replace fuel combustion engines. The amount of emission reductions achieved by a shift to electric vehicles depends on when policies such as vehicle emissions standards are introduced and how rapidly the electricity generation sector converts from fossil fuel to renewable energy sources.

Achieving emissions reductions in aviation and shipping will be more difficult but could potentially be achieved through greater use of biofuels.

Figure 8: Aviation emissions from domestic travel are projected to continue rising to 2030.

Stationary Energy

Emissions trajectory since 2005: Up

Emissions projections to 2030: Up

Prospects for emissions reduction: Moderate

Stationary energy emissions (also called direct combustion) are produced from burning fuels for energy used directly (rather than to generate electricity), either in the form of heat, steam or pressure. This includes emissions from energy production, mining, manufacturing, commercial and residential buildings (mainly from heating), agriculture, forestry, fishing and the military.

Emissions from electricity generation and transport are excluded from this sector, which have their own categories.

Changes in emissions:

Stationary energy is currently the third largest source of greenhouse gas emissions in Australia, responsible for 17% of emissions. The sector produced 96.9 $MtCO_2e$ in 2017, 3.8% above 2016 levels (Australian Government 2018). Manufacturing is responsible for one third of these emissions (33%), followed by direct energy use (23%), buildings (19%) and mining (16%) (Australian Government 2017).

Stationary energy emissions have increased by 18.2% since 2005, when the sector was responsible for 82 $MtCO_2e$.

Why are emissions going up?

Stationary energy emissions from LNG and mining operations have been increasing due to a large increase in the number of LNG production plants and higher demand for commodities such as coal and iron ore over the past decade or more (Australian Government 2017; 2018).

What level do emissions need to be in 2030 for a 26% reduction?

Reducing stationary energy emissions by 26% below 2005 levels requires the sector to reduce cumulative emissions to 2030 by 31% from current levels compared to business as usual.

Emissions are projected to increase to 2020 as Australia's LNG production and exports continue to rise, while mining emissions are predicted to rise until 2022. Thereafter emissions are expected to be broadly flat, with a fall in building emissions offset by an increase in agricultural emissions (Australian Government 2017). Under current policy settings and projections, Australia will not achieve a 26% reduction in emissions in the stationary energy sector by 2030.

Are there any federal or state government policies? Are these policies working?

The National Energy Productivity Plan aims to improve Australia's energy productivity by 40% between 2015 and 2030 (COAG Energy Council 2015). So far, there have been few policies or regulations implemented as part of this plan, other than Clean Energy Finance Corporation funding for energy efficiency projects (COAG Energy Council 2017). A number of state and territory governments have also established energy efficiency and productivity programs, while the Federal Government have established greenhouse and energy minimum standards for appliances and energy efficiency requirements for new non-residential buildings (Department of the Environment and Energy 2018b).

The Emissions Reduction Fund could also help reduce stationary energy emissions, although to date few projects have been implemented (Clean Energy Regulator 2017). These programs will help reduce the emissions intensity of a range of sectors, including stationary energy emissions from manufacturing, buildings and mining.

Stationary energy emissions are on the rise due to LNG, coal and iron ore exports.

What are the opportunities to reduce emissions in this sector?

Reducing our reliance on fossil fuels and increasing our use of renewable energy can help reduce stationary energy emissions. Improvements in energy efficiency can also help reduce emissions. For example, renewable energy can be an alternative to gas in many applications (ARENA 2015). However, compared to the electricity sector, reducing emissions from stationary energy is often more expensive, and some applications in manufacturing, buildings and mining operations will require further technological breakthroughs and development (ClimateWorks 2017). The many large LNG plants that have just been built are costly to change and, with expected lives of 30 to 50 years, will make reductions in this sector by 2030 difficult.

Figure 9: Stationary energy emissions have been increasing over the past decade largely as a result of increasing LNG production (pictured) and mining operations.

Agriculture

Emissions trajectory since 2005: Down

Emissions projections to 2030: Up

Prospects for emissions reduction: Difficult

Agriculture emissions include methane and nitrous oxide produced by the digestive processes of animals (such as cattle and sheep), manure management, rice cultivation, agricultural soils and field burning of agricultural residues. It also includes carbon dioxide emissions produced by the application of fertilizers, including urea and lime.

Emissions from agricultural machinery are excluded from this sector as they are included in another category. Methane and nitrous oxide are the main type of agriculture emissions. It should be noted that the majority of carbon dioxide emissions from agriculture are considered part of the natural carbon cycle and are not counted.

Changes in emissions:

Agriculture is currently the fourth largest source of greenhouse gas emissions in Australia, responsible for 13% of Australia's emissions. The sector produced 71.2 $MtCO_2e$ in 2017, a 1% increase from 2016 (Australian Government 2018). Two-thirds of agricultural emissions (46 $MtCO_2e$) are the result of grazing beef and sheep (Australian Government 2017).

Emissions have decreased by 6.3% since 2005, when the sector was responsible for 76 $MtCO_2e$.

Why are emissions going down?

Periods of low rainfall during the millennium drought have reduced agricultural activity, causing an overall fall in emissions from the sector over the past 13 years (Australian Government 2017).

What level do emissions need to be in 2030 for a 26% reduction?

Reducing agriculture emissions by 26% below 2005 levels requires the sector to reduce cumulative emissions to 2030 by 23% from current levels compared to business as usual.

Agricultural emissions are predicted to increase up to 2030 due to "an assumed return to average seasonal conditions" and increased food demand (Australian Government 2017). However, the effects of climate change increase the likelihood that average seasonal conditions will not return (Climate Council 2015). Under current policy settings, Australia is unlikely to achieve a 26% reduction below 2005 levels in emissions in the agriculture sector by 2030.

Are there any federal or state government policies? Are these policies working?

The Federal Government's Emissions Reduction Fund (which succeeded the Carbon Farming Initiative) has helped fund a number of emissions reduction projects across several sectors, including agriculture. However, most of these projects have not yet delivered any emissions reductions (Clean Energy Regulator 2017; Climate Council 2016). Only 30.5 million tonnes of carbon abatement have so far been delivered out of the total 191.7 million tonnes that were contracted under the fund (The Guardian 2018). This program was not provided with any further funding in the Federal Government's 2018 budget (Sydney Morning Herald 2018b).

Reduced agricultural activity during the millennium drought caused this sector's emissions to fall.

What are the opportunities to reduce emissions in this sector?

There are limited opportunities to reduce emissions in the agricultural sector. Reducing emissions will require both change to agricultural practices and significant behavioural change. Possible solutions include greater use of regenerative agriculture and managed grazing (Hawken 2017).

Achieving emissions reductions in the sector will be very difficult. Placing a significant emissions reduction burden on agriculture will place even more pressure on a sector that is already doing it tough.

Figure 10: Grazing beef and sheep are responsible for two thirds of Australia's agriculture emissions.

Fugitive Emissions

Emissions trajectory since 2005: Up

Emissions projections to 2030: Up

Prospects for emissions reduction: Difficult

Fugitive emissions are produced when greenhouse gases like methane and carbon dioxide are released (through venting or leaks) during the extraction, processing and delivery of fossil fuels. It does not include emissions produced when these fuels are burnt during the generation of electricity, operating mining equipment or transporting fossil fuels, which are covered in other categories.

Changes in emissions:

Fugitive emissions are the fifth largest source of greenhouse gas emissions in Australia, responsible for 10% of emissions. The sector produced 55.4 $MtCO_2e$ in 2017, a 10.5% increase from 2016 (Australian Government 2018). Fugitive emissions are mostly released from underground coal mines, coal seam gas and conventional gas production. Gas and coal production are each responsible for around 43% of fugitive emissions (Australian Government 2017).

Emissions have increased by 42.1% since 2005, when the sector was responsible for 39 $MtCO_2e$.

Why are emissions going up?

Fugitive emissions have increased significantly due to Australia's increasing LNG production and exports. When gas is extracted, significant amounts of greenhouse gases, particularly methane, are released into the atmosphere (Australian Government 2017; 2018).

Fugitive emissions have increased significantly due to Australia's growing LNG exports.

What level do emissions need to be in 2030 for a 26% reduction?

Reducing fugitive emissions by 26% below 2005 levels requires the sector to reduce cumulative emissions to 2030 by 33% from current levels compared to business as usual.

LNG production is projected to drive further increases in fugitive emissions to 2020 before growing more slowly to 2030 (Australian Government 2017). Under current policy settings, Australia will not achieve a 26% reduction in fugitive emissions below 2005 levels by 2030.

Are there any federal or state government policies? Are these policies working?

Some states have introduced statewide moratoriums on coal seam or unconventional gas extraction including Western Australia and Tasmania and it has been legislatively prohibited in Victoria. There are plans to ban unconventional gas extraction in parts of Western Australia and South Australia (Sydney Morning Herald 2018a). These policies will not reduce fugitive emissions from current levels but they will help to prevent further increases. In April 2018, the Northern Territory Government lifted its moratorium on unconventional gas exploration (Sydney Morning Herald 2018a).

There are no Federal Government policies expected to reduce fugitive emissions.

What are the opportunities to reduce emissions in this sector?

By transitioning to renewable energy and away from coal and gas, fugitive emissions can be eliminated in coming decades. However, this would also require Australia's economy to transition away from exporting coal and LNG, which were Australia's second and fourth largest exports respectively in 2016-17 (Austrade 2017). In the shorter term, greater methane burning (rather than venting) from gas production sites and coal mines could help reduce fugitive emissions.

Figure 11: Increasing LNG extraction from coal seam gas wells (pictured) has driven a significant increase in fugitive emissions.

Industrial Processes

Emissions trajectory since 2005: Up

Emissions projections to 2030: Down

Prospects for emissions reduction: Moderate

Emissions from industrial processes are produced as a by-product of materials and reactions used in production processes. These include the production of chemical, metal and mineral products and the consumption of synthetic gases.

Changes in emissions:

Emissions from industrial processes are the sixth largest source of greenhouse gas emissions in Australia, responsible for 6% of Australia's emissions. The sector produced 35.8 $MtCO_2e$ in 2017, a 2.9% increase from 2016. These increases were driven by higher iron and steel production as well as increasing emissions from products that are replacing ozone depleting substances (Australian Government 2018).

Emissions have increased by 11.9% since 2005, when the sector was responsible for 32 $MtCO_2e$.

Why are emissions going up?

Increases in emissions from industrial processes over the past decade have been driven by the replacement of ozone depleting substances with other substances that are greenhouse gases, such as hydrofluorocarbons. These emissions are responsible for 13 $MtCO_2e$, over one third of all emissions from industrial processes in Australia (Australian Government 2018).

Increased emissions from industrial processes have been driven by iron and steel production.

What level do emissions need to be in 2030 for a 28% reduction?

Reducing emissions from industrial processes by 26% below 2005 levels requires the sector to reduce cumulative emissions to 2030 by 22% from current levels compared to business as usual.

The phase-down of hydrofluorocarbons is expected to only marginally reduce emissions from industrial processes between 2020 and 2030 (Australian Government 2018). Under current policy settings, Australia will not achieve a 26% reduction below 2005 levels in emissions in the industrial processes sector by 2030.

Are there any federal or state government policies? Are these policies working?

Beginning in January 2018, Australia will restrict the amount of hydrofluorocarbons permitted to be imported into Australia between now and 2036. This policy is expected to lead to an 85% reduction in hydrofluorocarbon emissions by 2036 (Department of the Environment and Energy 2018a).

What are the opportunities to reduce emissions in this sector?

The phase down of hydrofluorocarbons will help reduce emissions from industrial processes by 2030. However, there are limited prospects to reduce emissions from the metal, mineral and chemical industries.

Figure 12: A large chemical plant in Germany. Emissions from industrial processes, including chemical production, are projected to continue increasing to 2030.

Waste

Emissions trajectory since 2005: Down

Emissions projections to 2030: Down

Prospects for emissions reduction: Good

Waste emissions are produced in landfill, waste water treatment, waste incineration and the biological treatment of solid waste. Methane is the major greenhouse gas that is produced when organic matter decays in the absence of oxygen.

Changes in emissions:

Waste emissions are the seventh largest source of greenhouse gas emissions in Australia, responsible for 2% of Australia's emissions. The sector produced 12.6 $MtCO_2e$ in 2017, a 1% increase from 2016. This increase was driven by an increase in emissions from solid waste disposal due to lower rates of methane capture at landfills (Australian Government 2018).

Emissions have decreased by 10% since 2005, when the sector was responsible for 14 $MtCO_2e$.

Why are emissions going down?

Prior to 2017, declines in waste emissions were driven by falling emissions from solid waste disposal due to higher rates of methane capture. However, methane capture rates fell in 2017 (Australian Government 2018).

What level do emissions need to be in 2030 for a 26% reduction?

Reducing waste emissions by 26% below 2005 levels requires the sector to reduce cumulative emissions to 2030 by 5% from current levels compared to business as usual.

Waste emissions are projected to decrease until 2022 as a result of increased recycling and methane capture. Beyond 2022, emissions are projected to rise again as a result of population growth and the conclusion of the Emissions Reduction

Waste emissions are expected to reduce to 2022 due to methane capture and increased recycling.

Fund. Overall, waste emissions are forecast to reduce to 10 $MtCO_2e$ in 2020 and still be at this level in 2030. If these projections are correct, the waste sector is broadly on track to reduce emissions by 26% below 2005 levels (Australian Government 2018).

Are there any federal or state government policies? Are these policies working?

The Federal Government's Emissions Reduction Fund has achieved some level of abatement of emissions in the waste sector. However, it is likely that many of these reductions in waste emissions would have occurred regardless. As such, waste emissions reductions credited under this program may not constitute additional reductions in emissions (The Guardian 2018).

This program was not provided with any further funding in the Federal Government's 2018 budget (Sydney Morning Herald 2018b).

What are the opportunities to reduce emissions in this sector?

In light of China's decision to no longer accept Australia's waste, there are opportunities for Australia to increase rates of reusing and recycling to reduce the amount of waste going into landfill. This will help reduce waste emissions.

By improving recycling rates and increasing methane capture, it is possible to continue reducing emissions from the waste sector. However, there is limited scope for deep and rapid reductions in emissions.

Figure 13: The waste sector has reduced emissions by 10% since 2005, largely as a result of methane capture.

5. The electricity sector can and should do more

The Federal Government's proposed emissions target for the National Energy Guarantee implies that each sector of the economy will contribute a (pro rata) 26-28% share to achieving Australia's 2030 emissions reduction target. However, this is not the most cost effective or technologically efficient way of achieving emissions reductions.

Some sectors, such as electricity and transport, already have more affordable, readily available technologies that can be used to transition away from reliance on fossil fuels and reduce emissions. It would be more cost-effective to reduce emissions in these sectors by more than their pro-rata share of 26-28%. This would reduce the burden on other sectors, particularly agriculture, stationary energy and industrial processes, where solutions are either more expensive or will require further technological development (ClimateWorks 2017).

Emissions reductions above 26% in the electricity sector are realistic and achievable. Several studies have consistently found that there are no technical barriers to Australia achieving secure, reliable power from a very high proportion of renewable electricity.

Emissions reductions above 26% in the electricity sector are realistic and achievable. The electricity sector can and should do more.

Exactly how emissions reductions are divided up across different sectors can have a major effect on the cost of Australia meeting its emissions reduction targets.

The implied approach under the National Energy Guarantee is that every sector reduces emissions by its pro-rata share. A 26% emissions reduction from each sector by 2030 would imply the need to reduce greenhouse gas emissions from 2017 levels compared to business as usual by:

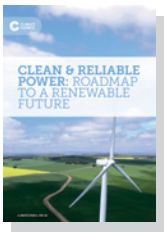
- 8% in the electricity sector
- 33% in the transport sector
- 31% in the stationary energy sector
- 23% in the agricultural sector
- 33% in fugitive emissions
- 22% in the industrial processes sector
- 5% in the waste sector

Australia's emissions reduction target of 26-28% by 2030 below 2005 levels is an inadequate response to the threat of climate change and not in line with the commitment Australia has made under the Paris Climate Agreement. The Climate Change Authority recommended a 45-65% emissions reduction target for 2030 below 2005 levels for Australia to do its fair share to reduce emissions. This is based on the scientific evidence, what comparable countries are doing and what is in the best interests of Australia (Climate Change Authority 2015).

If the electricity sector were to reduce emissions at least 60% below 2005 levels by 2030, it would lower the emissions reduction task for other sectors significantly. Given the current rate of renewable energy construction and industry momentum, along with the challenges to reducing emissions in the other sectors, the electricity sector can and should carry more of the nation's emissions reduction burden.

Australia needs an ambitious emissions reduction target and a credible climate policy that covers all sectors of the economy. The National Energy Guarantee in its current form proposes inadequate emissions reductions from the electricity sector, making it very difficult for Australia to reach even its weak emissions reduction target of 26-28% by 2030.

You can read more about what a credible climate and energy policy should look like in the Climate Council's report:



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