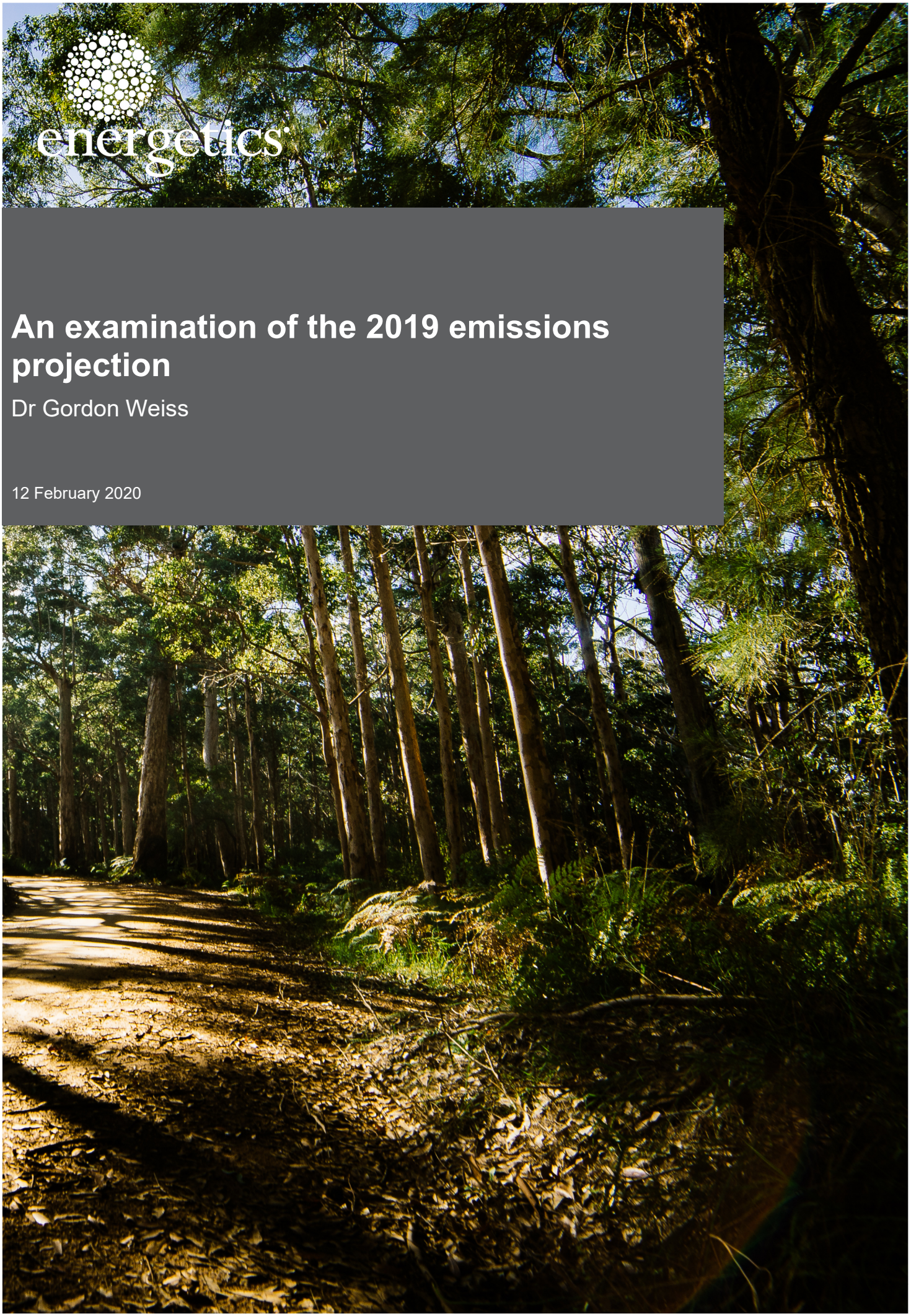

energetics

An examination of the 2019 emissions projection

Dr Gordon Weiss

12 February 2020

Executive summary

In response to the bushfire catastrophe, Prime Minister Scott Morrison stated that he would evolve Australia's climate policies. We have also heard that the Government will look to technologies to drive emissions reductions.

In the first of a series of three papers examining the technology pathways that Australia could adopt to achieve a net zero emissions economy, Energetics has reviewed Australia's emissions projections 2019, published by the Department of Agriculture, Water and the Environment in December 2019. What we see in this record of emissions reduction efforts is that Australia essentially met its Paris Target doing no more than business as usual and that improvements anticipated between now and 2030 are either cost effective transitions – replacing aging coal-fired power stations with new renewable generators and adopting electric vehicles; or the natural evolution of technology – better buildings, better industrial processes, better machines. There is no vision for any new 'disruptive' technologies.

Yet the 2019 Projection, while highlighting Australia's lack of ambition, also shows where the opportunities lie for deeper cuts and an economic transformation.

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1. The main takeaways

The 2019 projection of Australia's emissions was published by the Commonwealth in December 2019 [the 2019 Projection][1]. The headline results from the projection are:

- a projected cumulative shortfall of the National Determined Contribution under the Paris Agreement (Paris target) of 395 to 462 Mt CO_2-e (for the 26% and 28% reduction targets, respectively)
- an anticipated overachievement of the first and second commitment period Kyoto Protocol targets of 411 Mt CO_2-e.

Despite the Paris Agreement not yet allowing it, the Australian Government plans to apply the overachievement of the Kyoto target against the Paris target. In using these additional emissions reductions, the Government has declared that Australia will achieve its 26% reduction target by a slim margin of 16MtCO_2-e.[2]

The Australian Government has estimated that emissions in 2030 will be 511 Mt CO2-e. Figure 1 shows the historical and projected emissions for Australia. Some data values are in the Appendix.

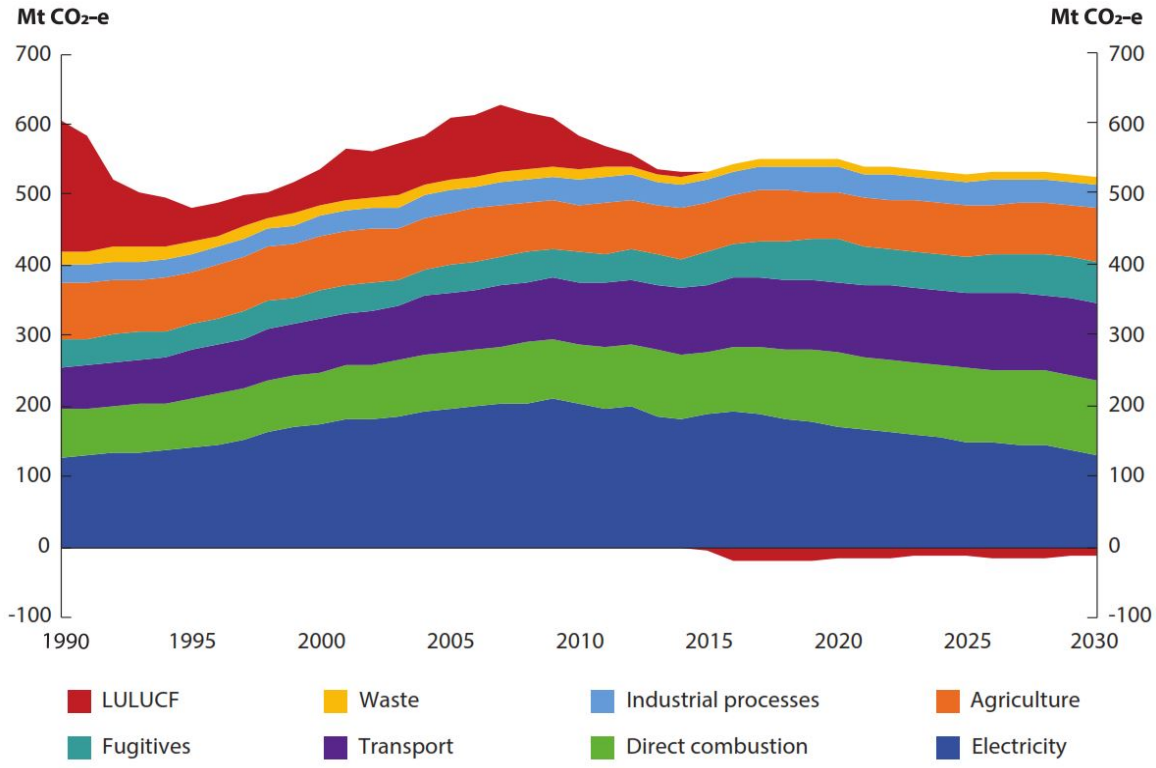

Figure 1: Australia's emissions, 1990 to 2030[3]

[1] Australian Government, Department of Environment and Energy, (December 2019), **Australia's emissions projections, 2019**.
[2] Strictly speaking, after applying the 411 Mt CO_2-e Australia will overachieve by the 26% reduction by 16 Mt CO_2-e and will require 51 Mt CO_2-e of cumulative emissions reduction between 2021 and 2030 to meet the 28% reduction target.
[3] ibid

It is worth noting that Figure 1 shows emissions reductions that are lower than all previous projections through to 2030 and follows the trend of always reducing the projected emissions. In this case, the drop in projected emissions compared to the projection issued in 2018 is due to:

- the inclusion of the Climate Solutions Fund which is projected to reduce emissions by 103 Mt CO_2-e
- stronger renewables deployment due to increased uptake of solar PV
- the inclusion of 50% renewable energy targets in several states
- updated forecasts of electricity demand.

In this paper, we explore two related issues – the robustness of the projection of emissions to 2030 and the consequences of applying the overachievement of the Kyoto target towards meeting the Paris target.

2. The Kyoto target – what has Australia really achieved?

Figure 2, taken from the 2019 Projection presents Australia's achievement relative to the Kyoto target for the second commitment period of 2013-2020. It shows how Australia's emissions have tracked well below the Kyoto target for most of the second commitment period. Further, it shows how the emissions in the period from 2010 to 2012, which are part of the first commitment period, were well below the target of 108% of the emissions in 1990.

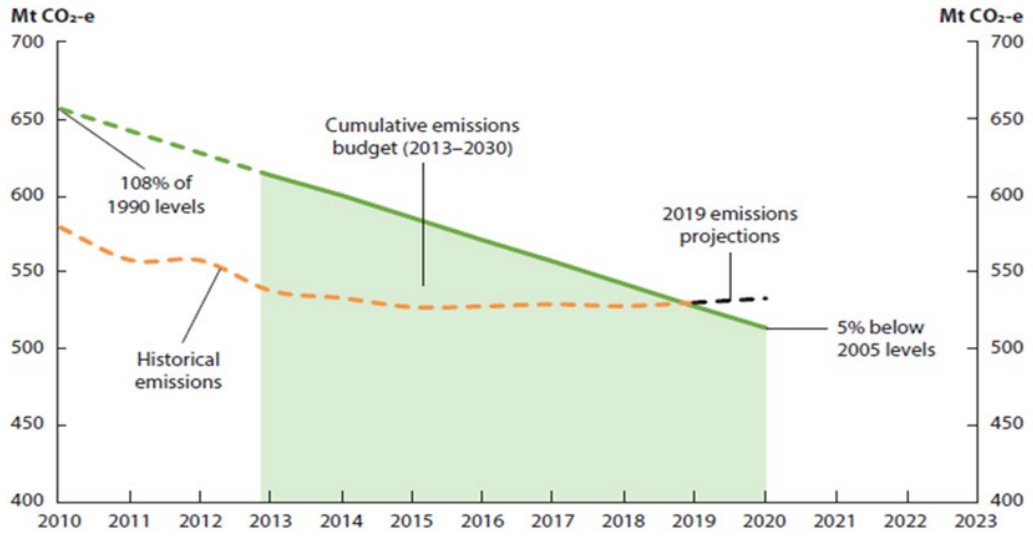

Figure 2: Australia's cumulative emissions reduction task to 2020[4]

Figure 3 looks at the scenario if emissions from land use, land use change and forestry (LULUCF) were not included in Australia's emissions profile.

Emissions excluding LULUCF have risen substantially since 1990 which is the base year for the first commitment period target. They have also risen since 2005 which is the base year for the second commitment period target. Non-LULUCF emissions exceeded notional targets based on the Kyoto Protocol settings by more than one billion tonnes of CO_2 over the 13 years that the Kyoto Protocol was in force.

This is a very different result than the actual overachievement of 411 Mt CO_2-e.

The bulk of Australia's emissions abatement to date has been delivered by a reduction in deforestation before 2013. The land sector carried this burden and rural landowners (including the Crown) had restrictions placed on the use of their land.

[4] ibid

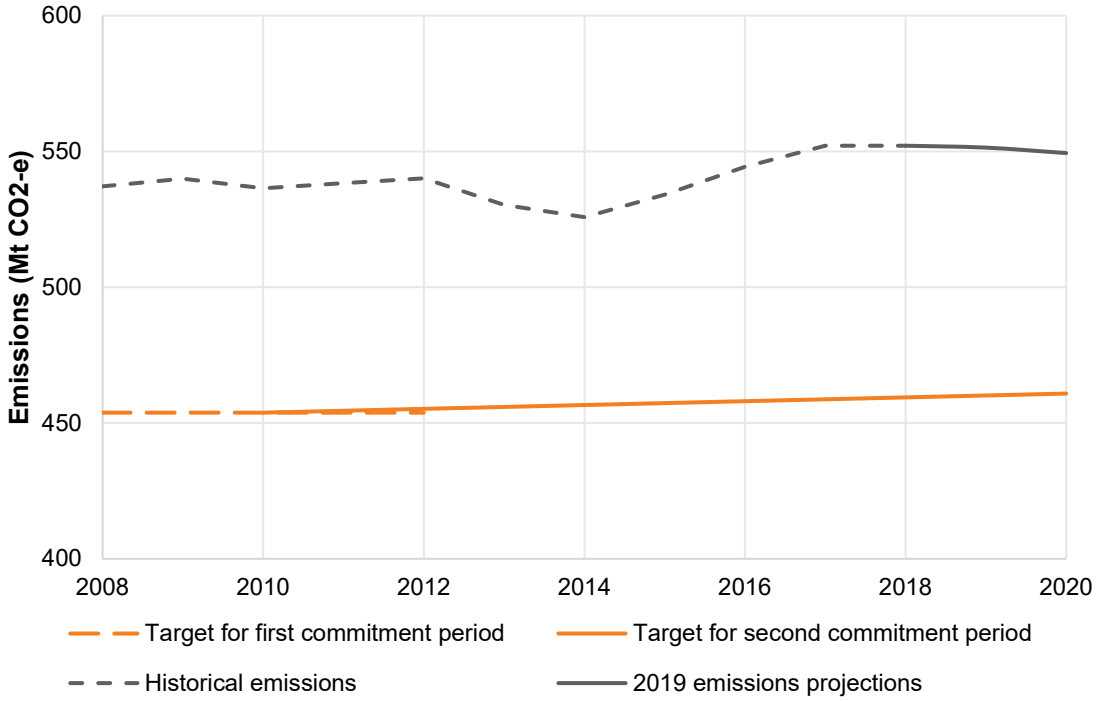

Figure 3: Australia's performance if LULUCF emissions are not included[5]

The trend in the emissions shown in Figure 3 is also revealing, consisting of an initial period to 2012 when emissions rose very slightly, a short period (2012 to 2014) when emissions fell, followed by a rebound (2014 to 2017) and then finally a period where emissions declined slowly.

Two features are important. The period when emissions fell corresponds to the time of the carbon pricing scheme. The rebound corresponded to the repeal of the Clean Energy Act and its replacement with the Emissions Reduction Fund (ERF) and Safeguard Mechanism. Because the ERF delivered abatement largely through the land sector, any impact of the ERF is not captured in Figure 3.

The weak downward trend after 2017 is due to a fall in emissions from the electricity sector.

This next figure shows the change to the emissions intensity of Australia's power generators and its impact on emissions. The emissions intensity of Australia's electricity has been falling in recent years due to the rise of renewable power generation – rooftop solar PV and utility scale wind and solar farms. Both were driven by government policies such as the Renewable Energy Target (RET) and the state-based feed-in tariffs. Without this change in the generation mix, the fall in emissions (excluding LULUCF) over the period of the carbon price would have largely disappeared and the weak downward trend in the latter years would have been replaced by an on-going rise in emissions.

[5] ibid

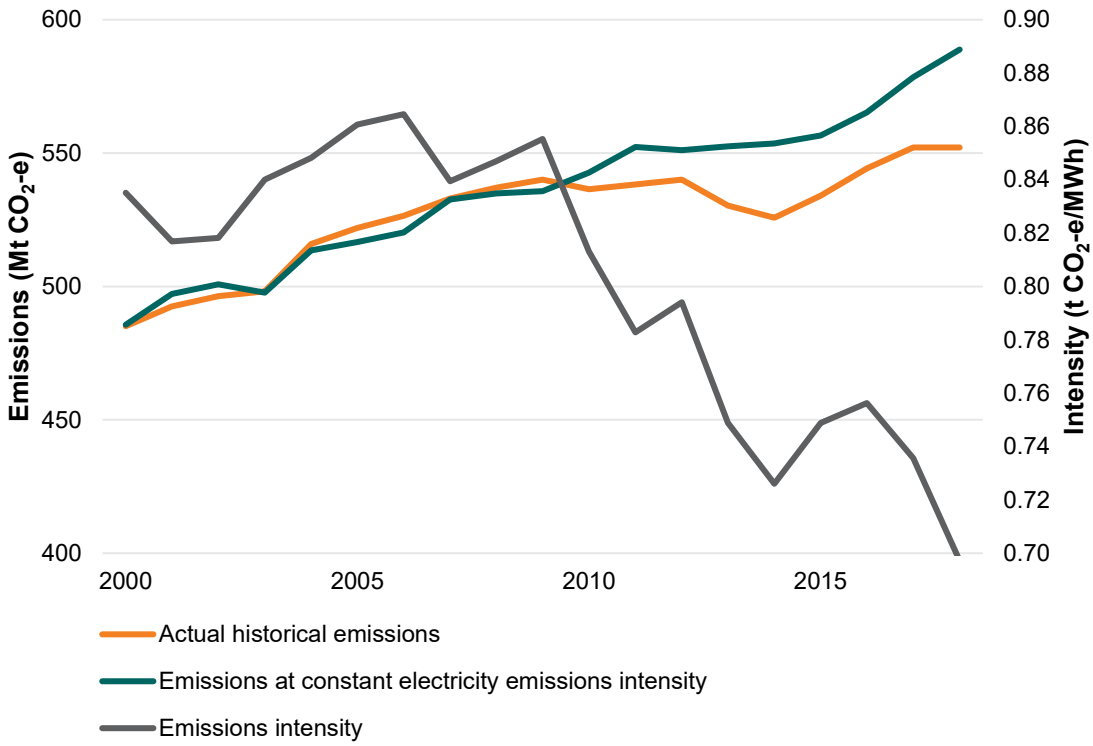

Figure 4: Emissions intensity of Australia's generation fleet

We draw two main conclusions from this:

- Australia's success at meeting its Kyoto targets is primarily due to action in one sector – the land sector. Deforestation (i.e. land clearing) has dropped significantly since 1990 and is a 'one-off' as it is currently less than 5% of Australia's emissions.
- The recent deployment of renewable power generation has been an important contributor to abatement over the past few years.

Except for these two sectors, Australia has done very little to prepare for future emissions abatement. This unfortunate reality is reflected in the 2019 Projection.

3. What the 2019 Projection really tells us

3.1. Electricity

What we found

The changing economics of renewable power generation coupled with the closure of the aging coal fired power stations sees the emissions from the electricity sector fall significantly compared to 2005.

Analysis

Electricity generation is the largest source of emissions and responsible for 34% of Australia's emissions in 2019. Emissions from electricity generation depend upon the fuel mix, and Figure 4 shows how the generation mix is expected to change. The Government is projecting a 34%

reduction in electricity generated from coal between 2018 and 2030, and a 22% reduction in emissions due to electricity generation from 2020 to 2030. These results imply a greater reduction in the capacity of the coal-fired generation fleet than is implied by AEMO's modelling of the withdrawal of coal-fired generators for the Integrated System Plan for the National Electricity Market.[6]

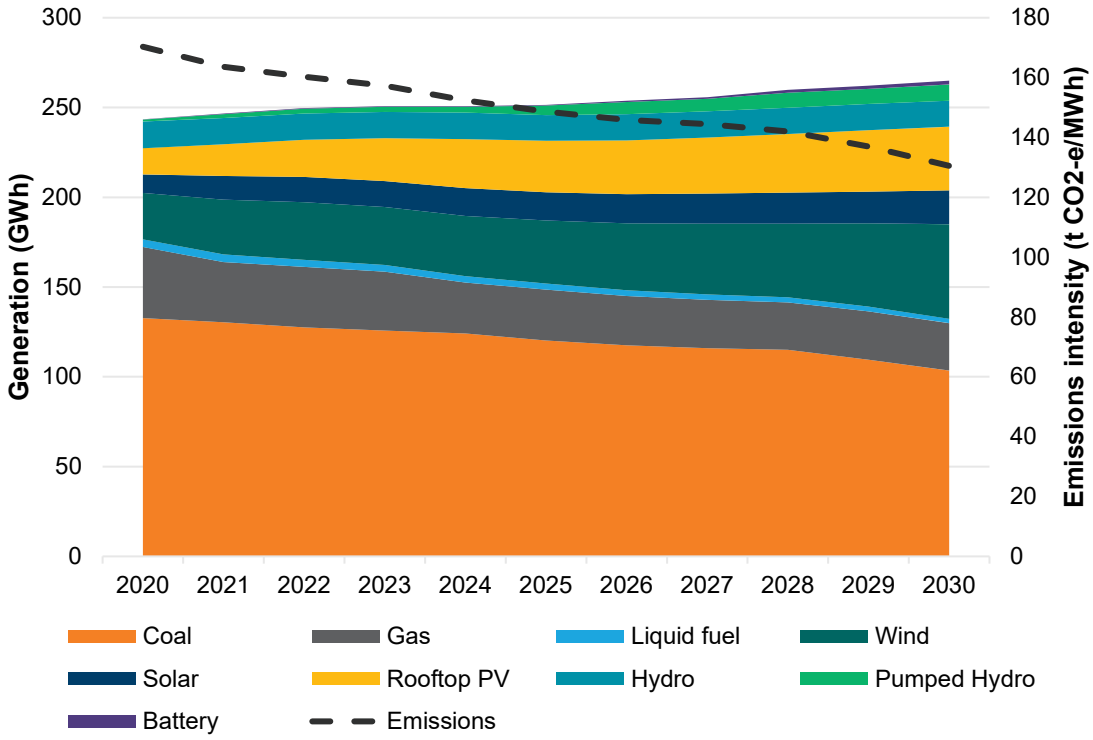

Figure 4: The projected generation mix and emissions from the electricity sector[7]

The Australian Government's projection sees a significant growth in generation from variable renewable sources, with the percentage of total generation from wind and solar rising from 10% in 2018 to 40% in 2030. This growth is driven by corporate PPAs[8], behind the meter solar PV in the residential and commercial sectors, and low-cost utility scale renewable generators replacing aging coal-fired power stations.

The modelling of electricity for the 2019 Projection included two major pumped hydro storage facilities - the Snowy 2.0 and Battery of the Nation projects as well as additional battery storage systems. These energy storage facilities working with the remaining gas fired generators will provide adequate firming for the 40% variable renewable generators.

Energetics' own model of the National Energy Market (NEM) largely confirms the projections of emissions from the Commonwealth. Our mid and high renewables scenarios estimate the output of coal-fired generators to be 107 TWh and 91 TWh respectively which is broadly consistent with the Commonwealth's figures. The variable renewable component of NEM electricity is 38% and

[6] Australian Energy Market Operator (July 2018), **Integrated System Plan for the National Electricity Market**.
[7] Australian Government, Department of Environment and Energy, (December 2019), **Australia's emissions projections, 2019**.
[8] Energetics, ***Corporate Renewable PPA Deal Tracker***.

49% in the mid and high renewable scenarios, again broadly consistent with the figures in the 2019 Projection.

Figure 4 also shows the expected emissions from the electricity sector. The displacement of coal and gas-fired generation leads to a 23% reduction in emissions in 2030 compared to 2020 and a 34% reduction compared to 2005. 2005 is the base year for Australia's Paris target.

Policy certainty?

Several states continue to pursue policies that support renewable generation. There are the state-based renewable targets such as the VRET and QRET and plans to develop infrastructure to support the renewable energy zones in NSW.

However, the projected reduction in coal-fired generation is not consistent with calls by members of the Australian Government for additional coal-fired power stations.[9] Even if that new coal-fired power station was required[10], investing in an additional new coal-fired power station would just force the early closure of an existing coal-fired power station. The cost-effective expansion of renewable generation would continue and coupled with the output from the new coal-fired power station, would bring forward the forced closure of aging uneconomic coal-fired power stations.

The rapid rise in variable renewable generation from 2018 to 2030 sees a 200% increase in renewables by 2030 producing close to 50% of the nation's power. Yet the same 50% renewable energy penetration was seen as a major threat to the Australian economy six months earlier during the Federal election campaign.

3.2. Direct combustion

What we found

The 2019 Projection largely applies the status quo and offers no guidance on how direct combustion can be decarbonised.

Analysis

Direct combustion just beats transport as the second largest emissions source, and it contributes 19% of Australia's emissions. The figure below shows the emissions from direct combustion by sub-sector.

[9] The Australian (2018), '***Barnaby Joyce urges Scott Morrison to back Collinsville coal-fired plant***'
[10] The market operator and others have made it clear that a coal-fired power station in north Queensland is not viable now, as seen ***in this article in the Australian Financial Review***.

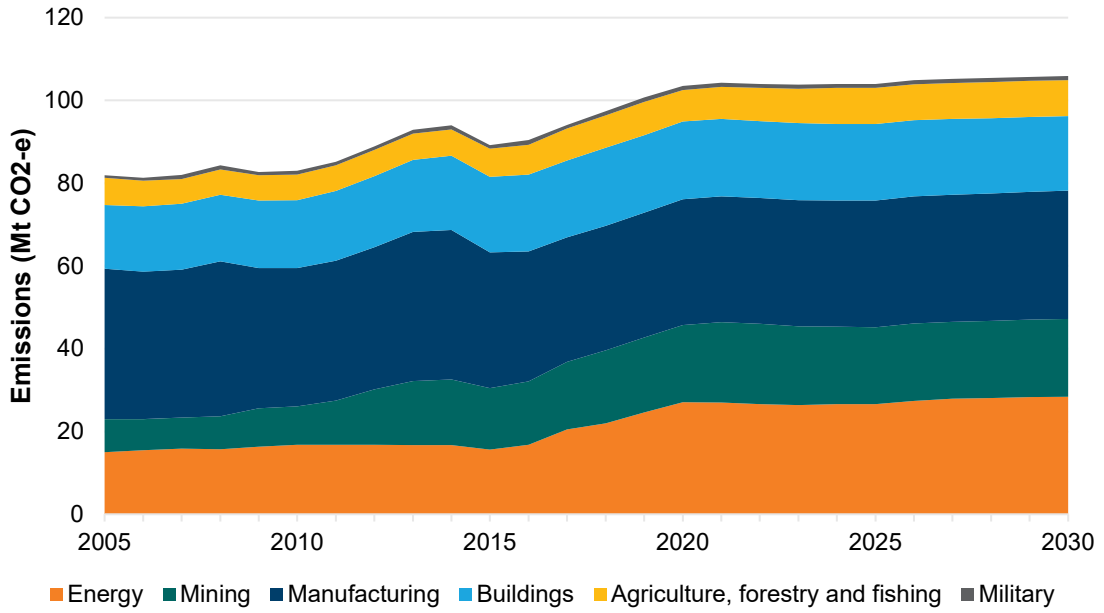

Figure 5: Emissions due to direct combustion, 2005 to 2030[11]

Another view is in Table 1. Two features stand out. First, there has been a significant increase in emissions due to stationary energy consumption. This aligns with the rise in energy production (i.e. the commissioning of the LNG trains) and on-going growth of the mining sector. The rise occurs in the period 2005 to 2020. After 2020, emissions from direct combustion are forecast to be largely constant in absolute terms although they are falling per unit of GDP and per capita.

Table 1: Emissions from direct combustion[12]

Sector	Emissions in 2030 (Mt CO_2-e)	2030 compared to 2005	2030 compared to 2020
Energy	28.4	189%	105%
Mining	18.8	235%	101%
Manufacturing	31	85%	102%
Buildings	18	117%	96%
Agriculture, forestry and fishing	8.7	132%	114%
Military	1	167%	100%
Total	**105.9**	**129%**	**102%**

In developing the projection for emissions from direct combustion, the Australian Government undertook a detailed bottom-up analysis. The levelling out of emissions for all the sub-sectors was due to a variety of reasons:

- Constant output in the case of energy
- Potential technological improvements such as advanced engine technologies, autonomous technologies, and the electrification of mining equipment

[11] Australian Government, Department of Environment and Energy, (December 2019), **Australia's emissions projections, 2019**.
[12] ibid

- Potential improvements in building performance driven by the Climate Solutions Package for the building sector. We also note that electrification of space heating (i.e. using reverse cycle air conditioners rather than gas heaters) is becoming very cost effective and this should see a reduction in emissions associated with space heating as reverse cycle air conditioners are less emissions intensive compared to gas heaters.
- Changes both up and down in the output of various industries.

The direct combustion sector makes no contribution to abatement in the period from 2020 to 2030 and in fact, sees an increase in emissions for the sector relative to 2005, and the 2019 Projection provides no guidance as to whether emissions due to direct combustion can ever be significantly reduced without a corresponding reduction in economic output. There is no suggestion of an emerging technology that can significantly decarbonise direct combustion.

3.3. Transport

What we found

The 2019 Projection is largely forecasting the status quo except for the car fleet, when the rise of electric vehicles will constrain the growth of emissions from light vehicle transport. The potential rapid growth in the EV fleet at the end of the decade will demand rapid expansion of the supporting infrastructure.

Analysis

Transport is responsible for 19% of Australia's emissions. Figure 6 shows the sources of emissions due to transport.

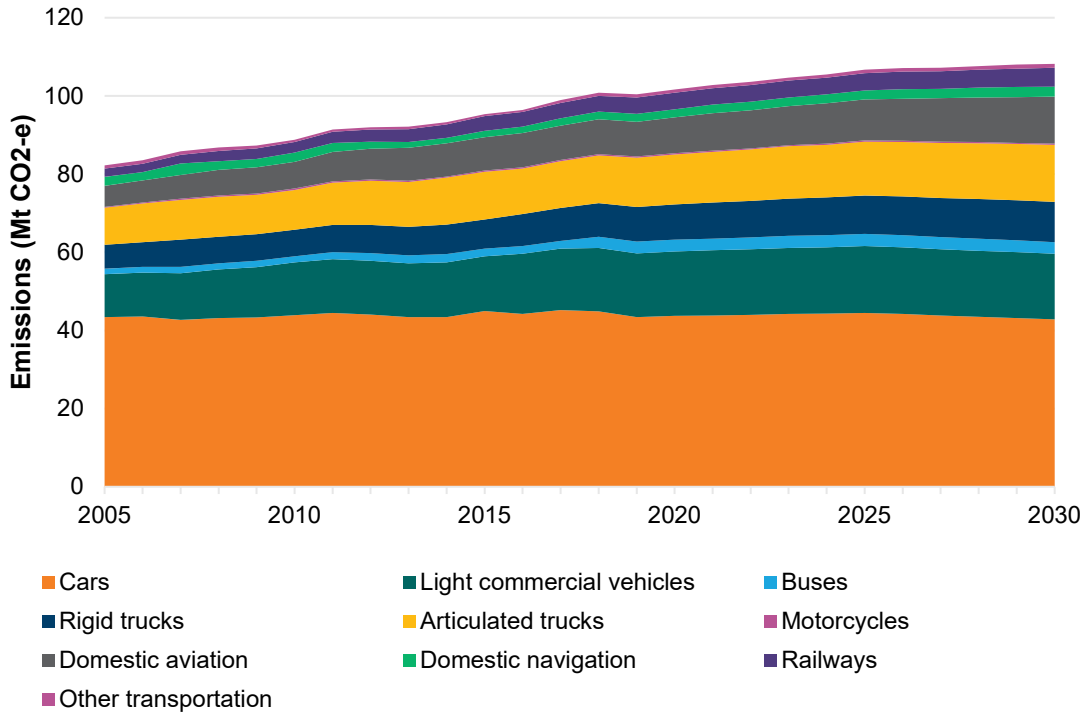

Figure 6: Emissions due to transport, 2005 to 2030[13]

[13] ibid

Currently around 50% of transport emissions are due to cars. The percentage contribution falls over the next decade as technological improvements associated with cars see emissions fall slightly while emissions from all other transport modes increase broadly in line with historical trends.

Light vehicle emissions are projected to decline by around one per cent in the period from 2020 to 2030, despite the distance travelled by passenger vehicles increasing by 18%. The improvement in the emissions intensity of cars is primarily due to the introduction of electric vehicles rather than improvements to the efficiency of internal combustion energy vehicles. The 2019 Projection estimates that 6% of cars will be electric by 2030, with the bulk of the uptake occurring after 2025. This will mean that EVs could represent around 20% of car sales in 2030. Energetics believes that EVs will be very cost competitive by the middle of the decade and so will not require policy measures to promote sales. However, a rapid rise in the size of the EV fleet will see a growing demand for infrastructure most notably charging stations.

3.4. Other sectors except LULUCF

What we found

The 2019 Projection largely applies the status quo.

Analysis

Emissions from Agriculture, Fugitives, Industrial processes and Waste together contribute one third of the nation's emissions. We see from Figure 7 and **Table 2** that the total emissions from these sectors are expected to be 10% above the corresponding emissions in 2005 and approximately the same as the emissions in 2020.

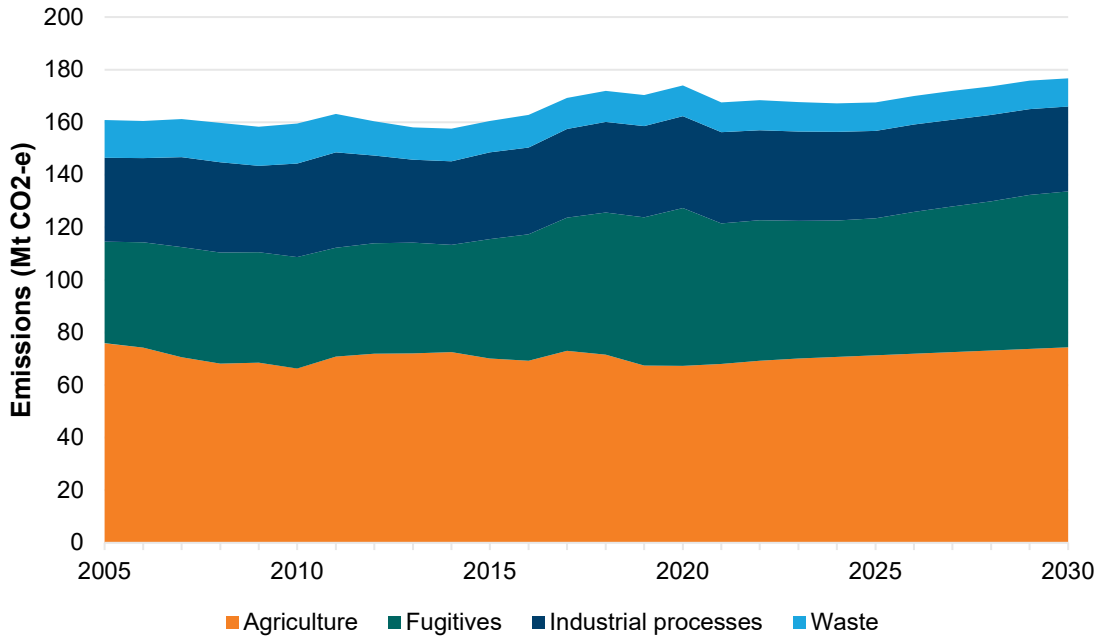

Figure 7: Emissions from other sectors, 2005 to 2030[14]

[14] ibid

The increase in fugitive emissions reflects the increase in activity in the mining and LNG sectors between 2005 and 2020 and a levelling off in activity after 2020. The slight decline in emissions from agriculture between 2005 and 2020 reflects a reduction in the sheep herd leading to lower enteric emissions. The rise post 2020 is an extension of the trend in other sub-sectors of agriculture seen in the period to 2020. The phase out of product used as substitutes for ozone depleting substances (i.e. hydrofluorocarbon-based refrigerants and fire retardants) drives the projected reduction in emissions from industrial processes.

The projection of emissions from these four sectors to 2030 just reflects the status quo to the present and no disruptive technologies are envisaged that would reduce the emissions intensity of the sectors.

Table 2: Emissions from agriculture, fugitives, industrial processes and waste

Sector	Emissions in 2030 (Mt CO_2-e)	2030 compared to 2005	2030 compared to 2020
Agriculture	74	98%	111%
Fugitives	59	153%	99%
Industrial processes	32	101%	92%
Waste	11	74%	91%
Total	**176**	**110%**	**102%**

3.5. Land use, land use change and forestry (LULUCF)

What we found

The Australian Government is relying on the Climate Solutions Package and enduring land clearing restrictions to realise the majority of the net negative emissions from the LULUCF sector.

Analysis

The figure shows the balance of emissions and sequestration due to land use, land use change and forestry. It shows the reduction in land clearing since 1990 and the rise in sequestration in forests over recent years. The latter has been driven by the decline in log harvesting activity in Australia's native forests, although this trend may be reversed as a response to the bush fires of 2019/2020.[15]

[15] Packham, B and Bashan, Y (January 2019), '***Forestry industry, CFMEU united on logging, burns to take fight to bushfires'***, The Australian.

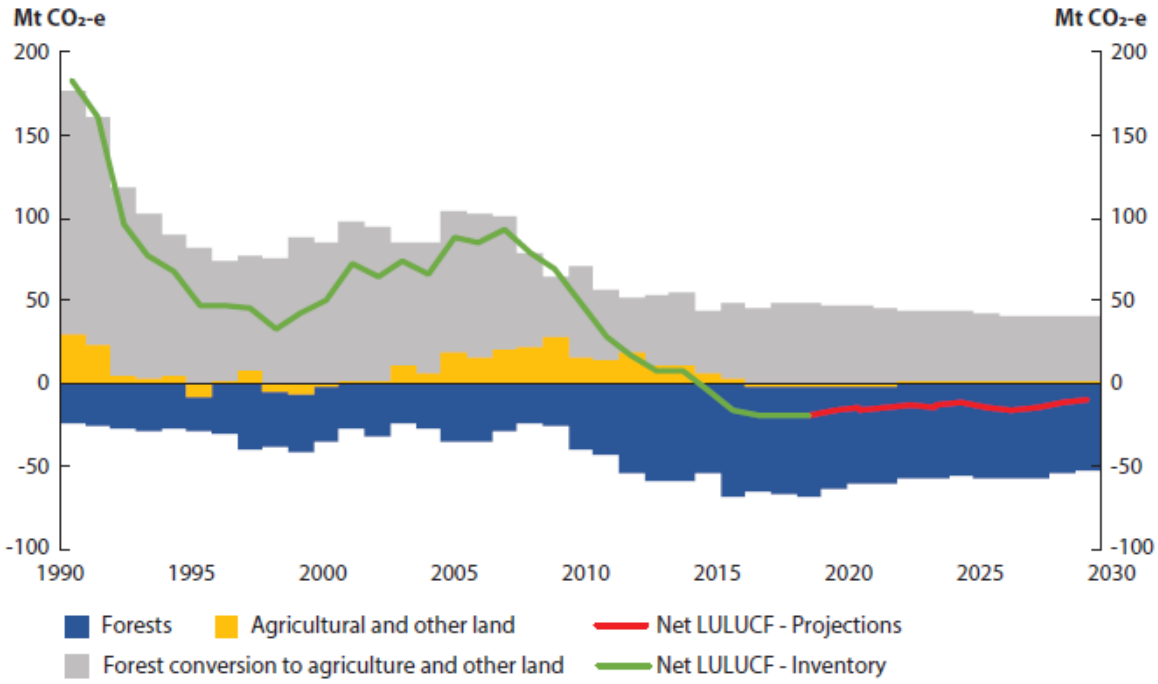

Figure 8: Emissions and removals from land use, land use change and forestry (LULUCF), 1990 to 2030[16]

The 2019 Projection report notes that the Climate Solutions Fund (CSF) is expected to deliver 103 Mt CO_2-e of additional abatement over the period 2021-2030, and that 78 Mt CO_2-e of the abatement will come from the LULUCF sector. This 78 Mt CO_2-e of additional abatement represents over 60% of the net emissions from the LULUCF sector. A failure of the CSF to deliver the anticipated abatement will see a reduction in the sequestration of the sector.

3.6. In summary

Our review of the 2019 Projection found that the expected reduction in emissions between now and 2030 is primarily due to the closure of the aging coal-fired power stations and their replacement by low cost renewable generators: a trend that has been evident for some years now. Some additional but minor emissions reduction comes from the initial electrification of the car fleet, starting in 2025.

Beyond these two items, the 2019 Projection is just an extension of the status quo, and any improvements in emissions intensity between now and 2030 are broadly consistent with the long-term improvements in technology.

We noted that the 2019 Projection included a strong technology uptake scenario. This largely assumed that "the costs of technologies, particularly renewables, batteries and electric vehicles, decline faster than in the baseline, encouraging greater uptake by households, businesses and industry", which essentially means more renewable generators and electric vehicles but no changes to the emissions intensity of other sectors.

[16] Australian Government, Department of Environment and Energy, (December 2019), **Australia's emissions projections, 2019**.

4. A national vision is needed

The Energy Minister, Angus Taylor writing in *The Australian*[17] reconfirmed the Government's desire to apply the carryover units from the Kyoto Protocol against the Paris Target, and the 2019 Projection has shown that on that basis Australia has effectively met the Paris Target doing no more than business as usual. As we have described, improvements between now and 2030 are either cost effective transitions – replacing aging coal-fired power stations with new renewable generators and adopting electric vehicles; or they just reflect the natural evolution of technology – better buildings, better industrial processes, better machines.

No new 'disruptive' technologies are envisioned.

However, after 2030 there will not be another basket of carryover units, and much more will be needed than closing a few more coal-fired power stations and buying more electric vehicles. And yet, Australia's current response to emissions reduction, as embodied in our Paris Target, provides no incentive to do any better. In the same opinion piece, the Energy Minister questioned "aggressive top-down targets" with no "clear pathways to deliver" and he noted that there is "enormous potential in established and emerging technologies such as hydrogen, carbon capture and storage, biofuels, lithium production and waste-to- energy".

On May 25, 1961, President John F. Kennedy asked the United States to "commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the Earth". The realisation of this audacious goal on July 20, 1969 transformed the United States and led to the discovery of much of the science and engineering that made the modern world.

Perhaps then the Australian Government could commit to achieving the Paris Target without applying the carryover units by finding ways that new Australian technologies could close the gap between the 2019 Projection and the Paris Target. Australia has unrivalled renewable energy resources and the strategic mineral resources needed to support a low-carbon future. What is needed is the science and engineering to apply these resources to the steep reduction of emissions from all sectors of the economy and bolster sequestration efforts for those emissions sources which cannot be eliminated.

Wouldn't this position Australia to have a leading role in the transition to a zero-carbon world?

[17] Taylor, A (December 2019): 'We should be proud of our climate change efforts', ***https://www.theaustralian.com.au/commentary/we-should-be-proud-of-our-climate-change-efforts/news-story/0dec56da908b04a1a55c69f1631c1b52***, The Australian.

Appendix A

Table 3: Australia's emissions to 2030 (Mt CO_2-e)[18]

	1990	1995	2000	2005	2010	2015	2020	2025	2030
Electricity	130	143	175	197	205	189	170	149	131
Direct combustion	66	71	75	82	83	89	104	104	106
Transport	61	68	74	82	89	95	102	107	108
Fugitives	37	37	40	39	42	45	60	52	59
Agriculture	80	72	78	76	66	70	67	71	74
Industrial processes	26	25	27	32	36	33	35	33	3 2
Waste	20	19	16	14	15	12	12	11	11
LULUCF	185	48	51	89	49	-4	-16	-11	-10
Total	605	483	536	611	585	531	534	516	511

Table 4: Electricity generation by source (GWh)[19]

Source	2018	2020	2025	2030
Coal	157,660	132,698	120,210	103,508
Gas	53,839	39,648	28,317	26,428
Liquid fuel	5,263	4,252	3,372	2,369
Wind	14,989	25,827	35,117	52,717
Solar	1,008	10,262	15,693	18,790
Rooftop PV	8,922	14,608	28,795	35,438
Hydro	15,839	14,918	14,287	14,541
Pumped Hydro		1,087	5,215	9,009
Battery		196	458	2,143
Total	**261,054**	**245,516**	**253,489**	**266,973**

[18] Australian Government, Department of Environment and Energy, (December 2019), **Australia's emissions projections, 2019**.
[19] Source: Figures for 2018 are actual values from the Australian Energy Statistics, Table O1, Australian electricity generation, by fuel type, physical units. Figures for 2020 and beyond are from the 2019 Projection.

About Energetics

Working with ASX200 and all levels of government, Energetics is a specialist energy and climate change risk management consultancy.

Our services include:

- Strategy, policy and financing
- Climate risk and adaptation
- Renewables and energy efficiency
- Energy accounting and data management
- Energy and carbon markets
- Reporting, compliance and program audit

We're more than carbon neutral.

Sustainability is core to Energetics' business.

In June 2008, Energetics became one of Australia's first consulting firms to achieve carbon neutrality through the Australian Government's Greenhouse Friendly Program.

Since the FY19 reporting year, our carbon neutrality has been certified under the Climate Active Carbon Neutral Standard (formerly the National Carbon Offset Standard – NCOS) for Organisations. Climate Active is a partnership between the Australian Government and Australian businesses to drive voluntary climate action. www.climateactive.org.au

This approach aligns with Energetics' commitment to best practice calculation of our complete emissions profile and with how we have assisted some of our clients with becoming carbon neutral. We offset 100% of the greenhouse gas emissions associated with the complete lifecycle of our organisation. Our offsets are sourced from projects that are Verified Carbon Standard (VCS) or Gold Standard accredited and contribute to Sustainable Development Goals 7 (Affordable and Clean Energy), 9 (Industry, Innovation and Infrastructure) and 13 (Climate Change).

In keeping with our Sustainability Policy, we drive continuous improvement by identifying and implementing internal carbon mitigation, sustainable procurement and behavioural change projects. Being a sustainability role model is one of our core business values. Every employee is given two days personal development time to volunteer in environmental or social sustainability activities within their communities.

Contact us

Energetics is a carbon neutral company

www.energetics.com.au

Sydney
Level 7, 132 Arthur St, North Sydney NSW 2060
PO Box 294 North Sydney NSW 2059
P: +61 2 9929 3911
F: +61 2 9929 3922

Perth
Level 3, 182 St Georges Tce, Perth WA 6000

P: +61 8 9429 6400
F: +61 2 9929 3922

Melbourne
Level 5, 190 Queen St, Melbourne VIC 3000
PO Box 652, CSW Melbourne VIC 8007
P: +61 3 9691 5500
F: +61 2 9929 3922

Brisbane
Level 12, 410 Queen St, Brisbane Qld 4000

P: +61 7 3230 8800
F: +61 2 9929 3922

Adelaide
The Hub
5 Peel St, Adelaide SA 5000
P: +61 2 9929 3911
F: +61 2 9929 3922

abn 67 001 204 039
acn 001 204 039
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