CLIMATE COUNCIL

STATE OF PLAY: RENEWABLE ENERGY LEADERS AND LOSERS

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Published by the Climate Council of Australia Limited.

ISBN: 978-0-6486793-7-0 (print)
978-0-6486793-6-3 (digital)

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Preface

States and territories are leading the transition to renewable energy in Australia, as the Federal Government is not only failing to lead but getting in the way of progress.

Every year the Climate Council tracks the relative progress of Australian states and territories based on their performance across a range of renewable energy metrics: share of electricity from renewable energy; proportion of households with rooftop solar; large-scale wind and solar capacity per capita; and targets or policies in place to support the transition. We outline the progress made by each state and territory government over the last twelve months in the race to a renewable future. This report is the Climate Council's fifth scorecard evaluating state and territory progress on renewable energy. This report follows on from previous state and territory renewable energy updates in 2014, 2016, 2017, and 2018.

We appreciate the assistance of Huw Jones in the preparation of this report. We would also like to thank the relevant state and territory departments for reviewing and providing feedback on the state and territory profiles.

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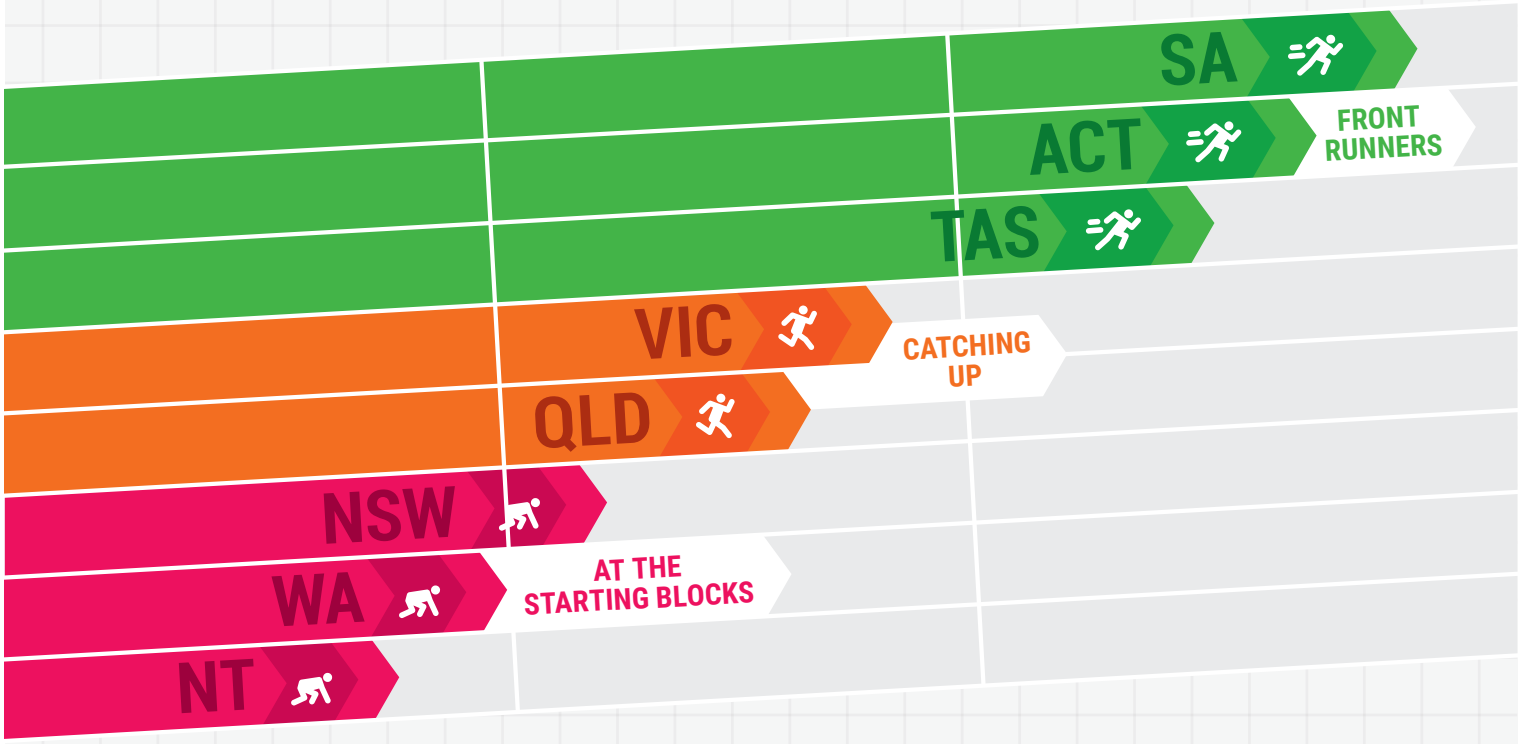
THE AUSTRALIAN RENEWABLE ENERGY RACE:

2019 SCORE CARD



State / Territory:	Renewable electricity (2018)	Wind & solar capacity per person (kW) (March 2019)	% solar households (Oct 2019)	Renewable energy targets	Net zero emissions targets	Highlights
SA (A)	51.2%	1.25	35.0%	Net 100% in the 2030s	Net zero by 2050	Aiming for 100% renewables in the 2030s. Over 50% wind and solar energy in the grid.
ACT (A)	54.1%	1.27	16.1%	100% by 2020	Net zero by 2045	On track to achieve 100% renewable energy from 1 January 2020.
TAS (A)	94.6%	0.60	15.1%	100% by 2022	Net zero by 2050	Aiming to support the National Electricity Market as the Battery of the Nation.
VIC (B)	17.3%	0.34	17.9%	25% by 2020; 40% by 2025; 50% by 2030	Net zero by 2050	Legislated 50% renewable energy target by 2030. Greatest capacity of wind and solar projects in the pipeline.
QLD (B)	8.8%	0.38	35.7%	50% by 2030	Net zero by 2050	Installed the most large-scale wind and solar per capita since last year's report.
NSW (C)	17.3%	0.25	20.4%	-	Net zero by 2050	Shortlisting large-scale renewables and storage for funding and supporting uptake of rooftop solar and batteries.
WA (C)	8.2%	0.28	28.8%	-	Net zero by 2050	Introduced an aspirational target of net zero emissions by 2050.
NT (C)	4.0%	0.12	18.1%	50% by 2030	(Draft target) Net zero by 2050	Introduced a draft aspirational target of net zero emissions by 2050.

Contents

Key Findings

1

South Australia has won this year's state and territory renewables race, with the ACT and Tasmania hot on its heels.

- South Australia, the Australian Capital Territory (ACT) and Tasmania are way ahead of the other states and territories across a range of renewable energy metrics. These include share of renewable energy, wind and solar capacity per capita, and policies in place to support the transition to renewable energy.
- South Australia is a global leader in transitioning to a grid with a high share of wind and solar PV energy. The state now generates over half of its electricity from wind and solar, and is aiming for net 100% renewable energy in the 2030s.
- The ACT is on track to achieve 100% renewable energy from 1 January 2020. This is a remarkable achievement and makes the ACT just the eighth jurisdiction in the world with a population above 100,000 – and the only one outside of Europe – to achieve 100% renewable electricity.
- Tasmania's Battery of the Nation plan could double Tasmania's renewable energy capacity and generate local jobs and billions of dollars in investment.

2

Victoria and Queensland are making good progress on the transition to renewable energy, but will need to work hard to catch the front runners.

- Victoria wins the 'Rising Star' Award for having the most substantial capacity of large-scale wind and solar projects in the pipeline of any state or territory.
- Queensland wins the 'Most Improved' Award for eclipsing the other states and territories in terms of increased large-scale wind and solar capacity per person from last year's report. Nearly half of the large-scale renewable energy projects completed across Australia in 2018 were in Queensland.
- Despite progress, Queensland is not on track to meet its target of 50% renewable energy by 2030.
- The Queensland Government continues to support new fossil fuel developments in the state, which is fundamentally at odds with action on climate change.

3

New South Wales and Western Australia are the only states without a renewable energy target, while the Northern Territory ranks last or near the bottom on most other metrics.

- The Northern Territory wins the 'Wooden Spoon' for finishing last in this year's renewables race, as it has in every scorecard to date. However, recent signals from the Northern Territory Government are encouraging.
- The Northern Territory recently announced a draft aspirational target for net zero emissions by 2050, making it the last state or territory to release a net zero target. While this is an important step in the right direction, the draft plan supports expansion of the territory's gas industry, which is incompatible with achieving net zero emissions.
- Like the Northern Territory, Western Australia's Government is supporting gas developments, while the New South Wales Government continues its vocal support for coal. There can be no new coal or gas projects, whether for export or domestic use, if Australia is to address intensifying climate change.

4

States and territories are driving the transition to a renewable future, in the face of the Federal Government's lack of leadership.

- Increasing global temperatures – driven primarily by greenhouse gas emissions from burning coal, oil and gas – are exacerbating extreme weather events in Australia and globally. Australians are enduring bushfire conditions, heatwaves and flooding made worse by climate change.
- To tackle climate change effectively, we must rapidly reduce our greenhouse gas emissions by accelerating the uptake of renewable energy and storage technologies. Emissions have been rising year-on-year for five years under the Federal Government. This is why leadership from states and territories is so crucial.
- If the Northern Territory's draft target for net zero emissions is adopted, it will mean that all states and territories will have a target for net zero emissions by 2050 at the latest. Australia will have a de facto target even in the absence of Federal Government leadership or policy.
- The Federal Government is not only failing to lead, it is getting in the way of state and territory leadership on renewable energy. As a result, several states and territories have declared the intention to go it alone on renewable energy policy. It is time for all states and territories to create their own forums for coordination and move on without the Federal Government.

1. The year in review: Leaders and losers in the renewables race

Following the summary on the next page, Section Two outlines the broader context underpinning this report. Section Three dives into the scorecard criteria, including share of renewable energy, large-scale wind and solar capacity per person, share of households with rooftop solar, and policies and targets to support the transition. Section Four profiles progress made by each state and territory since last year's report. Section Five highlights leadership at the local government level. Lastly, the Afterword calls for states and territories to create their own forums for coordination and move on without the Federal Government.

Figure 1: South Australia is in first place and is a global leader in transitioning to a grid with a high share of wind and solar backed by storage, thanks to projects such as the Hornsdale Wind Farm and Power Reserve.

THE YEAR IN REVIEW

LEADERS AND LOSERS IN THE RENEWABLES RACE

Each year the Climate Council compares the progress of states and territories across a range of renewable energy metrics: share of renewable electricity; share of households with rooftop solar; large-scale wind and solar capacity per capita; and government targets or policies in place to support the transition. This report is the Climate Council's fifth scorecard.

State and territory governments are leading the way in transitioning to renewables, as the Federal Government abandons the field on credible climate and energy policy. While all states and territories are making progress, some are way ahead in the race towards a renewable future, while others are still tying their shoes:

1ST PLACE: SOUTH AUSTRALIA

In first place, South Australia is now over 50% renewable and is aiming for 100% in the 2030s. The state is a global leader in integrating a high share of wind and solar into the grid. The state government has released a Hydrogen Action Plan, one of several states and territories seeking to seize the opportunities provided by renewable hydrogen.

2ND PLACE: ACT

Winning an **'Honourable Mention',** the ACT is on track for 100% renewable energy from 2020, and announced a new reverse auction to 'future proof' this achievement. Shifting focus to new sources of emissions, the ACT released a strategy for net zero emissions by 2045, focusing on emissions from transport and the built environment.

3RD PLACE: TASMANIA

Tasmania rounds out the front runners in third place this year. The state is on track to hit 100% renewable energy by 2022. Tasmania is progressing in its ambition to be the 'Battery of the Nation', conducting feasibility studies of three pumped hydro sites that could supply a massive new interconnector to Victoria over the next 10-15 years.

4TH PLACE: VICTORIA

Coming fourth, Victoria wins the **'Rising Star'** Award for having the greatest capacity of large-scale wind and solar in the pipeline. The state recently legislated a Victorian Renewable Energy Target of 50% by 2030, and has committed $1.3 billion to Solar Homes, a program to increase rooftop solar and storage.

5TH PLACE: QUEENSLAND

Queensland is fifth and wins the **'Most Improved'** Award for the most substantial increase in per person large-scale wind and solar capacity. However, the state is not on track to meet its target of 50% renewables by 2030, is late to release a policy plan for its net zero emissions by 2050 target, and continues to support new fossil fuel developments.

6TH PLACE: NEW SOUTH WALES

New South Wales is still coming off the starting blocks in sixth place. The state is making some progress but does not have a renewable energy target, and the government continues its vocal support for coal. More positively, the New South Wales Government has announced it will set interim targets to chart a course towards its target of net zero emissions by 2050.

7TH PLACE: WESTERN AUSTRALIA

Western Australia is second last. The state announced an aspirational target of net zero emissions by 2050 and is developing a climate policy, but has signalled ongoing support for the gas industry. Western Australia launched a Renewable Hydrogen Strategy but it includes a possible role for hydrogen produced from fossil fuel gas.

8TH PLACE: NORTHERN TERRITORY

The Northern Territory wins the **'Wooden Spoon'** for finishing in last place yet again. The government released a draft target of net zero emissions by 2050 and a draft roadmap to achieve it, although the plan supports the expansion of the gas industry. The territory has solar projects in the pipeline to hit 10% renewable energy.

2. States and territories step up as the Federal Government deserts the field

Increasing global temperatures – driven primarily by greenhouse gas emissions from burning coal, oil and gas – are exacerbating extreme weather events in Australia and globally. Worldwide, the last five years (2014-2018) have been the five warmest years ever recorded. This record is part of a sharp, long-term upswing in global temperatures, with 18 of the 19 hottest years on record all occurring since 2000 (NOAA 2019).

This warming trend is already affecting Australians. Nine of Australia's warmest ten years on record have occurred since 2005 (Bureau of Meteorology 2019a). In early 2019, tropical Queensland experienced severe flooding (Bureau of Meteorology 2019d). In spring 2019, New South Wales and Queensland experienced unprecedented and catastrophic bushfire conditions (Bureau of Meteorology 2019b). Devastating drought conditions are ongoing in southeast Australia (Bureau of Meteorology 2019c). Climate change is increasing the frequency and severity of extreme weather events and Australians are suffering as a result (Climate Council 2019a).

To tackle the climate crisis effectively, we must deeply and rapidly reduce our greenhouse gas emissions from electricity by accelerating the uptake of renewable energy and storage technologies. There can be no new fossil fuel projects. The window of opportunity is closing, and failure to act on climate change is placing Australian lives, our economy, and

To tackle climate change we need to deeply and rapidly reduce our greenhouse gas emissions by accelerating the uptake of renewables and storage.

our natural environment at risk. Solutions are readily available, but we lack political will at the federal level. State and territory governments have stepped in to drive the renewable transition, although some are doing much more than others.

Australia's greenhouse gas emissions have been rising year-on-year for the past five years according to the Federal Government's own data. Electricity is by far the highest emitting sector in Australia, contributing roughly 33% of Australia's total emissions (Department of the Environment and Energy 2019a). Electricity is also the sector where the solutions – transitioning to renewable energy and storage – are most readily available and cost-effective.

Emissions from the electricity sector have been decreasing in recent years in Australia, especially in the National Electricity Market (NEM), which includes the eastern states and South Australia. This is largely due to an increase in renewable energy and closure of coal-fired power stations. Nationally, renewable energy generation hit 19% in 2018 (Department of the Environment and Energy 2019b). However, the transition to renewables is not occurring rapidly enough to counter rising emissions in most other sectors of the Australian economy. Australia's electricity emissions must come down much faster, and other sectors of the economy must take action too, if Australia is to meet even its weak Paris target of 26-28% below 2005 levels by 2030.

In 2015, the Climate Change Authority (CCA) recommended an economy-wide emissions reduction target of 45-65% below 2005 levels by 2030. This target was developed based on scientific evidence, Australia's national interest, and action pledged by comparable countries (CCA 2015). The government rejected this target and instead adopted the dismal target of 26-28% by 2030. The Federal Government does not have a target beyond 2030.

Figure 2: Australia generated 19% of electricity from renewables in 2018 but must increase renewable energy much faster if we are meet even our weak Paris target.

Since then, Australia's emissions have continued to rise. In addition, the Paris Agreement ramped up international ambition by enshrining a goal of limiting temperature increase to 1.5°C. As a result, an economy-wide emissions reduction of 65% by 2030 – the upper end of the CCA's recommended target – should now be the minimum target. This requires deep, rapid cuts to our emissions from electricity.

Despite the need for increased ambition, the Federal Government is getting in the way of progress on renewable energy. The Coalition won the May 2019 federal election with no credible climate or renewable energy policy. Until recently, the Renewable Energy Target (RET) supported uptake of renewables across the country, despite repeated efforts by the Coalition to dismantle it (Climate Council 2019b). In 2015, the RET was slashed to 33,000GWh of new renewable generation[1] by 2020, and this target was met in September 2019 with the Cattle Hill Wind Farm in Tasmania (RenewEconomy 2019c). While this is a notable milestone, the Government has ruled out extending the RET or enacting new policy to accelerate the renewable transition (The Guardian 2018), leaving Australia with a policy vacuum at the federal level.

With the exception of projects driven by state and territory renewable purchases, this federal policy vacuum is causing the investment pipeline for new large-scale renewable projects to decline sharply. In 2019, new investment has fallen to levels last seen four years ago when former Prime Minister Abbott was trying to abolish the RET (Clean Energy Council 2019b).

Organisations as diverse as the Energy Users Association of Australia (EUAA 2017), the Clean Energy Council (SMH 2019c) and the states and territories themselves (AFR 2018) have called on the Federal Government to settle on an integrated climate and energy policy.

Taken together these calls suggest that the Federal Government's failure to lead has undermined investor confidence, driven up prices, and most importantly, meant that the

[1] Roughly 23% of total electricity demand.

Figure 3: The Renewable Energy Target (RET) helped drive an increase in renewables, such as the Bald Hills wind farm in Victoria, but the Federal Government has ruled out extending the target or enacting new policy.

electricity networks of Australia are failing to reduce emissions at their full potential.

In the absence of credible national climate and renewable energy policy, some state and territory governments have stepped up to fill the void. States and territories such as South Australia and the ACT are showing national and even international leadership in the transition to a renewable energy future.

The ACT is on track to hit 100% renewable energy from 1 January 2020. This makes it just the eighth jurisdiction in the world with a population above 100,000 – and the only one outside Europe – to achieve 100% renewable electricity (The Australia Institute 2019b). South Australia is pioneering the transition to a grid with majority renewable generation backed by storage, and now has one of the highest penetrations of wind and solar PV in the world (IEA 2019). Recently, there have been several days where South Australia's demand has been entirely met with wind and solar (OpenNEM 2019).

Other states and territories, such as New South Wales, Western Australia, and the Northern Territory, are making slow progress but could be doing much more. In the face of Federal Government inaction, state and territory leadership is vital if Australia is to take strong action on climate change.

States and territories are driving much needed progress in the absence of federal leadership, but some states and territories need to do much more.

Despite international progress in the transition to renewable energy, global emissions are still rising.

Globally, renewable energy now accounts for over 26% of all electricity produced, or 12.9% excluding large-scale hydro (Frankfurt School-UNEP 2019).

2018 was a strong year for renewable energy globally, although it appears that installation of new renewable energy capacity may be starting to level off after a boom in recent years (REN21 2019). In the decade 2010-19, more solar capacity was installed worldwide than any other power source, including fossil fuels (REN21 2019).

Despite this progress, global emissions from energy still rose in 2018 (REN21 2019). Countries must act much faster to accelerate the transition to renewable energy and storage if we are to limit global temperature rise to 1.5°C or well below 2°C, as globally agreed in the Paris Agreement.

At least nine countries produced over 20% of their electricity from wind and solar PV in 2018 (REN21 2019) (see Table 1). Australia, despite being the sunniest and one of the windiest countries in the world, generated only 11% of electricity from wind and solar in 2018 (Department of the Environment and Energy 2019b). Although Australia was among the top countries for new renewable capacity installed per person in 2018 (ARENA 2019a), we continue to trail behind the front runners in renewable generation and must transition much faster.

Australia must step up and lead the transition to a renewable energy future. Australia's per person greenhouse gas emissions are among the highest in the world, behind only smaller petro-states such as Qatar. Including fossil fuel exports, Australia is the fifth largest polluter in the world, equal to the total emissions of Russia (Climate Analytics 2019).

Australia is also the third-largest fossil fuel exporter in the world behind only Russia and Saudi Arabia (The Australia Institute 2019a). Australian states and territories such as South Australia and the ACT are leading the way in rapidly transitioning to renewable energy, but other states and territories need to do much more.

Table 1: At least nine countries produced over 20% of their electricity from wind and solar in 2018. Australia trails behind with 11%.

Country	% wind and solar electricity generation
Denmark	Over 50%
Uruguay	Over 30%
Ireland	Over 25%
Germany	Over 25%
Portugal	Over 20%
Spain	Over 20%
Greece	Over 20%
United Kingdom	Over 20%
Honduras	Over 20%
Australia	11%

Source: REN21 2019.

3. State and Territory Renewable Energy Scorecard 2019

Each year, the Climate Council tracks the relative progress of Australian states and territories in the transition to renewable energy. States and territories are compared on their performance across a range of criteria: share of electricity from renewable energy, proportion of households with rooftop solar, large-scale wind and solar capacity per capita, and targets and policies to support the transition.

South Australia, the ACT and Tasmania continue to lead in this year's renewable energy race, with South Australia in first place. Victoria and Queensland are catching up, while New South Wales, Western Australia and the Northern Territory are lagging at the back of the pack. The Northern Territory is once again in last place, despite improving on some metrics this year.

Figure 4: Lal Lal Wind Farm in Victoria. States and territories are scored on share of renewable energy, households with rooftop solar, large-scale wind and solar capacity per capita, and targets or policies to support the transition.

3.1 Percentage renewable electricity

Tasmania, the ACT, and South Australia continue their strong lead over the other states and territories on share of renewable energy. All three now source over 50% of their electricity from renewable energy (Table 2).

The proportion of electricity generated from renewable energy increased in all states and territories in 2018. The proportion of wind and solar energy increased in all states and territories except Tasmania, where the increase in renewables was due to an increase in hydro generation.

Over 50% of electricity used in Tasmania, the ACT, and South Australia is generated from renewable energy.

Table 2: State and territory share of renewable electricity generation. Tasmania continues to lead with 94.6%, while the Northern Territory is once again in last place with just 4%.

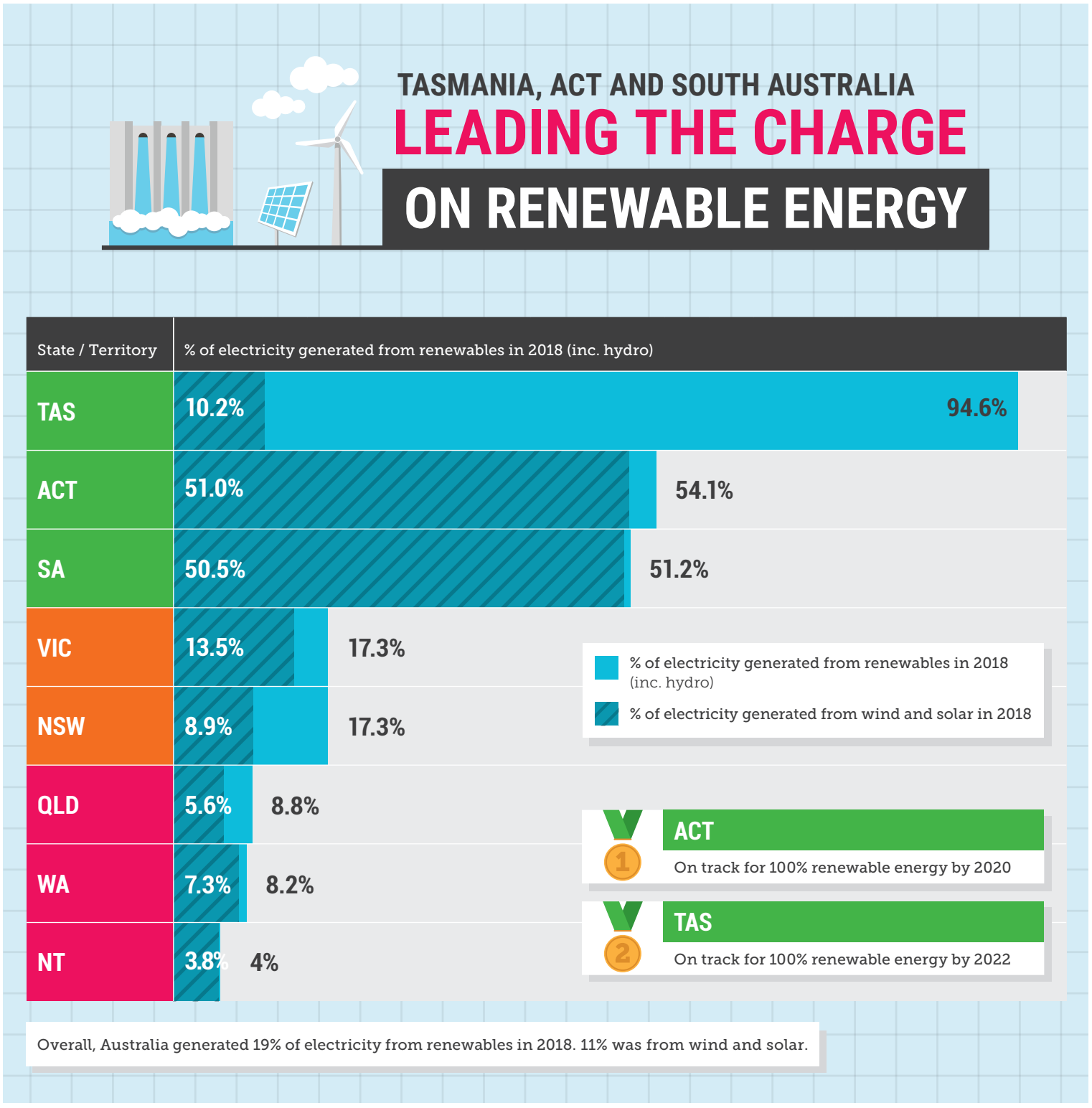
State/Territory	% of electricity generated from renewables in 2018 (inc. hydro)	% wind and solar electricity generation in 2018	Change in wind and solar generation from 2017
TAS	94.6	10.2	↓ 1.0
ACT	54.1[1]	51.0	↑ 7.9
SA	51.2	50.5	↑ 7.8
VIC	17.3	13.5	↑ 3.2
NSW	17.3	8.9	↑ 3.3
QLD	8.8	5.6	↑ 1.9
WA	8.2	7.3	↑ 0.8
NT	4.0	3.8	↑ 0.8

Source: Department of the Environment and Energy 2019b.

[1]Figure supplied by the ACT Government.

Note: Federal Government energy statistics are used here to provide a consistent means of comparing the states and territories. Individual states and territories may publish different figures based on different assumptions and data sources. For example, Victoria reports a higher figure for their state (20.5%) than Federal Government figures, as the Victorian Government includes the Murray hydroelectric station (located in NSW, but in Victoria's National Electricity Market region) in Victoria's total. The ACT is an exception, as the Federal Government does not report separately on the ACT and the ACT sources renewable energy from outside its geography to meet its target.

Figure 5: Some states and territories are leading the way in the transition to renewable energy, such as the ACT, Tasmania and South Australia, while others have a long way to catch up.



BOX 1: MANY ROUTES TO A RENEWABLE FUTURE

While three front runners – Tasmania, the ACT and South Australia – have now achieved over 50% renewables (see Figure 5), they have all taken a different approach to reaching this milestone.

Tasmania tops the list with nearly 95% renewable energy because of its high penetration of hydro-electric dams. Most of these dams were built before 1980, but Tasmania has made some renewable progress recently with the installation of new wind farms. While hydro is a form of renewable energy, it can be unreliable, as it is highly vulnerable to changes in rainfall and water availability. The state is on track for 100% renewables by 2022 and has ambitions to become the Battery of the Nation. Tasmania exports energy to Victoria via the Basslink cable and is reliant on imports during the warmer months.

The ACT achieved 54% renewable energy in 2018, but is on track for 100% from 2020 using an innovative approach. The ACT has minimal generation infrastructure within its small physical geography and sources electricity from the New South Wales section of the NEM. The ACT will hit 100% renewables thanks to contracts with projects located across the NEM. The ACT used reverse auctions to buy 640MW of renewable energy – enough to meet 100% of its annual demand – at the lowest price, to be supplied into the grid wherever it is generated.

South Australia achieved 51% renewable energy in 2018 by building significant large-scale wind and solar resources. South Australia has one of the highest grid penetrations of wind and solar PV in the world (IEA 2019). The state is now leading the way in solving the physical supply and demand challenges of a grid with a high share of wind and solar, including storage, dispatchability, and frequency control. For example, South Australia is building and integrating storage projects such as the world's largest grid scale battery, synchronous condensers, and a new interconnector to New South Wales. It is also building a renewable hydrogen industry to turn surplus renewable power into stored hydrogen for transport fuels and to help balance the grid.

3.2 Wind and solar capacity per person

2018 saw a boom in large-scale wind and solar projects in Australia, eclipsing previous records for investment and installed capacity. Investment in large-scale renewables hit $20 billion in 2018, with 14,500MW (or 14.5GW) of new renewable generation under construction or financially committed by the end of the year (Clean Energy Council 2019).

This is important progress, but follows a major drop in investment in 2014 and 2015 due to policy uncertainty from the Federal Government (Climate Council 2018). Federally, we are again entering a policy void, as the government has ruled out extending the RET or enacting new policy to drive the transition to renewables. As a result, investment in new renewables has started to decline sharply in 2019 (Clean Energy Council 2019b). State and territory governments play a critical role in driving uptake of renewables and storage, in the progress reflected here and into the future.

The ACT and South Australia are way ahead of the other states and territories on installed large-scale wind and solar capacity per capita, with Tasmania coming in third (see Table 3). Western Australia, New South Wales and the Northern Territory are once again bringing up the rear.

Victoria has now overtaken South Australia as the state with the largest total capacity of installed large-scale wind and solar (2,223MW), although South Australia (2,190MW) and New South Wales (2,014MW) are not too far behind (see Table 3). The Northern Territory continues to rank last in terms of both per capita and total installed wind and solar capacity.

Table 3: State and territory large-scale solar and wind capacity per capita in March 2019 (small-scale solar excluded).

State/Territory	Wind and solar installed capacity (MW)[1]	Population (in millions)[2]	Wind and solar capacity per person (kW)	Change (kW) from last year's report
ACT	542[3]	0.426	1.27	↑ 0.17
SA	2,190	1.749	1.25	↑ 0.19
TAS	319	0.533	0.60	↓ 0.11
QLD	1,938	5.077	0.38	↑ 0.31
VIC	2,223	6.566	0.34	↑ 0.08
WA	720	2.616	0.28	↑ 0.09
NSW	2,014	8.071	0.25	↑ 0.03
NT	29	0.246	0.12	↑ 0.06

Source: [1]CER 2019a; CER 2019b. [2]ABS 2019. [3]Figure supplied by the ACT Government.

Note: This is the latest data, including January to March of 2019, whereas the renewable electricity generation data in the previous section is from 2018 (the most recent data for that metric).

Figure 6: Ross River Solar Farm in Townsville. Queensland wins the 'Most Improved' Award for the most substantial increase in per capita wind and solar capacity from last year's report.

Queensland wins the 'Most Improved' Award, eclipsing the other states and territories in its increase in per capita wind and solar capacity from last year's report (see Table 3). Nearly half, or 17 of the 38, large-scale renewable energy projects completed across Australia in 2018 were in Queensland (Clean Energy Council 2019a). This moves Queensland up three rankings to fourth place this year on the wind and solar capacity criteria.

Wind and solar capacity figures should continue to rise over 2019 for all states and territories, and the ACT will hit 100% renewable energy from 2020 (ACT Government 2019b). All states have installed further large-scale wind and solar capacity between April and September 2019, while the territories have not (CER 2019b). Victoria has installed the most (604MW) in total capacity terms, but on a per capita basis, Tasmania (148MW or 0.28kW per capita) and South Australia (237MW or 0.14kW per capita) top the list.

Victoria, Western Australia, Tasmania, New South Wales and Queensland all have substantial large-scale wind and solar projects at the 'committed' stage, so should increase their capacity in the near future[2]. This includes 2,098MW in Victoria, the most of any state and territory in both total and per person terms. The Northern Territory and South Australia both have large-scale wind and solar projects of significant per capita capacity at the 'probable' phase[3].

All states and territories have substantial wind and solar projects in the pipeline – except the ACT, which will hit 100% renewable energy from 2020.

[2] Committed projects are defined by the Clean Energy Regulator (CER) as 'projects that have received all development approvals and reached a final investment decision according to the commercial understanding of the term'.

[3] Probable projects are defined by the CER as projects that 'have a high degree of confidence that they will proceed following a public announcement of a power purchase agreement with a strong counter party or other evidence of funding'.

3.3 Proportion of households with rooftop solar

The rapid rise of rooftop solar has continued since last year's report, with Australian households and businesses continuing to break records for rooftop solar installation. The share of households with rooftop solar has increased in all states and territories over the last year. In 2018, 1.55GW of rooftop solar was installed across Australia, a significant increase from the previous year (Clean Energy Council 2019a). 2019 looks set to once again surpass these records, driven in part by favourable policies from state and territory governments.

Australia leads the world in the proportion of households with rooftop solar (APVI 2018). As at June 2019, total installed capacity of rooftop solar was close to 9.0GW, representing over 2 million households - roughly one in five - with rooftop solar (Clean Energy Council 2019a). The average size of installed rooftop solar systems also continues to increase, as does the rate of battery storage installation, as the technology improves and costs decrease (Australian Energy Council 2019).

Queensland continues to lead on rooftop solar. Over one-third of all households in both Queensland (35.7%) and South Australia (35.0%) now have rooftop solar (see Table 4). The Northern Territory improved the most over the past year, hitting 18.1% in October 2019, up from 13.8% of households with rooftop solar in last year's report. This moves the Northern Territory up from last place to fifth this year.

Over one-third of households in both Queensland and South Australia now have rooftop solar.

Table 4: Share of households with rooftop solar by state and territory. Queensland and South Australia continue to lead.

State	% of households with rooftop solar by state and territory (October 2019)	Increase from last year's report	Number of postcodes where over 50% of households have rooftop solar (excluding postcodes with under 1,000 households)
QLD	35.7	2.8	33
SA	35.0	2.7	11
WA	28.8	2.1	-
NSW	20.4	2.8	3
NT	18.1	4.3	-
VIC	17.9	2.0	-
ACT	16.1	1.9	-
TAS	15.1	1.3	-

Source: APVI 2019.
Note: APVI statistics are used here to provide a consistent means of comparing the states and territories. Individual states and territories may publish different figures based on different assumptions and data sources.

Figure 7: Australia leads the world in rooftop solar. Roughly one in five Australian households have rooftop solar.

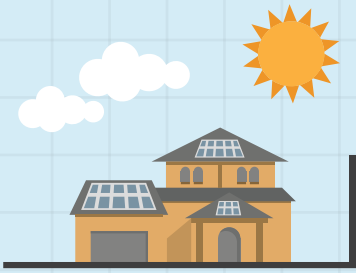
There are now 47 Australian suburbs where over 50% of households have installed rooftop solar, a significant increase from 26 in last year's report (APVI 2019). Queensland continues to dominate, with an impressive 33 of these solar suburbs. Of the remaining suburbs, 11 are in South Australia and 3 in New South Wales (see Table 4). Table 5 lists the top postcode in each state or territory for rooftop solar installation.

There are now 47 Australian suburbs where over half of all homes have rooftop solar.

Table 5: The top postcode in each state or territory for rooftop solar installation. Only suburbs with more than 1,000 dwellings are included.

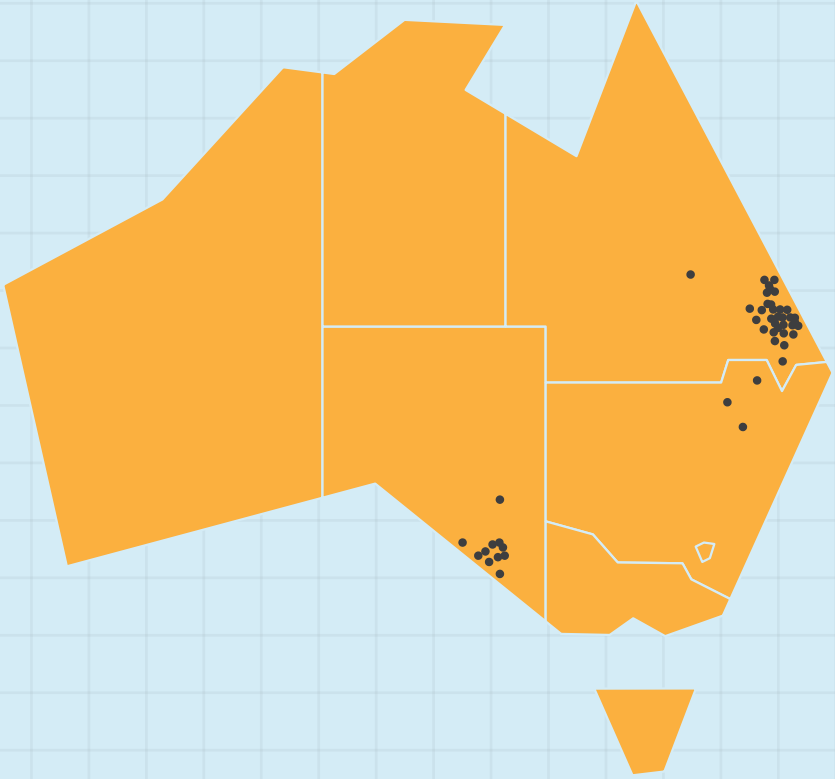
State	Postcode	Suburbs	Rooftop solar installations (October 2019)	% of households with rooftop solar
Queensland	4516	Elimbah	974	74.2%
South Australia	5117	Angle Vale	721	66.8%
New South Wales	2390	Narrabri	2175	59.1%
Western Australia	6083	Gidgegannup, Morangup	684	49.5%
Victoria	3678	Wangaratta	1150	41.2%
NT	836	Girraween, Herbert, Humpty Doo	842	29.2%
Tasmania	7277	Bridgenorth, Grindelwald, Legana, Rosevears	616	25.4%
ACT	2904	Fadden, Gowrie, Monash	1121	22.4%

Source: APVI 2019



POSTCODES WITH 50% OR HIGHER ROOFTOP SOLAR

47 suburbs in total
33 in Queensland
11 in South Australia
3 in New South Wales



Postcodes with over 50% Rooftop Solar

4516	QLD	4125	QLD	4518	QLD	5351	SA	5600	SA
5117	SA	4512	QLD	4555	QLD	4275	QLD	4519	QLD
4553	QLD	4563	QLD	2400	NSW	5153	SA	5212	SA
4280	QLD	4228	QLD	4514	QLD	4568	QLD	5330	SA
4270	QLD	4156	QLD	4306	QLD	5501	SA	4035	QLD
4561	QLD	5157	SA	4562	QLD	4521	QLD	2388	NSW
4520	QLD	4312	QLD	4505	QLD	4552	QLD	4159	QLD
4124	QLD	5171	SA	4037	QLD	4022	QLD		
5172	SA	5254	SA	4341	QLD	4165	QLD		
2390	NSW	4511	QLD	4504	QLD	4164	QLD		

Figure 9: There are now 47 Australian suburbs where over 50% of households have installed rooftop solar. 33 of these suburbs are in Queensland.

3.4 Renewable energy and emissions reduction targets and policies

State and territory governments are stepping up to fill the void created by the Federal Government's lack of credible climate and renewable energy policy. All states and territories now have net zero emissions targets by 2050 at the latest, at least in draft form (see Table 6 and Figure 10). Western Australia committed to an aspirational target of net zero emissions by 2050 in August 2019 (Government of Western Australia 2019b) and the Northern Territory announced a draft net zero emissions by 2050 target in September 2019 (Northern Territory Government 2019b). If the Northern Territory's target is officially adopted following public consultation, Australia will have a de facto target of net zero emissions by 2050 even in the absence of federal leadership and ambition.

All states and territories now have a target of net zero emissions by 2050 at the latest, although the Northern Territory's target is still in draft form.

Table 6: State and territory renewable energy targets and net zero emissions targets. All states and territories now have net zero emissions targets, at least in draft form.

	ACT[1]	VIC[2]	QLD[3]	TAS[4]	NT[5]	SA[6]	NSW[7]	WA[8]
Renewable electricity target	100% by 2020	25% by 2020; 40% by 2025; 50% by 2030	50% by 2030	100% by 2022	50% by 2030	100% in the 2030s	None	None
Net zero emissions target	By 2045	By 2050	By 2050	By 2050	By 2050 (Draft)	By 2050	By 2050	By 2050

Source: [1]ACT Government 2019a; ACT Government 2019b. [2]Premier of Victoria 2019; Victorian Government 2019a. [3]Queensland Government 2017. [4]Tasmanian Government 2017a; Tasmanian Government 2017b. [5]Northern Territory Government 2019b; Northern Territory Government 2019c. [6]Government of South Australia 2019d; Government of South Australia 2019b. [7]SMH 2019b. [8]Government of Western Australia 2019f.

Victoria and the ACT have legislated net zero emissions targets, while South Australia and Tasmania have committed to net zero targets but legislated less ambitious targets. New South Wales, Queensland, Western Australia and the Northern Territory all have aspirational net zero emissions targets. ACT is the most ambitious, committing to net zero emissions by 2045, whereas all other states and territories have committed to 2050.

With the exception of New South Wales and Western Australia, all states and territories also have renewable energy targets. These targets range in ambition from 100% renewable electricity by 2020 in the ACT to 50% by 2030 in Victoria, Queensland, and the Northern Territory (see Table 6 and Figure 10). Some states and territories, such as the ACT and Tasmania, are already on track to achieve these targets, while others, such as Queensland and the Northern Territory, still have to put policies and projects in place to achieve their targets.

All states and territories except New South Wales and Western Australia have a renewable energy target.

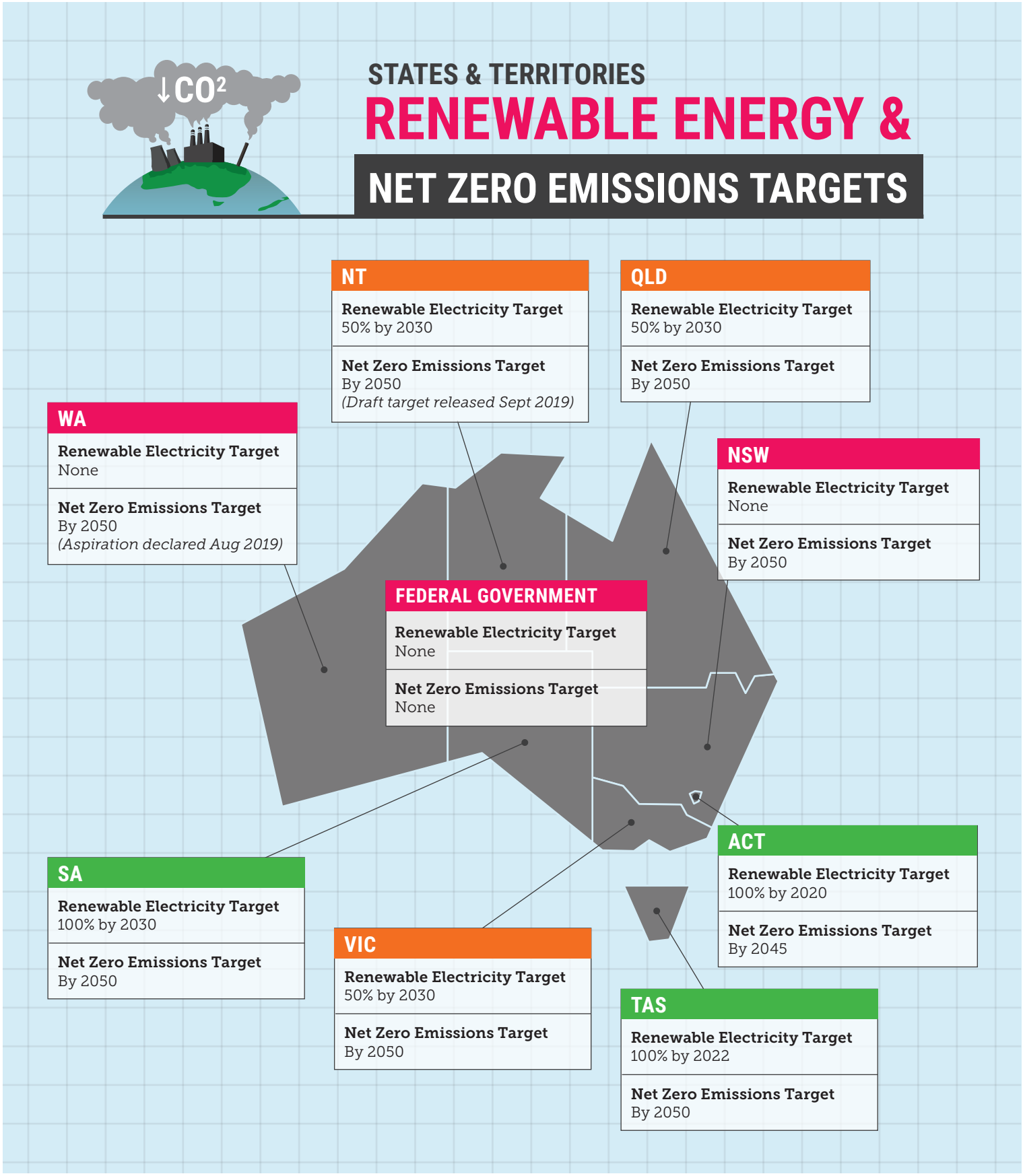


Figure 10: All states and territories now have a net zero emissions target, and all except New South Wales and Western Australia have a renewable energy target. The Federal Government now has neither.

4. The leaderboard: State and territory by renewable energy progress

4.1 Front runners

SOUTH AUSTRALIA

South Australia has taken the lead in this year's state and territory renewables race, after consistently placing as a front runner in every Climate Council scorecard. South Australia ranks in the top three for every metric, coming second for both proportion of households with rooftop solar and large-scale wind and solar capacity per person. On the latter metric, South Australia and the ACT (in first place) are way ahead of the other states and territories. South Australia has more than double the per person capacity of Tasmania, which comes in third.

Although South Australia comes third for share of electricity generated from renewables, the state is a global leader in transitioning to a grid with high variable renewable energy. South Australia on average sources over 50% of its electricity from wind and solar backed by storage, one of the highest shares of grid-integrated wind and solar in the world (IEA 2019). There have been several days recently where South Australia's demand has been entirely met with wind and solar (OpenNEM 2019).

In contrast, Tasmania (in first place) has a high percentage of hydro, while the ACT uses contracts with renewable generators located across the NEM to hit its renewable targets. Box 1 in Section 3 gives a more detailed description of the different approach taken by each.

FAST FACTS: SA

Percentage renewable power:
South Australia generated 51.2% of its electricity from renewable energy in 2018, a substantial jump from 43.4% in 2017[1].

Households:
South Australia now has over one-third of households with rooftop solar (35.0%), putting it in second place behind Queensland[2].

Policy

- South Australia has committed to a target of net zero emissions by 2050. The state also has a legislated target to reduce greenhouse gas emissions by at least 60% below 1990 levels by 2050[3].
- South Australia's Liberal state government has an aspirational target for net 100% renewable energy in the 2030s[4].
- In September 2019, South Australia launched its Hydrogen Action Plan, to identify optimal locations for renewable hydrogen production and scale up production[5].
- The South Australian Government is seeking to expedite Project EnergyConnect, a new SA-NSW interconnector. Several large-scale renewable projects rely on this interconnector to go ahead[6].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Government of South Australia 2019a; Government of South Australia 2019b. [4]Government of South Australia 2019d. [5]Government of South Australia 2019c. [6]Clean Energy Council 2019a.

Figure 11: South Australia is balancing the complexities of a grid with high wind and solar penetration with storage projects, including the Tesla big battery at the Hornsdale Power Reserve.

South Australia has committed to achieving net zero emissions by 2050. However, this was announced as part of the previous Labor state government's Climate Change Strategy and the current Liberal state government has requested the Premier's Climate Change Council develop a new climate change strategy (Government of South Australia 2019b). The state also has a legislated emissions reduction target to reduce greenhouse gas emissions by at least 60% below 1990 levels by 2050 (Government of South Australia 2019a).

South Australia's current Liberal state government refused to commit to the previous government's renewable energy target during the March 2018 state election. Since then, however, South Australia has continued its renewable energy boom and the government has recently announced it is aiming for net 100% renewables in the 2030s (Government of South Australia 2019d). Although vague, this is one of the most ambitious renewable energy targets amongst the states and territories.

South Australia now generates more than half its electricity from wind and solar.

Figure 12: South Australia generated 51.2% of electricity from renewable energy in 2018, including from projects such as the 132MW North Brown Hill Wind Farm.

South Australia has been investing heavily in household battery storage and is now home to Australia's largest 'virtual power plant', coordinating 1,000 batteries in a 5MW scheme (One Step Off the Grid 2019b). In a virtual power plant, the operation of a large number of solar and battery storage systems is controlled through software by an electricity retailer. This enables the generation, charge and discharge of the solar panels and batteries to be coordinated so that, together, the systems effectively operate as a power plant.

South Australia has significant large-scale wind, solar, and storage projects under construction or in the planning phase. For example, Neoen recently announced plans to build a record-breaking project in Burra that would involve 1,200MW of wind, 600MW of solar and 900MW of battery storage at full capacity. This would make it the largest wind farm in Australia and nine times the power rating of South Australia's first big battery at Hornsdale Wind Farm (The Advertiser 2019).

Several large-scale renewable projects – including the later stages of Neoen's Burra project – rely on the proposed new SA-NSW interconnector, Project EnergyConnect, going ahead. The South Australian Government is seeking to expedite the interconnector and has committed $200 million to the project (Clean Energy Council 2019a). Project EnergyConnect has also been granted Major Project Status, which recognises national strategic significance.

The state government recently released its Hydrogen Action Plan, which outlines its vision to make South Australia a leader in renewable hydrogen. The plan includes identifying locations for production and export infrastructure, as well as action needed in areas such as investment, regulation and trade to scale-up production for export and domestic consumption (Government of South Australia 2019c). While many state and territory governments have indicated an interest in renewable hydrogen, this is one of the most detailed plans released so far.

BOX 2: HYDROGEN ENERGY

Hydrogen can be produced using either renewable energy or fossil fuels. Renewable hydrogen uses renewable electricity to produce hydrogen by splitting water molecules into hydrogen and oxygen, with no resulting greenhouse gas emissions.

Hydrogen offers considerable advantages. Once produced, hydrogen can be stored and transported easily, creating a wide array of potential applications, including in sectors where decarbonisation is otherwise difficult. This includes replacing metallurgical coal in the production of steel, as well providing a lightweight fuel source for large aircraft. Hydrogen can also be used as temporary storage for the electricity network, helping the grid ride the peaks and troughs of wind and solar generation.

Hydrogen is emerging as a global market. Australia has the opportunity to become a leading hydrogen exporter, creating jobs and local investment. While Australia has boundless space and remarkable wind and solar reserves, many of our neighbours in the region do not. Hydrogen exports would allow these countries to meet their own energy needs with Australian wind and sun.

Renewable Hydrogen production and export could significantly reduce greenhouse gas emissions both domestically and overseas and boost Australia's economy. Australia's massive renewable energy resources mean Australia could become a superpower of the zero-carbon world, all while shoring up our own grid.

AUSTRALIAN CAPITAL TERRITORY

The ACT is in second place in this year's state and territory renewables race, falling from the top spot in last year's report. The ACT ranks in the top two for all scorecard metrics except rooftop solar, where it is second last.

The ACT is currently second for renewable energy behind Tasmania, but wins an 'Honourable Mention' for being on track to source 100% of its electricity from renewable energy from 1 January 2020. The ACT's final major renewable generator, the Hornsdale 3 wind farm in South Australia, began delivering on its contract from 1 October 2019. The territory now has all necessary infrastructure in place for 100% renewable electricity (ACT Government 2019b).

This is a remarkable achievement and makes the ACT just the eighth jurisdiction in the world with a population above 100,000 – and the only one outside of Europe – to achieve 100% renewable electricity (The Australia Institute 2019b). Box 1 in Section 3 provides more information on the ACT's approach to achieving this milestone, compared to the other front runners (Tasmania and South Australia).

FAST FACTS: ACT

Percentage renewable power:
The ACT consumed 54.1% renewable electricity in 2018, up from 46.2% in 2017. The ACT will hit 100% renewable energy from 1 January 2020[1].

Households:
16.1% of ACT households have rooftop solar, putting the ACT second last[2].

Policy

- On track to hit 100% renewable energy target from 2020, with the last of its major projects starting to deliver on its contract from 1 October 2019[3].
- The ACT is now shifting focus to other sources of emissions, including transport and phasing out household gas use[4].
- Released the ACT Climate Change Strategy 2019-2025, which lays out a plan to reach net zero emissions by 2045[4].
- The ACT Government has announced a new reverse auction for up to 250MW of new renewable energy generation with 20MW/40MWh of battery storage to 'future proof' its 100% renewables achievement[5].

Source: [1]Figure supplied by the ACT Government. [2]APVI 2019. [3]ACT Government 2019b. [4]ACT Government 2019a. [5]RenewEconomy 2019f.

The ACT wins an 'Honourable Mention' for being on track to hit 100% renewable energy from 1 January 2020.

Now that it is on track for 100% renewable energy, the ACT Government has announced a new reverse auction to 'future proof' this achievement. This is important as the population grows and the economy shifts towards electric vehicles and phasing out household gas use. The new reverse auction will run from November 2019 to February 2020 and will contract up to 200MW of new wind-equivalent renewable energy generation (or 250MW of solar), which must be delivered with 20MW/40MWh of battery storage. The battery storage will be located within the ACT to support the local electricity grid (RenewEconomy 2019d).

The ACT recently released its Climate Change Strategy 2019-2025, which lays out a vision for achieving its legislated target of net zero emissions by 2045. Within the net zero target, the government has committed to interim targets of 50-60% below 1990 levels by 2025, 65-75% by 2030 and 90-95% by 2040 (ACT Government 2019a).

Figure 13: The ACT is on track to achieve 100% renewable energy from 2020, with the third stage of the Hornsdale wind farm in South Australia (pictured) delivering on its contract from 1 October 2019.

The ACT is set to become the first jurisdiction outside of Europe, and only the eighth in the world, to achieve 100% renewable electricity.

The ACT is one of the only states and territories with a truly science-based emissions reduction target. The ACT used a 'carbon budget' approach[4], setting its targets in line with action required to keep warming below 2°C (ACT Government 2019a). While the ACT should increase this ambition over time – the Paris Agreement commits Australia to pursuing efforts to keep warming below 1.5°C – this science-based approach to climate policy formation is a step in the right direction. The strategy largely focuses on transport and gas, which will be the two largest sources of emissions from 2020 when the territory achieves 100% renewable electricity.

BOX 3: THE NEXT STEP: 100%+ RENEWABLES

When considering the transition to a renewable future, state and territory governments should plan not only for meeting 100% of today's electricity demand, but also for meeting future demand.

Electricity generation from the grid is responsible for half of Australia's greenhouse gas emissions from energy and one third of Australia's total emissions (Department of Environment and Energy 2019b). To deal with climate change adequately, all fossil fuel use must reach zero as soon as possible.

Non-electricity uses of fossil fuels are diverse. Most, however, can be electrified and powered by renewables either directly (such as installing solar to replace industrial-scale fuel oil or diesel generators), or through storage (such as conventional batteries or hydrogen fuel cells for road transport).

Batteries and hydrogen fuel cells will drastically increase demand on the electricity network. State and territory governments must plan for these increases in order to achieve and sustain 100% renewable electricity in the long term.

[4]The carbon budget is a scientifically robust approach to considering the amount of greenhouse gas emissions that can be 'spent' without causing the Earth to exceed a given temperature target. The budget is based on the relatively linear relationship between carbon dioxide concentrations and temperature rise.

TASMANIA

Tasmania comes third in this year's state and territory renewables race, maintaining its spot among the front runners. Tasmania is in the top three for every scorecard metric except rooftop solar, where it comes last.

Tasmania ranks first among the states and territories for share of electricity from renewable energy in 2018. Tasmania generated 94.6% renewable electricity in 2018, a substantial jump from 87.4% in 2017 and above the state's previous peak of 92% in 2016 (Climate Council 2018). These fluctuations are largely due to changes in rainfall and water availability, as Tasmania generates the majority of its renewable energy from hydro-electric dams.

Tasmania leads in renewable energy, mostly due to its large-scale hydro power, built through last century. Recent increases in renewable electricity generation have been slower than other front runners. Including existing hydro, Tasmania has all the necessary projects in place to achieve its target of 100% renewable electricity by 2022 (Green Energy Markets 2019).

FAST FACTS: TAS

Percentage renewable power:
Tasmania generated 94.6% of its electricity from renewable energy in 2018, the most of any state or territory[1].

Households:
15.1% of Tasmanian households have rooftop solar, putting it in last place[2].

Policy

- On track to hit its target of 100% renewable energy by 2022[3].
- Conducting feasibility assessments of potential pumped hydro sites for the Battery of the Nation program, to supply into the NEM when the second interconnector comes online[4].
- Tasmania has a target of net zero emissions by 2050 and the lowest per person emissions of any state or territory[5].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Green Energy Markets 2019. [4]Hydro Tasmania 2019a. [5]Tasmanian Government 2019.

Tasmania's Battery of the Nation plan could double Tasmania's renewable energy capacity and generate local jobs and billions of dollars in investment.

Figure 14: The Woolnorth wind farms in Tasmania. Tasmania leads in renewable energy generation but comes third for large-scale solar and wind capacity per person.

Tasmania comes third for large-scale solar and wind capacity per person, with less than half the per person capacity of South Australia in second place. However, Tasmania has recently added one major wind farm, with another one in the pipeline, that will significantly increase capacity. The Cattle Hill Wind Farm came online in September 2019 – and was the project that officially marked the achievement of Australia's federal 2020 Renewable Energy Target (RET) (RenewEconomy 2019c) – and the Granville Harbour Wind Farm is currently under construction (CER 2019b).

The Tasmanian Government is progressing its ambition to be the 'Battery of the Nation' – that is, to contribute significant renewable energy, primarily from wind and pumped hydro, into the NEM to be used on the mainland (Hydro Tasmania 2019c). While Tasmania has the weakest potential for solar in Australia, it has immense natural wind resources, especially the 'roaring forties' that buffet the western half of the island (Hydro Tasmania 2019b). Ultimately, the Battery of the Nation project could double Tasmania's renewable energy capacity, generate billions of dollars in investment, and create thousands of jobs in regional Tasmania over the next 10-15 years (Clean Energy Council 2019a).

The state is currently conducting a feasibility assessment of three potential pumped hydro sites for the Battery of the Nation initiative. One will be chosen to supply into the NEM when Marinus Link, the 1,500MW second undersea interconnector with Victoria, comes online (Hydro Tasmania 2019a). This is a long-term project – a recent ARENA study found that Marinus Link could be commercially viable 'in the 2030s or even sooner' (ARENA 2019b; TasNetworks 2019).

Tasmania has an emissions reduction target of net zero by 2050. In 2016, Tasmania was the first state or territory to achieve net zero emissions, largely due to the state's forests acting as a carbon sink. However, using land-use measures to achieve net zero emissions is unreliable, as the stored carbon can be released through land clearing, bushfires, or other extreme weather events. Tasmania's emissions have increased slightly since then, but it remains the state or territory with Australia's lowest emissions per capita (Tasmanian Government 2019).

4.2 Catching up

VICTORIA

Victoria comes fourth in this year's state and territory renewables race, maintaining its place from last year. Victoria comes in well behind the top three front runners on most metrics, but has policies in place to improve its performance.

Victoria wins the 'Rising Star' Award for having the greatest capacity of large-scale wind and solar projects in the pipeline of any state or territory. This is both on a total and capacity per person basis. Victoria is currently in the middle of the pack for per person large-scale wind and solar capacity, but now has the largest total capacity (2,223MW) (CER 2019a; CER 2019b).

These figures should increase significantly over the coming year. Victoria installed an additional 604MW of large-scale wind and solar between April and September 2019, the most of any state or territory over that period. Victoria also has the greatest capacity of large-scale wind and solar projects at the 'committed' stage (2,098MW), both in total and per person (CER 2019b). These achievements are due in part to Australia's largest ever reverse auction for renewable energy (928MW) held by the Victorian Government in September 2018 (Climate Council 2018).

FAST FACTS: VIC

Percentage renewable power:
Victoria generated 17.3% renewable electricity in 2018, up from 13.6% in 2017. Victoria is equal fourth (with NSW) on this metric, but there is a large gap between these two states and the front runners[1].

Households:
17.9% of Victorian households have rooftop solar, putting Victoria third last[2].

Policy

- The Victorian Government recently legislated a Victorian Renewable Energy Target (VRET) of 50% by 2030, building on previous targets[3].
- Legislated target of net zero emissions by 2050. As part of this legislation, the Victorian Government will set interim targets every five years to stay on track for the 2050 target[4].
- Committed $1.3 billion to the Solar Homes program as part of a suite of clean energy policies. The program was overwhelmed by demand and as a result, the state government has brought solar rebates forward and increased the frequency of release[5].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Premier of Victoria 2019. [4]Victorian Government 2019b. [5]Solar Victoria 2019b; One Step Off the Grid 2019a.

Victoria wins the 'Rising Star' Award for having the largest total and per person capacity of wind and solar projects in the pipeline.

In October 2019, the state government legislated a Victorian Renewable Energy Target (VRET) of 50% by 2030. The 50% target builds on the existing legislated targets of 25% renewable energy generation by 2020 and 40% by 2025 (Premier of Victoria 2019). Victoria is on track to meet its 2025 target and could meet its new 2030 target if it conducts further large-scale reverse auctions (Green Energy Markets 2019).

According to the Victorian Government, the 50% VRET will create approximately 24,000 jobs by 2030 and generate an additional $5.8 billion of economic activity in Victoria. The government also estimates that 50% renewable energy by 2030 would bring down power bills by roughly $32 per household per year (Premier of Victoria 2019).

Figure 15: Victoria's 420MW Macarthur Wind Farm. The state has a target of 50% renewable energy by 2030 and the most large-scale wind and solar capacity in the pipeline of any state or territory.

Victoria has also legislated an emissions reduction target of net zero by 2050. The *Climate Change Act 2017* requires that the state set interim emissions reduction targets every five years to stay on track for the 2050 goal. Victoria's Independent Expert Panel on Interim Emissions Reduction Targets has suggested interim targets of 32-39% below 2005 levels by 2025 and 45-60% by 2030 (Victorian Government 2019b). The Victorian Government must make a decision on these targets by 31 March 2020 (Victorian Government 2019a).

Victoria is currently third last for rooftop solar – falling one place from last year – but the government has policies in place to catch up. The government announced the $1.3 billion Solar Homes program in the lead up to the November 2018 state election as part of a suite of clean energy policies. Solar Homes offers eligible households a rebate of up to $2,225 for rooftop solar and an interest-free loan to assist with paying the rest (Solar Victoria 2019b). The government is also trialling a battery rebate scheme, with 1,000 rebates of up to $4,838 on offer. In total, the program will support the installation solar panels, batteries, and solar hot water systems on 770,000 houses across Victoria (Solar Victoria 2019a).

The Solar Homes program has faced some controversy, but the Victorian Government has worked to address this. Initially, rebates were released at the beginning of each month and these were being snapped up in less than an hour each time (One Step Off the Grid 2019d). Industry argued that this effectively put a cap on the market, as households who did not secure a rebate would wait for the next allocation, creating a difficult business environment for solar installers. In August 2019, the Victorian Government announced that it would release rebates twice monthly and bring forward the release of more solar rebates (One Step Off the Grid 2019a). Industry has responded positively to these changes so far, although rebates are still being taken up quickly each time they are released (One Step Off the Grid 2019d).

Victoria has legislated a target of 50% renewable energy by 2030.

QUEENSLAND

Queensland comes fifth in this year's state and territory renewables race, maintaining its place in the middle of the pack. Queensland performs strongly on some metrics but lags on overall renewable energy generation. However, the recent boom in renewables construction, which created more than 2,000 new jobs in Queensland, suggests that the state should improve its performance on this metric in coming years (Clean Energy Council 2019a).

Queensland wins the 'Most Improved' Award for its substantial increase in per person large-scale wind and solar capacity. Nearly half (17 out of 38) of the large-scale renewable energy projects completed across Australia in 2018 were in Queensland (Clean Energy Council 2019a). In one year, Queensland moved up three places to rank fourth for installed large-scale wind and solar capacity per person.

FAST FACTS: QLD

Percentage renewable power:
Queensland generated 8.8% of electricity from renewables in 2018, putting it third last. This should increase significantly in coming years due to the recent boom in renewables construction.

Households:
Queensland once again leads the other states and territories with rooftop solar on 35.7% of households. 33 suburbs in Queensland have rooftop solar on more than half of all households[2].

Policy

- Queensland's new state-owned generator, CleanCo (which includes gas) began trading on 31 October 2019[3].
- Target of net zero emissions by 2050, but the government is months late in releasing its green paper on how it will achieve this target after 2020[4].
- Renewable energy target of 50% by 2030 (but not on track to meet this target)[5].
- Providing grants and interest free loans for households to purchase batteries and rooftop solar plus batteries. Also trialling a rebate program for rental households in Northern Queensland[6].
- Released the Queensland Hydrogen Industry Strategy 2019-2024 and established the $15 million Queensland Hydrogen Industry Development Fund for renewable hydrogen[7].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Queensland Government 2019d. [4]Brisbane Times 2019b. [5]Green Energy Markets 2019. [6]Queensland Government 2019a; PV Magazine 2019. [7]Queensland Government 2019b.

Figure 16: The 250MW Kidston pumped hydro project is converting an abandoned goldmine in north Queensland into a resource providing storage for renewables and dispatchable energy on demand.

Queensland wins the 'Most Improved' Award for its remarkable increase in large-scale wind and solar capacity per capita.

Queensland is showing no signs of slowing down – it installed further large-scale wind and solar between April to September 2019 (CER 2019b) and has substantial renewable energy generation and storage capacity in the pipeline. This includes projects such as Genex Power's $1 billion project to convert the abandoned Kidston Goldmine into a 250MW pumped hydro resource, providing storage for renewables and dispatchable energy on demand. The pumped hydro project will be supported by 270MW of solar and 150MW of wind energy (Clean Energy Council 2019a).

Queensland's new state-owned generator CleanCo began trading in the NEM on 31 October 2019. CleanCo has a mandate to deliver 1,000MW of new renewable energy projects by 2025, part of the state's efforts to achieve its renewable energy target of 50% by 2030 (Queensland Government 2019d).

CleanCo's foundation assets include the 570MW Wivenhoe pumped hydro storage project and three smaller hydro stations. However, the Swanbank E gas power station, a fossil fuel generator, is also included in its portfolio of assets (Queensland Government 2019d). CleanCo has already shortlisted ten projects for Renewables 400, a government reverse auction to provide up to 400MW of renewable energy capacity, including up to 100MW of storage (Queensland Government 2019c).

Figure 17: Workers install solar panels at the Kidston solar farm, intended to be integrated with the Kidston pumped hydro storage project in north Queensland.

Even with this significant increase in renewables, Queensland is not on track to hit its renewable energy target. Current commitments – including CleanCo – and rooftop solar trajectories have Queensland on track to hit just under 30% by 2030 (Green Energy Markets 2019). The Queensland Government also continues to support new fossil fuel developments in the Bowen Basin and opening up the massive Galilee Basin (Brisbane Times 2019a). New coal mines are fundamentally at odds with effective action on climate change, regardless of whether they are for domestic consumption or export.

Queensland has an emissions reduction target of net zero by 2050, but the government is months late in releasing its green paper on how it will achieve this target. The green paper was due for release in June or July 2019 (Brisbane Times 2019b). The state government has also set an interim emissions reduction target of at least 30% below 2005 levels by 2030, but has no plans in place to meet these targets beyond 2020 (Brisbane Times 2019b).

In better news for the state, Queensland is once again in first place on rooftop solar. More than one-third (35.7%) of households have solar panels installed, and there are now 33 suburbs in Queensland where over half of all homes have rooftop solar (APVI 2019).

State government rooftop solar policies are moving to focus on battery storage and rental households. In November 2018, the Queensland Government announced $3,000 grants and interest-free loans of up to $10,000 for household batteries or combined solar-battery systems. The program was initially capped at 1,500 households but was so popular that the government added an additional 2,500 packages. This larger scheme was fully subscribed by the end of June 2019 (Queensland Government 2019a). In March 2019, the Queensland Government also announced a trial of $3,500 solar rebates for up to 1,000 rental households in Bundaberg, Gladstone and Townsville (One Step Off the Grid 2019c).

The state government also released the Queensland Hydrogen Industry Strategy 2019-2024 and established the $15 million Queensland Hydrogen Industry Development Fund in May 2019 (Queensland Government 2019b). The strategy outlines Queensland's vision to be a leader in Australian renewable hydrogen production by 2030, with a particular focus on export opportunities in Asia.

4.3 At the starting blocks

NEW SOUTH WALES

New South Wales is in sixth place in this year's state and territory renewables race, a similar performance to last year. New South Wales is in the middle of the pack for most metrics and lacks strong targets to improve on this. But, there are signs that the government is starting to move in the right direction, with new policies to increase large-scale renewables and storage and rooftop solar.

New South Wales generated 17.3% of its electricity from renewable sources in 2018, up from 12.6% in 2017 (Department of the Environment and Energy 2019b). New South Wales has nearly returned to its renewable peak of 17.5% in 2016, after a substantial drop in hydro generation in 2017 (Climate Council 2018).

New South Wales is one of only two states and territories, along with Western Australia, without a renewable energy target. This suggests a considerable lack of ambition from New South Wales. The state has recently introduced policies such as the Emerging Energy Program to increase renewable capacity, although New South Wales is yet to see much tangible progress.

FAST FACTS: NSW

Percentage renewable power:
New South Wales had 17.3% renewable electricity in 2018, up from 12.6% in 2017. The state is equal fourth with Victoria, but there is a large gap between these two states and the front runners[1].

Households:
20.4% of households in New South Wales have rooftop solar, keeping the state in fourth place[2].

Policy

- No renewable energy target.
- Providing interest free loans for solar-battery systems for up to 300,000 households over the next 10 years under the Empowering Homes Program[3].
- Pledged $1 billion to increasing interstate grid connections, including a new interconnector between New South Wales and South Australia[4].
- Shortlisted 21 renewable energy and storage projects to receive grant funding under the Emerging Energy program, supporting construction of up to 700MW of dispatchable electricity generation[5].
- Announced it will set interim targets to guide achievement of its target of net zero emissions by 2050[6].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]NSW Government 2019b. [4]SMH 2019a. [5]RenewEconomy 2019g. [6]SMH 2019b.

In particular, the state is looking to protect against electricity shortfalls when Liddell coal-fired power station closes in 2023 (RenewEconomy 2019e). The Emerging Energy Program will provide $75 million in grant funding to support up to 700MW of dispatchable electricity generation (RenewEconomy 2019e). The New South Wales Government recently shortlisted 21 renewable energy and storage projects for this funding, most of which include pumped hydro or battery storage. In addition, the government awarded over $7 million in grants for feasibility studies to ten proposed renewable energy and storage projects, together representing 2,150MW (NSW Government 2019a).

New South Wales does not have a renewable energy target and continues its vocal support for coal in the state.

Figure 18: Workers construct the 150MW Coleambally Solar Farm in New South Wales.

New South Wales is prioritising interstate transmission links. The state has pledged $1 billion towards Project EnergyConnect, an interconnector with South Australia (which includes a connection into Victoria), and is fast-tracking the approvals (SMH 2019a). The New South Wales Government also announced it will jointly contribute $102 million with the Federal Government to an upgrade to the interconnector with Queensland (RenewEconomy 2019g). These interconnectors provide another important risk reduction mechanism when Liddell closes.

New South Wales has a target for net zero emissions by 2050 and the government recently announced that it will set interim targets to chart a course towards this goal (SMH 2019b). This comes after the Premier scrapped earlier work, including an economy-wide plan for reducing emissions. Premier Berejiklian confirmed in September 2019 that her government is committed to the target and does not consider it 'aspirational' (SMH 2019b). However, no timeline has been announced for setting the interim targets, and it is not clear if the government intends to create a detailed policy plan for achieving them.

While the new Minister for Environment and Energy Matt Kean has spoken in favour of New South Wales becoming 'the Silicon Valley of clean technology', he has also voiced his support for the coal industry (SMH 2019b). Minister Kean stated he would consider legislating to ensure the long-term operation of coal mines and coal-fired power stations in the state (Daily Telegraph 2019) – a stance that is fundamentally inconsistent with emissions reduction.

New South Wales ranks fourth for rooftop solar and has policies in place that may improve its performance in coming years. The Government announced the Empowering Homes Program during the March 2019 state election, which supports the installation of up to 300,000 solar-battery systems over the next 10 years. The program provides interest free loans of up to $9,000 for a battery system or up to $14,000 for a solar-battery system (NSW Government 2019b). The first battery systems should be available for installation from summer 2019/2020 (NSW Government 2019b).

New South Wales is also trialling the Solar for Low Income Households program. The program will install free 3kW rooftop solar systems for 3,000 low-income households as a replacement for the Low Income Household Rebate (NSW Government 2019c).

New South Wales will provide interest free loans for up to 300,000 household solar-battery systems and free rooftop solar to 3,000 low-income households.

WESTERN AUSTRALIA

Western Australia is second last in this year's state and territory renewables race. This is a slight improvement from last year's equal last place finish with the Northern Territory, and the state is improving across a number of metrics. However, it could be doing much more to accelerate the transition to renewable energy.

Last year's report put a spotlight on Western Australia's poor performance. Western Australia was the only state or territory without neither a target to increase renewable energy nor to achieve net zero emissions, and had a low share of renewable energy generation (Climate Council 2018).

In December 2018, following the release of the report, Western Australia announced it was developing a new climate change policy (Government of Western Australia 2018b), due for release in 2020 (Government of Western Australia 2019b). In August 2019, the state announced an aspirational target of net zero emissions by 2050 (Government of Western Australia 2019f). However, in the announcement of this target, the government confirmed that it supports further development of the state's gas industry (Government of Western Australia 2019f). Given the significant greenhouse gas emissions generated from gas extraction, this is completely inconsistent with a zero emissions goal (CCWA 2019).

FAST FACTS: WA

Percentage renewable power:
Western Australia generated 8.2% renewable energy in 2018, a slight increase from 7.5% in 2017. This puts the state second last[1].

Households:
Western Australia ranks third for rooftop solar, with solar panels on 28.1% of households[2].

Policy

- No renewable energy target.
- Announced an aspirational target of net zero emissions by 2050. A broader climate policy will be released in 2020[3].
- Announced the staged closure of Muja C Power Station from October 2022 to October 2024[4].
- The Energy Transformation Strategy is reforming the electricity market in Western Australia to enable more renewable energy to join the grid[5].
- Opened a $10 million Renewable Hydrogen Fund as part of its Renewable Hydrogen Strategy, although the strategy includes a possible role for hydrogen produced from fossil fuel gas[6].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Government of Western Australia 2019f; Government of Western Australia 2019b. [4]Government of Western Australia 2019a. [5]Government of Western Australia 2019c. [6]Government of Western Australia 2019d; Government of Western Australia 2019e.

Western Australia still does not have a renewable energy target, joining New South Wales as one of only two states and territories left without a target. Western Australia is falling further behind on renewable energy generation, dropping to second last place behind Queensland this year, ahead of only the Northern Territory.

There are some indications that Western Australia will improve its performance in coming years, with a number of large-scale renewables projects recently completed, in construction, or soon to start (Clean Energy Council 2019a; CER 2019b). The state has also announced the staged closure of Muja C coal power station from October 2022 to October 2024 (Government of Western Australia 2019a). This follows the closure of Muja AB in 2018 (RenewEconomy 2019b).

In addition, Western Australia's Energy Transformation Strategy is reforming the state's electricity market to enable more renewables to join the grid. This includes the Distributed Energy Resources Roadmap, which is developing a plan to integrate solar panels, battery storage and electric vehicles into the power system (Government of Western Australia 2019c).

Rooftop solar is one area where Western Australia performs relatively well, coming third with solar panels installed on 28.1% of households. The government is supporting a range of innovative but small-scale initiatives, including the PowerBank trial. PowerBank allows participating households to virtually store excess power generated by their solar panels in grid-integrated battery storage during the day. Participants can then draw on this in the evening when their solar panels are no longer generating energy (Government of Western Australia 2018c).

The state is also taking some steps to boost remote access to solar, supporting 100kW of rooftop solar and 4MW of small-scale solar farms in remote Indigenous communities (Government of Western Australia 2018a; RenewEconomy 2019a).

Western Australia's support for ongoing gas development is fundamentally at odds with achieving net zero emissions by 2050.

Western Australia launched its Renewable Hydrogen Strategy in July 2019. As part of the strategy, Western Australia has opened a $10 million Renewable Hydrogen Fund to develop the industry, with $7 million earmarked for regional areas (Government of Western Australia 2019d). However, despite the name, the strategy contains references to Woodside Petroleum's plans for 'carbon neutral' hydrogen produced using gas (Government of Western Australia 2019e). Hydrogen produced from fossil fuels has no place in renewable hydrogen strategies.

There are currently two massive renewable hydrogen projects proposed for Western Australia. The Asian Renewable Energy Hub is proposing a 15,000MW (15GW) wind and solar project in the Pilbara, with the intention to produce green hydrogen for domestic consumption and export. Another 5,000MW wind and solar project was recently proposed near Kalbarri at the edge of the state's main grid, also with plans to produce hydrogen for domestic and international use (RenewEconomy 2019f). These projects could potentially position the state as an export leader, although both are still at proposal stage.

Figure 19: The Albany Wind Farm in Western Australia. The state has improved on some scorecard metrics this year but could be doing much more.

NORTHERN TERRITORY

The Northern Territory receives the 'Wooden Spoon' for coming last in this year's state and territory renewables race, as it has every year since these reports began in 2014. While the Northern Territory is showing signs of improvement this year, it is well behind the rest of the competition and comes last on most metrics except rooftop solar.

In September 2019, the Northern Territory announced a draft aspirational target of net zero emissions by 2050 (Northern Territory Government 2019b). This made the Northern Territory the last state or territory (following Western Australia by only a few weeks) to release a net zero emissions target. If the target is adopted following public consultation, Australia will have a de facto target of net zero emissions by 2050 even in the absence of Federal Government policy or leadership.

The Territory also released the NT Climate Change Response as part of the public consultation, which maps out a high-level vision to achieve the net zero emissions target across the economy. The strategy recognises that the Northern Territory's solar resources present tremendous economic opportunities, including the potential to export renewable hydrogen to other Australian states and territories and to Asia (Northern Territory Government 2019b). However, the document also supports the expansion of the territory's gas industry, which cannot be included in any path to net zero emissions.

FAST FACTS: NT

Percentage renewable power:
The Northern Territory is in last place, generating 4% of its electricity from renewables in 2018, up slightly from 3% in 2017[1].

Households:
18.1% of households in the Northern Territory have rooftop solar, jumping from last place in last year's rankings to fifth this year[2].

Policy

- In September 2019, released a draft aspirational target of net zero emissions by 2050 and a draft policy plan to achieve this, pending public consultation[3].
- Announced two new 10MW solar farms that should increase the Northern Territory's renewable energy to 10% by the end of 2019[4].
- Renewable energy target of 50% by 2030[5].
- Rooftop Solar for Schools provides panels to schools with an education program on solar technology[6].

Source: [1]Department of the Environment and Energy 2019b. [2]APVI 2019. [3]Northern Territory Government 2019b. [4]Northern Territory Government 2019a. [5]Northern Territory Government 2019c. [6]Northern Territory Government 2018.

Figure 20: Yulara Solar Farm in the Northern Territory. Despite its significant solar resources, the Northern Territory has the lowest share of renewable energy of any state or territory.

The Northern Territory has a renewable energy target of 50% by 2030 but generated only 4% of its electricity from renewable energy in 2018. This is the lowest of any state or territory. The Territory Government is supporting two new 10MW solar farms, Batchelor and Manton Dam. Together with the 25MW Katherine Solar Farm that is currently under construction, these projects should increase renewable generation to 10% in the Northern Territory by the end of 2019 (Northern Territory Government 2019a). The territory is slowly moving in the right direction; however, it will have to dramatically increase ambition to meet the 2030 target.

The Northern Territory improved the most out of all states and territories this year on rooftop solar. 18.1% of households now have solar panels, up from 13.8% in last year's report. This moves the Territory up three places from last place (eighth) to fifth this year. The Territory Government's $1,000 household grants for rooftop solar likely played a role in this achievement (RenewEconomy 2017).

The government has also committed $5 million to the Rooftop Solar for Schools program. The program provides solar systems, including monitoring and measurement equipment, to schools with educational programs teaching students about solar technology (Northern Territory Government 2018).

Although still at proposal stage, the 3GW Sun Cable project, expected to be located near Tennant Creek in the Northern Territory, would be the world's biggest solar farm. The project is designed to export energy to Singapore through a 3,800km cable (Sun Cable 2019). Australian billionaire and Atlassian co-founder Mike Cannon-Brookes recently announced that he would invest in the $25 billion project, which could produce up to $800 million per year for the Northern Territory once operational (AFR 2019b). This project is still very early stage and would take at least seven or eight years to complete construction.

The Northern Territory receives the 'Wooden Spoon' for finishing last – as it has in all four previous reports.

5. Leadership at the local level: Councils step up in the renewable energy race

In addition to leadership from state and territory governments, local governments around Australia are increasingly stepping up their work on renewable energy.

Over 115 councils representing more than 13 million Australians have joined the Climate Council's local government climate alliance Cities Power Partnership (CPP). As part of joining the CPP, councils commit to regional renewable energy and emissions reduction projects (Cities Power Partnership 2019a). A number of councils are even moving into large-scale renewable energy investment – or building their own renewable projects.

This section shines a spotlight on some of the local government front runners from around the country.

Eyre Peninsula's Community Solar Scheme aims to have solar on every household in the region that wants it within three years.

Figure 21: Workers install solar panels on a Logan City Council building, just south of Brisbane.

SOUTH AUSTRALIA

Eyre Peninsula Local Government Association

In September 2019, the Eyre Peninsula Local Government Association unveiled an ambitious plan to support every household in the region to install a solar system, with finance and battery options available (ABC News 2019). The Eyre Peninsula, home to 60,000 residents, has been plagued by blackouts, with residents left without power for days at a time on multiple occasions. The Community Solar Scheme aims to increase energy security while helping residents save on their power bills (ABC News 2019).

The Community Solar Scheme aims to have solar systems installed and running for all households that want it within three years. The project also aims to provide access to those traditionally locked out of the rooftop solar market, including renters, pensioners and leasing business owners (ABC News 2019).

TASMANIA

City of Hobart

Local governments across Tasmania are showing leadership on renewable energy, with the City of Hobart the front runner. The City of Hobart is installing 2,600 solar panels on buildings across its local area, generating 750kW of renewable energy (City of Hobart 2019).

QUEENSLAND

City of Logan

The City of Logan, just south of Brisbane, is punching above its weight in the renewable energy race. The suburban council, which has installed 29 solar systems across the local government area (Logan City Council 2019), was also Australia's first council to build a completely off-grid water reservoir (Logan City Council 2017). The Round Mountain Reservoir uses a solar-battery system micro-grid to power its "electro-chlorinator", which maintains local drinking water quality.

Figure 22: The 15MW Sunshine Coast Solar Farm, which offsets 100% of the electricity consumption of Sunshine Coast Council's facilities and operations.

Sunshine Coast Council

Sunshine Coast Council switched on the 15MW Sunshine Coast Solar Farm in 2017. This made it Australia's first local government to offset 100% of its electricity consumption across all of its facilities and operations with renewable energy (ABC News 2017). Since the launch, the solar farm has gone from strength to strength, saving the council $1.7 million in its first year of operation, doubling initial savings expectations (Sunshine Coast Council 2018).

VICTORIA

The Melbourne Renewable Energy Project

City of Melbourne became Australia's first capital city to power its operations with 100% renewable energy in January 2019 (The Guardian 2019a). This was achieved through a huge renewable energy purchase agreement, a joint project between the City of Melbourne, City of Port Phillip, City of Yarra, Moreland City Council and a number of universities and cultural institutions.

The Australia-first power purchase agreement saw the fourteen members of the buying group combine their purchasing power to support the construction of the 80MW Crowlands Wind Farm in regional Victoria (City of Melbourne 2019). The construction of the wind farm created 140 local jobs, and is now powering town halls, bank branches, universities and street lights across Melbourne (City of Melbourne 2019).

Hepburn Shire

The community of Hepburn, north-west of Melbourne, is home to Australia's first community-owned wind farm (The Hepburn Advocate 2018). The two-turbine wind farm produces enough energy to offset greenhouse gas emissions from the neighbouring town of Daylesford.

In 2019, Hepburn Shire released a new strategy to take its entire community to net-zero emissions by 2030. The strategy outlines a vision to work with residents to switch to 100% renewable energy and to curtail emissions from agriculture, stationary energy, transport and gas use (Hepburn Shire Z-Net 2019). The plan won the 2019 Premier's Community Award for Sustainability (Premier's Sustainability Awards 2019).

NEW SOUTH WALES

Southern Sydney Regional Organisation of Councils

Late in 2018, 18 local governments from across Sydney joined forces under the Southern Sydney Regional Organisation of Councils (SSROC) to purchase power from the Moree Solar Farm (SSROC 2018). The project went live in July 2019 and provides up to 35% of each council's retail energy needs, helping to keep operational power bills down while reducing greenhouse gas emissions. The contract with Moree Solar Farm is set to run until 2030.

City of Newcastle

Newcastle, a city once famous for its coal port, has emerged as a local government leader in renewable energy. In 2019, City of Newcastle committed to powering its operations with 100% renewable energy from 2020. This shift to renewables is set to save ratepayers up to $4.8 million in electricity costs (City of Newcastle 2019). Newcastle is also constructing its own 5MW solar farm on the former Summerhill landfill site, which will join a landfill gas generator and a small wind turbine already installed at the waste facility (City of Newcastle 2018).

WESTERN AUSTRALIA

City of Fremantle

City of Fremantle has set a target to be 100% renewable by 2025, and was Australia's second city, and the first in Western Australia, to be awarded carbon neutral status (City of Fremantle 2019a). City of Fremantle has installed solar systems across eight buildings (Cities Power Partnership 2019b), and has sign off on a major plan to develop an eight-hectare urban solar farm on a former landfill site (City of Fremantle 2019b).

Newcastle, a city once known for its coal port, has emerged as a local government leader on renewable energy.

6. Afterword: Moving on without the Federal Government

There are now several states and territories approaching, or aiming to be powered by, 100% renewable energy in the coming years or decades. This level of ambition is vital to take effective action on climate change and limit future dangerous warming.

Transitioning to a grid powered by 100% renewable energy requires deep collaboration and coordination, especially amongst states and territories connected to the NEM. High level coordination between state and territory governments has been lacking, and the Federal Government has played a large role in this.

The forum for national energy policy planning and coordination between state, territory, and federal governments is the Council of Australian Governments (COAG) Energy Council. The Federal Energy Minister has exclusive power to call these meetings, which are required to occur a minimum of twice per year (COAG Energy Council 2019). However, in 2019 Minister Taylor failed to call a meeting of the COAG Energy Council for almost a year. A meeting was finally scheduled for November 2019, eleven months after the previous meeting (AFR 2019a).

The Federal Government is not only failing to lead, it is getting in the way of state and territory leadership on renewable energy. In the eleven months between COAG Energy Council meetings, the Federal Energy Minister attacked states and territories for setting ambitious targets and for their failure to plan (The Age 2019), despite failing to convene the forum where they might do so.

As a result, several states and territories have declared their intention to go it alone on climate change and renewable energy policy (The Guardian 2019b). While this is the right idea in the face of Federal Government inaction, coordination remains important. It is time for state and territory governments, especially those that are part of the National Electricity Market, to create their own forums for coordination and planning and move on without the Federal Government, to supercharge the transition to a renewable energy future.

In the absence of Federal Government leadership, it is up to the states and territories to work together to accelerate the transition to renewables.

References

ABC News (2017) Sunshine Coast Council stays true to its name by opening its own solar farm in a local government first. 24 July 2017. Accessed at: https://www.abc.net.au/news/2017-07-24/sunshine-coast-council-solar-farm-opens-in-local-govt-first/8738320.

ABC News (2019) 'Bold' scheme launches power to every property on SA's Eyre Peninsular with solar. 6 September 2019. Accessed at: https://www.abc.net.au/news/2019-09-06/bold-solar-scheme-launched-to-power-whole-eyre-peninsula/11459992.

ACT Government (2019a) ACT Climate Change Strategy. Accessed at: https://www.environment.act.gov.au/cc/act-climate-change-strategy.

ACT Government (2019b) Final infrastructure in place as ACT set to deliver on 100% renewable electricity target. Accessed at: https://www.cmtedd.act.gov.au/open_government/inform/act_government_media_releases/rattenbury/2019/final-infrastructure-in-place-as-act-set-to-deliver-on-100-renewable-electricity-target.

The Advertiser (2019) Biggest wind farm in Australia announced for Burra. 11 September 2019. Accessed at: https://www.adelaidenow.com.au/news/south-australia/neoen-to-build-1-billion-wind-solar-and-battery-project-at-burra-in-south-australias-mid-north/news-story/2e75dab5bd0813c9451a43b93c666280.

AFR (Australian Financial Review) (2018) COAG energy meeting: Tempers flare as Angus Taylor blocks NSW 'net zero' plan. 19 December 2018. Accessed at: https://www.afr.com/politics/coag-energy-meeting-tempersflare-as-angus-taylor-blocks-nsw-net-zeroplan-20181219-h19acd.

AFR (Australian Financial Review) (2019a) Taylor finally calls COAG energy meeting - in two months. 23 September 2019. Accessed at: https://www.afr.com/companies/energy/taylor-finally-calls-coag-energy-meeting-in-two-months-20190923-p52u41.

AFR (Australian Financial Review) (2019b) Cannon-Brookes' Plan to Power Singapore. 24 September 2019. Accessed at: https://www.afr.com/policy/energy-and-climate/cannon-brookes-plan-to-export-aussie-solar-power-to-singapore-20190924-p52u9o.

The Age (2019) Power cuts may hit as many as 1.3 million Victorian homes this summer. 21 August 2019. Accessed at: https://www.theage.com.au/politics/victoria/power-cuts-may-hit-as-many-as-1-3-million-victorian-homes-this-summer-20190821-p52jdf.html.

ARENA (Australian Renewable Energy Agency) (2019a) Australian renewables growing at record rates. Accessed at: https://arena.gov.au/blog/australian-renewables-growing-at-record-rates/.

ARENA (2019b) Second Bass Strait interconnector technically feasible. Accessed at: https://arena.gov.au/blog/marinus-feasible/.

APVI (Australian PV Institute) (2018) Solar Trends Report for Solar Citizens. Accessed at: http://apvi.org.au/wp-content/uploads/2018/12/Solar-Trends-Report-for-Solar-Citizens-FINAL_11-12-18_2_logos.pdf.

APVI (2019) Mapping Australian photovoltaic installations. Accessed at: https://pv-map.apvi.org.au/historical#4/-26.67/134.12.

Australian Energy Council (2019) Solar Report: Quarter 2, 2019. Accessed at: https://www.energycouncil.com.au/media/16671/australian-energy-council-solar-report_-june-2019_final.pdf.

The Australia Institute (2019a) High Carbon from a Land Down Under: Quantifying CO_2 from Australia's fossil fuel mining and exports. Accessed at: https://www.tai.org.au/content/high-carbon-land-down-under-quantifying-co2-australia-s-fossil-fuel-mining-and-exports.

The Australia Institute (2019b) Class ACT: How the Australian Capital Territory became a global energy leader. Accessed at: https://www.tai.org.au/content/class-act-how-australian-capital-territory-became-global-energy-leader.

Brisbane Times (2019a) More coal mines on map for Queensland as government calls for tenders. 2 August 2019. Accessed at: https://www.brisbanetimes.com.au/politics/queensland/more-coal-mines-on-map-for-queensland-as-government-calls-for-tenders-20190802-p52d6q.html.

Brisbane Times (2019b) Queensland's climate response "stalled by Labor's federal poll loss". 1 October 2019. Accessed at: https://www.brisbanetimes.com.au/national/queensland/queensland-s-climate-response-stalled-by-labor-s-federal-poll-loss-20191001-p52wll.html.

Bureau of Meteorology (2019a) Annual Climate Statement 2018. Accessed at: http://www.bom.gov.au/climate/current/annual/aus/.

Bureau of Meteorology (2019b) Special Climate Statement 71—severe fire weather conditions in southeast Queensland and northeast New South Wales in September 2019. Accessed at: http://www.bom.gov.au/climate/current/statements/scs71.pdf.

Bureau of Meteorology (2019c) Drought (Issued 8 November 2019). Accessed at: http://www.bom.gov.au/climate/drought/.

Bureau of Meteorology (2019d) Special Climate Statement 69—an extended period of heavy rainfall and flooding in tropical Queensland. Accessed at: http://www.bom.gov.au/climate/current/statements/scs69.pdf.

CCA (Climate Change Authority) (2015) Final Report on Australia's Future Emissions Reduction Targets, 2 July 2015. Accessed at: http://climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/Final-report-Australias-future-emissions-reduction-targets.pdf.

CCWA (Conservation Council of Western Australia) (2019) Runaway Train: The Impact of WA's LNG industry on meeting our Paris targets and national efforts to tackle climate change. Accessed at: https://www.cleanstate.org.au/wp-content/uploads/2019/11/CCWA0493-LNG-Report-DIGITAL.pdf.

CER (Clean Energy Regulator) (2019a) Historical large-scale renewable energy target supply data. Accessed at: http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/Large-scale-Renewable-Energy-Target-market-data/large-scale-renewable-energy-target-supply-data/historical-large-scale-renewable-energy-target-supply-data#2001--2018-accredited-power-stations-data.

CER (2019b) Large-Scale renewable energy target supply data. Accessed at: http://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/Large-scale-Renewable-Energy-Target-market-data/large-scale-renewable-energy-target-supply-data.

Cities Power Partnership (2019a) Cities Power Partnership. Accessed at: https://citiespowerpartnership.org.au/.

Cities Power Partnership (2019b) City of Freemantle. Accessed at: https://citiespowerpartnership.org.au/partners/city-of-fremantle/.

City of Fremantle (2019a) Zero carbon energy. Accessed at: https://www.fremantle.wa.gov.au/one-planet/zero-carbon-energy.

City of Fremantle (2019b) South Freemantle solar farm gets environmental approval. Accessed at: https://www.fremantle.wa.gov.au/news-and-media/1572019-south-fremantle-solar-farm-gets-environmental-approval.

City of Hobart (2019) City's support for climate action. Accessed at: https://www.hobartcity.com.au/Council/News-publications-and-announcements/Latest-news/climate-action-support.

City of Melbourne (2019) Melbourne Renewable Energy Project: A new generation of energy. Accessed at: https://www.melbourne.vic.gov.au/business/sustainable-business/mrep/Pages/melbourne-renewable-energy-project.aspx.

City of Newcastle (2018) Building begins on City's solar farm. Accessed at: https://www.newcastle.nsw.gov.au/Council/News/Latest-News/Building-begins-on-City-s-solar-farm-(1).

City of Newcastle (2019) City sets sights on 100% renewable electricity target. Accessed at: https://www.newcastle.nsw.gov.au/Council/News/Latest-News/City-sets-sights-on-100-renewable-electricity-targ.

Clean Energy Council (2019a) Clean Energy Australia Report 2019. Accessed at https://assets.cleanenergycouncil.org.au/documents/resources/reports/clean-energy-australia/clean-energy-australia-report-2019.pdf.

Clean Energy Council (2019b) Australia's Clean Energy Investment Outlook. Accessed at: https://assets.cleanenergycouncil.org.au/documents/resources/reports/CEC-briefing-paper-Australias-clean-energy-investment-outlook-September-2019.pdf.

Climate Analytics (2019) Evaluating the significance of Australia's global fossil fuel carbon footprint. Accessed at: https://climateanalytics.org/media/australia_carbon_footprint_report_july2019.pdf.

Climate Council (2018) Powering progress: States renewable energy race. Accessed at: https://www.climatecouncil.org.au/resources/states-renewable-energy/.

Climate Council (2019a) Weather Gone Wild: Climate change-fuelled extreme weather in 2018. Accessed at: https://www.climatecouncil.org.au/resources/climate-change-extreme-weather/.

Climate Council (2019b) Climate Cuts, Cover-ups and Censorship. Accessed at: https://www.climatecouncil.org.au/wp-content/uploads/2019/04/Climate-Cuts-Cover-Ups-and-Censorship.pdf.

Climate Council (2019c) Factsheet: Climate Policies of Major Australian Political Parties. Accessed at: https://www.climatecouncil.org.au/resources/factsheet-climate-policies-major-australian-political-parties/.

COAG Energy Council (Council of Australian Governments Energy Council) (2019) Meetings. Accessed at: http://www.coagenergycouncil.gov.au/meetings.

Daily Telegraph (2019) State Energy Minister Matt Kean says coal is here to stay. 10 September 2019. Accessed at: https://www.dailytelegraph.com.au/news/nsw/nsw-government-will-legislate-to-embrace-new-coal-mines-and-keep-coalfired-power-stations-going/news-story/b770e2e76ae2a81ab4cc08d9b2230051.

Department of the Environment and Energy (2019a) Quarterly Update of Australia's National Greenhouse Gas Inventory for March 2019. Accessed at: http://www.environment.gov.au/climate-change/climate-science-data/greenhouse-gas-measurement/publications/quarterly-update-australias-nggi-mar-2019.

Department of the Environment and Energy (2019b) Australian Energy Statistics, Table O, Electricity generation by fuel type 2017-18 and 2018. Accessed at: https://www.energy.gov.au/publications/australian-energy-statistics-table-o-electricity-generation-fuel-type-2017-18-and-2018.

EUAA (Energy Users Association of Australia) (2017) Electricity. Accessed at: https://euaa.com.au/wp-content/uploads/2017/03/EUAA_Key-Policy-Positions-Summary-20171.pdf.

Frankfurt School-UNEP Centre (2019) Global Trends in Renewable Energy Investment 2019. Accessed at: https://fs-unep-centre.org/research/report.

Government of South Australia (2019a) Climate change legislation. Accessed at: https://www.environment.sa.gov.au/topics/climate-change/climate-change-legislation.

Government of South Australia (2019b) Climate Change Strategy and Blue Carbon Strategy. Accessed at: https://www.environment.sa.gov.au/topics/climate-change/programs-and-initiatives/climate-change-blue-carbon-strategy.

Government of South Australia (2019c) Hydrogen in South Australia. Accessed at: http://www.renewablessa.sa.gov.au/topic/hydrogen.

Government of South Australia (2019d) Billions of renewable investment rests on interconnector. Accessed at: https://premier.sa.gov.au/news/billions-of-renewable-investment-rests-on-interconnector.

Government of Western Australia (2018a) Lower electricity bills for Aboriginal communities installing solar. Accessed at: https://www.mediastatements.wa.gov.au/Pages/McGowan/2018/11/Lower-electricity-bills-for-Aboriginal-communities-installing-solar.aspx.

Government of Western Australia (2018b) McGowan Government to develop new climate change policy. Accessed at: https://www.mediastatements.wa.gov.au/Pages/McGowan/2018/12/McGowan-Government-to-develop-new-climate-change-policy.aspx.

Government of Western Australia (2018c) PowerBank trial to revolutionise bulk battery storage in WA homes. Accessed at: https://www.mediastatements.wa.gov.au/Pages/McGowan/2018/10/PowerBank-trial-to-revolutionise-bulk-battery-storage-in-WA-homes.aspx.

Government of Western Australia (2019a) Muja Power Station in Collie to be scaled back from 2022. Accessed at: https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/08/Muja-Power-Station-in-Collie-to-be-scaled-back-from-2022.aspx.

Government of Western Australia (2019b) Climate change consultation to help shape WA response. https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/09/Climate-change-consultation-to-help-shape-WA-response.aspx.

Government of Western Australia (2019c) Energy Transformation Strategy. https://www.wa.gov.au/organisation/energy-policy-wa/energy-transformation-strategy.

Government of Western Australia (2019d) Renewable Hydrogen Fund. http://www.drd.wa.gov.au:80/projects/EnergyFutures/Pages/Renewable-Hydrogen-Fund.aspx.

Government of Western Australia (2019e) Renewable hydrogen industry. http://www.drd.wa.gov.au:80/projects/EnergyFutures/Pages/Renewable-Hydrogen-Industry.aspx.

Government of Western Australia (2019f) State government details emissions policy for major projects. https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/08/State-Government-details-emissions-policy-for-major-projects.aspx.

Green Energy Markets (2019) Renewable Energy Index - May 2019. Accessed at: http://greenmarkets.com.au/images/uploads/Resources/RE_Index/Renewable_Energy_Index_-_May_2019.pdf.

The Guardian (2018) Coalition won't replace renewables target after it winds down in 2020. 18 September 2018. Accessed at: https://www.theguardian.com/australia-news/2018/sep/18/coalition-wont-replace-renewables-target-after-it-winds-down-in-2020.

The Guardian (2019a) Melbourne becomes first city with all council infrastructure powered by renewables. 17 January 2019. Accessed at: https://www.theguardian.com/australia-news/2019/jan/17/melbourne-becomes-first-city-with-all-council-infrastructure-powered-by-renewables.

The Guardian (2019b) Clean energy set to provide 35% of Australia's electricity within two years. 30 July 2019. Accessed at: https://www.theguardian.com/australia-news/2019/jul/31/clean-energy-set-to-provide-35-of-australias-electricity-within-two-years.

The Hepburn Advocate (2018) The expansion of Hepburn Wind will mean the park will generate enough energy to offset an estimate of 3000 households. 21 Novembe2018. Accessed at: https://www.hepburnadvocate.com.au/story/5765298/hepburn-wind-to-expand-to-solar-making-it-the-first-community-owned-hybrid-wind-and-solar-park-in-the-state/.

Hepburn Shire Z-Net (2019) Community Transition Plan. Accessed at: https://z-net.org.au/wp-content/uploads/2019/04/Z-Net_CTP_Screen-1.pdf.

Hydro Tasmania (2019a) Pumped hydro. Accessed at: https://www.hydro.com.au/clean-energy/battery-of-the-nation/pumped-hydro.

Hydro Tasmania (2019b) About renewable energy. Accessed at: https://www.hydro.com.au/clean-energy/about-renewable-energy.

Hydro Tasmania (2019c) Battery of the Nation. Accessed at: https://www.hydro.com.au/clean-energy/battery-of-the-nation#.

IEA (International Energy Agency) (2019) Status of Power System Transformation 2019. Accessed at: https://www.iea.org/publications/reports/statusofpowersystemtransformation2019/.

Logan City Council (2017) Cutting edge technology provides off-grid power solutions in Australia-first. Accessed at: https://www.logan.qld.gov.au/about-council/news-and-publications/media-releases/media-releases/cutting-edge-technology-provides-off-grid-power-solutions-in-australia-first.

Logan City Council (2019) Powering ahead on solar system installations. Accessed at: https://www.logan.qld.gov.au/about-council/news-and-publications/media-releases/media-releases/powering-ahead-on-solar-system-installations.

NOAA (National Oceanic and Atmospheric Administration) (2019) Global Analysis – Global Climate Report – Annual 2018. Accessed at: https://www.ncdc.noaa.gov/sotc/.

Northern Territory Government (2018) Rooftop solar in schools. Accessed at: https://education.nt.gov.au/school-programs-and-initiatives/rooftop-solar-in-schools.

Northern Territory Government (2019a) Creating jobs, delivering election commitment: massive boost for NT renewables. Accessed at: http://newsroom.nt.gov.au/mediaRelease/28612.

Northern Territory Government (2019b) NT Climate Change Response. Accessed at: https://haveyoursay.nt.gov.au/climate-change-response.

Northern Territory Government (2019c) Roadmap to renewables. Accessed at: https://roadmaptorenewables.nt.gov.au/.

NSW Government (2019a) Emerging Energy Program. Accessed at: https://energy.nsw.gov.au/renewables/clean-energy-initiatives/emerging-energy-program.

NSW Government (2019b) Empowering Homes. Accessed at: https://energy.nsw.gov.au/renewables/clean-energy-initiatives/empowering-homes.

NSW Government (2019c) Solar for low income households. Accessed at: https://energysaver.nsw.gov.au/households/solar-and-battery-power/solar-low-income-households.

One Step Off the Grid (2019a) "Big win for industry," as Victoria triples number of rooftop solar rebates for September. 28 August 2019. Accessed at: https://onestepoffthegrid.com.au/victoria-triples-number-of-rooftop-solar-rebates-on-offer-for-september/.

One Step Off the Grid (2019b) "Australia's largest" virtual power plant completed by AGL in South Australia. 26 September 2019. Accessed at: https://onestepoffthegrid.com.au/australias-largest-virtual-power-plant-completed-by-agl-in-south-australia/.

One Step Off the Grid (2019c) Queensland rebates encourage landlords to install rooftop solar for renters. 1 October 2019. Accessed at: https://onestepoffthegrid.com.au/queensland-rebates-encourage-landlords-to-install-rooftop-solar-for-renters/.

One Step Off the Grid (2019d) Another 4,000 Victorian solar rebates snapped up in 80 minutes. 1 October 2019. Accessed at: https://onestepoffthegrid.com.au/another-4000-victorian-solar-rebates-snapped-up-in-80-minutes/.

OpenNEM (2019) Energy: South Australia. Accessed at: https://opennem.org.au/energy/sa1/.

Premier of Victoria (2019) A stronger renewable energy target for Victoria. Accessed at: https://www.premier.vic.gov.au/a-stronger-renewable-energy-target-for-victoria/.

Premier's Sustainability Awards (2019) 2019 winners. Accessed at: https://www.sustainabilityawards.vic.gov.au/Past-Winners/Winners-2019.

PV Magazine (2019) Queensland launches solar for renters trial. 7 March 2019. Accessed at: https://www.pv-magazine-australia.com/2019/03/07/queensland-launches-solar-for-renters-trial/.

Queensland Government (2017) Transition to a zero carbon economy. Accessed at: https://www.qld.gov.au/environment/climate/climate-change/transition.

Queensland Government (2019a) Interest-free loans for solar and storage. Accessed at: https://www.qld.gov.au/community/cost-of-living-support/concessions/energy-concessions/solar-battery-rebate/about-the-program.

Queensland Government (2019b) Hydrogen industry development. Accessed at: http://www.dsdmip.qld.gov.au/industry/priority-industries/advanced-manufacturing/hydrogen-industry-development.html.

Queensland Government (2019c) Renewables 400. Accessed at: https://www.business.qld.gov.au/industries/mining-energy-water/energy/renewable/projects-queensland/renewables-400.

Queensland Government (2019d) Renewable generator pumping power prices down. Accessed at: http://statements.qld.gov.au/Statement/2019/10/31/renewable-generator-pumping-power-prices-down.

REN21 (Renewable Energy Policy Network for the 21st Century) (2019) Renewables 2019 Global Status Report. Accessed at: https://www.ren21.net/gsr-2019.

RenewEconomy (2017) NT backs 50% renewables plan, to boost home solar and batteries. 27 November 2017. Accessed at: https://reneweconomy.com.au/nt-backs-50-renewables-plan-to-boost-home-solar-and-batteries-64285/.

RenewEconomy (2019a) W.A. to fund solar farms in six remote Indigenous communities. 10 May 2019. Accessed at: https://reneweconomy.com.au/w-a-to-fund-solar-farms-in-six-remote-indigenous-communities-66975/.

RenewEconomy (2019b) Western Australia to close Muja coal units – to lower power bills, stabilise grid. 6 August 2019. Accessed: https://reneweconomy.com.au/western-australia-to-close-muja-coal-units-to-lower-power-bills-stabilise-grid-59710/.

RenewEconomy (2019c) Tasmania wind farm delivers Australia renewables target. But what's next? 3 September 2019. Accessed at: https://reneweconomy.com.au/tasmania-wind-farm-delivers-australia-renewables-target-but-whats-next-54074/.

RenewEconomy (2019d) ACT to get big battery as part of new wind, solar, auction to support shift to EVs. 11 September 2019. Accessed at: https://reneweconomy.com.au/act-to-get-big-battery-as-part-of-new-wind-solar-auction-to-support-shift-to-evs-92343/.

RenewEconomy (2019e) NSW reveals grants shortlist for nearly 3GW of renewables and storage capacity. 1 October 2019. Accessed at: https://reneweconomy.com.au/nsw-reveals-grants-shortlist-for-nearly-3gw-of-renewables-and-storage-capacity-94233/.

RenewEconomy (2019f) Massive 5,000MW solar and wind projects set to fuel WA's hydrogen expansion. 8 October 2019. Accessed at: https://reneweconomy.com.au/massive-5000mw-solar-and-wind-projects-set-to-fuel-was-hydrogen-expansion-91993/.

RenewEconomy (2019g) NSW, Canberra finally wake up to grid needs ahead of Liddell coal closure. 28 October 2019. Accessed at: https://reneweconomy.com.au/nsw-canberra-finally-wake-up-to-grid-needs-ahead-of-liddell-coal-closure-96291/.

SMH (Sydney Morning Herald) (2019a) NSW fast-tracks approval process for $1b electricity grid connections. 28 August 2019. Accessed at: https://www.smh.com.au/national/nsw/nsw-fast-tracks-approval-process-for-1b-electricity-grid-connections-20190828-p52lr6.html.

SMH (Sydney Morning Herald) (2019b) "Silicon Valley of solar": NSW to set interim carbon reduction targets. 8 September 2019. Accessed at: https://www.smh.com.au/environment/climate-change/silicon-valley-of-solar-nsw-to-set-interim-carbon-reduction-targets-20190908-p52p6d.html.

SMH (Sydney Morning Herald) (2019c) NSW warns of 'going it alone' on energy as industry moans federal gap. 30 July 2019. Accessed at: https://www.smh.com.au/politics/federal/nsw-warns-of-going-it-alone-onenergy-as-industry-moans-federal-gap-20190730-p52c32.html.

Solar Victoria (2019a) What we do. Accessed at: https://www.solar.vic.gov.au/what-we-do.

Solar Victoria (2019b) Solar Rebates. Accessed at: https://www.solar.vic.gov.au/solar-rebates.

SSROC (Southern Sydney Regional Organisation of Councils) (2018) 18 NSW Councils sign 39GWh per year landmark renewable energy agreement to cut emissions and costs. Accessed at: https://ssroc.nsw.gov.au/18-nsw-councils-sign-39gwh-per-year-landmark-renewable-energy-agreement-to-cut-emissions-and-costs/.

Sun Cable (2019) Renewable energy for Singapore & Australia. Accessed at: https://www.suncable.sg.

Sunshine Coast Council (2018) Serious savings stack up as solar farm turns one. Accessed at: https://www.sunshinecoast.qld.gov.au/Council/News-Centre/Sunshine-Coast-Solar-Farm-turns-one.

Tasmanian Government (2017a) Tasmania to set zero net emissions target. Accessed at: http://www.premier.tas.gov.au/releases/tasmania_to_set_zero_net_emissions_target.

Tasmanian Government (2017b) Re-elected Hodgman Government to make Tasmania energy self-sufficient. Accessed at: http://www.premier.tas.gov.au/releases/re-elected_hodgman_government_to_make_tasmania_energy_self-sufficient.

Tasmanian Government (2019) Tasmanian Greenhouse Gas Emissions Report 2019. Accessed at: http://www.dpac.tas.gov.au/__data/assets/pdf_file/0005/473774/Tasmanian_Greenhouse_Gas_Emissions_Report_2017.pdf.

TasNetworks (2019) A 1500 MW Marinus Link is technically feasible and delivers greatest benefits. Accessed at: https://projectmarinus.tasnetworks.com.au/2019/10/a-1500-mw-marinus-link-is-technically-feasible-and-delivers-greatest-benefits/.

Victorian Government (2019a) Emissions reduction targets. Accessed at: https://www.climatechange.vic.gov.au/reducing-emissions/emissions-targets.

Victorian Government (2019b) Independent expert advice on interim targets. Accessed at: https://www.climatechange.vic.gov.au/reducing-emissions/interim-targets.

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