Australian Government
Clean Energy Regulator

RENEWABLE ENERGY TARGET

THE ACCELERATION IN RENEWABLES INVESTMENT IN 2018

ENCOURAGING RENEWABLE ENERGY IN AUSTRALIA

Contact details

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Statements made by third parties in the report do not necessarily reflect the views and opinions of the Clean Energy Regulator.

Contact

General enquiries:

Mail GPO Box 621
Canberra ACT 2601

Phone 1300 553 542 if calling within Australia
+61 2 6159 3100 if calling from overseas
13 14 50 translating and interpreting services
133 677 TTY service
1300 555 727 speak and listen service

Email enquiries@cleanenergyregulator.gov.au

Website www.cleanenergyregulator.gov.au

Enquiries about this report:

Communications
and Contact Centre
Corporate Branch
Clean Energy Regulator
Phone: 02 6159 3100

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Cover photo: Boco Rock Wind Farm, NSW

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ENCOURAGING RENEWABLE ENERGY IN AUSTRALIA

Photo: Solar Plant, Broken Hill, NSW

Letter of transmittal

The Hon Angus Taylor MP
Minister for Energy and Emissions Reduction
Parliament House
Canberra ACT 2600

Dear Minister

I am pleased to submit *The acceleration in renewables investment in 2018,* which is the 2018 administrative report of the Renewable Energy Target.

The report is submitted for presentation to the Parliament in accordance with section 105 of the *Renewable Energy (Electricity) Act 2000*.

The report covers the operations of the *Renewable Energy (Electricity) Act 2000* for the 2018 calendar year and the annual statement and supporting information about progress towards meeting the 2020 Large-scale Renewable Energy Target.

Yours sincerely

David Parker AM
Chair, Clean Energy Regulator
20 June 2019

Contents

Chair's foreword

The transition of Australia's electricity sector to renewables is proceeding apace with more capacity per capita being installed in Australia than any other country.[1] Investment in renewables is strong, and there is now enough capacity built or under construction to exceed the 2020 Large-scale Renewable Energy Target by a substantial margin. The Renewable Energy Target continues to deliver emissions reductions in our electricity sector, helping Australia meet our international emissions commitments.

In May 2018 we said there was enough capacity built or committed to meet the 2020 Large-scale Renewable Energy Target. From May to December 2018 there was an additional 3766 megawatts of firmly announced projects. This suggests that 2018 was the year in which commercial factors became a stronger driver for ongoing investment in renewables than incentives coming from the Large-scale Renewable Energy Target. Large-scale generation certificate prices fell significantly over this period as new generation came online and as the scale of the pipeline of new investment became clearer.

The transition to renewables poses some challenges to the operation of our electricity grids and is changing the economics of thermal generation. When combined with storage technologies, renewables offer flexible capacity to help match changing profiles of supply and demand.

We are seeing a significant increase in batteries at all scales, and many planned pumped hydro projects and proposed investments in the grid infrastructure. These will need to come on line quickly and at scale to accommodate potential additions of variable renewable energy. This will be a watch point in the next few years.

Consumers are becoming more informed about their options. We continue to see growth in rooftop photovoltaic (PV) for households and businesses, even as the level of the support from subsidies under the Small-scale Renewable Energy Scheme gradually decreases between now and when the scheme ends in 2030.

With the surge in renewables it is important to maintain a strong focus on compliance and integrity. We have, for example, collaborated with industry to implement the Solar Panel Validation Initiative, to provide a way to verify that panels are genuine. This innovation can be expanded to verify other elements of an installation.

1 Blakers, A, Stocks, M, Lu, B, *The Conversation*, 'Australia: the renewable energy superstar', 8 Feb 2019, p.1, available at: http://re100.eng.anu.edu.au/publications/assets/100renewables.pdf.

In May 2018 we said there was enough capacity built or committed to meet the 2020 Large-scale Renewable Energy Target. From May to December 2018 there was an additional 3766 megawatts of firmly announced projects.

Photo: Capital East Solar Farm, NSW

We also continue to streamline and automate our own processes to improve efficiency for our clients and our agency. We are not a safety regulator but we do collaborate with electrical safety agencies by passing on inspections results we obtain under the Renewable Energy Target.

There is a strong pipeline of investment in the next year or so and the entry of new investors with strong balance sheets supports the view that there is an underlying strength to potential investment. Our agency is playing its role providing a stable regulatory framework for the transition to renewables by providing authoritative information to the market and collaborating with the electricity market bodies that are responsible for ensuring system reliability and security.

David Parker AM
Chair, Clean Energy Regulator

2018 Annual Statement Progress towards the 2020 target

In 2018 it became certain that the Large-scale Renewable Energy Target of 33,000 gigawatt hours will be achieved in 2020.[2]

Overall findings

At the end of 2018, enough utility-scale renewables capacity was commissioned and generating, or under construction, to meet the Large-scale Renewable Energy Target in 2020.

The portion of household electricity bills attributable to the Large-scale Renewable Energy Target was $9.85 per quarter for the average household electricity bill in 2018.[3]

The Large-scale generation certificate spot price moderated significantly towards the end of the year from around $85.00 in January to $47.50 in December 2018 and fell further to $31.00 by mid-March 2019. This will moderate the costs to electricity retailers and should be reflected in the pass through cost to electricity bills in 2019.

Capacity

A record 3455 megawatts of constructed projects were accredited in 2018, more than triple the 1113 megawatts accredited in 2017, the previous record.

In 2017, the Clean Energy Regulator stated that 6400 megawatts would need to be commissioned between 2017 and 2019 to meet the target in 2020. This capacity will be accredited and generating ahead of schedule, around mid-2019.

Since 1 January 2016, 11,611 megawatts of new capacity has been firmly announced. Of this, 4474 megawatts has been commissioned[4] against the 6400 megawatts required to meet the 2020 target. A further 5408 megawatts is under construction and an additional 1729 megawatts of projects hold a power purchase agreement. We would expect these projects to reach financial close and start construction in 2019.

This is due to the higher level of Large-scale renewable energy capacity build by the industry in the three years from 2017 to 2019 than the first 16 years of the scheme.

Certificate prices

Large-scale generation certificate spot prices stayed around the $85.00 mark for most of 2018 before rapidly falling to around $47.50 in December 2018 and further to $31.00 by mid-March 2019.

This fall was likely due to a combination of the market recognising the 2020 target will be materially exceeded and our updated stance on deferral of certificate liability. This position was articulated clearly in our market update published in October 2018.[5]

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2 This statement is made in compliance with the requirement for the Clean Energy Regulator to make an annual statement to the Parliament on how the scheme is tracking towards the 2020 target, and any impact the Large-scale Renewable Energy Target is having on electricity prices.

3 Methodology taken from the Australian Energy Market Commission, 2018 Residential Electricity Price Trends Methodology Report, December 2018, available at: https://www.aemc.gov.au/market-reviews-advice/residential-electricity-price-trends-2018.

4 This figure is slightly lower than 2017-2018 capacity. It does not include projects that were already committed in 2015 and adjustments to exclude non-renewable capacity.

5 Clean Energy Regulator, Large-scale generation certificate market update – October 2018, available at: www.cleanenergyregulator.gov.au.

Once it was clear the 2020 target will be exceeded, the Clean Energy Regulator communicated to the market that we had no objections to the use of shortfall in the expectation that liable entities would true up these positions with Large-scale generation certificates in a subsequent year, as allowed for under the law.

The take up of this option by industry has likely shifted demand for certificates beyond 2020. It also brought forward and smoothed the expected fall in Large-scale generation certificate prices. This will likely reduce the impact of the Large-scale Renewable Energy Target on electricity prices in 2019 and beyond.

As a result, a healthy 7.1 million surplus of certificates remained available in the market following the annual surrender of certificates in February 2019, down from 9.4 million the previous year.

Considering lower forward contract prices, and the large increase in supply expected in 2019, the Clean Energy Regulator expects further declines in the spot certificate price in 2019.

Liability

On-time surrender of Large-scale generation certificates reduced to 86.1 per cent from 93.3 per cent in 2017 as more liable entities chose to utilise shortfall provisions. As certificate prices are falling, there will be a commercial incentive for liable entities who paid shortfall charges in 2018 or earlier to purchase certificates and redeem the shortfall charge within the allowable three-year period.

Household electricity prices

According to the Australian Energy Market Commission, the Large-scale Renewable Energy Target accounted for an estimated 2.9 per cent (or an average $9.85 per quarter) of the average household electricity bill in 2018. The Clean Energy Regulator expects the certificate spot price to continue to moderate as liquidity improves; and this should further reduce the pass through cost to electricity bills in 2019 and beyond.

Looking forward

The Clean Energy Regulator expects approximately 4000 megawatts of Large-scale capacity will be accredited in 2019, taking the total to around 8400 megawatts generating since 2017.

With the capacity of new build commencing generation in 2018 combined with the expected accreditations in 2019 and 2020, we expect generation to step up from around 22,000 gigawatt hours in 2018 to around 30,000 gigawatt hours in 2019 and 40,000 gigawatt hours in 2020.[6]

This additional renewable energy generation will deliver large reductions in greenhouse gas emissions from the electricity sector. Quarterly electricity emissions have already fallen from 53.2 Mt CO_2-e in September 2008 to 44.1 Mt CO_2-e at end September 2018. This trend is shown in Figure 1.[7]

The current pipeline of projects that the Clean Energy Regulator is tracking suggests that we could see similar levels of capacity commissioned in 2020 and 2021 as we expect in 2019, though with less certainty.

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6 It is not possible to forecast this with precision as a number of factors can affect this such as the year to year variability in hydro generation and potential curtailment of wind and solar at times.

7 Australian Energy Market Operator, Quarterly Energy Dynamics - Q4 2018, February 2019, p.14 available at: https://www.aemo.com.au/Media-Centre/AEMO-publishes-Quarterly-Energy-Dynamics---Q4-2018 and Department of Environment and Energy, Quarterly Update of Australia's National Greenhouse Gas Inventory: September 2018, p.9 available at: http://www.environment.gov.au/climate-change/climate-science-data/greenhouse-gas-measurement/publications/quarterly-update-australias-national-greenhouse-gas-inventory-sept-2018.

Beyond that, the extent of the likely build is necessarily more uncertain, however, we can make observations on the factors currently at play.

The strong momentum in new firm project announcements continued in 2018 and early 2019 well beyond the point where it was clear the 2020 target would be met. Hence, it is likely that during 2018 the key driver of new announcements shifted from Renewable Energy Target incentive to commercial factors and state procurement processes.

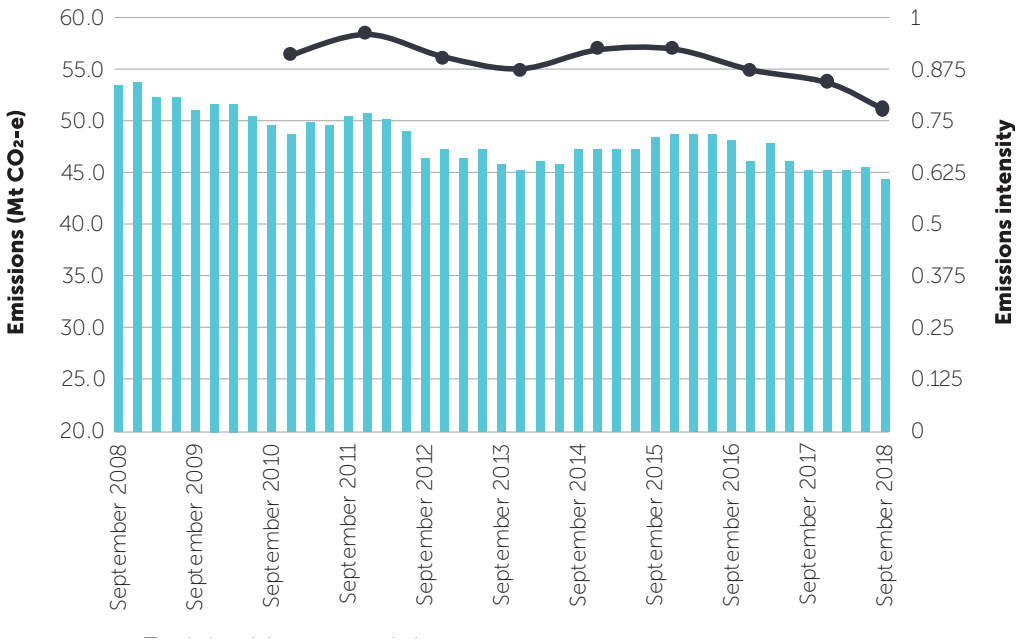
There is evidence of an increasing number of power purchase agreements from both retailers and corporates for commercial reasons.[8] The record level of new construction over the past two years, combined with ongoing technology cost reductions, contributed to reported costs required for new renewables projects declining materially on a per megawatt hour basis.

There is also greater diversification in the finance models of new project developers, with some international participants not needing to raise debt finance in Australia.

In relation to potential 'headwinds', there has been much public discussion on grid and connection constraints in a number of areas as well as changing Marginal Loss Factors[9] impacting a number of projects as more power stations become connected in constrained parts of the grid.

Although it is clear the 2020 target will be exceeded, we will continue to track and publish the investment pipeline of firm projects to support policy considerations and planning by electricity market bodies to manage the transition. General market feedback is that the data is valued.

Figure 1: Quarterly electricity emissions and National Electricity Market emissions intensity



8 ESCO Pacific, BlueScope Steel Signs Largest Corporate Solar Offtake in Australia, July 2018 available at: http://www.escopacific.com.au/media_releases/bluescope-steel-signs-largest-corporate-solar-offtake-australia/

9 Australian Energy Market Operator, Draft Marginal Loss Factors for the 2019-20 Financial Year, March 2019 p.28-33 available at: https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Security-and-reliability/Loss-factor-and-regional-boundaries.

Outcomes for 2018

5 gigawatts
of renewable capacity installed

1.5 GW ↑37%
Small-scale solar PV capacity

3.5 GW ↑218%
Large-scale renewable capacity accredited

29.8m ↑38%
Small-scale technology certificates validated

22.9m ↑21%
Large-scale generation certificates validated

8.1 ↑23%
gigawatts of cumulative Small-scale solar PV capacity

18.8 ↑23%
gigawatts of cumulative Large-scale renewable capacity accredited

13,400 ↑17%
gigawatt hours of electricity generated or displaced by Small-scale systems

22,350 ↑26%
gigawatt hours generated by Large-scale renewable energy power stations

29.8m ↑144%
Small-scale technology certificates acquitted

24.3m ↑5%
Large-scale generation certificates acquitted

Photo: Woden Southern Cross Club, ACT

The Renewable Energy Target

The purpose of the Renewable Energy Target is to encourage investment in renewable energy and reduce greenhouse gas emissions. It does this by creating a market for renewable energy certificates, which help drive investment in the sector.

On the supply side of the market, participants create certificates for each megawatt hour of renewable energy generated or displaced (no longer required from the grid). On the demand side, liable entities (mainly electricity retailers) source certificates in proportion to the total electricity they acquire in an assessment year.

The Renewable Energy Target comprises the:

- **Large-scale Renewable Energy Target**, which is to generate an additional 33,000 gigawatt hours of electricity from renewable sources in 2020, compared with 1997 levels. This scheme encourages companies to invest in new Large-scale renewable energy power stations, including solar and wind farms, and hydro and biomass power stations.
- **Small-scale Renewable Energy Scheme**, which provides incentives for households and businesses to install Small-scale systems. This includes solar panels, solar water heaters, Small-scale wind or hydro systems and air source heat pumps.

The Large-scale Renewable Energy Target and Small-scale Renewable Energy Scheme are set out in the *Renewable Energy (Electricity) Act 2000*.

The Act provides for electricity used for emission-intensive trade-exposed activities to be exempt from Renewable Energy Target liability.

For more detail on how the Renewable Energy Target works, see www.cleanenergyregulator.gov.au.

5 gigawatts

of renewable capacity installed

Photo: Small-scale installation, London Circuit, ACT

CHAPTER 1

Year in review

Year in review

Australia's renewable energy acceleration

The transformation of Australia's electricity grid is accelerating. Australia is installing solar and wind so fast that it is now leading the world in the per capita deployment rate for renewables, overtaking Germany and the United Kingdom (see Figure 2).[10]

2018 was another record-breaking year for new Large-scale renewable energy power stations and Small-scale solar PV installations for households and businesses. Total renewable capacity installed under the Renewable Energy Target more than doubled from 2.2 gigawatts in 2017 to 5 gigawatts in 2018.

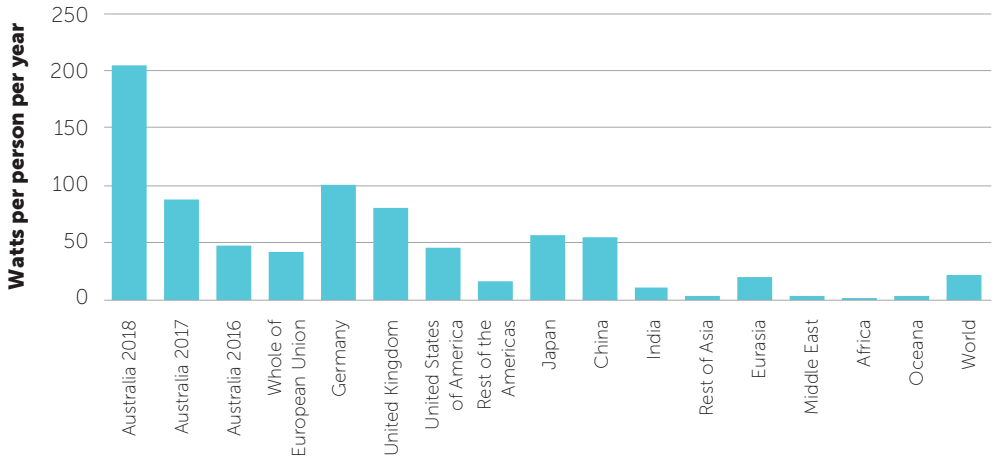
The year was characterised by a fundamental shift to solar for households, businesses and large utility-scale power stations, with a notable increase in the mid-scale solar range of 15 kilowatts to 5 megawatts[11] (see more about the shift to solar in Chapter 2 from page 18).

Large-scale increases ahead of the target

Construction of new renewable capacity under the Large-scale Renewable Energy Target continued to increase during the year, ahead of the trajectory required to meet the 2020 target. We expect current levels of investment to remain in the near-term, as costs of renewables continue to fall and appetite for power purchase agreements grow, with sufficient new generating capacity by the second half of 2019 to meet the 2020 target.

Some 11.6 gigawatts of capacity has been firmly announced since 1 January 2016. Of this, more than 4.5 gigawatts are already accredited and generating, 5.4 gigawatts are under construction and 1.7 gigawatts are subject to power purchase agreements with construction to begin in 2019. The split between Large-scale wind and solar projects remained similar in 2018, with solar accounting for 50 per cent of the firmly announced capacity.

Figure 2: Global per capita renewables deployment rate, 2018



10 Blakers, A, Stocks, M, Lu, B, *The Conversation*, 'Australia: the renewable energy superstar', 8 Feb 2019, p.1, available at: http://re100.eng.anu.edu.au/publications/assets/100renewables.pdf.

11 There are 1000 kilowatts in 1 megawatt and 1000 megawatts in 1 gigawatt.

The firmly announced capacity in the pipeline of projects significantly exceeds the 6.4 gigawatts required to meet the 2020 Large-scale Renewable Energy Target. This capacity will generate approximately 32,400 gigawatt hours of renewable energy electricity when commissioned.

2018 saw several record-breaking outcomes, including:

- 361 power stations accredited, up from 124 in 2017, with the majority (86 per cent) being solar power stations between 100 kilowatts to 5 megawatts
- 3.5 gigawatts accredited, bringing the total accredited capacity to 18.8 gigawatts
- 22,350 gigawatt hours of renewable energy generated above baseline,[12] and
- 22.9 million Large-scale generation certificates validated.

The generation capacity of the accredited and firmly announced projects will create enough Large-scale generation certificates to exceed the target.

Generation from power stations increased in 2018 due to the large increase in the generation capacity of power stations accredited throughout 2017 and 2018.

Small-scale investment continues to grow

Investment by Australian households and businesses in Small-scale renewable energy systems continued to grow in 2018, largely due to reduced technology costs, a competitive market and electricity costs.

The ongoing momentum in 2018 was characterised by the following outcomes:

- 24 per cent increase in Small-scale PV installations, compared with 2017
- more than 2 million Small-scale solar PV installations in total, bringing the overall number of all Small-scale renewable energy systems to more than 3.1 million
- more than 1.5 gigawatts of Small-scale solar PV capacity installed (a 37 per cent increase on 2017), bringing the cumulative national total to more than 8.1 gigawatts
- more than 60,000 solar water heaters (including air source heat pumps) installed
- 13,400 gigawatt hours of electricity generated or displaced (no longer needed from the grid) by Small-scale renewable energy systems
- 29.8 million Small-scale technology certificates validated.

The average size of Small-scale solar PV systems continued to increase in 2018, up by 11 per cent from 6.4 kilowatts in 2017 to 7.1 kilowatts in 2018.

Traditionally, most Small-scale solar PV systems have been installed in the residential sector. As technology costs have fallen, uptake by businesses has increased and there is an increased focus on residential rental markets and government housing.

Investment and innovation

The renewables roll out across the nation is delivering economic growth, especially in regional areas, creating stronger local economies and localised job growth.

In 2018 a record $26 billion was invested in Large-scale renewables projects.[13] This led to new employment opportunities with the creation of 13,000 jobs, a large proportion in regional areas.[14]

12 The existing generation of renewable source electricity in 1997 is referred to as baseline (see Glossary for more information).

13 Clean Energy Council, 'Clean energy project investment doubles in 2018 to top record $20 billion', 11 December 2018, available at: https://www.cleanenergycouncil.org.au/news/clean-energy-project-investment-doubles-in-2018-to-top-record-20-billion.

14 *Ibid.*

2018 investment highlights include:

- Queensland—$6.9 billion invested, more than 4500 direct jobs created
- Victoria—$5.2 billion invested, more than 3800 direct jobs created, and
- New South Wales—$4.3 billion invested, more than 2100 direct jobs created.[15]

The strong growth in renewables in Australia is attracting international investors, further evidence that the market is maturing. Of the current pipeline of projects, at least 5400 megawatts have secured international equity or financing.

In addition to the support provided by the Renewable Energy Target, a range of other factors have driven the uptake of renewables, including:

- investments by the Australian Renewable Energy Agency and Clean Energy Finance Corporation to assist the renewable energy industry to drive down cost curves (see page 30)
- state and territory schemes that encourage deployment of Large-scale and Small-scale renewables (see page 30), and
- the rise of corporate power purchase agreements used by companies to reduce electricity prices and support sustainability priorities (see page 30).

Innovation is also contributing to the sustainability and growth in renewables. New and emerging technologies are offering potential to improve efficiencies, reduce costs and increase generation, while pairing with energy storage can help to balance variable generation and deliver power when demand for electricity is high.

Innovative use of technology also extends to reducing the impact of renewable energy power stations on wildlife. For example, a novel aerial monitoring and detection technology is being trialled to prevent harm to birds.

15 *Ibid.*

A WORD **FROM INDUSTRY**

Wind farm trials eagle detector technology

New technology will be trialled to protect eagles at Cattle Hill Wind Farm on the shore of Lake Echo in central Tasmania.

The project will include 48 Goldwind turbines and associated infrastructure. Construction is underway, with the wind farm expected to be fully operational by late 2019.

Goldwind Australia will install the innovative IdentiFlight® aerial monitoring and detection technology system as one of the key initiatives to mitigate the impact on Tasmanian Wedge-tailed Eagles at the project site.

IdentiFlight's tower-mounted optical units detect flying objects and then use algorithms to identify eagles within seconds. If an eagle's speed and flight path indicate a risk of collision with a wind turbine, a signal is generated to automatically shut down the specific wind turbine.

The Cattle Hill Wind Farm will have 16 IdentiFlight units located to detect eagles and shut down any of the 48 turbines as necessary.

John Titchen, Goldwind Managing Director, said this will be the first wind farm in Australia to trial the newly available innovative aerial monitoring and detection technology.

'Goldwind Australia understands the importance of balancing the need for clean, renewable energy while protecting Tasmania's unique wildlife, particularly the endangered Tasmanian Wedge-tailed Eagle. We are very pleased to have partnered with IdentiFlight to apply this recently developed innovative technology to reduce impacts on the Tasmanian Wedge-tailed Eagle. We look forward to sharing the results of this first Australian trial following installation,' said John.

President of IdentiFlight, Tom Hiester, said the technology was developed to promote the successful coexistence of avian wildlife and wind energy.

'Results from IdentiFlight trials on wind farms in the United States have demonstrated its effectiveness in mitigating impacts on the iconic bald and golden eagles,' said Tom.

Photo: Cattle Hill Wind Farm, TAS

This content was provided by Goldwind.

Increase in renewables is transforming electricity markets

The deployment of renewables is pivotal to Australia's transition to a low carbon economy. The scale of transition is unprecedented and the pace of change accelerating.

As the Australian Energy Market Operator's Chief Executive Officer, Audrey Zibelman, stated, 'There are 6.5 solar panels being installed on rooftops every minute in Australia. We are leading the world in terms of implementation. We have to look at the future, we have no choice but to look at the transition that is going on'.[16]

To accommodate the rapid penetration of variable renewables generation that is geographically dispersed, parts of Australia's grids need to be strengthened. New responses that offer flexibility to balance changes in generation, demand and time of use are also needed (see Chapter 4 from page 34 for more on the opportunities and challenges associated with the integration of more renewables).

Increased volumes of Large-scale renewable energy power stations and Small-scale solar PV also pose challenges to our administration of the Renewable Energy Target. We are actively seeking ways to improve efficiencies and effectively manage compliance risks that come with more renewables (see Chapter 5 for information on major initiatives to strengthen the integrity of our schemes).

Emissions reductions accelerate

The Renewable Energy Target reduces Australia's emissions by displacing coal and gas used for electricity generation and heating with renewable sources such as solar, wind and hydro.

Australia has two targets to reduce greenhouse emissions under international agreements:

- 5 per cent below 2000 levels by 2020 (under the Kyoto Protocol), and
- 26–28 per cent below 2005 levels by 2030 (under the Paris Agreement).

Data from the Australian Energy Market Operator's final quarterly energy dynamics report for 2018 indicated that National Energy Market emissions were the 'lowest on record' and down 9 per cent on the same quarter in 2017.[17] Over the decade 2008 to 2018, annual National Electricity Market emissions have reduced by 38 million metric tonnes of carbon dioxide equivalent (Mt CO_2-e), caused by lower emissions intensity (approximately three-quarters of the reduction) and reduced consumption of grid electricity (the remaining quarter).[18]

National Energy Market emissions intensity is now 15 per cent below the 2008 level, with wind and solar continuing to displace gas and brown coal generation, and now starting to displace black coal generation.[19] This increase in renewables is a direct result of the Renewable Energy Target.

Reduced consumption of grid electricity is driven by energy efficiency and rooftop solar PV—as households and businesses generate their own solar electricity they reduce the amount of electricity they draw from the grid. In this way, the Small-scale Renewable Energy Scheme also contributes to the reduction in emissions.

16 Audrey Zibelman quoted in *RenewEconomy*, 'Two visions of Australia's energy future—flexible vs fair dinkum', 10 October 2018, available at: https://reneweconomy.com.au/two-visions-of-australias-energy-future-flexible-vs-fair-dinkum-25203/.

17 Australian Energy Market Operator, Quarterly Energy Dynamics - Q4 2018, February 2019, p.14 available at: https://www.aemo.com.au/Media-Centre/AEMO-publishes-Quarterly-Energy-Dynamics---Q4-2018

18 The Australia Institute, National Energy Emissions Audit, January 2019, p.7 available at: http://www.tai.org.au/content/national-energy-emissions-audit-january

19 *Ibid.*

National Energy Market emissions intensity is now 15 per cent below the 2008 level, with wind and solar continuing to displace gas and brown coal generation, and now starting to displace black coal generation.

Photo: Small-scale solar installations

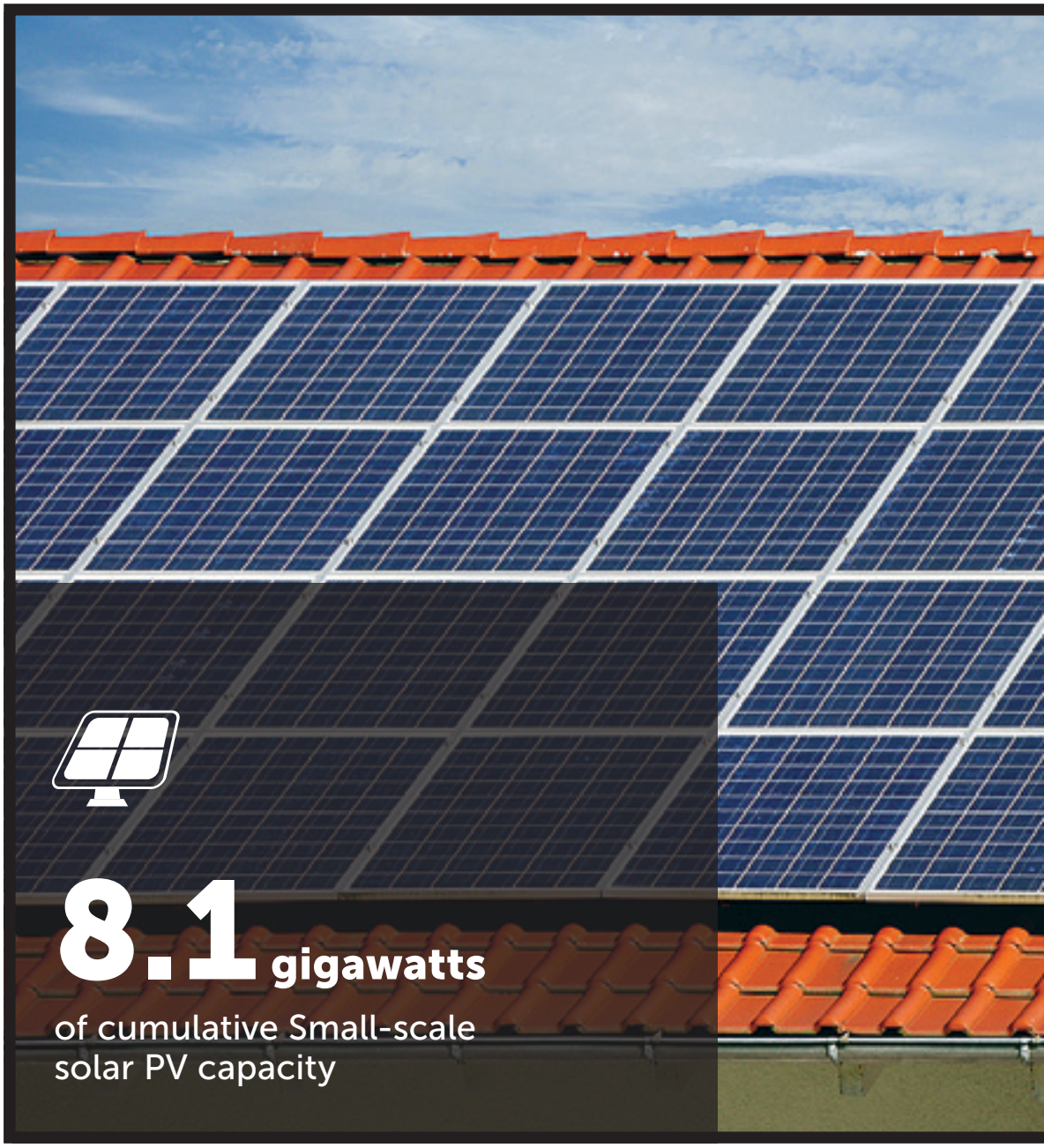


Photo: Small-scale roof top solar installation

CHAPTER 2

The solar shift

The solar shift

Changing drivers for solar PV installations

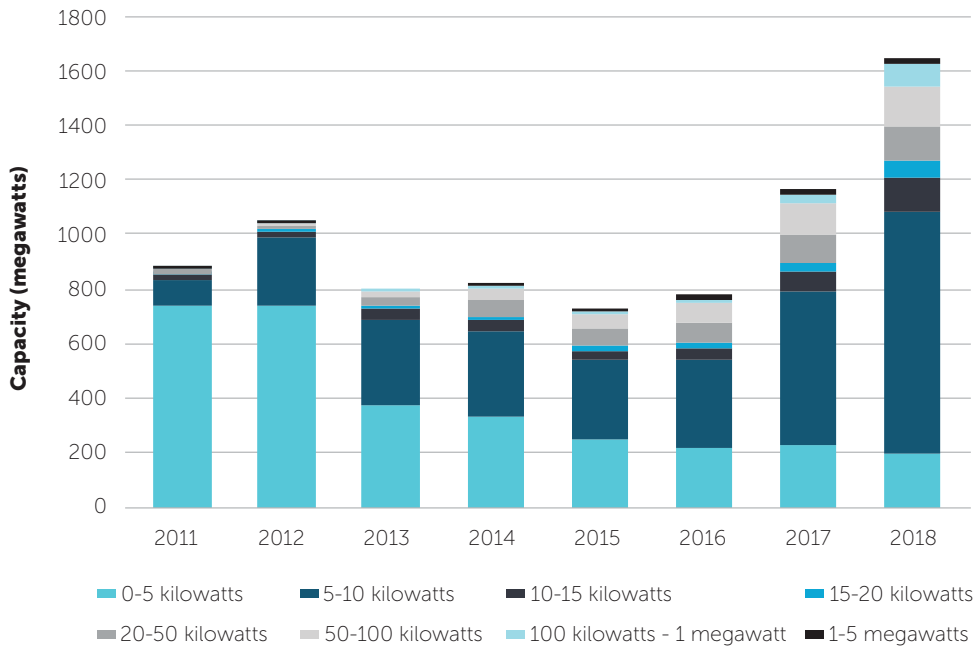
The shift to solar is happening across the board, from Small-scale residential installations, to mid-scale commercial and industrial solar on small and large businesses. In a significant year for mid-scale solar PV in Australia, a total of 433 megawatts of solar capacity was installed in 2018. This is a 44 per cent increase compared with the mid-scale solar capacity installed in 2017.

Analysis of more than 40 years of data on solar PV modules shows that each time the installed solar PV capacity doubles, the price of solar PV modules drops by 28 per cent.[20] Based on this data, the cost of solar PV is likely to continue to decline.

The early driver for the solar PV surge was the solar credits multiplier introduced in 2009 to provide an additional financial incentive for solar PV installations under the Small-scale Renewable Energy Scheme. This financial incentive made Small-scale solar PV the dominant technology, taking over from solar water heaters, previously the technology type of choice.

Now, payback period and consumer sentiment are the main drivers for uptake. The average payback period for a 5 kilowatt system is around four years—less if state incentives are also available. Falling technology prices significantly reduce the upfront cost of systems. When combined with high electricity prices, this encourages more and more homeowners and businesses to choose solar PV to meet their energy requirements.

Figure 3: Solar PV capacity in the Renewable Energy Target, 2011 to 2018



20 Bloomberg New Energy Finance, Solar's 28% Experience Curve Is Steeper Than Expected, 22 February 2017.

Small-scale solar systems increase in size

From 2011 to 2013, during the peak of the solar credits multiplier, most residential solar PV systems installed were between 1.5–5 kilowatts. Since then, residential installations have continued to increase in size. Now, most residential systems installed are from 5–10 kilowatts, mainly in the 6–7 kilowatt range. Systems of this size also have the highest uptake of concurrent battery storage installations.[21]

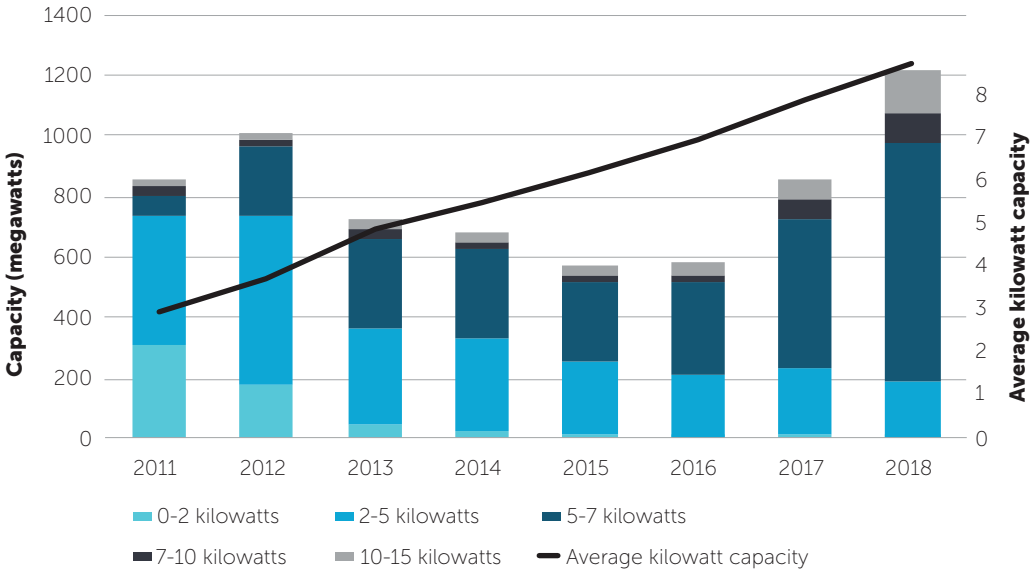
Notably, the observed trend of larger systems extends to an increasing number of 10–15 kilowatt capacity systems being installed on residential homes.

Previously, systems of this size were installed mostly on small commercial premises. The trend toward larger system sizes is seen in the year-on-year growth in the average kilowatt capacity of installed solar PV systems.

We expect the commercial attractiveness of Small-scale solar PV to continue in 2019. We also expect this shift to larger residential solar PV systems of 10–15 kilowatts to continue.[22]

The rate of concurrent battery installations is also likely to increase due to the availability of incentives; batteries enable consumers to avoid high electricity prices at times of peak demand by storing their self-generated electricity for later use.

Figure 4: Small-scale Renewable Energy Scheme capacity, 2011 to 2018



21 Battery storage systems are not incentivised under the Small-scale Renewable Energy Scheme. Some consumers may choose to install a battery system at the same time as installing a solar PV system.

22 Previously we classified systems under 10 kilowatts as residential systems within the Small-scale Renewable Energy Scheme. Current data, however, shows that 80 per cent of systems between 10 and 15 kilowatts are located on residential properties. Based on current data, we have amended our definition of commercial within the Small-scale Renewable Energy Scheme to refer to systems between 15 and 100 kilowatts.

Photo: Newcastle Art Gallery, Newcastle, NSW

Mid-scale solar systems surge

Solar PV is commercially attractive for small and large businesses and industrial facilities that consume high levels of electricity during the day. These 'behind the meter' solar PV systems generate electricity primarily for self-consumption, only exporting excess generation to the grid. Systems between 15 kilowatts and 5 megawatts, referred to as 'mid-scale' systems,[23] are typically installed where there is a good match between demand for electricity and PV generation profiles. This leads to short payback periods for the system and allows businesses to enjoy electricity cost savings over a longer period.

The number of mid-scale solar PV systems has increased over time. In 2018 there were 9495 mid-scale solar systems installed with a total capacity of 433 megawatts. This is a 34 per cent increase in the number of mid-scale solar PV systems installed, and a 44 per cent increase in the capacity of these systems, compared with 2017.

We have noticed participants who would have typically entered at the top end of the Small-scale Renewable Energy Scheme are now going directly into the Large-scale Renewable Energy Target, with installations between 100 kilowatts and 5 megawatts. This is likely due to the reduced cost of systems, payback periods being within leasing tenures, and larger systems providing a better match to the consumption needs of the business.

The rise in mid-scale solar PV systems has paved the way for innovative ventures across diverse businesses, industries and institutions such as enabling landowners to use their properties to host mid-scale solar farms, and educational institutions to install solar across campuses.

23 Previously we classified systems between 10 kilowatts and 1 megawatt as 'commercial and industrial' systems and systems over 1 megawatt as utility-scale power stations. To align with recent trends in the industry, we now classify solar PV systems between 15 kilowatts and 5 megawatts as mid-scale solar PV systems.

A WORD **FROM INDUSTRY**

Solar provides opportunity to repurpose farm properties

In late 2016, Yates Electrical Services launched its first Large-scale solar farm in Renmark, South Australia. The 187.2 kilowatt site is part of the company's Redmud Green Energy project, which aims to create a distributed network of Large-scale solar PV generating sites throughout South Australia. The goal is to reactivate redundant land parcels, boost the economic growth of regional areas, improve the reliability and sustainability of the network, and support South Australia's pioneering efforts towards operating as a renewables-dominated market. As of the beginning of 2019, Redmud Green Energy has delivered 46 Large-scale solar projects throughout regional South Australia.

By creating solar farm solutions of up to 1 megawatt, Redmud Green Energy has provided an incentive for business owners, landowners and growers to diversify their business practices assisting their operations through access to cheaper, cleaner energy solutions, as well as providing supplementary income streams and vastly reducing reliance on the unpredictable, and often volatile, primary production markets. The Redmud Green Energy project built on the strengths of Yates Electrical Services' history of solar installations, involving more than 1200 local residential solar installations in the Riverland region since 2011.

The company is now looking at integrating storage solutions to these solar farms, so the systems can react to Australian Energy Market Operator signals to store generated energy during low-demand periods and export energy during peak periods, regardless of whether the site is currently generating. This energy arbitrage system will further support the energy grid, alleviating pressure on current infrastructure by providing dispatchable generation when it is most required.

The Redmud Green Energy project involves some 20 sites in various stages of development, with another 50 put forward for site viability studies.

The Large-scale generation certificates generated by the solar farm installations have made up a significant amount of revenue, providing additional security to business owners, landowners and growers, as well as a substantial business case for investment in South Australia's renewable energy industry.

Photo: Renmark, SA. Yates Electrical Services

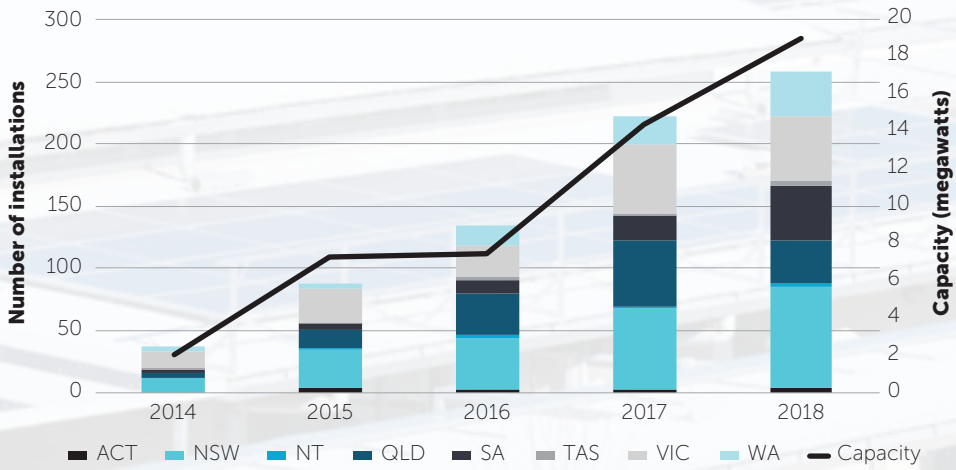
This content was provided by Yates Electrical Services.

Spotlight on...solar powered education

A growing number of educational institutions across the country are installing solar PV, with the size of these systems also increasing. There was a 16 per cent increase in installations and a 32 per cent increase in installed capacity in 2018 compared with 2017.

Similar to businesses, educational institutions use most of their electricity between 9 am and 5 pm. Lower electricity costs for schools, vocational educational facilities and universities provides a strong economic case for installing solar PV. Many of these educational institutions also use these systems to educate their students on renewable energy generation and sustainability.

Figure 5: Installations and capacity on schools and universities greater than 15 kilowatts, 2014 to 2018



New South Wales, Victoria and Queensland have the most installations on educational buildings.

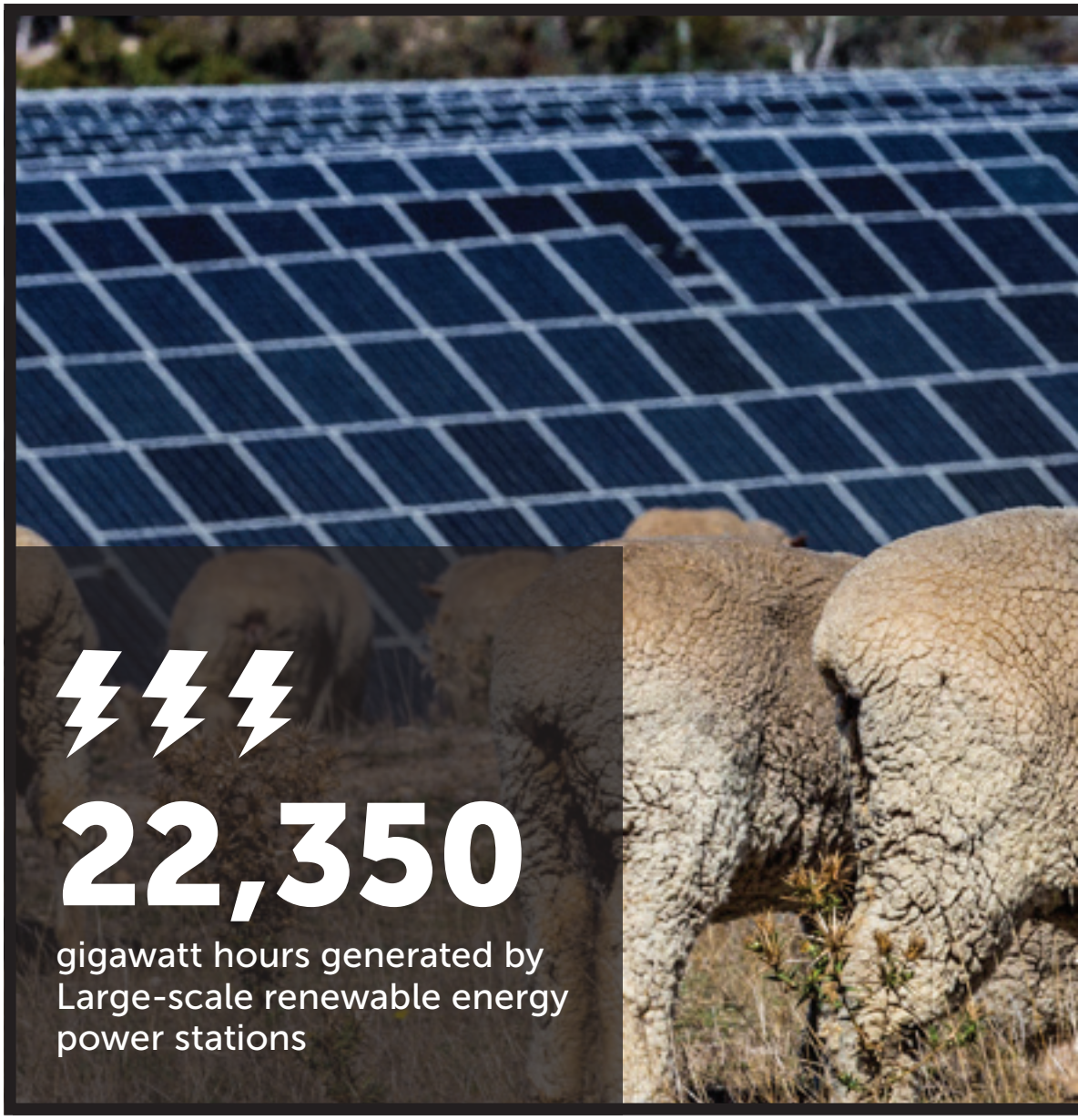
Educational institutions participate in both the Small-scale Renewable Energy Scheme and Large-scale Renewable Energy Target.

In past years, educational institutions participating in the Large-scale Renewable Energy Target were predominantly large universities. The University of Melbourne and University of Queensland were the first to install solar PV across multiple buildings on their campuses.

This year saw a shift towards smaller schools participating in the Large-scale Renewable Energy Target. There was a 100 per cent increase in the number of schools accredited under the Large-scale Renewable Energy Target and a 71 per cent increase in installed capacity compared with 2017.

The number of schools installing systems between 15 and 100 kilowatts in the Small-scale Renewable Energy Scheme appears to be slowing as schools seek out these larger-sized systems.

Photo: Amaroo School, Canberra, ACT



22,350

gigawatt hours generated by Large-scale renewable energy power stations

Photo: Royalla Solar Farm, ACT

CHAPTER 3

Demand for renewable energy

Demand for renewable energy

Historically, increased investment in renewables has primarily been driven by large liable entities (usually tier one electricity retailers) that are required to obtain and surrender certificates to meet their obligations under the Renewable Energy Target.

In 2018 market dynamics reached a turning point. Drivers of demand for renewables have now clearly shifted. Increased competition has expanded the writing of power purchase agreements to tier two electricity retailers. Tier one electricity retailers only underpin 22 per cent of the 11.6 gigawatt renewable energy project pipeline but represent 60 per cent of demand in the National Electricity Market.

At the same time, high electricity prices and sustainability drivers have led to the growth of corporate power purchase agreements (see page 30). Together these drivers suggest that investment in renewables is now driven more by commercial factors than the Renewable Energy Target.

State and territory incentive programs and targets also continued to support investment in both Large-scale and Small-scale renewables in 2018.

The boom in utility-scale renewable energy projects will significantly boost supply for the Large-scale generation certificate market. The increased availability of Large-scale generation certificates reduced certificate spot prices in 2018. The lower spot price cut the cost of the Renewable Energy Target for consumers, and may result in lower electricity pass through costs for households and businesses in future years.

Setting the renewable percentages

Many liable entities play a role in both the supply and demand side of the market for renewable energy certificates, as some operate power stations under the Large-scale Renewable Energy Target and support installations for households and businesses in the Small-scale Renewable Energy Scheme.

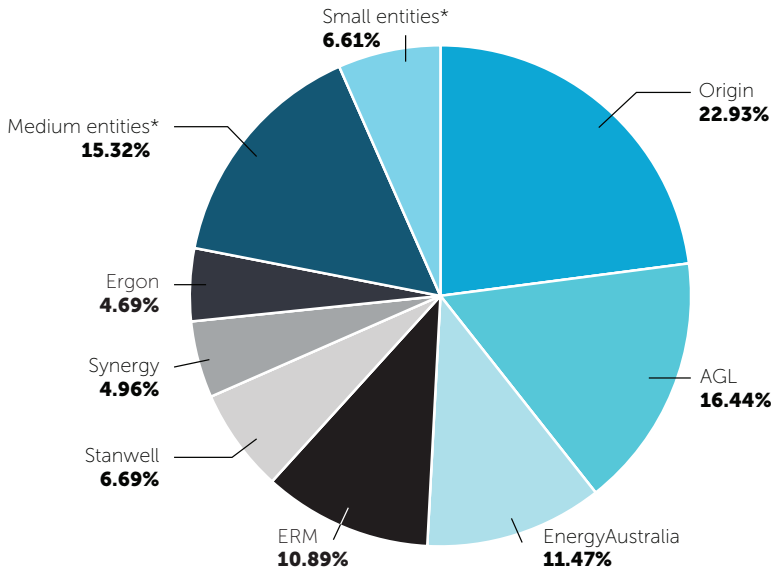
Under the Renewable Energy Target, liable entities are required to surrender Large-scale generation certificates and Small-scale technology certificates (STC) in proportion to the electricity they acquire in a year.

The number of certificates liable entities need to surrender is determined by applying the renewable power percentage for Large-scale generation certificates and the Small-scale technology percentage for Small-scale technology certificates to an entity's relevant acquisitions of electricity, minus any exemption, for that calendar year.

The Minister for Energy and Emissions Reduction sets the percentages before 31 March of the calendar year.[24] The renewable power percentage for 2018 was 16.06 per cent. The Small-scale technology percentage for 2018 was 17.08 per cent.

24 For details about how the renewable power percentage and the Small-scale technology percentage are calculated, see www.cleanenergyregulator.gov.au.

Figure 6: Liable entities by liability percentage, 2018



*Medium entities have a liability between 100,000 and 1 million certificate liability and small entities have less than 100,000.

Deferral of liability

For 2018, across both the Large-scale Renewable Energy Target and Small-scale Renewable Energy Scheme, liable entities surrendered 93.3 per cent of certificates on time, down from 95.5 per cent for the 2017 assessment year.

The surrender rate for Large-scale generation certificates in 2018 was 86.1 per cent, down from 93.3 per cent in 2017. For Small-scale technology certificates, the surrender rate was 99.9 per cent.

Liable entities may surrender Large-scale generation certificates for more than 90 per cent of their liability and carry forward a shortfall of less than 10 per cent of their liability to the following assessment year. Carry forward shortfall does not result in a shortfall charge.

Liable entities with shortfall of greater than or equal to 10 per cent of their liability must pay a shortfall charge of $65 for each Large-scale generation certificate not surrendered.[25]

In October 2018 we released an updated position on shortfall. This position stated that as the Large-scale Renewable Energy Target will be exceeded, we have no objections to the use of shortfall provided liable entities true up their position by surrendering sufficient Large-scale generation certificates within the allowable three-year period.

A total of $458 million (or the equivalent of 7.5 million Large-scale generation certificates) of shortfall charges generated in 2016, 2017 and 2018 is in consolidated revenue, which may be redeemed by liable entities within three years.[26] Of this, $220 million relates to the payment of charges for 3.4 million Large-scale generation certificates in shortfall for the

25 Shortfall and shortfall charge information is available at: www.cleanenergyregulator.gov.au.

26 Entities that have paid the shortfall charge can subsequently surrender additional certificates and obtain a refund, less an administrative fee. Refunds may only be claimed during the 'allowable refund period' (which ends three years after the entity pays a shortfall charge) and if the entity did not have any shortfall for the assessment year immediately before the year the refund is sought.

2018 assessment year. In addition to paid shortfall for the 2018 assessment year there was a further shortfall of 0.5 million certificates carried forward to 2019.

The use of shortfall by liable entities has likely shifted demand into future years and smoothed and brought forward a fall in Large-scale generation certificate prices.

For Small-scale technology certificates, the surrender rate in 2018 was 99.9 per cent. As the STC clearing house provides unlimited certificates at $40 per certificate (GST exclusive), well below the shortfall charge of $65, a very high surrender rate continues.

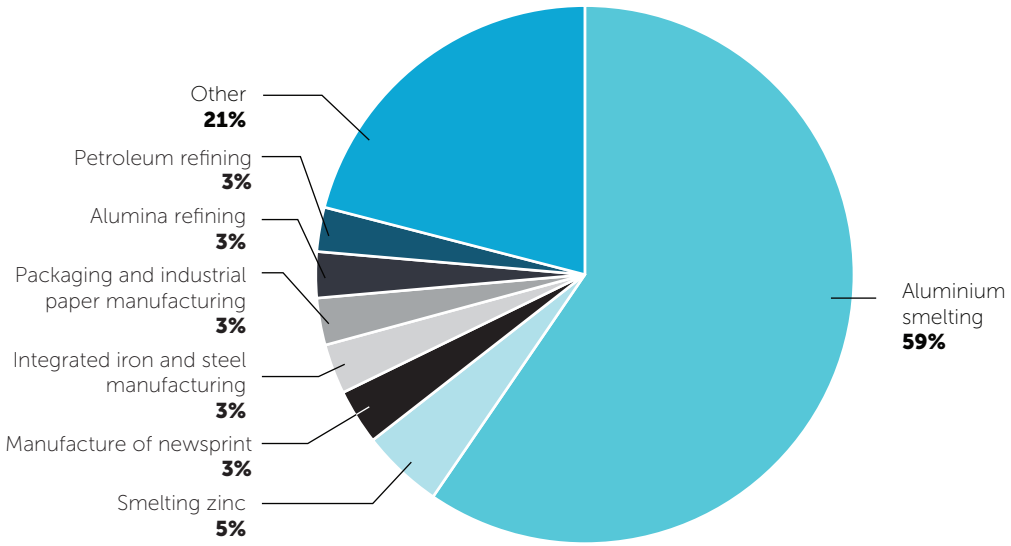
We publish the details of all entities in shortfall (see Appendix A).

Emissions-intensive trade-exposed exemptions

The *Renewable Energy (Electricity) Act 2000* allows exemptions from Renewable Energy Target liability for companies conducting eligible emissions-intensive trade-exposed activities. Companies eligible for exemption are issued with a certificate detailing an amount of exemption in megawatt hours. They then agree to a commercial arrangement with their electricity retailer, which can then use the exemption certificate to reduce their obligation under the Renewable Energy Target.

A total of 211 exemption certificates were issued for 2018. This is an increase of 23 per cent compared with 2017. Of these, 192 were issued under the old production calculation method and 19 were issued under the new electricity use method (see page 51 for more information).

Figure 7: Total amount of emissions-intensive trade-exposed exemption, for 2018



The exemptions represent 39,126 gigawatt hours of electricity that can be used to reduce electricity retailers' relevant acquisitions and hence the amount of renewable energy certificates they need to surrender to meet their liability obligations.

Certificate prices and impact on household electricity bills

According to the Australian Energy Market Commission, the Renewable Energy Target accounted for an estimated 5 per cent (or an average of $68.50 per year) of the average household electricity bill in 2018. The Large-scale Renewable Energy Target was estimated to contribute $39.40 and the Small-scale Renewable Energy Target around $29.10.

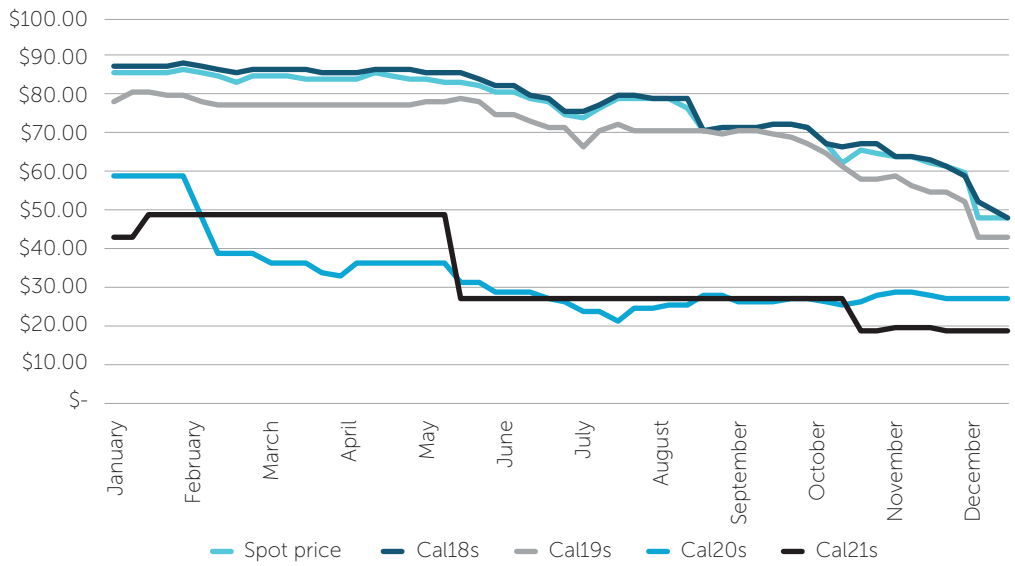
The Australian Energy Market Commission's modelling suggests that across the next few years wholesale electricity costs are expected to decrease in all jurisdictions of the National Energy Market, in part due to additional renewable energy and battery storage entering the market.[27]

Large-scale generation certificate spot prices fell sharply towards the end of 2018—from $85.30 in January to $70.50 at the end of August, before falling a further 33 per cent to finish the year at $47.50.

The fall in Large-scale generation certificate prices will likely reduce the impact of the Large-scale Renewable Energy Target on electricity prices in 2019 and 2020, despite the increase in the renewable power percentage and the Small-scale technology percentage.

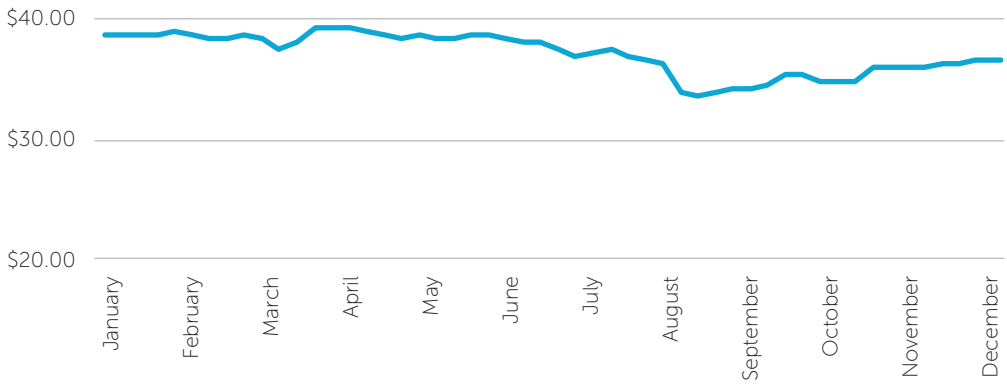
The Small-scale technology certificate spot price was more stable throughout the year, fluctuating between $33.50 and $39. The Australian Energy Market Commission estimated the impact of the Small-scale Renewable Energy Scheme to be $29.10 per household in 2018.

Figure 8: Large-scale generation certificate spot and forwards price, 2018



27 Australian Energy Market Commission, 2018 Residential Electricity Price Trends Review, December 2018, p.i available at: https://www.aemc.gov.au/market-reviews-advice/residential-electricity-price-trends-2018.

Figure 9: Small-scale technology certificate spot price, 2018



A changing dynamic in renewables demand

Drivers of investment in renewables are diversifying. Aside from the Renewable Energy Target, state and territory incentive schemes are bolstering demand and power purchase agreements are finding favour with corporate entities. A number of institutions such as the Australian Renewable Energy Agency and the Clean Energy Finance Corporation have also played a central role in driving the cost of renewables down and supporting investment to enable Australia to meet the Large-scale Renewable Energy Target.

During 2018 several state and territory incentive programs encouraged further investment in both Large-scale and Small-scale renewables, to meet individual state and territory targets. These programs include incentives that make Small-scale renewables more accessible to those previously unable to take advantage of these systems, such as low income households, renters and public buildings. Newer initiatives are encouraging the co-installation of batteries and solar PV systems, which will improve reliability and assist in grid stability. These schemes are expected to drive even higher levels of Small-scale installations from 2019 onwards.

Corporate power purchase agreements

A power purchase agreement is a contract between two parties, where the buyer purchases electricity generated by the seller.

These agreements have traditionally been between Large-scale renewable energy power stations and electricity retailers. However, rising electricity costs combined with low renewable energy costs means it is becoming commercially viable for businesses to enter into corporate power purchase agreements with renewable energy electricity generators, to meet all or part of their energy needs.

Corporate power purchase agreements are likely to drive new investment in renewables post-2020 and soak up the surplus of Large-scale generation certificates available in the 2020s. Large Australian corporates have begun to sign contracts to purchase Large-scale generation certificates after 2020, intending to voluntarily surrender the certificates to meet carbon neutral goals or to enhance their corporate social responsibility.

While several Australian companies have led the field in signing corporate power purchase agreements for renewable energy—such as Bluescope, Telstra and Nectar Farms—industry-led initiatives are also growing.

For example, the global RE100 initiative includes 162 of the world's most influential companies that are committed to sourcing the equivalent of their entire energy demand through 100 per cent renewables. In 2018, the Commonwealth Bank of Australia became the first Australian corporate to join RE100. While it was the first Australian company to join, almost three-quarters of RE100 companies have operations in Australia, including Mars, Fujitsu and Carlton United Breweries.

Spotlight on...the Business Renewables Centre Australia

Collaborative initiatives between industry, environmental groups and academia have been established to demystify corporate power purchase agreements and increase their uptake.

In 2018, the Business Renewables Centre Australia was formed to simplify, streamline and accelerate corporate purchasing of Large-scale wind and solar energy and storage.

The goal of the Business Renewables Centre Australia is to deliver 5 gigawatts of renewable energy power purchase agreements by 2030.

The Business Renewables Centre Australia is an initiative by Climate-KIC Australia, WWF-Australia's Renewable Energy Buyers Forum and the Institute for Sustainable Futures, and is funded by the Australian Government.

Photo: Solar Plant, Wayville, SA

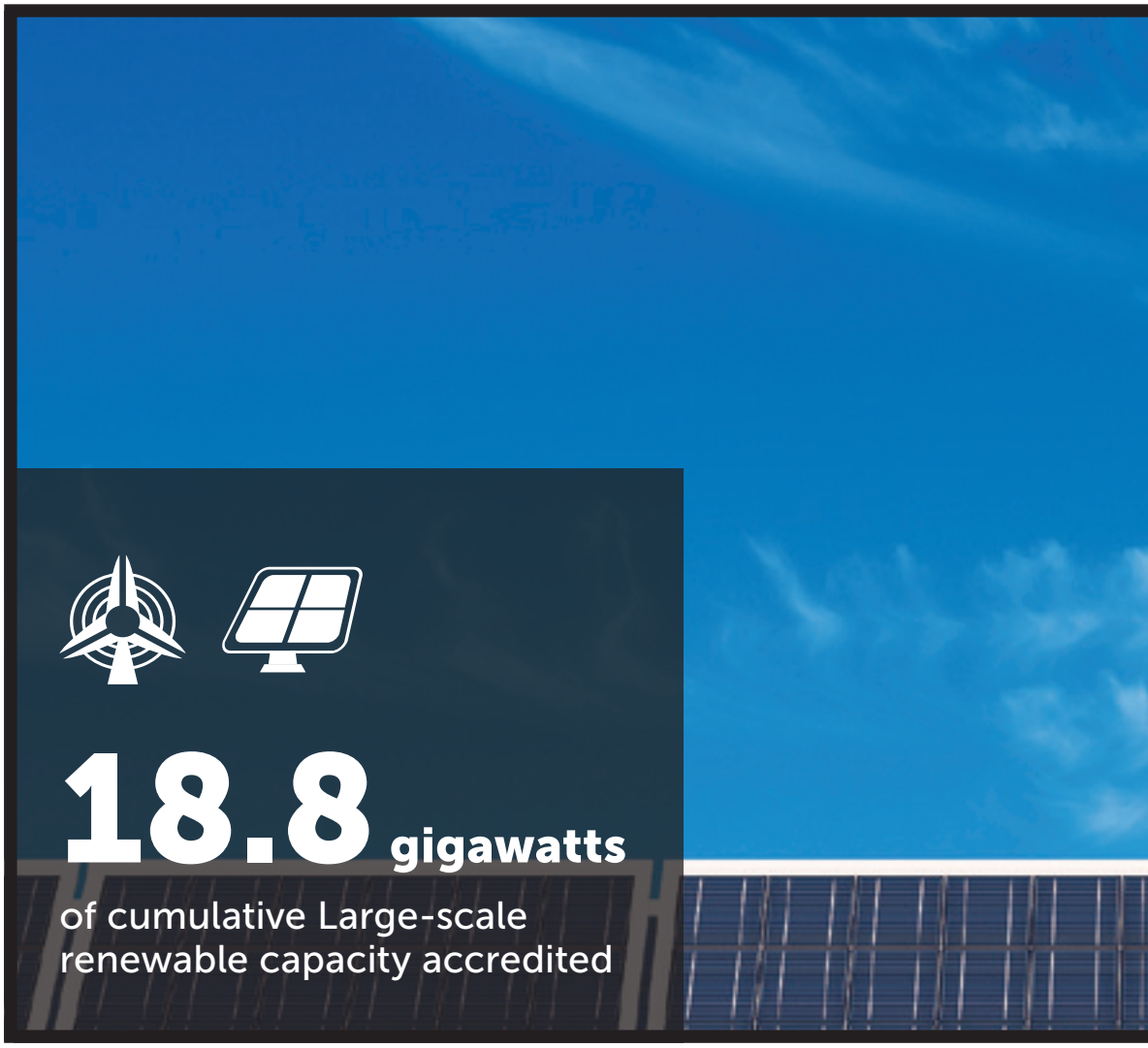


Photo: Clean Energy Regulator

CHAPTER 4

Managing the transition to higher variable renewable energy penetration

Managing the transition to higher variable renewable energy penetration

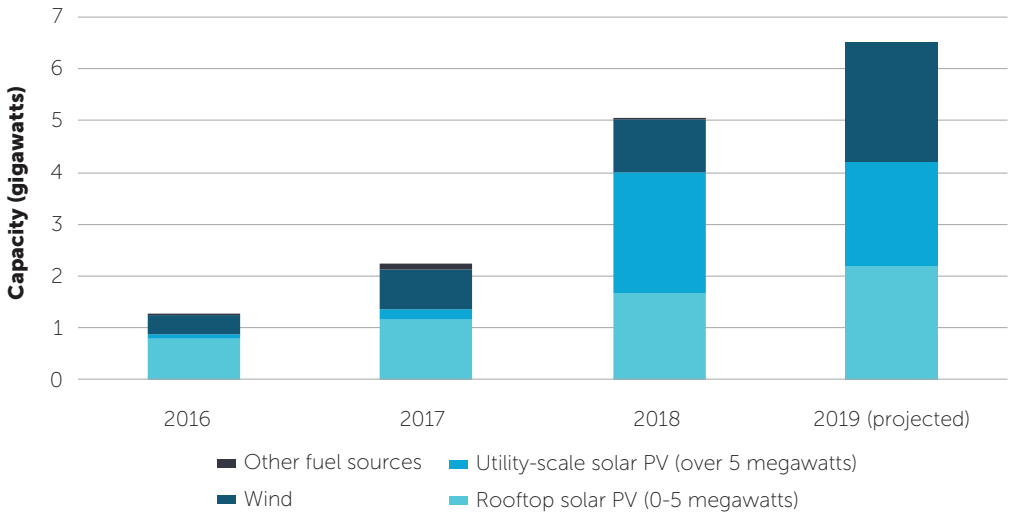
The challenge for Australia's electricity market

The Renewable Energy Target has driven the unprecedented deployment of rooftop solar PV and utility-scale renewables in Australia over the past few years. This growth is expected to continue in 2019. While the variable renewable energy capacity has increased rapidly since 2016, over the same period more than 2300 megawatts[28] of coal fired synchronous generation capacity has been retired from the National Electricity Market.

The Renewable Energy Target incentivises generation from renewable energy sources, which diversifies the energy resources in the electricity grid and reduces greenhouse gas emissions from the electricity sector. However, the Renewable Energy Target does not incentivise the flexible capacity required to support the transition to an electricity grid with a high penetration of variable renewable energy.

Australia's National Electricity Market operates on one of the world's longest interconnected power systems, stretching from Port Douglas in Queensland to Port Lincoln in South Australia and across the Bass Strait to Tasmania—a distance of around 5000 kilometres. The unique size and shape of Australia's National Electricity Market means the rapid transformation of the energy supply requires complex management.

Figure 10: New renewable capacity, 2016 to 2019



28 South Australia's Northern and Playford power stations closed in May 2016 followed by Victoria's Hazelwood in 2017.

The National Electricity Market was designed around large thermal generators located close to major load centres. Now, large renewable power stations are typically distant from those load centres and cities are increasingly generating significant amounts of electricity from solar systems on rooftops.

The Australian Energy Market Operator has been using its operational levers to ensure the electricity grid is operating within technical limits. This includes constraining the dispatch of renewable generators at times in areas where there is too much wind and solar generation and insufficient synchronous generation, as well as relying on the Reliability and Emergency Reserve Trader program.

Dispatchability and predictability in the National Electricity Market

In an electricity grid, supply and demand must be kept in balance to ensure frequency and voltage remains within tight technical limits. In Australia, the Australian Energy Market Operator manages the operation of the National Electricity Market and the challenges that come with balancing supply and demand of a large, changing electricity grid[29] with a high penetration of renewables. To keep the National Electricity Market within technical requirements, both the Australian Energy Market Operator and network service providers need access to operational levers. These represent the ability manage dispatch and configure power system services to maintain system security and reliability as well as the ability to both measure energy demand and generation output in real time and forecast into the future.[30]

These levers were an inherent part of a grid of mostly uniform energy supply, which comprised Large-scale fossil fuel-fired synchronous generators. This was relatively easy with predictable demand allowing large thermal power plants to slowly ramp up and down to meet that demand. Achieving the same level of stability in the grid transformed with varied energy resources located far from loads requires greater levels of flexibility, including generation sources that can be ramped up and down much more rapidly to keep supply and demand in balance.

Electricity supply from weather dependent utility-scale wind and solar generators is currently less predictable than electricity supply from fossil fuel-fired synchronous generators. More than 8 gigawatts of distributed Small-scale solar PV is on rooftops, and this presents the Australian Energy Market Operator with a significant challenge in forecasting how these systems will behave at any given time as it depends on the level of sunlight available over a sizeable geographic area. The aging thermal generators also face potential issues in maintaining generation on hot summer days when demand peaks and high temperatures may increase the likelihood of plant failures. The slower ramp rate of these thermal generators means they are unable to respond quickly to sudden changes in supply or demand caused by changing weather or as a result of thermal power station outages.

Flexibility in the National Electricity Market

A flexible electricity grid is one that can respond quickly to sudden changes in electrical supply or demand. This is increasingly important for a grid with high penetrations of variable renewable energy.

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29 Australian Energy Market Operator, Integrated Systems Plan, July 2018, p.4, available at: https://www.aemo.com.au/-/media/Files/Electricity/NATIONAL ENERGY MARKET/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf.

30 Australian Energy Market Operator, Power Systems Requirements, March 2018, p.5, available at: https://aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power-system-requirements.pdf.

Technologies and standard techniques are available to improve the flexibility of a grid with high penetration of renewables and an ageing fleet of thermal generators. These include open cycle gas turbine and diesel generation systems, battery storage, virtual power plants, pumped hydro energy storage and demand response, as well as increased grid and interconnection capacity (see Table 1). All of these systems have been, or are in the process of being, deployed in Australia.

Future options include concentrated solar thermal with storage, hydrogen and biomass based systems.

Table 1: Technologies or mechanisms for flexibility in the National Electricity Market

Technology or mechanism for flexibility	How is flexibility achieved?
Large-scale and Small-scale batteries	Batteries can be charged using thermal, wind or solar energy at times of low demand. This stored energy can be released during periods of high demand, for example Small-scale batteries can be used by the household at night during peak demand when electricity prices are high. Batteries can provide excellent grid stability services due to the speed (milliseconds) with which they absorb or dispatch electricity on demand. Batteries are typically used for relatively short duration interventions of minutes or hours.
Virtual power plants	Virtual power plants are a coordinated group of distributed energy resources and can have similar functionality to Large-scale batteries. They offer additional flexibility through the central management of aggregated Small-scale batteries that can dispatch or consume electricity to manage local voltage or frequency variations to improve grid stability.
Pumped hydro energy storage	Pumped hydro can effectively act as a battery, by storing excess energy from any power source including thermal, renewables (such as wind and solar) and releasing the energy when required. Pumped hydro quickly responds to changes in demand by ramping up or down in a matter of seconds, delivering a flexible source of power. In contrast to batteries, pumped hydro can provide power for hours or days depending on the size of the water storage capacity.
Open cycle gas turbines and diesel generation systems	Open cycle gas turbines can be started within minutes and ramped up and down quickly to meet spikes in demand or sudden changes in loads. However, they are relatively expensive to operate due to high fuel costs coupled with low efficiency at part load. Diesel generation systems have faster ramp rates than open cycle gas turbines and can maintain higher efficiency at part loads, but are expensive to operate for long periods due to the cost of fuel.
Increased connectivity	A more interconnected grid provides better use of resources across the National Electricity Market, through both access to lower-cost resources and realising the benefits of diversity from different resources in different locations with different generation profiles.
Demand response	Demand response offers flexibility through instantaneously reducing demand when supply is insufficient to meet demand. The use of this mechanism can reduce the need for involuntary load shedding.

Examples of increased flexible resources in the National Electricity Market

Tasmania has a large wind resource firmed by existing reservoirs across several hydroelectric schemes. This offers significant potential to deliver dispatchable on-demand generation and power system stability services to the National Electricity Market. Marinus Link, if it proceeds, will be able to support power transfers of up to 1200 megawatts between Tasmania and Victoria. This is in addition to the existing 500 megawatts Basslink Interconnector, which already supplies some of the peak load capacity to the eastern mainland states over summer.

In addition to the Snowy 2.0 pumped hydro project, an increasing number of mid-size pumped hydro power stations are being planned in New South Wales, Queensland and South Australia.

An increasing number of Large-scale renewable power stations are including additional infrastructure in their design in anticipation of installing energy storage systems. Large-scale and Small-scale batteries can be deployed much faster than building pumped hydro energy storage systems. A number of Large-scale renewable energy projects are co-locating battery storage with wind or solar farms, including Kennedy Energy Park in Queensland comprising 43.5 megawatts of wind power, 15 megawatts of solar power and a 2 megawatt battery, and the Gannawarra Solar Farm in Victoria with 50 megawatts of solar power and a 25 megawatt battery.

With the highest per capita uptake of Small-scale rooftop solar PV in the world, Australia's focus for virtual power plants is to coordinate rooftop solar PV and battery storage. Battery storage is growing rapidly in Australia, with Bloomberg New Energy Finance[31] estimating a 37 per cent increase in batteries between 2017 and 2018, and an expectation this will triple by 2019 with an expected 60,000 batteries installed. The data that is voluntarily disclosed to our agency on batteries installed concurrently with Small-scale solar PV systems shows a 16 per cent increase in the number of batteries between 2017 and 2018. This is partially driven by subsidy programs in several states and territories.

31 Bloomberg New Energy Finance, 'Australia Residential Storage to Triple, Despite High Cost', November 2018, p.2.

A WORD **FROM INDUSTRY**

On the path to decarbonisation

The past year saw the most significant growth in renewables in Australian history. As an independent green power producer, Neoen Australia is part of this transition. With more than 1 gigawatt of assets in operation or under construction, Neoen is looking forward to supporting Australia's next steps on the pathway to decarbonisation.

'We believe new investments and a long-term approach are the most critical ingredients for low electricity prices, local economic stimulation, and real progress towards decarbonising Australia's economy. Ultimately, it is important that the industry gets certainty with a constant, predictable and clear emissions trajectory over the next decade,' said Franck Woitiez, Managing Director, Neoen Australia.

The main challenge facing industry and governments is how to integrate renewable energy into the grid. As renewable energy is becoming more affordable and costs continue to decline, increasing solar and wind generation is changing the nature of the electricity grid.

Neoen aims to ensure a smooth transition by consistently delivering sustainable, reliable and competitive energy to Australians.

'We are always looking to invest in innovative solutions that are good for consumers, the climate and businesses,' said Franck.

For example, Neoen owns and operates the Hornsdale Power Reserve (HPR) in South Australia—the world's largest lithium-ion battery in operation today. In 2018, the HPR delivered close to $40 million in cost savings in the wholesale electricity market by increasing competition and smoothing variable renewable energy. HPR ensures electricity is available when solar or wind farms cannot generate electricity. The battery charges when wholesale electricity prices are low and discharges when demand for electricity is high. It also helps stabilise the electricity grid, as it can dispatch electricity at record speeds. In 2018, there were unexpected outages from some coal generators, particularly in extreme heat. On many occasions, Neoen's battery stabilised the grid in less than one-tenth of a second, faster than the blink of an eye. With solutions like the HPR, Australia has proven that renewables can be integrated into the grid effectively.

Photo: Neoen Hornsdale Battery, SA

This content is based on an interview with Neoen Australia.

Supporting predictability in the National Electricity Market through data sharing

The Australian Energy Market Operator values access to data from multiple agencies at both state and federal levels to assist them to maintain and improve power security and to develop forecasts to improve the dispatch system's ability to balance supply and demand. For example, the Australian Energy Market Operator registers all power stations over 30 megawatts, but has little visibility of smaller capacity systems.

We continue to provide key information gathered through the schemes we administer regarding distributed energy sources and utility-scale renewable energy power stations that can help manage the transition of the grid. We assist this transition by providing data and information through:

- An automated data exchange on Small-scale solar PV systems with the Australian Energy Market Operator. This will be extended to cover all Large-scale systems, in particular those sized below 30 megawatts, for which the Australian Energy Market Operator has little visibility. We are also a member of the Distributed Energy Resources Register working group set up by the Australian Energy Market Operator.
- The Solar Panel Validation Initiative (see page 45), which addresses the issue of unapproved panel installations in the Small-scale Renewable Energy Scheme. This initiative will be augmented to incorporate batteries.
- Information sharing with various agencies regarding the pipeline of utility-scale renewable energy projects to ensure there is transparency on the pace and scale of renewable energy projects.

A WORD **FROM INDUSTRY**

Strong partnership supports highly distributed energy system

Australian consumers lead the world in adopting Distributed Energy Resources in their homes and businesses, creating operational challenges as well as exciting opportunities with a decentralised generation model.

The Australian Energy Market Operator is working to smooth Australia's transition to a power system with high penetrations of distributed energy.

Effective integration of distributed energy resources has the potential to:

- provide new sources of energy and system support services that improve reliability and increase market competition, reducing wholesale energy costs
- delay or eliminate the need for certain network investments, reducing network costs, and
- enable consumers to install greater levels of rooftop solar PV, while adding resiliency to networks.

The Australian Energy Market Operator is working closely with the energy sector on a dedicated Distributed Energy Resource Program to integrate and coordinate the value from scalable distributed energy resources to maintain safe, reliable, secure and affordable energy moving forward.

The Australian Energy Market Operator forecasts that by 2030, Australians will have installed at least 16 gigawatts of solar PV systems smaller than 100 kilowatts in size across the National Electricity Market. This means the Australian Energy Market Operator will need to ensure a significant transformation of the power system and its operational practices to maintain a secure and reliable grid. Key to this is managing predictability and dispatchability.

To improve predictability, the Australian Energy Market Commission made a final rule change requiring the Australian Energy Market Operator to develop and implement a national database of distributed energy resources, including information on the number, location and technical characteristics of distributed energy resources such as rooftop solar, battery systems and micro-grids.

The need for predictability extends to the dynamic characteristics of high penetrations of distributed energy. Recent events, such as the power system disturbance on 25 August 2018, highlight how these dynamic characteristics can help or hinder efforts to stabilise the system.

The Australian Energy Market Operator is collaborating with Energy Networks Australia, Distributed Network Service Providers and the Australian Standards Committee to develop nationally consistent technical standards for distributed energy resources to help safeguard stability and security of our power system, as well as ensure customers with distributed

Photo: Rooftop solar, Australia

This content was provided by the Australian Energy Market Operator.

energy resources have the capability to access new products and services. The Australian Energy Market Operator and the Clean Energy Regulator are also working with the University of New South Wales and Solar Analytics to better analyse and understand system events.

In addition, the Australian Energy Market Operator is developing systems that manage dispatchability of a power system with high distributed energy resources. Australian Energy Market Operator has partnered with several virtual power plants and demand response providers to design effective system management tools. The intention is to develop and implement frameworks for real time coordination of distributed batteries, electric vehicle charging and other flexible loads, to maximise the holistic benefits of large volumes of distributed PV generation.

Looking forward

As the rapid pace of renewable investment continues, planning for the integration of a much higher penetration of renewables into the national electricity grid is the next key phase in Australia's transition to a clean energy future. As the penetration of variable renewable energy passes 40 per cent, technologies such as storage[32] are required to support the grid. Introducing flexible technologies and mechanisms assists with the challenges facing the National Electricity Market. The National Electricity Market is currently seeing renewable energy generation[33] of a little over 21 per cent, with Tasmania at 95 per cent and South Australia at 51 per cent.

If flexible capacity does not keep pace with the addition of variable renewable energy, the Australian Energy Market Operator may have to keep using its operational levers to ensure the electricity grid is operating within technical limits.

Looking forward as the Australian Energy Market Operator's 2019–20 Integrated System Plan is delivered we will see a more interconnected system with significant levels of storage as well as synthetic and actual inertia to maintain the operational effectiveness of the National Electricity Market. This, together with a range of more flexible energy capacity, will provide electricity market operators with the tools to improve the stability and efficiency of electricity systems while accelerating carbon abatement in Australia.

32 Energy Networks Australia, *Electricity Network Transformation Roadmap: Final Report*, April 2017, available at: https://www.energynetworks.com.au/roadmap-final-report.

33 Department of the Environment and Energy, Australian Energy Statistics, Table 0, March 2019, available at: https://www.energy.gov.au/publications/australian-energy-statistics-table-o-electricity-generation-fuel-type-2017-18-and-2018.

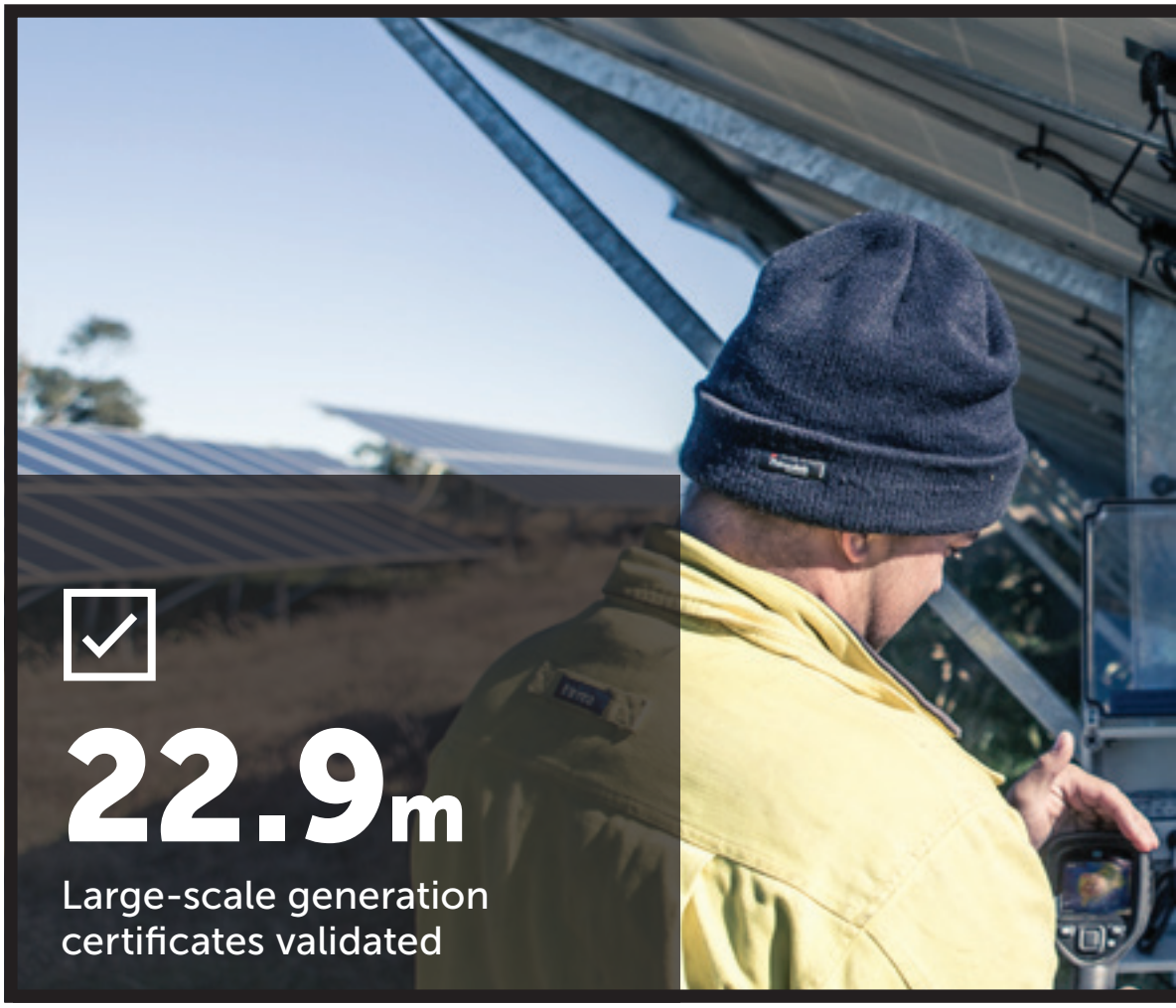


Photo: Capital East Solar Farm, NSW

CHAPTER 5

Maintaining the integrity of the Renewable Energy Target in a growing market

Maintaining the integrity of the Renewable Energy Target in a growing market

Innovation required to ensure scheme integrity

With significant increases in installations of renewables across all types of technologies and sizes, our agency is stepping up to manage increasing volumes while maintaining service standards. To maintain integrity in our schemes we must innovate to respond to the pressures of additional volume and complexity.

We have invested in industry capability to improve compliance, including innovative new solutions to verify panel serial numbers and educate industry stakeholders. Further, to cope with higher volumes of transactions we have enhanced our REC Registry's capability by streamlining power station accreditation applications and certificate creation for our Large-scale participants. This has created efficiencies for our clients and our agency.

In any industry where there is rapid growth, it is important to pay attention to the training and safety of workers, particularly in the case of electrical safety. We are working with industry bodies and state and territory governments that manage these safety risks to ensure they are aware of the rapid growth in renewables so they can respond appropriately.

Investing in industry capability and compliance

We recognise that the integrity of the Small-scale scheme can be lifted if industry is encouraged to adopt best practice in business operations.

Increasing agents' capability and standards: SRES Smart

Individuals and businesses that install eligible Small-scale systems can create and trade Small-scale technology certificates. In most cases, they assign the right to create their certificates to registered agents in return for a discount on the installation of the system.

SRES Smart is an online initiative to increase new and existing registered agents' competency and capability to better protect themselves and the scheme before certificates are created.

It includes a series of modules, knowledge checks and a self-assessment tool for applicants to demonstrate they understand the expected capability and standards of practice necessary to participate in the scheme.

SRES Smart expands on previously implemented Fit and Proper Person checks and requirements.[34] It provides our agency with evidence and assurance that registered agents understand their responsibilities.

Registered agents are an important control in the Small-scale Renewable Energy Scheme, and it is essential that they understand their role in the scheme and lower their risk of accidental non-compliance and fraud by third parties.

34 The Fit and Proper Person check is a key control to protect the integrity of the schemes we administer. Requirements generally consider a person's past compliance with the law, whether they are insolvent, and whether they have necessary capabilities and competence to effectively fulfil their intended scheme role.

Increasing the role of registered agents in scheme integrity: Project Sentinel

Registered agents play a critical role in maintaining the integrity of the Small-scale Renewable Energy Scheme by meeting their obligations under the *Renewable Energy (Electricity) Act 2000.*

Registered agents are responsible for compliance and demonstrating due diligence in their dealings with installers and retailers, and throughout the certificate creation process—in effect, they are the scheme 'sentinel'.

During 2018, we implemented Project Sentinel, using an 80/80 approach to engage with 80 agents who create 80 per cent of Small-scale technology certificates. Through this project we gathered compliance intelligence regarding agents' preparedness and diligence.

The project identified that generally agents understood the need to have robust due diligence and compliance processes. However, a significant proportion did not have adequate measures in place and were deemed a high risk to the integrity of the scheme. This can have a significant impact when certain agents are responsible for creating high volumes of certificates.

The next phase of Project Sentinel in 2019 will focus on the identified high risk agents and involve gathering information from agents and other relevant parties in the certificate supply chain (such as retailers or installers) to further assess the agents' suitability to participate in the scheme and improve their compliance practices. In serious cases, it may involve applying proportionate sanctions.

Checking solar panels are genuine: Solar Panel Validation Initiative

We have partnered with the solar industry to implement the Solar Panel Validation Initiative to address the installation of unapproved solar panels in the Small-scale Renewable Energy Scheme. This initiative progressed from a successful pilot in 2017 to full-scale roll out in 2018.

Solar panel validation aims to protect consumers and the integrity of the scheme. It provides an easy way to check and confirm that panels installed under the Small-scale Renewable Energy Scheme are genuine and approved—meaning they are backed by manufacturer warranties, meet Australian standards for quality and performance, and are eligible for Small-scale technology certificates.

The initiative has two parts: mobile phone apps for installers; and databases of verified solar panel serial numbers, received directly from manufacturers. Installers use the app to scan solar panel serial numbers, which are then checked against a database to ensure they are genuine and approved panels. This information is then sent to us and we use it when assessing claims for Small-scale technology certificates.

There are currently 15 manufacturers participating in the initiative, and three partners have produced apps and databases for installers to use. This covers around 60 per cent of all solar panel brands associated with Small-scale technology certificate creations under the Small-scale Renewable Energy Scheme. We are seeking to expand this initiative to cover batteries and inverters in the future.

In 2019 we expect the number of apps to increase as more partners develop their own apps or validation services under the initiative.

Photo: Small-scale roof top solar, Clean Energy Regulator

A WORD **FROM INDUSTRY**

Solar panel validation good for business as well as customers

With more than 20 years' experience as a solar energy retailer, Solargain has seen first-hand the challenges, opportunities and significant growth in Australia's renewable energy markets.

Small-scale technology certificates drive Solargain's cash flow, which means fast certificate approvals are fundamental to the company's success and growth as a business.

Joining the Solar Panel Validation Initiative has improved the turnaround for approvals of Small-scale technology certificates and streamlined Solargain's administration work. The initiative has made the business much more efficient, allowing it to deliver better services to its consumers.

Before using the app, Solargain needed to conduct manual checks to ensure solar systems and Small-scale technology certificate applications were compliant and complete. This was time and resource intensive.

With solar validation, Solargain has been able to automate many of these check and balances, making the company more efficient and competitive. Its solar installers use the phone app to confirm solar panels are genuine by simply uploading photos of the solar panel barcodes. Administration staff also use the validation services to digitise customer and install records. This means there is no need to manually enter or check data unless required. Not only does solar panel validation remove human error in data entry, it also streamlines paperwork, making it far quicker to process.

The Solar Panel Validation Initiative is a prime example of government and business working together to tackle complex problems.

Photo: Small-scale roof top solar

This content is based on an interview with Solargain.

Installation quality

Inspections program

As required under the legislation, we inspect a statistically significant sample of solar panel systems that have received incentives under the Small-scale Renewable Energy Scheme. The inspections assess conformance with the relevant Australian standards, Clean Energy Council guidelines, state and territory electrical safety standards and scheme eligibility requirements.

Of the 3678 inspections conducted in 2018, 80 were found to be unsafe. This is an unsafe rate of 2.2 per cent, up slightly from 1.9 per cent in 2017. Common issues detected related to water ingress into electrical components and identification of products subject to recalls.

Our role is to ensure the integrity of the Small-scale Renewable Energy Scheme by providing the results of unsafe and substandard inspections to the relevant state and territory electrical safety regulators that are responsible for work health and safety for renewables. We also provide this information to the Clean Energy Council, which manages the accreditation of solar panel installers and approves the key components used.

While the inspections program delivers outcomes for the sample of solar panel systems we inspect, industry bodies and electrical safety regulators also leverage the program data to provide national outcomes such as improving Australian standards, installation guidelines and the education and training of installers.

For example, our inspection data has highlighted issues with some DC isolators. Initially this resulted in the strengthening of installation guidelines and training in September 2015. As some issues persisted, regulators and industry bodies continued to take action, recalling specific DC isolators every year from 2014 and introducing a range of more stringent requirements from July 2018. These actions should continue to improve the quality of installations.

Table 2: Inspections by state, 2018

State	Systems safe	Systems substandard	Systems unsafe	Number of systems inspected
ACT	53	8	1	62
NSW	724	168	22	914
NT	23	5	0	28
QLD	794	213	17	1024
SA	276	71	1	348
TAS	29	14	3	46
VIC	506	140	19	665
WA	445	129	17	591
Total	**2850**	**748**	**80**	**3678**

A WORD **FROM INDUSTRY**

Improving safety in the solar industry

The Clean Energy Council supports the Clean Energy Regulator to ensure the safety and quality of Australian solar and energy storage systems. Clean Energy Council accreditation programs constantly raise the bar on the quality and safety of solar design and installation, solar products and marketing and retailing practices.

Installer accreditation

By the end of 2018 there were 5922 Clean Energy Council-accredited installers working in Australia and New Zealand. Growth was strong, with the number increasing by more than 1000 over the year.

The Clean Energy Council took enforcement action against 590 installers in 2018. Actions included: demerit points; suspended accreditation of 173 installers; and cancelled accreditation of five installers.

In a further effort to improve safety and quality, from mid-2019 changes to the Clean Energy Council *Install and Supervise Guidelines* will reduce the number of installations an accredited installer can sign off each day, from three to two.

Product assurance

The Clean Energy Council's Product Assurance Program verifies and tests solar PV modules and inverters against Australian and international standards. In 2018, the program extended to battery energy storage systems and battery systems, using the *Best Practice Guide: Battery Storage Equipment—Electrical Safety Requirements* developed in collaboration with CSIRO, electrical safety regulators and industry associations.

Also in 2018 the Clean Energy Council delisted 13 PV module brands (246 types), suspended five PV module brands (134 types) and delisted six inverter brands (72 types), based on the results of its independent product testing program.

In December 2018 the Clean Energy Council mandated the most up-to-date international standards for PV modules, resulting in the removal of more than half of the modules that had previously appeared on the Clean Energy Council Approved Product List.

The Clean Energy Council also collaborated with product manufacturers and electrical safety regulators on changes to standards that would allow DC isolators to be encased within inverters, to address a significant safety concern for solar PV systems.

Batteries can also present a safety risk at their end of life. In partnership with the Australian Battery Recycling Initiative, the Clean Energy Council published a guide for consumers and installers regarding the recycling and disposal of used batteries.

Photo: Small-scale solar installation, Clean Energy Council

Solar retailer approval

The Clean Energy Council's Approved Solar Retailer program is a voluntary industry Code of Conduct, and the only industry code of its kind authorised by the Australian Competition and Consumer Commission. Program signatories commit to responsible sales and marketing and adhere to solar industry best practice, including providing a five-year, whole-of-system warranty. Program applicants are rigorously assessed and less than two-thirds are accepted as signatories.

The Solar Retailer Code of Conduct Administrator monitors the behaviour of signatories, acts where necessary and identifies areas of the program that are not being met. The Clean Energy Council received 36 complaints in 2018, with 21 resolved and 15 finished as of January 2019. A strengthened complaints handling procedure for breaches and rectifications will be introduced from 4 March 2019.

Based on 2017 sales volume, 227 Code signatories accounted for 36 per cent of the solar market.

This content was provided by the Clean Energy Council.

Information sharing

Amendments were made to Clean Energy Regulator Regulations in 2018 that increase our ability to share data with Commonwealth, state and territory partners. The updated Regulations make it easier for our agency to disclose vital data, such as battery storage and solar PV system location information, to emergency services for the purpose of health and safety.

We have continued to work with emergency services and electrical safety regulators. During 2018 we established an information sharing agreement with seven emergency service organisations across the nation.

We have also worked with solar PV industry bodies including the Clean Energy Council, Smart Energy Council, Master Electricians Australia, and the National Electrical and Communications Association, to issue a coordinated message to their members regarding PV installation safety and to develop a battery installation checklist.

Improving the administration of the Renewable Energy Target

Australian National Audit Office findings

In 2018 the Australian National Audit Office conducted a performance audit into the Administration of the Renewable Energy Target. The audit aimed to provide assurance over the robustness of the Renewable Energy Target's operation and achievement of its objectives. The audit concluded we effectively administer the Renewable Energy Target. The Australian National Audit Office made four recommendations for our agency to address:

1. assess the extent to which the Renewable Energy Target scheme data shows any residual systemic electrical safety risks for small generation units installed under the scheme and inform those stakeholders in the best position to effect further treatments
2. establish governance mechanisms to manage our investigations function that ensure mandated investigation requirements are contained in standard operating procedures, the procedures are consistently applied and that investigations are undertaken in a timely manner
3. develop an overarching map to document and link the various elements of the operation and governance of the Renewable Energy Target scheme
4. refine the design of our performance measurement and reporting framework to ensure it is addressing the requirements of the Commonwealth performance framework to demonstrate progress against our agency's purpose using relevant, reliable and complete performance criteria.

We accepted all recommendations and have started work to implement them.

Enhancing our systems with REC Registry improvements

In response to the unprecedented growth in the Renewable Energy Target, we continue to refine and automate our agency's controls to adapt and keep pace. In 2018 we released enhancements to the REC Registry to accommodate the increased levels of certificate activity as we track to 2020.

Our REC Registry is the secure online system for all scheme transactions and enables the market to operate. We streamlined the Large-scale generation certificate creation process to enable power stations to enter generation and supporting data directly to the REC Registry. Visibility of the assessment process is now also available, enabling nominated persons to track the status of their certificate creations.

The enhancements to the REC Registry reduce processing times and allow us to administer our schemes more efficiently.

Expanding data analysis capabilities

We have also enhanced the risk-based approach to the assessment of Large-scale generation certificate claims, informed by our agency's operational experience in administering the scheme.

We have developed analytical tools to enhance assessments on claims representing higher risk or that are randomly sampled. These tools use data visualisation, statistical techniques and incorporate third party data to provide assurance over the veracity of power station generation data. These tools help to automate the evaluation of claims and place increased scrutiny over generation data. Anomalies identified during assessments result in re-evaluation of previous claims to address any under or over-creation of certificates. This may also result in an increased likelihood of further assessments for future claims.

These changes have seen a significant reduction in the average assessment time for Large-scale generation certificate claims, while also increasing the integrity of the certificates.

New method to calculate exemptions

In December 2017, the Renewable Energy (Electricity) Regulations 2001 were amended to introduce a new exemption certificate method: the electricity use method. This new method calculates exemption based on electricity consumed by emissions-intensive trade-exposed activities at the site during a calendar year, rather than the previous production calculation method, which was based on an industry average electricity intensity factor and an estimate of the year's production. This allows exemption to be determined more accurately.

Most companies have until 2020 to start using the new electricity use method.

The value of exemption certificates under the Renewable Energy Target is approximately $500 million a year.[35] As such, it is important to be sure of the accuracy and veracity of the exemptions data we assess.

In conjunction with the new electricity use method, we released an online form and new assessment process to make it easier for companies that apply under the electricity use method.

The online application form is available using our Client Portal.[36] This is a fundamental shift in the way we receive and process exemption certificate applications, which has previously involved paper-based processing.

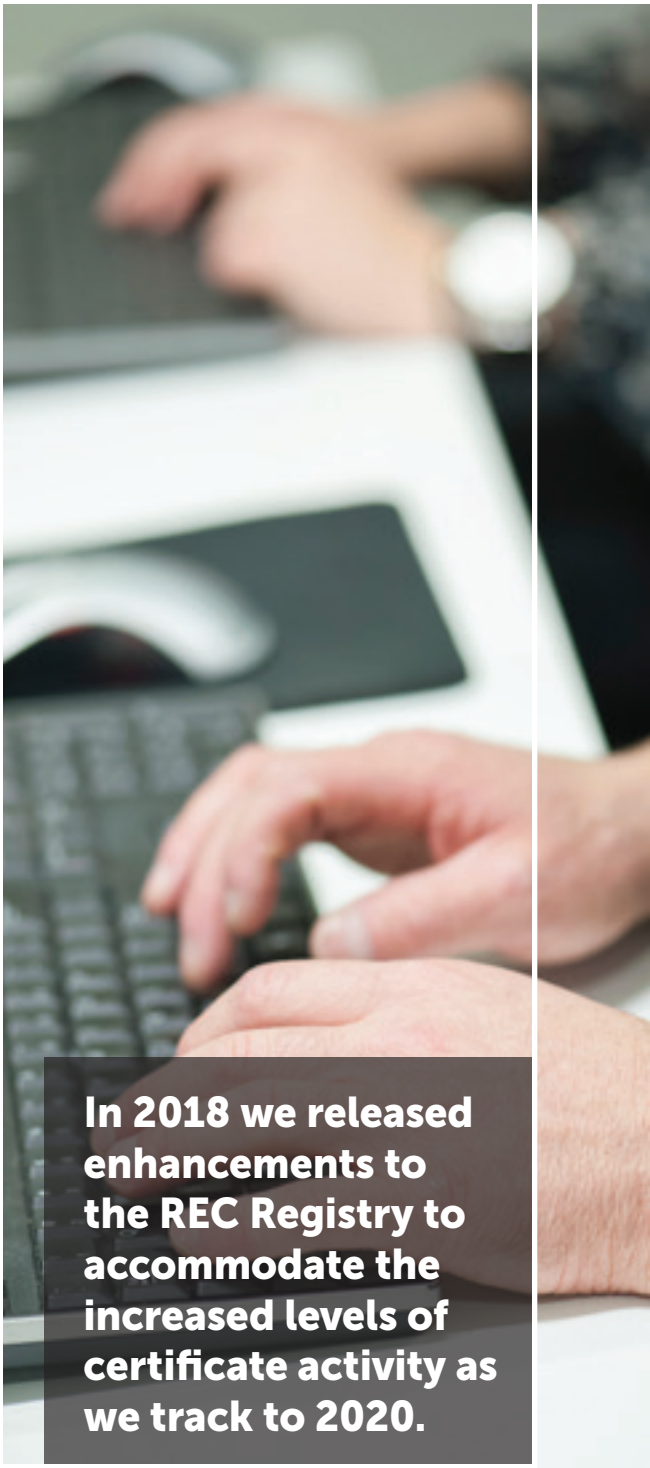
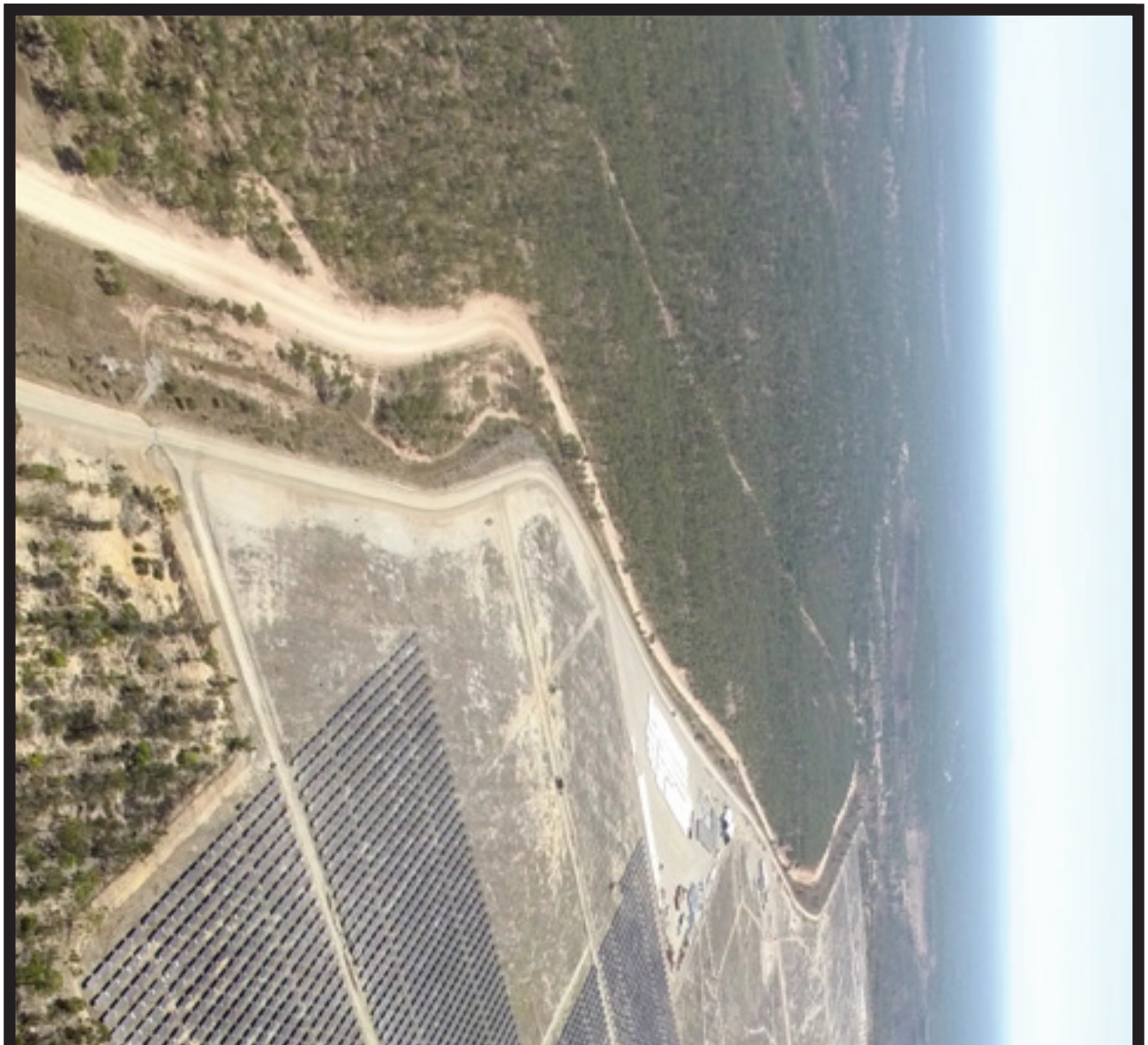


Photo: Clean Energy Regulator

35 Actual values of certificates may vary based on negotiations between the emissions-intensive trade-exposed entity and liable entity.

36 The Client Portal is a secure entry point where clients can access online forms, systems and other information.

Photo: Kidston Solar Project, Genex Power, Qld



Appendices

Appendices

Appendix A: The year in numbers

The following details from 2018 provide a quick reference for key data on the administration of the Renewable Energy Target.

Large-scale Renewable Energy Target

Supply

	Description	Metric
2018	Large-scale renewable energy power stations accredited	361
	Large-scale renewable energy power stations by energy source	5 biomass 6 hydro 339 solar 11 wind
	Large-scale renewable energy capacity accredited	3.5 gigawatts
	Large-scale generation certificates validated	22,991,450
	Large-scale renewable energy power station above baseline generation	22,350 gigawatt hours
Cumulative	Cumulative number of all Large-scale renewable energy power stations	1072
	Cumulative Large-scale renewable energy capacity accredited	18.8 gigawatts
	Committed and probable construction of new Large-scale renewable energy power stations announced since 1 January 2016	11.6 gigawatts

Demand

	Description	Metric
2018	Large-scale generation certificates acquitted	24,277,951
	Large-scale generation certificates voluntarily surrendered (mainly for GreenPower)	687,816
	Large-scale Renewable Energy Target on-time surrender	86.1 per cent
	Total Large-scale certificate shortfall charge	$220 million
	Exemption issued to emissions-intensive trade-exposed activities	39,126 gigawatt hours

Small-scale Renewable Energy Scheme

Supply

	Description	Metric
2018	New Small-scale systems installed	276,933
	Small-scale systems installed by type	216,784 solar panel systems 40,487 solar water heaters 19,662 air source heat pump
	Total capacity for Small-scale generation units installed	1.5 gigawatts
	Average capacity of solar panel systems	7.1 kilowatts
	Number of residential (0–15 kilowatt) solar PV system installations and capacity	Installations: 207,598 Capacity: 1.2 gigawatts
	Number of mid-scale (15–100 kilowatt) solar PV system installations and capacity	Installations: 9186 Capacity: 324 megawatts
	Number of Small-scale solar PV system installations by state and territory	3628 Australian Capital Territory 55,616 New South Wales 2136 Northern Territory 52,815 Queensland 21,381 South Australia 2470 Tasmania 45,840 Victoria 32,898 Western Australia
	Small-scale technology certificates validated	29,878,136
Cumulative	Cumulative number of installed Small-scale systems	3,190,276
	Cumulative number of installed Small-scale systems by type	2,033,684 solar panel systems 905,693 solar water heaters 250,458 air source heat pumps 423 wind systems 18 hydro systems
	Cumulative capacity for small-generation units	8.1 gigawatts
	Generation and displacement by Small-scale systems	13,394 gigawatt hours

Demand

	Description	Metric
2018	Small-scale technology certificates acquitted	29,811,199

Scheme integrity

	Description	Metric
2018	Inspections of Small-scale systems	3678 inspections 80 unsafe (2.2 per cent) 748 substandard (20 per cent)

Appendix B: Shortfall list

Large-scale generation certificate shortfall of more than 10 per cent for 2018

Liable entity	LGC liability (No. of certificates)	LGCs surrendered	LGC shortfall (No. of certificates	LGC shortfall (percentage of total LGC liability)	Value of LGC shortfall charge ($)
Alinta DEWAP Pty Ltd	82,431	0	82,431	100	5,358,015
Alinta Energy Transmission (Roy Hill) Pty Ltd	39,000	0	39,000	100	2,535,000
Alinta Sales Pty Ltd	401,133	0	401,133	100	26,073,645
AUSTRALIAN POWER PARTNERS B V and Others	4018	0	4018	100	261,170
Braemar Power Project Pty Ltd	397	0	397	100	25,805
Change Energy Pty LTd	5908	0	5908	100	384,020
Online Power & Gas Pty Ltd	3	0	3	100	195
Perth Energy Pty Ltd	188,202	0	188,202	100	12,233,130
Synergen Power Pty Limited	48	0	48	100	3,120
Lumo Energy Australia Pty Ltd	152,551	0	152,443	99.92	9,908,795
Lumo Energy (SA) Pty Ltd	34,866	0	34,528	99.03	2,244,320
Lumo Energy (QLD) Pty Ltd	6300	0	6087	96.61	395,655
IPOWER 2 PTY LIMITED and IPOWER PTY LIMITED TA Simply Energy	798,263	29,790	768,473	96.26	49,950,745
Lumo Energy (NSW) Pty Ltd	2941	0	2827	96.12	183,755
Red Energy Pty. Limited	714,247	140,183	567,762	79.49	36,904,530
Alinta Energy Retail Sales Pty. Ltd.	567,152	136,491	430,661	75.93	27,992,965
EnergyAustralia Pty Ltd	1,845,796	1,149,111	696,685	37.74	45,284,525

Glossary

Accredited power station

Power stations that generate electricity from an eligible renewable energy source can apply to participate in the Large-scale Renewable Energy Target by applying to become an accredited power station. Accredited power stations can create Large-scale generation certificates for electricity generated from their renewable energy sources.

Baseline

The baseline is the amount of eligible electricity that an accredited power station must generate during a year before Large-scale generation certificates can be created for that electricity. We determine baselines for power stations that operated before 1997 as prescribed by the Renewable Energy (Electricity) Regulations 2001.

Certificate spot price

Certificate spot price refers to the current market price for Large-scale generation certificates and Small-scale technology certificates.

Committed projects

Committed projects are Large-scale renewable energy projects that have received all development approvals and reached a final investment decision according to the commercial understanding of the term.

Displaced/displacement

The reduction in demand for electricity from the grid attributed to the installation of a solar water heater or air source heat pump.

Generation from accredited renewable energy power stations

Accredited power stations can create Large-scale generation certificates up until the end of the calendar year after the year in which they generated the electricity.

The number of Large-scale generation certificates reported for 2018 may be adjusted in future.

GreenPower

GreenPower is the only voluntary state and territory government accredited program that enables electricity providers to purchase renewable source electricity on behalf of households or businesses.

Kilowatt

A kilowatt is a measurement of power. Power is the rate at which the energy is generated or used. One kilowatt is equal to 1000 watts.

Kilowatt hour

A kilowatt hour is a measure of electrical energy equivalent to 1000 watts being used for 1 hour.

Liable entity

A person who, during a year, makes a relevant acquisition of electricity is called a liable entity. Liable entities are mainly electricity retailers.

Megawatt

A megawatt is a measurement of power. Power is the rate at which electrical energy is generated or used. One megawatt is equal to 1 million watts or 1000 kilowatts.

Megawatt hour

A megawatt hour is a measure of electrical energy equivalent to 1000 kilowatts being used for 1 hour.

Nominated person

A nominated person is the owner or operator of a power station applying for accreditation. The nominated person for an accredited power station may create a certificate for each whole megawatt hour of electricity generated by the power station during a year that is in excess of the power station's baseline.

Power purchase agreement

A power purchase agreement is a contract between two parties, one which generates electricity (the seller) and the other looking to purchase electricity (the buyer). Under the Renewable Energy Target, the seller is often the operator of a Large-scale renewable energy power station, and the buyer is often an electricity retailer (liable entity).

Probable projects

Probable construction or probable projects have a high degree of confidence that they will proceed following a public announcement of a power purchase agreement with a strong counterparty or other evidence of funding.

Registered agent/person

Retailers, traders and installers who wish to help individuals and small businesses install a Small-scale system at their premises and claim certificates must apply to us to become a registered agent.

Renewable power percentage

The basis for calculating the number of Large-scale generation certificates that a liable entity must surrender for a given year. The calculation is set out in the Renewable Energy (Electricity) Regulations 2001.

Shortfall charge

Liable entities who fail to meet their compliance obligations under the Renewable Energy Target are required to pay a shortfall charge. This charge is $65 per megawatt hour of shortfall and is not tax deductible.

Small-scale technology percentage

The basis for calculating the number of Small-scale technology certificates (STC) that a liable entity must surrender for a given year. The calculation is set out in the Renewable Energy (Electricity) Regulations 2001.

Small-scale technology certificate (STC) clearing house

Market participants can buy and sell STC, through the STC clearing house at a fixed price of $40 (ex GST). We operate the STC clearing house, which is available through the REC Registry.

Substandard

A substandard Small-scale system does not meet key clauses in the Clean Energy Council standards and requirements for installation, or relevant Australian Standards, and may lead to premature equipment failure or other issues. The installation work and or equipment should be improved. The system owner should contact the installation company or a qualified installer to rectify the items listed for improvement.

Unsafe

An unsafe system has a safety hazard which poses an imminent risk to a person or property. The inspector shuts down the system and renders it safe. The inspector also advises the relevant state or territory regulatory authority of the nature and extent of the safety risk. The system owner should contact the installation company or a qualified installer to rectify the items listed for improvement.

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