

An aerial photograph of a vast, green landscape. In the foreground, a large industrial facility is visible, consisting of numerous white rectangular containers or batteries arranged in rows. A winding road cuts through the green fields behind the facility. In the background, a massive wind farm with many wind turbines is scattered across the horizon under a cloudy sky.

# CLEAN ENERGY AUSTRALIA REPORT 2020



# CONTENTS

- 4** Introduction
- 6** 2019 snapshot
- 12** Jobs and investment in renewable energy by state
- 15** Project tracker
- 16** Renewable Energy Target a reminder of what good policy looks like
- 18** Industry outlook: small-scale renewable energy
- 22** Industry outlook: large-scale renewable energy
- 24** State policies
  - 26** Australian Capital Territory
  - 28** New South Wales
  - 30** Northern Territory
  - 32** Queensland
  - 34** South Australia
  - 36** Tasmania
  - 38** Victoria
  - 40** Western Australia
- 42** Employment
- 44** Renewables for business
- 48** International update
- 50** Electricity prices
- 52** Transmission
- 54** Energy reliability
- 56** Technology profiles
  - 58** Battery storage
  - 60** Hydro and pumped hydro
  - 62** Hydrogen
  - 64** Solar: Household and commercial systems up to 100 kW
  - 72** Solar: Medium-scale systems between 100 kW and 5 MW
  - 74** Solar: Large-scale systems larger than 5 MW
  - 78** Wind

# INTRODUCTION



**Kane Thornton**  
Chief Executive,  
Clean Energy Council

Whether it was the achievement of the Renewable Energy Target, a record year for the construction of wind and solar or the emergence of the hydrogen industry, by any measure 2019 was a remarkable year for the Australian renewable energy industry.

More than 2.2 GW of new large-scale renewable generation capacity was added to the grid in 2019 across 34 projects, representing \$4.3 billion in investment and creating more than 4000 new jobs. Almost two-thirds of this new generation came from large-scale solar, while the wind sector had its best ever year in 2019 as 837 MW of new capacity was installed across eight new wind farms.

Perhaps the year's biggest story though is the ongoing exceptional performance of the rooftop solar sector. After breaking records in each of the previous two years, the sector smashed through the 2 GW barrier for the first time in 2019. The 2.2 GW of new capacity added was almost double the record set just two years ago and the number of systems installed was the highest since the solar boom of 2012.

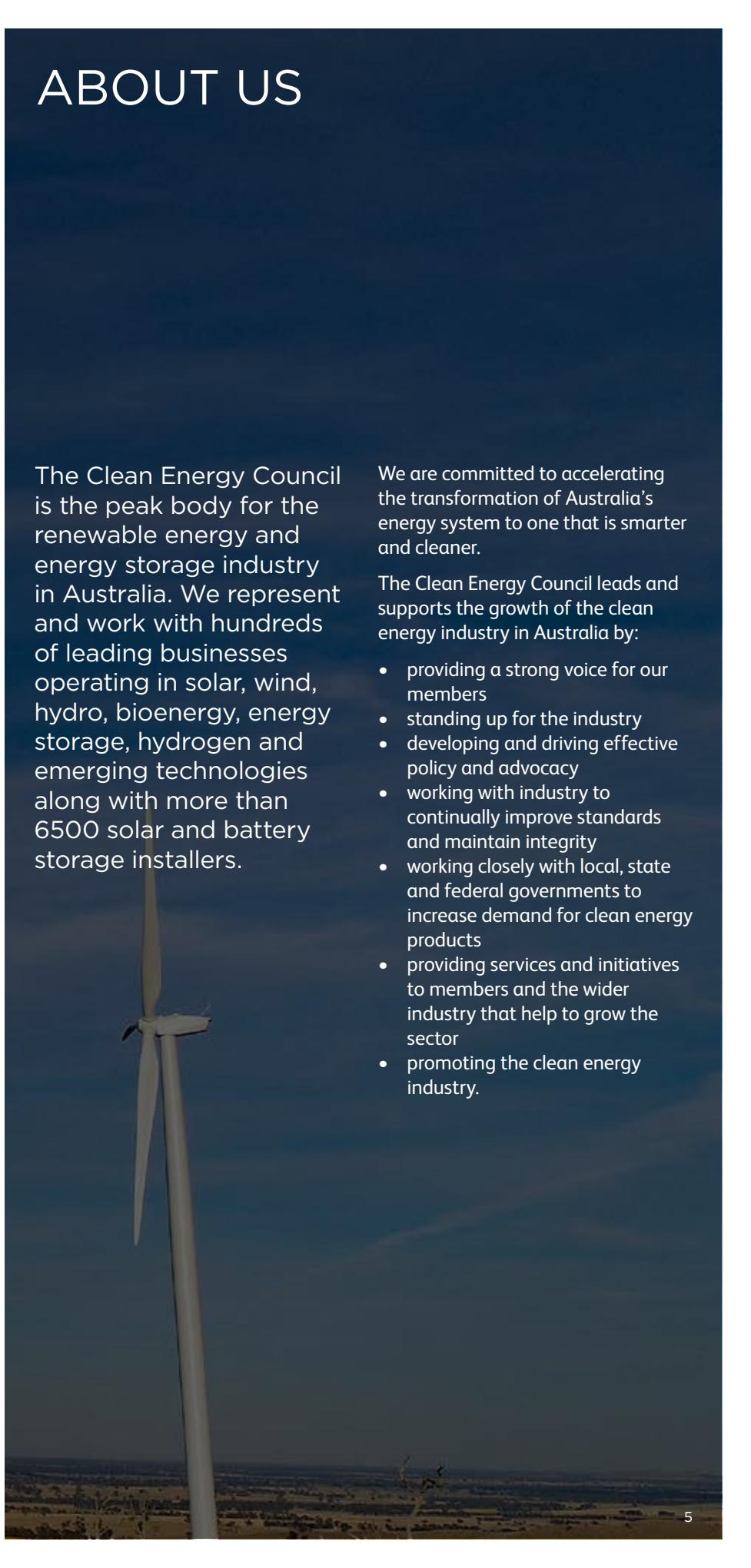
The energy storage sector is also starting to pick up momentum, with the more than 22,000 small-scale batteries installed in 2019 taking Australia's household storage capacity past 1 GWh for the first time. And with a further 15 utility-scale batteries under construction and several other projects financially committed at the end of 2019, 2020 promises to be a breakthrough year for batteries in Australia.

Despite the industry's record-breaking year, the electricity grid and the lack of a long-term energy policy continue to be a barrier to further growth for large-scale renewable energy investment. Grid congestion, erratic transmission loss factors and system strength issues caused considerable headaches for project developers in 2019 as the grid struggled to keep pace with the transition to renewable energy. While Australia's energy regulators are working hard to address these issues, a quick resolution is essential to ensuring that the industry's momentum can be restored. These grid issues and the lack of policy certainty were both major factors in the slowdown in new projects securing financial commitment in 2019.

While 2019 wasn't without its challenges, the future of renewable energy in Australia remains bright. There is an enormous pipeline of renewable energy and energy storage projects and strong customer demand for rooftop solar and batteries. These will be critical in replacing Australia's ageing coal-fired power stations, meeting Australia's climate change targets and ensuring affordable and reliable power supply. The coming year therefore promises to be another extraordinary one for renewable energy in Australia, and I look forward to seeing just how much progress we can make towards our goal of Australia being powered by clean energy.



# ABOUT US



The Clean Energy Council is the peak body for the renewable energy and energy storage industry in Australia. We represent and work with hundreds of leading businesses operating in solar, wind, hydro, bioenergy, energy storage, hydrogen and emerging technologies along with more than 6500 solar and battery storage installers.

We are committed to accelerating the transformation of Australia's energy system to one that is smarter and cleaner.

The Clean Energy Council leads and supports the growth of the clean energy industry in Australia by:

- providing a strong voice for our members
- standing up for the industry
- developing and driving effective policy and advocacy
- working with industry to continually improve standards and maintain integrity
- working closely with local, state and federal governments to increase demand for clean energy products
- providing services and initiatives to members and the wider industry that help to grow the sector
- promoting the clean energy industry.

# 2019 SNAPSHOT

While 2019 was another record year for renewables, uncertainty threatens to slow momentum.

Another year of extraordinary growth saw records tumble in 2019 as state governments, industry and communities embraced the transition to clean energy.

There were 34 large-scale projects completed in 2019, increasing Australia's large-scale renewable energy capacity by 2.2 GW and generating \$4.3 billion in investment and more than 4000 new jobs.

Renewable energy was responsible for 24 per cent of Australia's total electricity generation in 2019, an increase of 2.7 percentage points on 2018. For a brief period, renewables passed the 50 per cent mark of total generation in the National Electricity

Market in November. While this was only fleeting, it will be an increasingly common occurrence as renewable energy penetration increases in the coming years.

The wind sector had its best ever year in 2019, with 837 MW of capacity added across eight new wind farms. For the first time, wind overtook hydro as Australia's leading clean energy source, accounting for more than 35 per cent of Australia's renewable energy generation.

Records were also broken across the board in solar as the large, medium and rooftop sectors installed more capacity than ever before. The large-scale solar sector saw 1416 MW of new capacity added in 2019 across 27 solar

# 24%

of total electricity generation from renewable sources – a record high

# 4000

jobs generated by large-scale clean energy projects in 2019

# 2.2 GW

of new large-scale capacity installed in 2019

farms, while the rooftop solar industry smashed last year's record of 1.6 GW to break the 2 GW milestone for the first time.

Hydro power contributed 25.7 per cent of Australia's renewable energy generation. This was lower than previous years due to the ongoing impact of the drought in eastern Australia and the massive growth experienced by wind and solar.

However, despite all the records broken in 2019, ongoing uncertainty threatens to slow the industry's momentum. The continued lack of a federal energy policy and transmission and connection challenges resulted in new investment commitments falling by more than 50 per cent in 2019, from

\$10.7 billion in 2018 to just \$4.5 billion in 2019.

Some of the challenges currently affecting the industry can be put down to growing pains as transmission investment has failed to keep pace with the industry's rapid growth. In 2019, this was most keenly felt in the West Murray region of Victoria and New South Wales, where several wind and solar farms were forced to curtail their output to maintain grid stability. If left unresolved, these issues threaten to undermine investment confidence and severely slow the construction of much needed new clean energy capacity.

The biggest achievement of 2019 was the fulfillment of the Large-scale

Renewable Energy Target (RET) more than a year ahead of the 2020 deadline. Australia reached the RET in September 2019 following the completion of the 148 MW Cattle Hill Wind Farm, capping off a massive effort by the industry over close to two decades. This significant milestone has transformed renewable energy from one of the most expensive kinds of energy generation to the cheapest, on the way delivering tens of thousands of jobs to regional areas and tens of billions of dollars in investment.

Energy was firmly on the agenda at the May 2019 federal election, with the two major parties taking up vastly different positions on energy and climate change. The Labor party



Image: Hallett Wind Farm, South Australia

# 2019 SNAPSHOT CONTINUED

>50%

of South Australia's energy came from renewable sources in 2019

\$370m

of hydrogen projects backed under the National Hydrogen Strategy

presented a strong platform of emissions reduction and renewable energy policies, including a 50 per cent renewable energy target by 2030. In comparison, the Coalition offered little in the way of renewable energy policy and its climate policy consisted of a top up of the Abbott-era Emissions Reduction Fund.

A notable shift in public sentiment occurred towards the end of 2019 as devastating bushfires swept across much of the country. Pressure mounted on the government to acknowledge the growing impact of climate change and take meaningful action to reduce Australia's carbon emissions.

In the absence of federal leadership, the states and territories continued to fill the gap in 2019. The ACT became

just the eighth major jurisdiction in the world to generate 100 per cent of its energy from renewable sources, while South Australia continues to push ahead with its renewable transition. More than 50 per cent of the state's electricity came from renewables in 2019 and it is now aiming to source 100 per cent of its power from clean energy by 2030.

The hydrogen industry made significant progress in 2019, with the COAG Energy Council agreeing in November to back \$370 million of hydrogen projects under the National Hydrogen Strategy. The states are also jumping on board, with both South Australia and Western Australia creating their own hydrogen strategies as they look to take advantage of the significant opportunities on offer.

<sup>1</sup> Green Energy Markets. Electricity generation equivalent in households is calculated using a weighted national average consumption level of 4.596 MWh (from Australian Energy Market Commission, *Residential electricity price trends 2018*, 21 December 2018, [aemc.gov.au/sites/default/files/2018-12/2018%20Price%20Trends%20-%20Final%20Report%20-%20CLEAN.PDF](http://aemc.gov.au/sites/default/files/2018-12/2018%20Price%20Trends%20-%20Final%20Report%20-%20CLEAN.PDF))

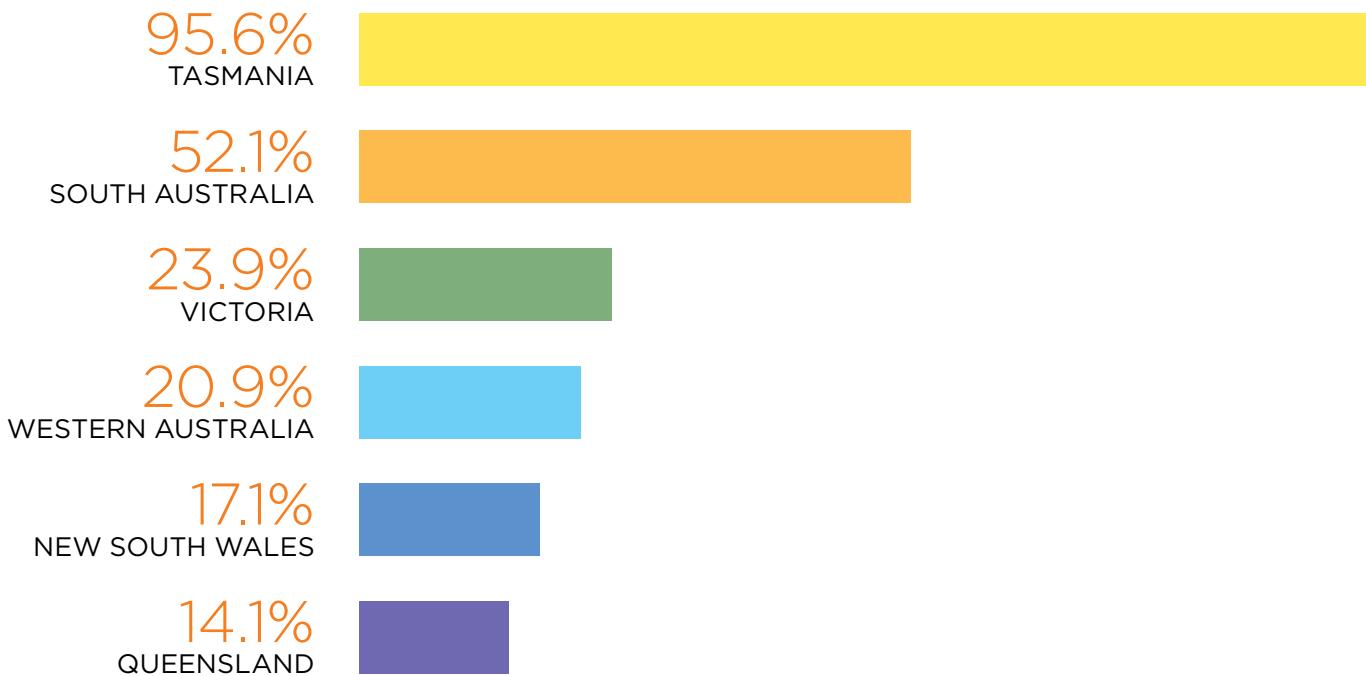
## RENEWABLE ENERGY GENERATION<sup>1</sup>

TECHNOLOGY	GENERATION (GWh)	PERCENTAGE OF RENEWABLE GENERATION	PERCENTAGE OF TOTAL GENERATION	EQUIVALENT NUMBER OF HOUSEHOLDS POWERED OVER COURSE OF THE YEAR
Wind	19,487	35.4%	8.5%	4,240,013
Hydro	14,166	25.7%	6.2%	3,082,150
Small-scale solar	12,269	22.3%	5.3%	2,669,440
Large-scale solar	5141	9.3%	2.2%	1,118,596
Bioenergy	3314	6.0%	1.4%	721,005
Medium-scale solar	716	1.3%	0.3%	155,867
<b>TOTAL</b>	<b>55,093</b>	<b>100.0%</b>	<b>24.0%</b>	<b>11,987,070</b>

Image: Kiewa Hydroelectric Scheme, Victoria

# 2019 SNAPSHOT CONTINUED

## RENEWABLE ENERGY PENETRATION BY STATE

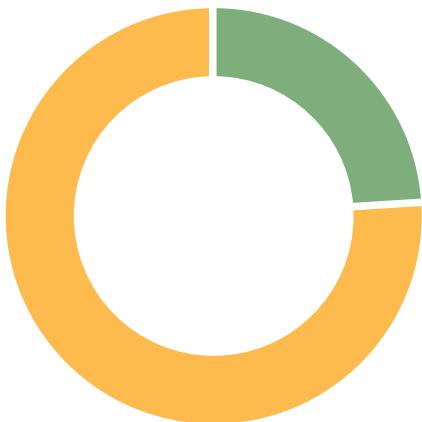


## RENEWABLE ENERGY PENETRATION BY STATE<sup>2</sup>

STATE	TOTAL GENERATION (GWh)	FOSSIL FUEL GENERATION (GWh)	TOTAL RENEWABLE GENERATION (GWh)	PENETRATION OF RENEWABLES
TAS	10,786	473	10,313	95.6%
SA	15,062	7213	7849	52.1%
VIC	47,780	36,352	11,428	23.9%
WA	19,264	15,242	4022	20.9%
NSW	71,011	58,851	12,160	17.1%
QLD	66,068	56,747	9321	14.1%
<b>NATIONAL</b>	<b>229,971</b>	<b>174,879</b>	<b>55,093</b>	<b>24.0%</b>

<sup>2</sup> Green Energy Markets. Total generation includes NEM and WEM data and small-scale solar.  
The ACT is part of the NSW region and there is no data available for the small NT grid.

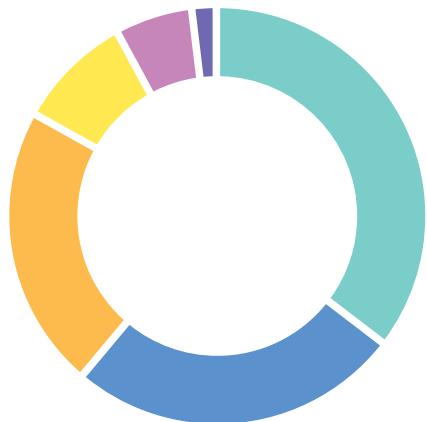
**ANNUAL ELECTRICITY  
GENERATION IN 2019**



● Renewables  
● Fossil fuels

24%  
76%

**RENEWABLE GENERATION  
BY TECHNOLOGY TYPE**



Technology Type	Percentage
Wind	35.4%
Hydro	25.7%
Small-scale solar	22.3%
Large-scale solar	9.3%
Bioenergy	6.0%
Medium-scale solar	1.3%

**sunwiz**



Helping leaders grasp  
the solar & storage  
markets since 2009

Insightful Market Analysis  
Invaluable Strategic Consulting

Australia's foremost source  
of solar market intelligence



**1300 SUN WIZ (1300 786 949)**

**[www.sunwiz.com.au](http://www.sunwiz.com.au)**

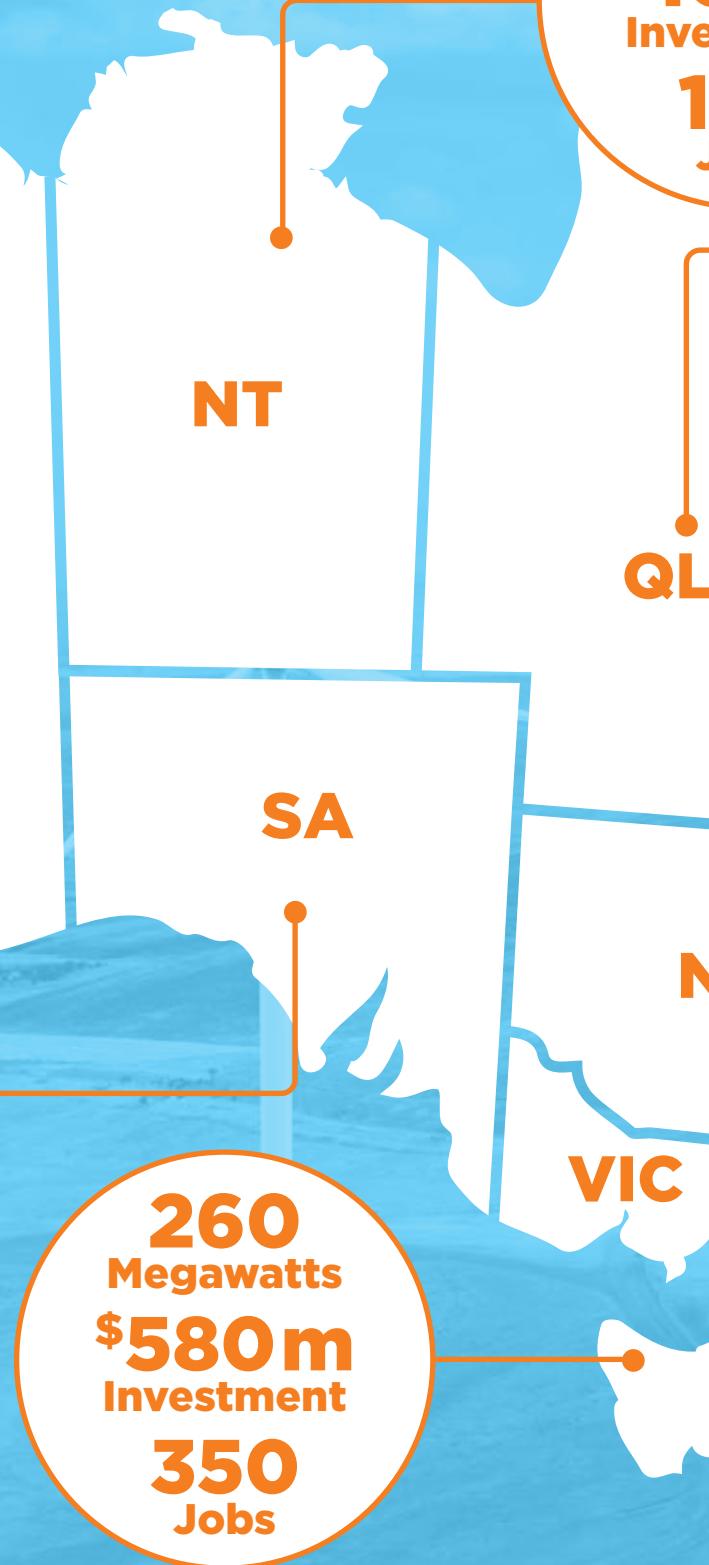




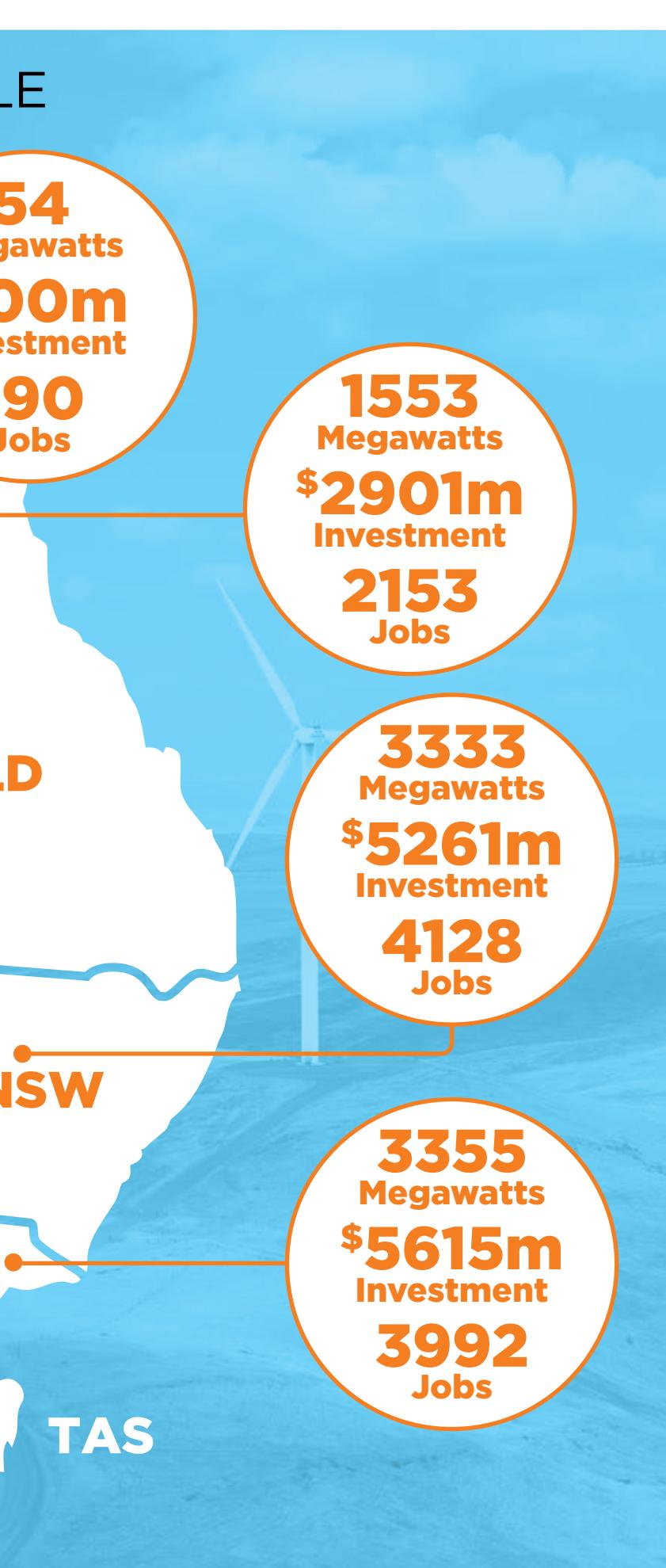
**JOBs AND  
INVESTMENT  
IN RENEWABLE  
ENERGY  
BY STATE**

# THE CONSTRUCTION BOOM FOR LARGE-SCALE RENEWABLE ENERGY PROJECTS

(PROJECTS UNDER CONSTRUCTION OR FINANCIALLY COMMITTED)\*



\* From 2017 to 10 March 2020



## TOTALS

**11,149  
Megawatts**

**\$20.4b  
Investment**

**14,678  
Jobs**

# PROJECT TRACKER

## RENEWABLE ENERGY PROJECTS COMPLETED IN 2019

TECH	STATE	OWNER	PROJECT	CAPACITY (MW)
Wind	NSW	AGL PARF	Silverton Wind Farm	200
Wind	QLD	Mount Emerald Wind Farm	Mount Emerald Wind Farm	180
Solar	QLD	Edify Energy	Daydream Solar Farm	150
Hybrid	WA	APA Power Holdings	Badgingarra Renewable Facility	147.5
Solar	NSW	John Laing	Finley Solar Farm	133
Wind	SA	ENGIE	Willogoleche Wind Farm	119
Solar	QLD	Palisade Investment Partners	Ross River Solar Farm	116
Wind	NSW	Bodangora Wind Farm	Bodangora Wind Farm	113
Solar	QLD	APA Group	Darling Downs Solar Farm	110
Solar	QLD	Lilyvale Asset Co	Lilyvale Solar Farm	100
Solar	QLD	Pacific Hydro	Haughton Solar Farm	100
Solar	VIC	Neoen	Numurkah Solar Farm	100
Solar	SA	Arcadia Energy Trading	Tailem Bend Solar Farm	95
Solar	VIC	BayWa r.e.	Karadoc Solar Farm	90
Solar	NSW	New Energy Solar	Beryl Solar Farm	87
Wind	VIC	Pacific Hydro	Crowlands Wind Farm	80
Solar	QLD	Clermont Asset Co	Clermont Solar Farm	75
Solar	QLD	Adani	Rugby Run Solar Farm - Stage 1	65
Solar	QLD	Edify Energy	Hayman Solar Farm	50
Solar	QLD	Diamond Energy	Oakey Solar Farm - Stage 1	25
Solar	NSW	ARENA	White Rock Solar Farm	20
Solar	QLD	Chinchilla Solar	Chinchilla Solar Farm (Baking Board)	20
Solar	WA	Bookitja/IBA Northam Solar	Northam Solar Farm	10
Solar	VIC	Diamond Energy	Girgarre Solar Project	8
Solar	VIC	Deakin University/AusNet Services	Waurn Ponds Microgrid Project	7.3
Solar	WA	Aggreko	Granny Smith Mine Hybrid Power Station	7.3
Wind	VIC	Epic Energy	Timboon West Wind Farm	7.2
Wind	VIC	Epic Energy	Yawong Wind Farm	7.2
Solar	NSW	Meralli Solar	Kanowna Solar Farm	5
Solar	NSW	City of Newcastle	Summerhill Solar Farm	5
Solar	NSW	Kanowna Solar	Bullarah Solar Farm	5
Solar	SA	Pirie Solar Farm	Pirie Solar Farm	5
Solar	SA	Terregra Renewables	Mobilong Solar Farm	5
Solar	SA	Canadian Solar	Mannum Solar Farm- Stage 1	5

Note: Due to new information becoming available, some of these projects were also listed as complete in the 2019 Clean Energy Australia report.

# RENEWABLE ENERGY TARGET A REMINDER OF WHAT GOOD POLICY LOOKS LIKE



Ever since it was first established by the Howard Government in 2001, critics of the Renewable Energy Target (RET) claimed that it would never be reached. So when the Clean Energy Regulator announced in September 2019 that the RET had been officially met, it was with a sense of vindication that the industry celebrated its fantastic achievement.

The RET is one of the rare success stories to come out of Australian energy policy in the past 20 years. The introduction of the target initiated Australia's energy transformation by providing the certainty that has enabled wind and solar to progress from one of the most expensive kinds of power generation to the cheapest. In the process, the RET has reduced the emissions from Australia's electricity sector more than any other policy, delivered tens of billions of dollars in investment and provided tens of thousands of jobs for regional Australians.

The completion of the RET more than a year ahead of schedule is a remarkable achievement, especially considering that the industry virtually ground to a halt between 2013 and 2015 when the Abbott Government

threatened to abolish the scheme. That the industry was able to recover from such a significant setback so quickly and comprehensively is a testament to the unstoppable momentum of Australia's transition to a clean energy future.

Now that the RET has been fulfilled, questions have inevitably begun to turn to what's next. The continued absence of a policy to replace the RET leaves clean energy, and the energy industry as a whole, in a state of uncertainty at a time when investment in new generation should be increasing to replace our ageing fleet of coal-fired power stations and meet our emissions reductions commitments.

While there doesn't look to be any end in sight to the federal political impasse, the good news is that the states and

territories and Australia's energy regulators are stepping up to fill the void. Every state and territory has committed to zero net emissions by 2050 and almost all have their own renewable energy targets. The energy regulators have also begun planning for a future in which renewables are the dominant form of generation through new pricing models and transmission investment plans.

The RET serves as a shining example of just how much can be achieved with a long-term energy policy. If our federal politicians ever end their bitter fighting to agree on another nationwide energy policy, we can only hope that its impact on the renewable energy industry will be just as profound as the RET's has been.

# IMAGINING THE SUN

Over 1,600 MW of  
PV inverters supplied  
to Australia

**Ingeteam**

READY FOR YOUR CHALLENGES

[www.ingeteam.com](http://www.ingeteam.com)

australia@ingeteam.com

Ingeteam Australia Pty Ltd.  
iAccelerate Centre, Building 239  
Innovation Campus, Squires Way  
North Wollongong, NSW 2500 – Australia



Tel.: +61 455 421 490



24/7 Control Centre Trading & Operations

Construction Management

#### OUR ACCREDITATIONS



**ISO 9001**  
QUALITY MANAGEMENT SYSTEM



**ISO 55001**  
ASSET MANAGEMENT

Asset Management Services



**ENGINEERING**



**CONTRACT MANAGEMENT**



**ACCOUNTING**

Asset Management & Advisory Services  
for Renewable Energy Investments

**(07) 3103 0393**

[www.quintasenergy.com.au](http://www.quintasenergy.com.au)

# SMALL-SCALE RENEWABLE ENERGY

## 2.2 GW

of rooftop solar installed across Australia in 2019

## 78,931

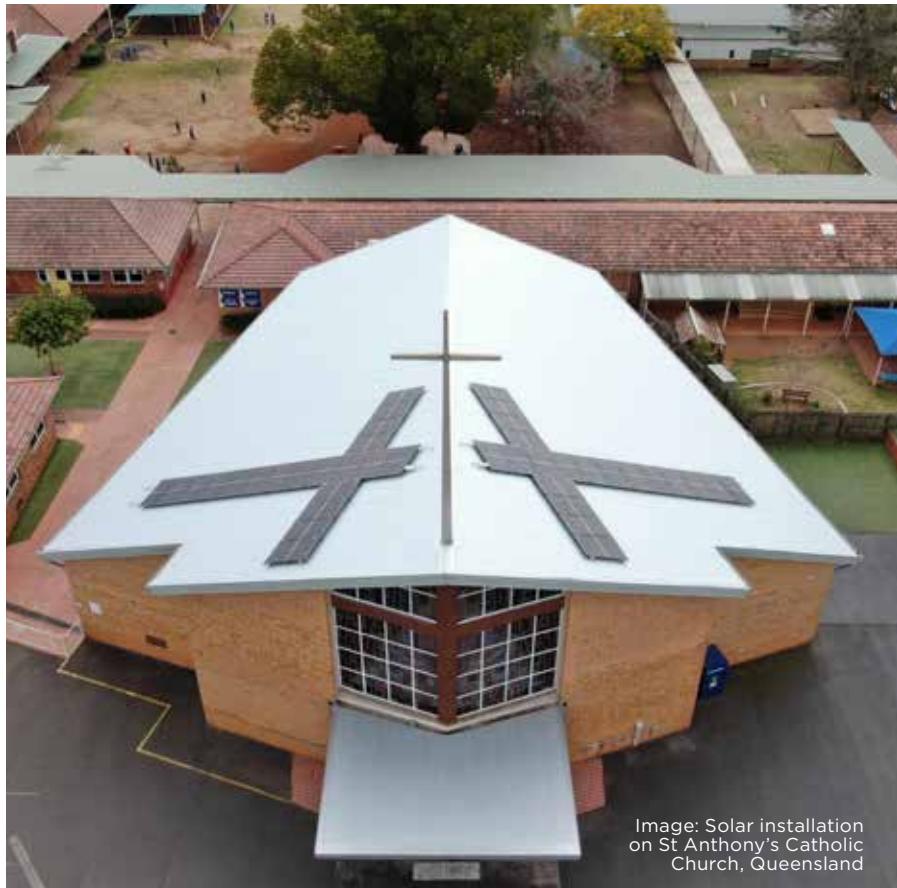
solar installations in NSW

## 686

Clean Energy Council Approved Solar Retailers

## 6566

Clean Energy Council Accredited Installers



The small-scale solar juggernaut continued in 2019 as rooftop solar installations passed the 2 GW milestone for the first time and celebrated a hat-trick of record-breaking years. The 2.2 GW installed in 2019 smashed the previous record of 1.6 GW set in 2018 and was almost double the amount of small-scale solar capacity installed in 2017.

The number of small-scale solar installations in 2019 was the highest since 2012 as every state saw a significant increase in installations compared to 2018. New South Wales led the way with 78,931 installations, closely followed by Queensland with 73,726 and Victoria with 59,610.

Victoria's 2019 performance is even more remarkable considering that the state's small-scale solar industry effectively ground to a halt for several

months in 2019. Following stronger than expected demand for its Solar Homes Program, the Victorian Government suspended rebates in April 2019. When the program was reopened in July, it included a monthly limit of 3333 rebates, which were snapped up in less than an hour. This placed an artificial cap on the industry that severely reduced the number of new installations in Victoria. Following extensive lobbying by the Clean Energy Council, the government agreed to expand the number of rebates available each month in August, allowing the industry to continue providing clean energy to Victorian consumers and businesses.

The Clean Energy Council's Approved Solar Retailer program grew by 313 per cent in 2019 as numerous government solar schemes required companies to be signatories to the program to participate.

The number of Approved Solar Retailers increased from 166 at the end of 2018 to 686 in 2019, meaning that more Australian consumers can be confident that they are purchasing solar from a company they can trust. The year also saw a significant increase in the number of Clean Energy Council accredited installers, which increased to 6566 in 2019, up from 5864 in 2018.

Substantial progress was made on the New Energy Tech Consumer Code in 2019, a new consumer code that will set minimum standards of good practice and consumer protection for products such as solar PV systems, batteries, electrical vehicle charging and other emerging energy products and services. The code is currently under review but is expected to come into effect later in 2020.



Despite the strides taken, we often forget that the renewable energy industry is still relatively young. And with a young and fast-changing industry, the impact of decision making may not be fully understood by the government and regulators prior to changing legislation. This was evident in 2019 with decisions made by both the Queensland and Victorian governments.

In April 2019, the Queensland Government introduced new regulations requiring licensed electricians to lift and bolt solar panels onto mounting frames.

The legislation was implemented without warning, immediately adding significant cost and delays to existing and planned projects. It also would have resulted in a shortage of qualified electricians to take on these tasks to meet the needs of the booming Queensland solar industry.

The Victorian Government abruptly froze rebates under its Solar Homes Program in April 2019 after a stronger than expected response to the program. This brought the Victorian rooftop solar industry to a sudden and unexpected halt. The program was reopened in July with

a monthly limit on rebates. However, the pent-up demand after the sudden closure meant the rebates were exhausted in less than an hour when they reopened in July.

The Clean Energy Council played a significant role in working towards a resolution in both states to limit the lasting impact on the industry. It is a reminder that representatives from the government, industry and Clean Energy Council should work together to identify impacts to the industry before legislation is tabled and passed.

## CASE STUDY

### EMBRACING SUSTAINABLE INNOVATION WITH A NOD TO HERITAGE

The 4 kW solar PV system with 10 kWh of battery back-up on the *Welcome to the Jungle* house in Sydney highlights the push towards sustainable architectural design as part of a range of innovative environmental systems creating a home of the future.

Integrating sustainability under strict heritage controls, in addition to energy generation the property includes

provisions for beehives, an aquaponics system, rainwater harvesting, fruit and vegetable gardens, flowering native plants, recycled and filtered water, a worm farm, compost and electric car charging.

To allow space for a rooftop garden, solar panels are installed vertically on a north-facing wall using a bespoke mounting system to complement the structural framework. Black backsheets

solar panels from WINAICO blend the panels into the heritage façade and panels are placed so the solar array sits flush with the windows.

But the panel placement does more than look good – the rooftop isolator was installed directly behind the panels to meet solar install accessibility guidelines, and the panel and clip system allows for seamless upgrades to newer technologies.



Shading from trees on the north-facing wall is managed with a DC optimiser and a battery storage system allows the battery to charge in off-peak periods to allow for peak energy consumption.

The system provides for most of the family's electricity needs, with excess electricity sold back to the grid. The system also uses weather data and predicted

energy consumption to allow the occupants to make smarter decisions about electricity usage.

An attraction for engineering and architecture students at the nearby University of Sydney, the project earned Australia Wide Solar's Lee Johnson a 2019 Clean Energy Council Solar Design and Installation Award in the Under 30 kw category.



Image: Welcome to the Jungle House, New South Wales

# LARGE-SCALE RENEWABLE ENERGY

**89**

large-scale projects under construction or financially committed at the end of 2019

**10,800+**

jobs created from large-scale renewable construction in 2019

Image: Dubbo Solar Hub, New South Wales

Despite policy uncertainty and transmission and connection challenges, the number of large-scale projects underway at the end of 2019 increased to 89, compared to 87 in 2018. While the future pipeline is slowing, there remains considerable activity in the industry as the 89 projects are creating almost 11,000 jobs and delivering 7.6 GW of new clean energy capacity.

While solar accounts for approximately 60 per cent of the new projects being built, the 27 wind farms under construction or financially committed will provide the majority of new capacity. This highlights the contrast

between the two technologies, with solar farms often smaller but able to be deployed more quickly, while wind farms provide considerable amounts of new generation but usually take a number of years to build.

Australia's biggest projects – Snowy 2.0 and the Battery of the Nation – both remain in the early stages of development. Geological studies began for Snowy 2.0 in 2019 as engineers looked to get an understanding of the rock that the project's more than 26 km of tunnels will have to pass through. The Battery of the Nation project is dependent on the construction of Marinus Link,

an additional undersea cable connecting Tasmania to the mainland. TasNetworks completed a feasibility study on the cable in 2019, finding that it would be viable at 1500 MW.

The strong momentum built by the large-scale renewable energy industry in recent years came under threat towards the end of 2019 as ongoing policy uncertainty, grid connection issues and marginal loss factors resulted in the level of new investment commitments falling by more than 50 per cent. This is of significant concern considering that new generation is desperately needed and that at stake is generation roughly equal to the current size of the National

<sup>3</sup> Australian Energy Market Commission, *Coordination of generation and transmission investment implementation – access and charging*, 1 March 2019, [www.aemc.gov.au/market-reviews-advice/coordination-generation-and-transmission-investment-implementation-access-and-charging](http://www.aemc.gov.au/market-reviews-advice/coordination-generation-and-transmission-investment-implementation-access-and-charging)



Electricity Market (NEM) (50 GW) that is expected to connect to the grid over the next 10 years.<sup>3</sup>

Several reviews and reforms have been introduced to address these issues, including the Australian Energy Market Operator's Integrated System Plan and the Energy Security Board's market reform designs from 2025. These will be crucial in allowing more renewables to connect to the grid as the NEM transitions to clean energy and Australia looks to develop a renewable hydrogen export industry.

## CASE STUDY SHOWCASING WOMEN IN RENEWABLES

Bridget Ryan



The Clean Energy Council's commitment to supporting and empowering women in clean energy continued in 2019 with a number of new Women in Renewables initiatives.

The Clean Energy Council values gender diversity as part of building a stronger industry and recognises the importance of living these values by only holding and speaking at events that embrace gender diversity.

The Clean Energy Council also champions talented and inspirational women in the renewable energy industry via its Speakers Guide. The Speakers Guide showcases skilled and insightful women for event organisers looking for a diverse speaker panel. The third edition of the Speakers Guide was published in 2019, featuring over 170 women, and is an invaluable tool for increasing

gender diversity at both clean energy events and other events that want to hear from the talented pool of women in the clean energy industry.

The Clean Energy Council again partnered with the Monash Business School and the Australian Institute of Company Directors (AICD) to provide Women in Renewables scholarships. The scholarships enable the professional development of female employees in the clean energy industry.

The 2020 scholarship in partnership with the Monash Business School was awarded to Bridget Ryan, the Policy and Government Lead at GreenSync. The 2020 scholarship in partnership with the AICD will be awarded in early 2020.

For more information about these and other Women in Renewables initiatives visit [cleanenergycouncil.org.au/women](http://cleanenergycouncil.org.au/women).

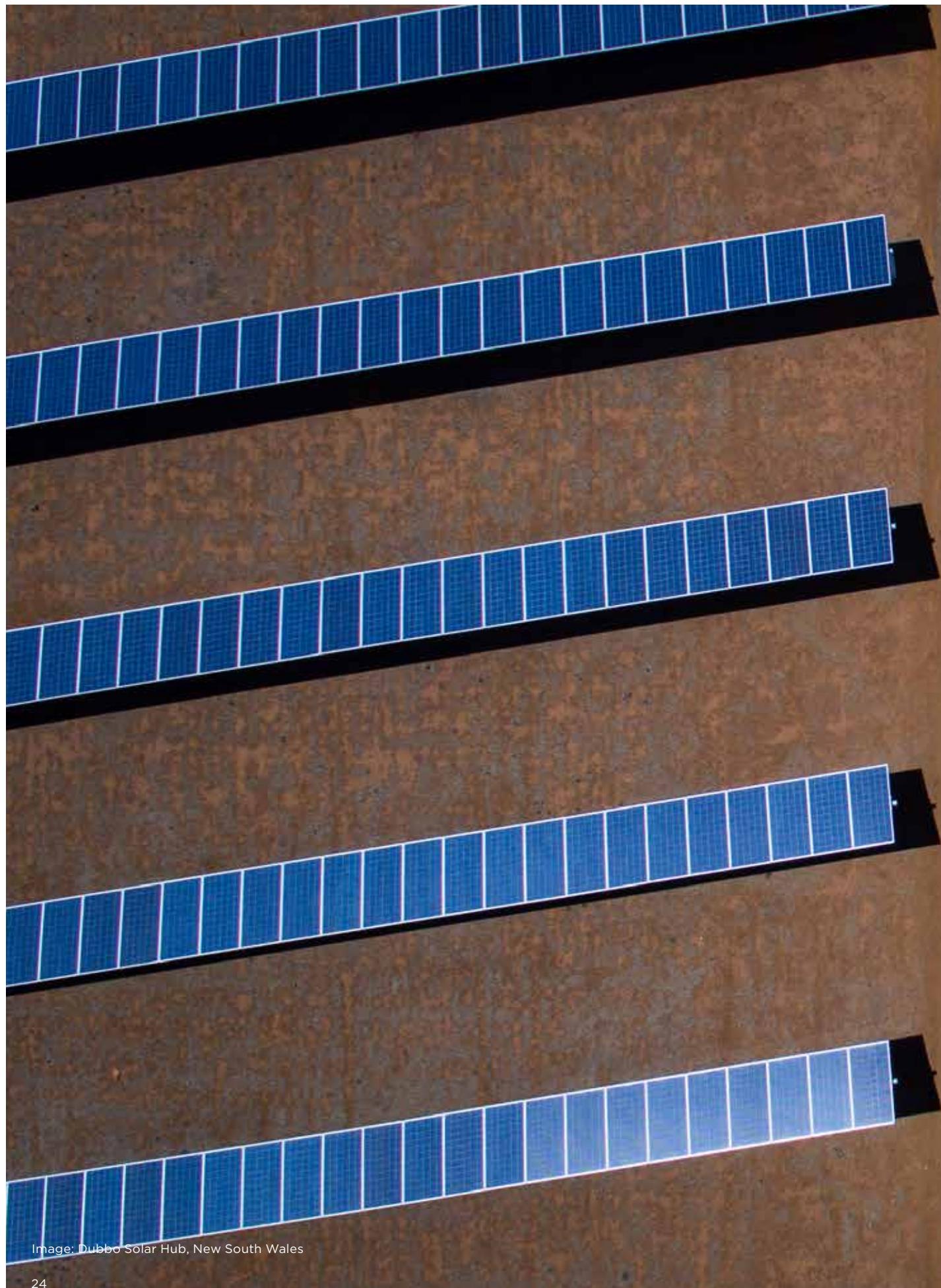


Image: Dubbo Solar Hub, New South Wales

## STATE POLICIES

Renewable energy supplies between 8 and 100 per cent of the electricity needs of Australia's states and territories. This extraordinary range reflects the differing natural resources of each region as well as the variations in historical commitments to support renewable energy.

Despite several policy missteps that took the shine off solar accessibility, most of the states and territories are investing strongly in a clean energy future – albeit with a patchwork of renewable energy targets and emissions reduction goals and varying levels of political commitment.

# AUSTRALIAN CAPITAL TERRITORY



## KEY PROGRAMS, POLICIES AND INITIATIVES

- **2045 zero net emissions target**
- **Reached 100 per cent renewable energy target**
- **Launched additional renewable energy reverse auction**

The ACT has delivered on its ambitious target to generate 100 per cent of its energy needs from renewable sources. It's only the eighth major jurisdiction in the world to do this, and the first outside Europe. Although the ACT doesn't have the same energy challenges as some states, it's taking action on climate change.<sup>4</sup>

To maintain its 100 per cent renewables position, the ACT launched an additional reverse auction for large-scale renewable technology in 2019. The reverse auction is open to all types of renewable energy projects, with capacities starting at 200 MW for wind and 250 MW for solar. Community

engagement is a priority for the government, with bidders expected to engage with local communities and the local renewable energy industry and contribute to the ACT Government's Renewable Energy Innovation Fund.<sup>5</sup> The government recommends that proposals consider the Clean Energy Council's *Community Engagement Guidelines for the Australian Wind Industry* and ARENA's best practice community consultation guidelines for establishing social licence to operate large-scale solar facilities in Australia.

To move towards its target of zero net emissions by 2045, the ACT is now focusing on the two largest sources of

emissions: transport (60 per cent) and gas usage (22 per cent).<sup>6</sup> The government will commit to using renewable electricity in all new public buildings and change laws so that it's no longer compulsory for new suburbs to connect to gas. The ACT is also prioritising investment in long-term emissions reduction measures rather than purchasing carbon offsets.<sup>7</sup> It's on track for a zero-emissions bus fleet by 2040<sup>4</sup> and thousands of new trees will take canopy coverage in the territory from 21 to 30 per cent.

<sup>4</sup> D Jervis-Bardy, The Canberra Times, *Green machine: ACT first 'major' city outside Europe to transition 100 per cent renewable energy*, 18 September 2019, [www.canberratimes.com.au/story/6390793/canberra-first-city-outside-europe-to-go-100-green-energy/](http://www.canberratimes.com.au/story/6390793/canberra-first-city-outside-europe-to-go-100-green-energy/)

<sup>5</sup> ACT Government, *New renewable electricity auction*, 15 November 2019, [www.environment.act.gov.au/energy/cleaner-energy/new-renewable-electricity-auction](http://www.environment.act.gov.au/energy/cleaner-energy/new-renewable-electricity-auction)

<sup>6</sup> D Jervis-Bardy, The Canberra Times, *Gas to go under ACT government's zero emissions plan*, 16 September 2019, [www.canberratimes.com.au/story/6388167/act-to-phase-out-gas-under-governments-zero-emissions-plan/](http://www.canberratimes.com.au/story/6388167/act-to-phase-out-gas-under-governments-zero-emissions-plan/)

<sup>7</sup> M Mazengarb & G Parkinson, Renew Economy, *ACT to phase out gas as it launches next stage of zero carbon strategy*, 16 September 2019, [www.reneweconomy.com.au/act-to-phase-out-gas-as-it-launches-next-stage-to-zero-carbon-strategy-92906/](http://www.reneweconomy.com.au/act-to-phase-out-gas-as-it-launches-next-stage-to-zero-carbon-strategy-92906/)



**100%**  
of the ACT's electricity came from  
renewable sources in 2019



Image: Hornsdale Wind Farm, South Australia



## KEY PROGRAMS, POLICIES AND INITIATIVES

- 2050 zero net emissions target
- Government creating new renewable energy zone for 3000 MW of projects
- Electricity Strategy focussed on affordability and reliability

By failing to set a renewable energy target, New South Wales could fall short of its 2050 zero net emissions target. And with only 17.1 per cent of the state's energy coming from renewable sources, NSW is falling well behind most other states.<sup>8</sup>

The NSW Government released its Electricity Strategy in late 2019, with a focus on affordable electricity and a secure energy supply. It included a plan to create a renewable energy zone – with 3000 MW of renewables investment – which could start to close the gap on the state's emissions target. The pilot renewable energy zone in the state's Central West will boost

investment in the region and could power up to 1.3 million homes.<sup>9</sup>

The NSW and Federal Governments have agreed to share the financial responsibility – up to \$102 million – to upgrade the Queensland-NSW interconnector. As older power stations are decommissioned, the interconnector will have the capacity to transfer 190 MW of Queensland power to ensure a reliable energy supply for NSW and the ACT. This project is a priority under the NSW Government's Transmission Infrastructure Strategy, with plans to kick off construction in 2021 following regulatory approval.<sup>10</sup>

A new 900 km interconnector between NSW and South Australia, with an additional line into Victoria, is also awaiting regulatory approval. ElectraNet and Transgrid are working together on the interconnector, called Project EnergyConnect, to deliver energy security, reduced prices and economic benefits for the states. The interconnector passes through renewable energy zones across Australia, enabling new renewable projects that may create 250 ongoing jobs in South Australia and 700 in NSW.<sup>11</sup>

<sup>8</sup> S Letts, ABC News, *Renewable energy is growing, but NSW and Queensland are still undershooting their targets*, 10 July 2019, [www.abc.net.au/news/2019-07-02/renewable-energy-targets-may-not-be-met-by-all-states/11267824](http://www.abc.net.au/news/2019-07-02/renewable-energy-targets-may-not-be-met-by-all-states/11267824)

<sup>9</sup> NSW Government, *NSW Electricity Strategy*, [energy.nsw.gov.au/media/1926/download](http://energy.nsw.gov.au/media/1926/download)

<sup>10</sup> Transgrid, media release, *Federal and State government support for QNI upgrade confirmed*, 27 October 2019, [www.transgrid.com.au/news-views/news/2019/Pages/governments-support-for-QNI-upgrade.aspx](http://www.transgrid.com.au/news-views/news/2019/Pages/governments-support-for-QNI-upgrade.aspx)

<sup>11</sup> Project EnergyConnect, website, [www.projectenergyconnect.com.au/](http://www.projectenergyconnect.com.au/)



17.1%

of NSW's electricity came from  
renewable sources in 2019\*



\* The NSW figure includes the ACT.

Image: Rooftop solar installation in Coffs Harbour, New South Wales



## KEY PROGRAMS, POLICIES AND INITIATIVES

- 2050 zero net emissions target
- Government released response for action plan
- Major project status for Australia/Singapore power link

Despite committing to source 50 per cent of its power from renewables by 2030, progress has been slow in the Northern Territory (NT), with just 8 per cent of the state's electricity sourced from renewables.<sup>12</sup>

With most states embracing renewable technology and making progress towards transitioning to a clean energy electricity system, the NT is still some way behind. The territory remains committed to gas exports and onshore fracking, which doesn't necessarily align with a state serious about its renewable energy targets.<sup>13</sup>

In September 2019, the NT released its response for action plan. It addresses climate risk and considers economic and business opportunities for the territory,<sup>14</sup> setting a 2050 zero net emissions target with a focus on solar.

The NT has typically focused on gas generation but optimal weather conditions make it the perfect candidate for a clean energy system, with a report from Beyond Zero Emissions flagging the possibility of the territory transitioning to 100 per cent clean energy.<sup>15</sup>

A proposal from the Water and Power Corporation seeks to impose strict conditions on new solar projects, which would make them unviable by adding as much as 30 per cent to owner costs. The proposal would also retrospectively apply to existing projects, including the Katherine Solar Farm and the Manton and Batchelor solar projects.<sup>16</sup>

Construction has begun on the NT's largest solar farm with battery storage. The 25 MW Katherine Solar Farm will include 100,000 panels and be able to generate approximately 700,000 MWh

of power each year. The \$40 million project has a power purchase agreement with Jacana Energy.<sup>17</sup>

Sun Cable's Australia/Singapore power link has been recognised with major project status due to its likely significant contribution to regional economic development. This \$20 billion project near Tennant Creek includes provisions for a 10 GW solar farm and 20-30 GWh storage facility. It's the largest solar farm under development in the world, and could create up to 1000 jobs during construction and 300 ongoing jobs once it's fully operational.<sup>18</sup> The project is backed by Andrew 'Twiggy' Forrest and Mike Cannon-Brookes as co-lead investors. The electricity will supply the Darwin and Singapore markets with export via a 4500 km transmission network.<sup>19</sup>

<sup>12</sup> R Fitzgerald, Katherine Times, *Sunshine vs Fracking: The residents fighting to expose the costs*, 4 February 2020, [www.katherinetimes.com.au/story/6609165/sunshine-vs-fracking-the-residents-fighting-to-expose-the-costs/](http://www.katherinetimes.com.au/story/6609165/sunshine-vs-fracking-the-residents-fighting-to-expose-the-costs/)

<sup>13</sup> C Heaney, ABC News, *NT Government criticised over 'incompatible' renewable energy strategy*, 25 November 2019, [www.abc.net.au/news/2019-11-25/renewable-energy-review-finds-northern-territory-running-last/11734952](http://www.abc.net.au/news/2019-11-25/renewable-energy-review-finds-northern-territory-running-last/11734952)

<sup>14</sup> S Vorrath, Renew Economy, *NT backs massive solar push to reach zero emissions target*, 19 September 2019, [reneweconomy.com.au/nt-backs-massive-solar-push-to-reach-zero-emissions-target-37886/](http://reneweconomy.com.au/nt-backs-massive-solar-push-to-reach-zero-emissions-target-37886/)

<sup>15</sup> A Morton, The Guardian, *Clean energy found to be a pathway to prosperity for Northern Territory*, 20 June 2019, [www.theguardian.com/australia-news/2019/jun/20/clean-energy-found-to-be-a-pathway-to-prosperity-for-northern-territory](http://www.theguardian.com/australia-news/2019/jun/20/clean-energy-found-to-be-a-pathway-to-prosperity-for-northern-territory)

<sup>16</sup> G Parkinson, Renew Economy, *Billionaires' huge solar dream overshadows troubling energy wars in top end*, 6 December 2019, [reneweconomy.com.au/billionaires-huge-solar-dream-overshadows-troubling-energy-wars-in-top-end-99660/](http://reneweconomy.com.au/billionaires-huge-solar-dream-overshadows-troubling-energy-wars-in-top-end-99660/)

<sup>17</sup> M Mazengarb, Renew Economy, *Construction starts at Northern Territory's largest solar farm*, 18 July 2019, [reneweconomy.com.au/construction-starts-at-northern-territorys-largest-solar-farm-94452/](http://reneweconomy.com.au/construction-starts-at-northern-territorys-largest-solar-farm-94452/)

<sup>18</sup> C McLennan, The Katherine Times, *Plans for world's biggest solar farm at Tennant Creek*, 22 July 2019, [www.katherinetimes.com.au/story/6285081/plans-for-worlds-biggest-solar-farm-at-tennant-creek/](http://www.katherinetimes.com.au/story/6285081/plans-for-worlds-biggest-solar-farm-at-tennant-creek/)

<sup>19</sup> B Doherty & A Morton, The Guardian, *Billionaires invest in giant Australian solar farm to supply power to Singapore*, 20 November 2019, [www.theguardian.com/environment/2019/nov/20/billionaires-invest-in-giant-australian-solar-farm-to-supply-power-to-singapore](http://www.theguardian.com/environment/2019/nov/20/billionaires-invest-in-giant-australian-solar-farm-to-supply-power-to-singapore)

# 10 GW

proposed size of the Sun Cable  
project near Tennant Creek



Image: Yulara Solar Farm, Northern Territory



## KEY PROGRAMS, POLICIES AND INITIATIVES

- Government mandate to support 1000 MW of new renewable generation by 2025
- CleanCo commenced trading on the National Electricity Market
- Renewables 400 program in Request for Proposals stage

Queensland's newest publicly owned energy company, CleanCo, started trading on the National Electricity Market on 31 October 2019. It was a step in the right direction towards Queensland's 50 per cent renewable energy target, but it still has a lot of work to do if it is to achieve the target by 2030.<sup>20</sup>

CleanCo is part of a government mandate to support 1000 MW of new renewable generation by 2025. Legislative change saw foundation assets owned by CS Energy and Stanwell – with the capacity to generate 1120 MW – transferred to CleanCo. CleanCo is now responsible for the Renewables 400 procurement program, a reverse auction to build 400 MW of new renewable energy and storage projects in Queensland. A number of projects have already been shortlisted and the Request for Proposals stage starts in 2020.<sup>21</sup>

In 2019, the solar industry faced a significant challenge when the government made a sudden change to legislation without industry consultation. The new laws would have required licensed electricians to perform simple solar installation tasks – such as lifting and bolting solar panels onto mounting frames – on projects greater than 100 kW, despite these tasks being performed successfully by skilled labourers and trades assistants. Following several court challenges and advocacy by the Clean Energy Council, the decision was overturned.<sup>22</sup> An electrical safety roundtable was then announced by the government to work with industry to establish a best practice safety framework for solar farms.<sup>23</sup>

Electricity supply well above demand resulted in Queensland experiencing negative electricity prices several times towards the end of 2019. This was attributed to strong solar generation

and an outage of the interconnector with New South Wales.

Coopers Gap Wind Farm is now operational, with 50 out of 123 planned turbines feeding into the NEM. This 453 MW project will generate enough energy to power 264,000 homes. It is feeding into the grid via a new 275 kV substation operated by Powerlink.<sup>24</sup>

The viability of the Kidston pumped hydro project came under threat in 2019 after an off-take agreement with EnergyAustralia fell through. However, project developer Genex Power was able to extend the deadline to meet the conditions of its \$610 million loan from the Northern Australia Infrastructure Fund until June 2020, which should give it enough time to renegotiate the contracts so that it can achieve financial close on the project.<sup>25</sup>

<sup>20</sup> S Letts, ABC News, *Renewable energy is growing but NSW and Queensland are still undershooting their targets*, 10 July 2019, [www.abc.net.au/news/2019-07-02/renewable-energy-targets-may-not-be-met-by-all-states/11267824](http://www.abc.net.au/news/2019-07-02/renewable-energy-targets-may-not-be-met-by-all-states/11267824)

<sup>21</sup> CleanCo, website, [cleancoqueensland.com.au/](http://cleancoqueensland.com.au/)

<sup>22</sup> Clean Energy Council, media release, *Regional jobs and communities the big winners from court of appeal decision on solar*, 25 June 2019, [www.cleanenergycouncil.org.au/news/regional-jobs-and-communities-the-big-winners-from-court-of-appeal-decision-on-solar](http://www.cleanenergycouncil.org.au/news/regional-jobs-and-communities-the-big-winners-from-court-of-appeal-decision-on-solar)

<sup>23</sup> Clean Energy Council, *Queensland solar roundtable a welcome initiative*, 26 June 2019, [www.cleanenergycouncil.org.au/news/queensland-solar-roundtable-a-welcome-initiative](http://www.cleanenergycouncil.org.au/news/queensland-solar-roundtable-a-welcome-initiative)

<sup>24</sup> Queensland Government, media release, *Queensland – Australia's greatest fan of renewable energy*, 1 August 2019, [statements.qld.gov.au/Statement/2019/8/1/queensland-australias-greatest-fan-of-renewable-energy](http://statements.qld.gov.au/Statement/2019/8/1/queensland-australias-greatest-fan-of-renewable-energy)

<sup>25</sup> S Vorrrath, Renew Economy, *Genex gets loan reprieve for Kidston pumped hydro project*, 13 November 2019, [reneweconomy.com.au/genex-gets-loan-reprieve-for-kidston-pumped-hydro-project-63393/](http://reneweconomy.com.au/genex-gets-loan-reprieve-for-kidston-pumped-hydro-project-63393/)



**14.1%**  
of Queensland's electricity came  
from renewable sources in 2019



Image: Haughton Solar Farm, Queensland



## KEY PROGRAMS, POLICIES AND INITIATIVES

- Over 50 per cent of power sourced from renewable energy
- 100 per cent renewable energy target by 2030
- SA-NSW interconnector given major project status

South Australia shows that even with a leadership change, progress towards a clean energy future is possible. Already generating 50 per cent of power from wind and solar, the state is now aiming to source 100 per cent of its electricity from renewable energy by the end of the decade.

SA's success stems from a shared view that renewables mean cheaper prices for households and economic opportunities through investment and manufacturing. Once reliant on coal, gas and imported power generation, SA now has more than 2675 MW of large-scale wind, solar and storage.<sup>26</sup>

The recent push to renewable energy led to South Australia having the lowest electricity spot prices in the country for the latter part of 2019; the first time it has surpassed all states for

consecutive months. Wind and solar generation was key to this outcome and also boosted reliability of supply for the state.<sup>27</sup>

The state is exploring hydrogen generation, with its wind and solar resources enabling it to generate, use and export 100 per cent renewable hydrogen. SA is also trialling smaller projects such as the 30 MW hydrogen electrolyser in Port Lincoln. A bigger hybrid project incorporating wind, solar and hydrogen is on the horizon at Neoen's Crystal Brook project. It will be a super hub consisting of 125 MW of wind, 150 MW of solar, 130 MW of battery storage and 50 MW of hydrogen.<sup>28</sup>

The new SA-NSW interconnector was given major project status by the SA Government. Called Project EnergyConnect, the new interconnector

will deliver benefits to South Australia, including cheaper power prices, improved reliability and opportunities to export renewable energy.<sup>29</sup>

In November 2019, Neoen announced plans to expand the Hornsdale Power Reserve by 50 per cent. With funding from the SA Government, the Clean Energy Finance Corporation and the Australian Renewable Energy Agency, the 50 MW/64.5 MWh upgrade will be able to manage 50 per cent of SA's inertia needs and help the state towards its 100 per cent renewable energy target. It will also result in additional consumer savings of \$47 million per year, ensure faster responses to system outages and keep electricity supply quality high. Construction has already commenced on the project, with completion expected in the first half of 2020.<sup>30</sup>

<sup>26</sup> G Parkinson, Renew Economy, *South Australia's stunning renewable energy transition, and what comes next*, 5 November 2019, [reneweconomy.com.au/south-australias-stunning-renewable-energy-transition-and-what-comes-next-79597/](http://reneweconomy.com.au/south-australias-stunning-renewable-energy-transition-and-what-comes-next-79597/)

<sup>27</sup> A Morton, The Guardian, *South Australia's clean energy shift brings lowest power prices on national grid, audit finds*, 24 December 2019, [www.theguardian.com/australia-news/2019/dec/24/south-australias-clean-energy-shift-brings-lowest-power-prices-on-national-grid-audit-finds](http://www.theguardian.com/australia-news/2019/dec/24/south-australias-clean-energy-shift-brings-lowest-power-prices-on-national-grid-audit-finds)

<sup>28</sup> G Parkinson, Renew Economy, *South Australia unveils plan for 100 per cent renewable hydrogen economy*, 24 September 2019, [reneweconomy.com.au/south-australia-unveils-plans-for-100-renewable-hydrogen-economy-58723/](http://reneweconomy.com.au/south-australia-unveils-plans-for-100-renewable-hydrogen-economy-58723/)

<sup>29</sup> M Bloch, Solar Quotes, *Proposed SA-NSW interconnector granted major project status*, 28 June 2019, [www.solarquotes.com.au/blog/sa-nsw-interconnector-mb1113/](http://www.solarquotes.com.au/blog/sa-nsw-interconnector-mb1113/)

<sup>30</sup> N Harmsen, ABC News, *South Australia's giant Tesla battery output and storage set to increase by 50 per cent*, 20 November 2019, [www.abc.net.au/news/2019-11-19/sa-big-battery-set-to-get-even-bigger/11716784](http://www.abc.net.au/news/2019-11-19/sa-big-battery-set-to-get-even-bigger/11716784)



52.1%

of South Australia's electricity came  
from renewable sources in 2019



Image: Lake Bonney Battery Energy Storage System, South Australia



## KEY PROGRAMS, POLICIES AND INITIATIVES

- **Battery of the Nation project progressing**
- **Support for new Bass Strait interconnector**
- **Proposed 1 GW solar and wind farm**

Tasmania's Battery of the Nation vision could see the Apple Isle making a greater contribution to the National Electricity Market (NEM). The Australian Renewable Energy Agency has committed up to \$5 million to the project<sup>31</sup>, which focuses on wind and hydro and increasing transmission and interconnection opportunities. Victoria will be a significant beneficiary from the Battery of the Nation, with the project helping the state to mitigate the risks associated with the early or unplanned retirement of its coal-fired power stations.

Marinus Link, an additional transmission cable across the Bass Strait, is an important part of the Battery of the Nation strategy. The

cable will help to reduce power prices and improve electricity reliability. A feasibility study has found the benefits are greater when more coal-fired plants retire from the NEM.<sup>32</sup>

Research has found a 1500 MW link is technically feasible and commercially viable. It will create \$1.4 billion in economic benefits and 1400 jobs for Tasmania and \$1.5 billion of economic activity and 1400 jobs for Victoria. If it proceeds, it could be operational by 2027.<sup>33</sup>

The Granville Harbour Wind Farm is now sending power to the grid, with 31 turbines completed and a 30 per cent increase to wind power capacity. This \$280 million project takes advantage

of the strong winds coming off the Southern Ocean. The project is supported by a \$59 million investment by the Clean Energy Finance Corporation and secured by a long-term power purchase agreement with Hydro Tasmania.<sup>34</sup>

UPC Renewables has proposed the construction of two massive wind farms at Jim's Plain and Robbins Island in Northern Tasmania that together could provide up to 1 GW of new renewable generation. The two wind farms, which may also include solar, will seek development approval during 2020 with the goal of starting construction by the end of 2021.<sup>35</sup>

<sup>31</sup> Hydro Tasmania, website, *Battery of the Nation*, [www.hydro.com.au/clean-energy/battery-of-the-nation](http://www.hydro.com.au/clean-energy/battery-of-the-nation)

<sup>32</sup> K Murphy, The Guardian, *Scott Morrison heads to Tasmania to support 'battery of the nation' plan*, 27 February 2019, [www.theguardian.com/australia-news/2019/feb/27/scott-morrison-heads-to-tasmania-to-support-battery-of-the-nation-plan](http://www.theguardian.com/australia-news/2019/feb/27/scott-morrison-heads-to-tasmania-to-support-battery-of-the-nation-plan)

<sup>33</sup> Marinus Link, media release, *TasNetworks releases business case assessment for a second Bass Strait electricity interconnector*, 4 December 2019, [www.marinuslink.com.au/2019/12/tasnetwork-shares-bca-and-padr/](http://www.marinuslink.com.au/2019/12/tasnetwork-shares-bca-and-padr/)

<sup>34</sup> S Vorrath, Renew Economy, *Granville Harbour wind farm nears first generation in Tasmania*, 21 October 2019, [reneweconomy.com.au/granville-harbour-wind-farm-nears-first-generation-in-tasmania-57842/](http://reneweconomy.com.au/granville-harbour-wind-farm-nears-first-generation-in-tasmania-57842/)

<sup>35</sup> UPC Renewables, website, *Robbins Island Wind Farm*, [robbinsislandwindfarm.com/](http://robbinsislandwindfarm.com/)



**95.6%**  
of Tasmania's electricity came from  
renewable sources in 2019



Image: Tarraleah Hydroelectric Power Station, Tasmania



## KEY PROGRAMS, POLICIES AND INITIATIVES

---

- 50 per cent renewable energy target by 2030 now law
- Government supports KerangLink transmission line

Victoria's 50 per cent renewable energy target by 2030 became law in October 2019. Despite strong opposition from the state Liberal Party in the leadup, it comfortably passed state parliament. The legislation provides certainty for the renewable energy industry and encourages investment in clean energy projects. Having a firm target could generate as many as 24,000 jobs while reducing energy prices for homes and businesses.<sup>36</sup>

The Victorian Government abruptly froze rebates under its Solar Homes Program in April 2019 after a stronger than expected response to the program. This decision created

significant challenges and uncertainty for the solar industry, and an emergency roundtable saw 14,000 rebates for systems that hadn't yet been installed allowed to proceed.<sup>37</sup> When the program was reopened in July with a monthly rebate limit, available rebates were exhausted in less than an hour. This put an artificial cap on the industry, causing significant hardship for Victorian solar companies that weren't able to get enough business to remain viable. The Clean Energy Council ran a strong campaign calling on the government to remove the artificial cap that it had unwittingly placed on the solar industry. In August,

the Victorian Government significantly increased the number of rebates, which helped to reduce the pent-up demand and alleviate the pressure on the industry.<sup>38</sup>

The Victorian Government has asked the Federal Government to fast-track investment in the KerangLink transmission line between NSW and Victoria. KerangLink will give Victoria greater access to energy generation from NSW, including the Snowy 2.0 pumped hydro project, which will be especially important if any of Victoria's coal-fired power plants close earlier than expected.<sup>39</sup>

---

<sup>36</sup> S Vorrath, Renew Economy, *Victoria 50 per cent by 2030 renewable energy target voted into law*, 30 October 2019, [reneweconomy.com.au/victoria-50-by-2030-renewable-energy-target-voted-into-law-18513/](http://reneweconomy.com.au/victoria-50-by-2030-renewable-energy-target-voted-into-law-18513/)

<sup>37</sup> Clean Energy Council, *Progress made but no end in sight for the Victorian Solar Coaster*, 15 May 2019, [www.cleanenergycouncil.org.au/news/progress-made-but-no-end-in-sight-for-the-victorian-solar-coaster](http://www.cleanenergycouncil.org.au/news/progress-made-but-no-end-in-sight-for-the-victorian-solar-coaster)

<sup>38</sup> Clean Energy Council, *Victorian solar industry in crisis as August solar homes rebates run out within hours*, 1 August 2019, [www.cleanenergycouncil.org.au/news/victorian-solar-industry-in-crisis-as-august-solar-homes-rebates-run-out-within-hours](http://www.cleanenergycouncil.org.au/news/victorian-solar-industry-in-crisis-as-august-solar-homes-rebates-run-out-within-hours)

<sup>39</sup> A Morton & K Murphy, The Guardian, *Victoria asks Angus Taylor to fast-track work on Snowy-Melbourne energy line*, 18 November 2019, [www.theguardian.com/australia-news/2019/nov/18/victoria-asks-angus-taylor-to-fast-track-work-on-snowy-melbourne-energy-line](http://www.theguardian.com/australia-news/2019/nov/18/victoria-asks-angus-taylor-to-fast-track-work-on-snowy-melbourne-energy-line)



**23.9%**

of Victoria's electricity came from renewable sources in 2019



Image: Crowlands Wind Farm, Victoria



## KEY PROGRAMS, POLICIES AND INITIATIVES

- \$10 million Renewable Hydrogen Fund
- Asian Renewable Hub grows to 15 GW
- Horizon Power using stand-alone systems for remote customers

Western Australia is one of only two states without a renewable energy target. But there is increasing activity in the renewable space, with several new wind and solar projects coming online or breaking ground in 2019.

APA Group opened its \$40 million Badgingarra Solar Farm in Hill River in December 2019. The 19.25 MW project is part of APA's renewable precinct, which is expected to save more than 8.5 million tonnes of greenhouse gases over the next 25 years and power 220,000 homes each year.<sup>40</sup>

South Energy is making a foray into the WA renewables market with proposed solar farms at Waroon (183 MW) and Benger (100 MW). The \$250 million Waroon project will include 488,800 solar panels and a 20 MW battery and is expected to be completed in 2022. Benger is proposed to have 265,000 solar panels and a 10 MW battery.<sup>41</sup>

The state's first grid-scale solar farm, Greenough River, is adding 30 MW of solar to its capacity. Electricity generated by this project is sold to WA's Water Corporation for its desalination plant.<sup>42</sup>

The WA Government introduced its \$10 million Renewable Hydrogen Fund in 2019. Grants of between \$300,000 and \$3 million will be provided for studies, setting up demonstrations or for new capital works projects. Regional areas have \$7 million earmarked for projects, while \$1 million has been allocated for research into administration and regulatory reforms. It won't just be generating hydrogen for export, with the WA Government prioritising projects using hydrogen in regional areas, mixing it with mains gas supplies and using it for transport fuel.<sup>43</sup>

The proposed Asian Renewable Energy Hub has again grown in scope to 15 GW of wind and solar capacity. Backed

by CWP Renewables, Macquarie Group and Vestas, the project is positioning itself for the renewable hydrogen export market<sup>44</sup> with potential to generate 50 TWh per year.

Government-owned electricity retailer Horizon Power is using solar and storage to serve some remote customers through off-grid systems. This improves electricity reliability and reduces the cost of maintaining poles and wires in remote areas. WA Energy Minister Bill Johnston congratulated Horizon Power on deploying the stand-alone power systems, which align with WA's Energy Transformation Strategy.<sup>45</sup>

<sup>40</sup> M Maisch, PV Magazine, *APA opens new solar farm in its Western Australian renewables precinct*, 4 December 2019, [www.pv-magazine-australia.com/2019/12/04/apa-opens-new-solar-farm-in-its-western-australian-renewables-precinct/](http://www.pv-magazine-australia.com/2019/12/04/apa-opens-new-solar-farm-in-its-western-australian-renewables-precinct/)

<sup>41</sup> M Maisch, PV Magazine, *183 MW solar farm approved for south-west WA, another 100 MW project on the cards*, 28 November 2019, [www.pv-magazine-australia.com/2019/11/28/183-mw-solar-farm-approved-for-south-west-wa-another-100-mw-project-on-the-cards/](http://www.pv-magazine-australia.com/2019/11/28/183-mw-solar-farm-approved-for-south-west-wa-another-100-mw-project-on-the-cards/)

<sup>42</sup> M Maisch, PV Magazine, *Juwi lands Greenough River solar farm expansion deal*, 5 September 2019, [www.pv-magazine-australia.com/2019/09/05/juwi-lands-greenough-river-solar-farm-expansion-deal/](http://www.pv-magazine-australia.com/2019/09/05/juwi-lands-greenough-river-solar-farm-expansion-deal/)

<sup>43</sup> M Mazengarb, Renew Economy, *WA opens \$10m hydrogen fund to boost renewable gas production and exports*, 18 September 2019, [reneweconomy.com.au/wa-opens-10m-hydrogen-fund-to-boost-renewable-gas-production-and-exports-63479/](http://reneweconomy.com.au/wa-opens-10m-hydrogen-fund-to-boost-renewable-gas-production-and-exports-63479/)

<sup>44</sup> G Parkinson, Renew Economy, *Pilbara green hydrogen project grows to 15GW wind and solar*, 12 July 2019, [reneweconomy.com.au/pilbara-green-hydrogen-project-grows-to-15gw-wind-and-solar-97972/](http://reneweconomy.com.au/pilbara-green-hydrogen-project-grows-to-15gw-wind-and-solar-97972/)

<sup>45</sup> I Murphy, Energy Magazine, *WA region goes off-grid with renewable power system*, 4 October 2019, [www.energymagazine.com.au/wa-region-goes-off-grid-with-renewable-power-system/](http://www.energymagazine.com.au/wa-region-goes-off-grid-with-renewable-power-system/)



**20.9%**  
of WA's electricity came from  
renewable sources in 2019



Image: Granny Smith Mine Hybrid Power Station, Western Australia

# EMPLOYMENT

The renewable energy industry continued to employ thousands of Australians in 2019, with 22,926 working in construction, operations and maintenance and solar rooftop installation across the sector.



Image: Numurkah Solar Farm, Victoria

Many of the jobs in the renewable energy industry are in regional areas, where developers often hire locals as part of their social licence obligations. A great example of this is the strategic employment and training program employed by Beon Energy Solutions at its Karadoc Solar Farm in Victoria. Under this program, Beon provided local employment opportunities for 90 long-term unemployed people, 38 Aboriginal people, 14 people from culturally and linguistically diverse backgrounds and four people with disabilities. In addition, Beon partnered with local education and training organisations to create 25 new electrical apprenticeships. Another example comes from the Mount

Emerald Wind Farm in Queensland, where the development of the wind farm allowed one worker to give up the fly-in, fly-out life and work closer to home.

However, we are still a long way from fully realising the employment opportunities on offer in renewable energy. Globally, the industry currently employs 11 million people,<sup>46</sup> but this is forecast to increase to more than 35 million jobs by 2050 as the transition to renewable energy accelerates.<sup>47</sup> In Australia, the nascent hydrogen industry is expected to be a major job creator in coming years, with Chief Scientist Alan Finkel forecasting that the industry could create thousands of jobs, many of which will be in regional

areas close to the renewable energy projects used to create hydrogen.<sup>48</sup>

The number of CEC Accredited Installers grew by 11 per cent in 2019, with the program passing 6500 installers for the first time in December. Much of this growth was due to the rooftop solar industry's record year in 2019 and the requirement for installers to be accredited under a number of state government rebate schemes.

The renewable energy industry's strong growth in recent years has resulted in a skills shortage for both qualified electricians with the skills to install and maintain solar systems and clean energy specialists.<sup>49</sup> In an effort to address these shortages, the Clean

## EMPLOYMENT IN RENEWABLES

Construction

**12,202**

Operations and maintenance

**2537**

<sup>46</sup> International Renewable Energy Agency, *Renewable energy and jobs: annual review 2019*, [www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jun/IRENA\\_RE\\_Jobs\\_2019-report.pdf](http://www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Jun/IRENA_RE_Jobs_2019-report.pdf)

<sup>47</sup> J Paige, Power Technology, *Renewable energy to create 35 million power sector jobs: Report*, 21 January 2020, [www.power-technology.com/news/renewable-energy-to-create-35-million-power-sector-jobs-report/](http://www.power-technology.com/news/renewable-energy-to-create-35-million-power-sector-jobs-report/)

<sup>48</sup> M Mazengarb, Renew Economy, *Finkel's national hydrogen strategy gets green light, but could be lifeline for coal*, 22 November 2019, [reneweconomy.com.au/finkels-national-hydrogen-strategy-gets-green-light-but-could-be-lifeline-for-coal-69939/](http://reneweconomy.com.au/finkels-national-hydrogen-strategy-gets-green-light-but-could-be-lifeline-for-coal-69939/)



22,926

jobs in renewables

8188

jobs in rooftop solar

11%

increase in the number of CEC accredited installers in 2019

Energy Council launched its Renewable Energy Careers Expo in 2019, an event to bring university students together with renewable energy companies to highlight the clean energy job opportunities on offer.

Renewable energy is also providing communities that have traditionally relied on coal with an opportunity to re-skill. One such example is the proposed Star of the South off-shore wind farm. Located off the coast of traditional coal country in Victoria's Latrobe Valley, the wind farm could create up to 2000 construction and 300 ongoing jobs. This offers a unique opportunity for former electricity sector workers to re-skill and transition away from the fossil fuel industry.<sup>50</sup>



Solar rooftop installation

8188



**CASE STUDY  
RENEWABLE PROJECTS GIVE LOCALS A KICK START**

The renewables industry is helping build a more sustainable Australia, while creating jobs and economic growth in regional areas. And community engagement is paramount to the success of delivering projects. Renewable projects can revitalise small towns by employing workers on site and indirectly creating jobs in the wider community. It's good for business and good for the community to recruit a local workforce and provide training and support.

Many work opportunities are suitable for all ages. From apprenticeships to mature age employment, renewable energy projects can provide a kick start or new opportunity for those willing to learn. The jobs are also multi-functional so workers skill up in a range of areas without travelling for FIFO (fly-in, fly-out) style roles, and those with transferable skills find meaningful work after redundancy or retrenchment.

However, finding all the workers needed for projects is a key barrier

to growth. Helping the industry to develop the right skills and meet demand is a priority for the Clean Energy Council.

The first Renewable Energy Careers Expo was held in October 2019 to allow students to see what a career in renewable energy looks like and meet with potential employers in the sector. The Renewable Energy Careers Expo is being expanded across the country in 2020.

The Clean Energy Council also commissioned the Institute of Sustainable Futures to conduct a national jobs survey to measure employment across the clean energy sector. The results will provide the industry and government with tangible data about opportunities presented by the renewable energy industry.

Clean energy will be a driving force for jobs and economic growth, and can bring many benefits and opportunities to Australia.

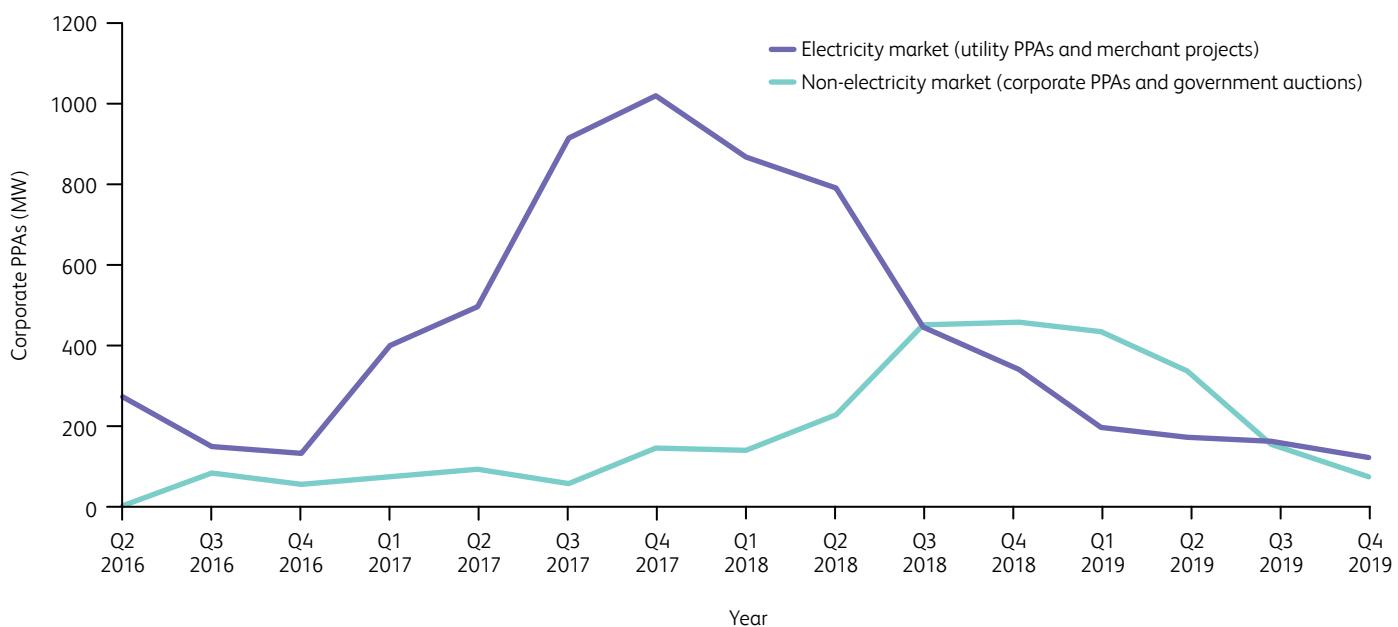
49 Australian Industry and Skills Committee, *Renewable and sustainable energy*, 3 February 2020, [nationalindustryinsights.aisc.net.au/industries/electrotechnology/renewable-and-sustainable-energy](http://nationalindustryinsights.aisc.net.au/industries/electrotechnology/renewable-and-sustainable-energy)

50 B Preiss, *The Age*, *Testing begins for first offshore wind farm in Australia*, 10 November 2019, [www.theage.com.au/national/victoria/testing-begins-for-first-offshore-wind-farm-in-australia-20191110-p53970.html](http://www.theage.com.au/national/victoria/testing-begins-for-first-offshore-wind-farm-in-australia-20191110-p53970.html)

# RENEWABLES FOR BUSINESS

There was a slowdown in corporate renewable power purchase agreements (PPAs) in 2019, mostly reflecting the wider market environment, but they were still highly sought-after by a growing range of Australian businesses.

## MEGAWATTS CONTRACTED IN PPAs<sup>51</sup>



While the volume of renewable energy contracted globally through corporate renewable PPAs increased from 12 GW in 2018 to 15 GW in 2019,<sup>52</sup> there was a noticeable slowdown in Australia with less than half the volume contracted.

There were 22 new corporate renewable PPAs announced, which contracted 400 MW of capacity and supported projects totalling 1500 MW. Some of the major PPA deals announced in 2019 included:

- The City of Sydney, negotiating a 10-year PPA with Sapphire Wind Farm (270 MW), Bomen Solar Farm (120 MW) and a community-owned solar farm near Nowra for 28 GWh per annum.

- Coles, negotiating a 10-year PPA with Wagga Wagga, Junee and Corowa Solar Farms (260 MW) for 154 GWh per annum.
- Westpac, negotiating a 10-year PPA with Bomen Solar Farm (120 MW) for 21 GWh per annum.
- Viva Energy, negotiating a PPA with Mt Gellibrand Wind Farm (132 MW) for 25 GWh per annum.

This is the tip of the iceberg. There is a much larger pipeline of corporate renewable PPAs in development and negotiation. The Business Renewables Centre Australia estimates that its buyer membership may procure contracts in the range of 300-500 MW in 2020 based on survey responses.

However, some deals were unable to be completed in 2019 due to market and regulatory uncertainties (e.g. changes in marginal loss factors impacting on project revenues and contract prices), while the influx of new buyers without energy market experience lengthened negotiation time. Market and regulatory factors such as the federal election, grid connection delays and the potential for reductions in wholesale electricity prices also created uncertainty for all parties. While the underlying demand for corporate renewable PPAs remains strong, the market will receive a significant boost if these issues can be quickly resolved.

As the Renewable Energy Target is now fully subscribed, the corporate

51,53 Business Renewables Centre-Australia

52 International Energy Agency, *Global PPA volumes by sector, 2009-2019*, 16 January 2020, [www.iea.org/data-and-statistics/charts/global-ppa-volumes-by-sector-2009-2019](http://www.iea.org/data-and-statistics/charts/global-ppa-volumes-by-sector-2009-2019)

**22**

corporate PPAs signed  
in 2019

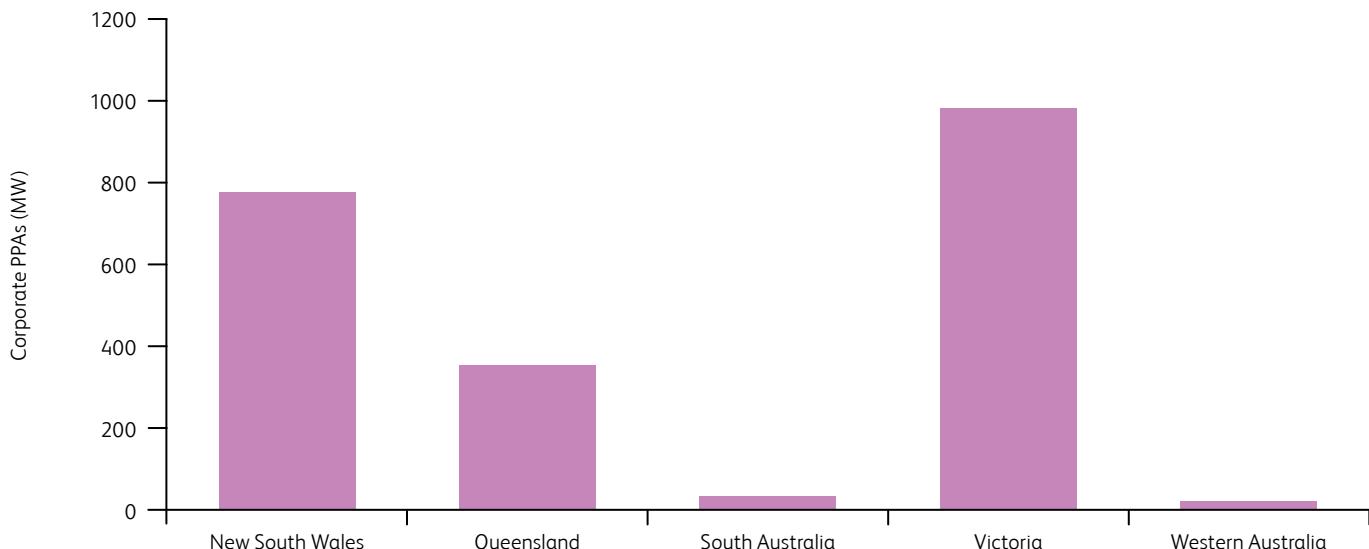
**400 MW**

contracted for under corporate  
PPAs in Australia in 2019

**15 GW**

of power purchased through  
PPAs globally in 2019

### **LEADING STATES FOR CORPORATE PPAs (MW)<sup>53</sup>**



renewables PPA market will play a crucial role in the prospects for large-scale renewable energy in 2020. PPAs from outside the electricity market (government auctions and corporate PPAs) have generally outstripped investment from inside the electricity market. The two segments came together in 2019, but short-term prospects are stronger for corporate renewable PPAs.

The major market innovation over the last 12 months has been the rapid development and demand for retail PPAs. This is where buyers contract for power from a solar or wind farm via a retailer, rather than the buyer and the project contracting directly as is the case with a wholesale PPA. Whereas

retail PPAs and products are rare in the US, the Australian market has quickly diversified as retailers respond to the growth in demand amongst mid-scale buyers (broadly from around 5 GWh per annum to 50 GWh per annum).

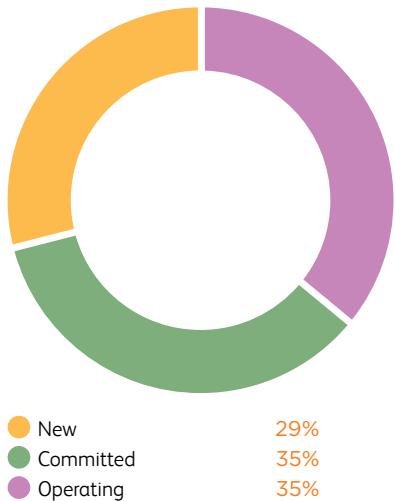
Compared to other markets, Australia has fewer large buyers. Consequently, growing demand among mid-scale buyers is essential for the longer-term future of corporate renewable PPAs. There is significant product experimentation and innovation occurring as retailers develop different models to cater to mid-scale buyers. Retailers are offering greater flexibility in terms, with PPAs of 3, 5, 7 and 10 years, combining and on-selling PPAs from their portfolio and in some cases

aggregating buyers for new projects and offering products ranging from fixed-price contracts to spot price exposure.

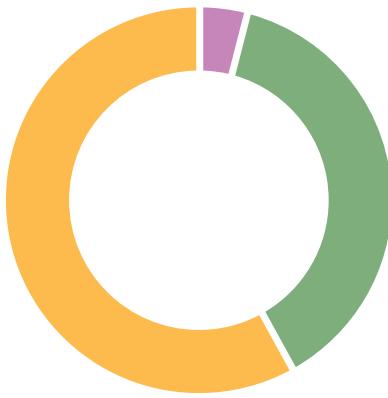
Wholesale PPAs still lead in terms of the volumes contracted with solar and wind farms but there is now an even split in the number of deals between wholesale and retail PPAs.

# RENEWABLES FOR BUSINESS CONTINUED

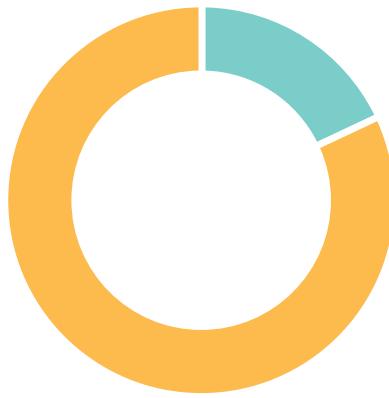
**CORPORATE PPAs BY PROJECT DEVELOPMENT STAGE (MW)<sup>54</sup>**



**CORPORATE PPAs BY CONTRACT TYPE (MW)<sup>54</sup>**



**CORPORATE PPAs BY TECHNOLOGY TYPE (MW)<sup>54</sup>**



**We put more energy into your future**

- Profit-to-member super fund
- Top tier investment performance
- Competitive fees
- Workplace seminars

Learn more about Equip and our employer services at  
[www.equipsuper.com.au](http://www.equipsuper.com.au)



Together Trustees Pty Ltd ABN 64 006 964 049, AFSL 246383, Together is the trustee of the Equipsuper Superannuation Fund ABN 33 813 823 017 ("Equip" or "The Fund").

**CASE STUDY**  
**DRINKING SUNSHINE: PPA TO PROVIDE LOW CARBON BEER**



Image: AHA NSW and National President Scott Leach and Lion Australia Managing Director James Brindley

Beers are best enjoyed when the pub and the brewery have flicked the switch to renewables.

The Australian Hotels Association (AHA) and the Tourism Accommodation Association (TAA) have partnered with ENGIE Australia & New Zealand and Simply Energy in NSW and the ACT to build the world's first industry-scale aggregated power purchase agreement (PPA).

This landmark aggregation deal – the first of its kind – combines the energy load of almost 250 pubs and accommodation hotels to deliver improved price visibility and competitiveness. In another

first, anchor partner Lion Australia has pooled its energy needs for the Tooheys Brewery in NSW with the participating venues.

One hundred per cent of the aggregated electricity load of participating members and Lion Australia will draw from renewable solar farms. AHA and TAA's long-term commitment with ENGIE is helping grow large-scale investment in new renewable sources.

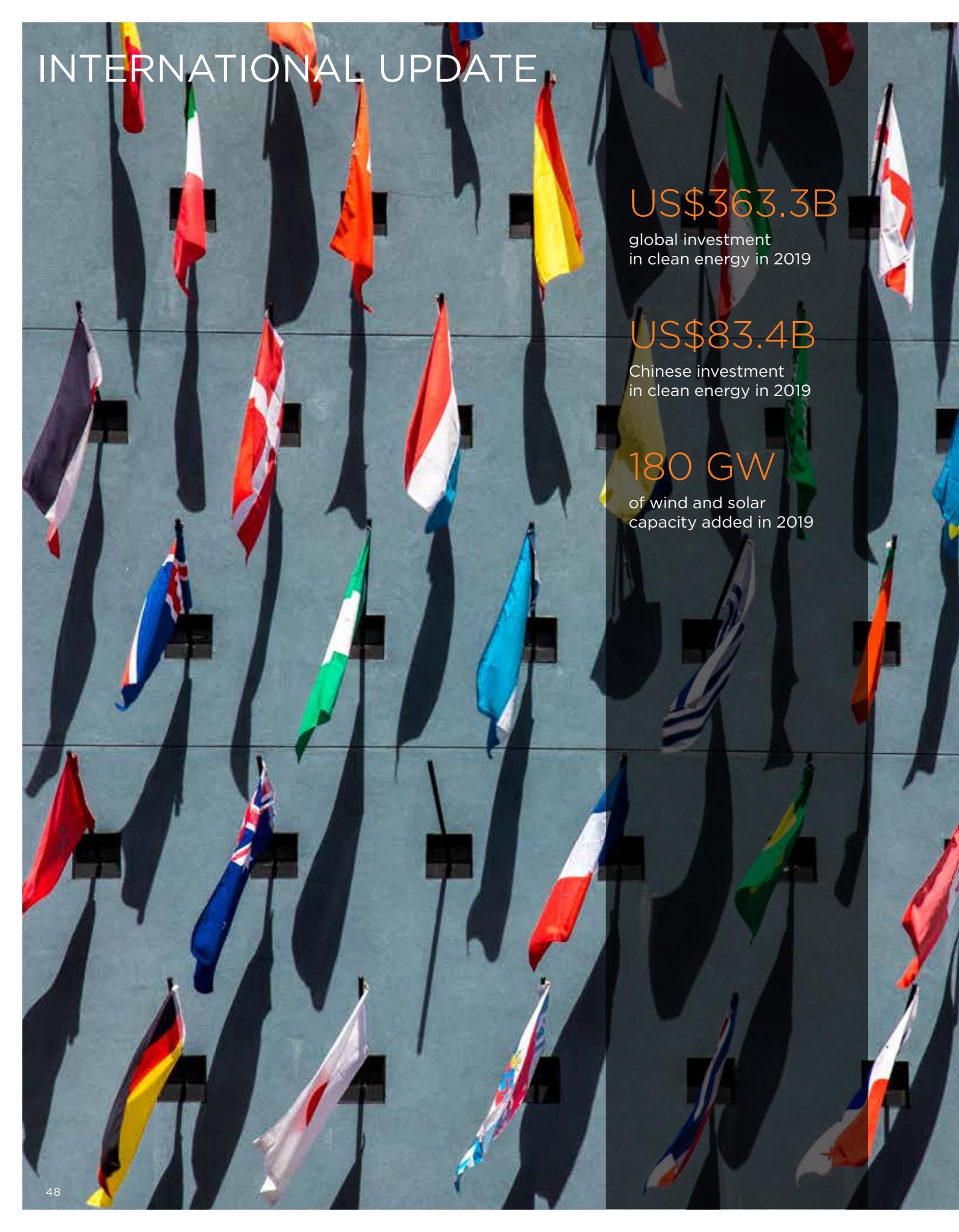
ENGIE Australia & New Zealand Chief Executive Officer, Augustin Honorat, noted "it's typically only the largest industrial energy users who are able to enter into these arrangements with enough load

to underwrite new investments in renewable energy at low prices".

AHA NSW and National President Scott Leach said "this is a groundbreaking deal which will help break the back of high electricity prices paid by our members, while simultaneously reducing our carbon footprint."

Lion Australia Managing Director James Brindley said: "In addition to striking a better deal for participating members, this deal will see Lion's Tooheys Brewery reduce its carbon emissions by 40 per cent. Lion will be offsetting its remaining organisational carbon footprint in 2020."

# INTERNATIONAL UPDATE



**US\$363.3B**

global investment  
in clean energy in 2019

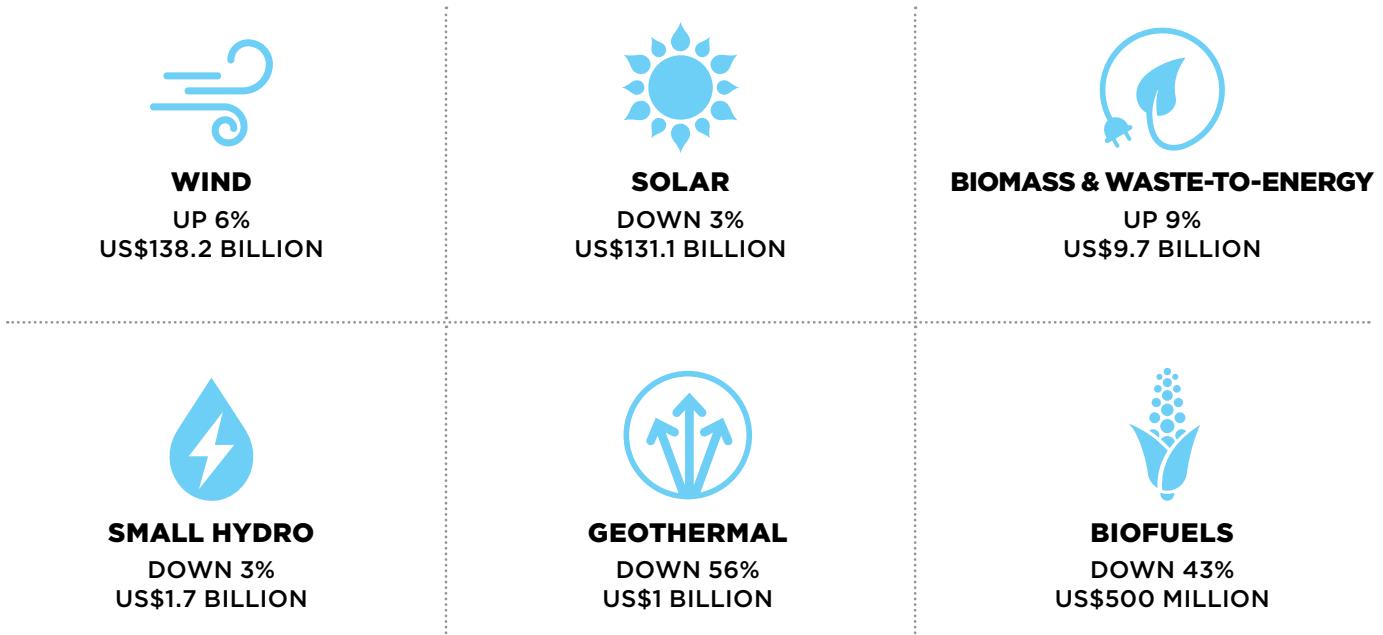
**US\$83.4B**

Chinese investment  
in clean energy in 2019

**180 GW**

of wind and solar  
capacity added in 2019

## GLOBAL RENEWABLE ENERGY INVESTMENT BY TECHNOLOGY<sup>55</sup>



Worldwide investment in renewable energy was US\$363.3 billion in 2019 – slightly higher than the figure reported in 2018. Out of this figure, which includes research and development and private equity deals, investment in renewable energy capacity was US\$282.2 billion. Wind and solar was responsible for US\$138.2 billion and US\$131.1 billion of total investment respectively, with 180 GW of new capacity added throughout the year.<sup>56</sup>

While China was once again the largest investor in renewable energy at US\$83.4 billion, 2019 saw its lowest investment

since 2013. Solar was the major factor in this, with 2019's US\$25.7 billion investment less than a third of the record achieved in 2017. In comparison, the US saw a 28 per cent increase in investment to reach a new record of US\$55.5 billion. This was largely down to wind and solar developers looking to take advantage of federal tax credits before they are wound down in 2020.<sup>57</sup>

Over the past decade, more than US\$2.5 trillion in investment has seen global renewable energy capacity increase by more than 400 per cent.<sup>58</sup> This means that renewable energy now

accounts for around one third of total installed electricity capacity around the world.<sup>59</sup>

More than 220 companies have signed up to the RE100 initiative, a global pledge for businesses to source 100 per cent of their electricity requirements from renewable energy. Some of the world's largest companies have signed up to the initiative, including Apple, Coca-Cola and Google, while several Australian businesses are also on-board, including all of the big four banks, software company Atlassian and insurance giant QBE.

<sup>55</sup> V Henze, Bloomberg New Energy Finance, *Late surge in offshore wind financings helps 2019 renewables investment to overtake 2018*, 16 January 2020, [about.bnef.com/blog/late-surge-in-offshore-wind-financings-helps-2019-renewables-investment-to-overtake-2018/](http://about.bnef.com/blog/late-surge-in-offshore-wind-financings-helps-2019-renewables-investment-to-overtake-2018/)

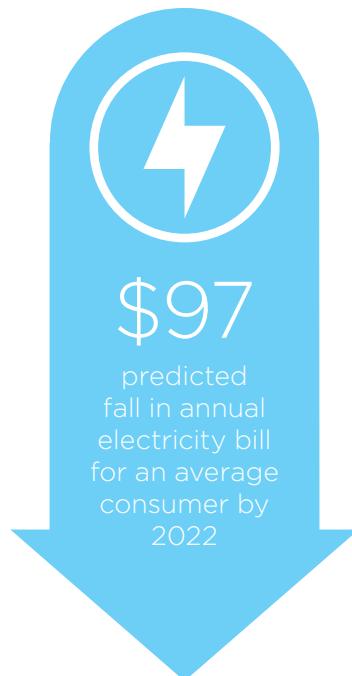
<sup>56</sup> Ibid.

<sup>57</sup> Ibid.

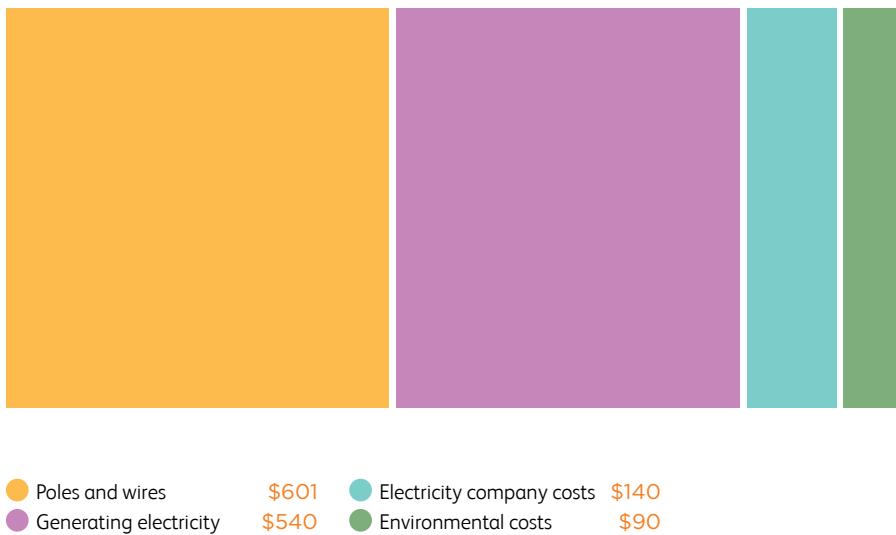
<sup>58</sup> Bloomberg New Energy Finance, *A decade of renewable energy investment, led by solar, tops USD 2.5 trillion*, 6 September 2019, [about.bnef.com/blog/decade-renewable-energy-investment-led-solar-tops-usd-2-5-trillion/](http://about.bnef.com/blog/decade-renewable-energy-investment-led-solar-tops-usd-2-5-trillion/)

<sup>59</sup> International Renewable Energy Agency, *Renewable energy now accounts for a third of global power capacity*, 2 April 2019, [irena.org/newsroom/pressreleases/2019/Apr/Renewable-Energy-Now-Accounts-for-a-Third-of-Global-Power-Capacity](http://irena.org/newsroom/pressreleases/2019/Apr/Renewable-Energy-Now-Accounts-for-a-Third-of-Global-Power-Capacity)

# ELECTRICITY PRICES



## WHAT MAKES UP YOUR POWER BILL, 2018-19<sup>60</sup>



Following record price rises in recent years, electricity costs have finally started to ease as the influx of renewable energy generation reduces prices for Australian consumers and businesses.

In welcome news for Australian consumers and businesses, the Australian Energy Market Commission's annual report on residential electricity price trends found that average household power bills are expected to fall by 7.1 per cent between 2019 and 2022. This is primarily driven by an 11.6 per cent (\$62) reduction in wholesale prices as 8594 MW of new, mostly renewable generation comes online. While only making up a small proportion of the average electricity bill, environmental policy costs will also fall by 23.9 per cent (\$21) due to reductions in the cost of large-scale generation certificates as the Large-scale Renewable Energy Target winds down.<sup>62</sup>

However, price falls will not be felt evenly across Australia, with price reductions

ranging from \$278 in Queensland to \$27 in South Australia. In Western Australia, prices are expected to actually increase by 6.4 per cent (\$102) between 2019 and 2022. This is largely due to the state's reliance on gas-fired power stations, with increased gas prices expected to drive up the wholesale price of electricity by 7.5 per cent.

The Federal Government used its election mandate to pass its so-called big-stick legislation in November 2019. The legislation gives the Australian Competition and Consumer Commission (ACCC) the power to seek penalties of up to \$10 million from energy retailers that fail to pass on savings to consumers, unreasonably refuse to offer contracts or manipulate the market to influence prices. In the most serious cases, the

<sup>60</sup> Australian Energy Market Commission, *Residential electricity price trends 2019 – final report*, 9 December 2019, [aemc.gov.au/sites/default/files/2019-12/2019%20Residential%20Electricity%20Price%20Trends%20final%20report%20FINAL.pdf](http://aemc.gov.au/sites/default/files/2019-12/2019%20Residential%20Electricity%20Price%20Trends%20final%20report%20FINAL.pdf)

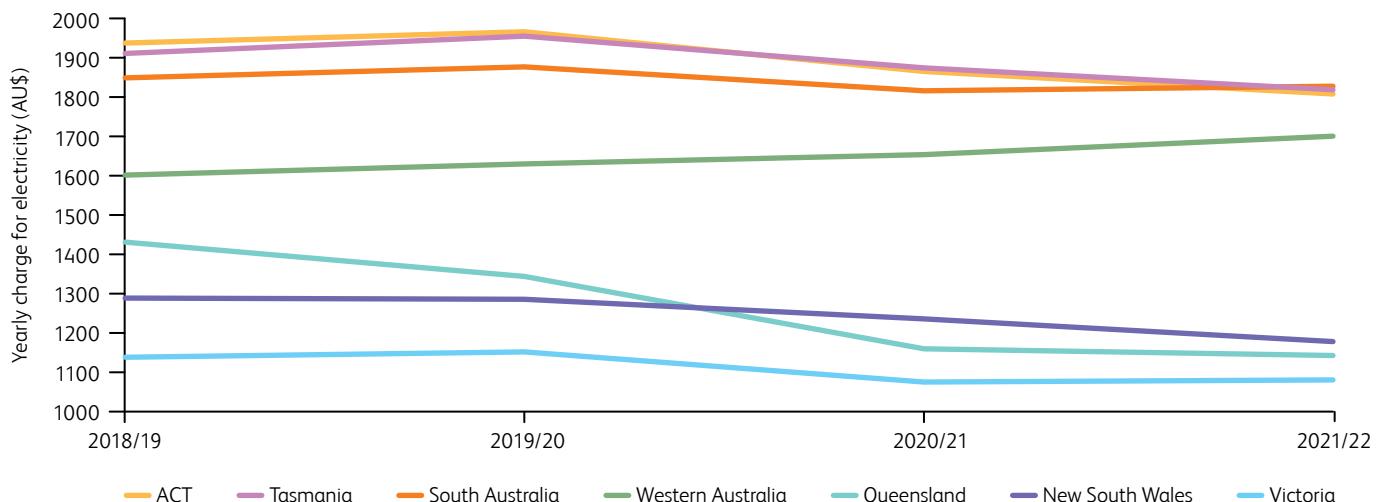
<sup>61</sup> Ibid.

<sup>62</sup> Ibid.

<sup>63</sup> J Hayne, ABC News, *The Federal Government's 'big stick' energy bill has been introduced, here's what it would do*, 18 September 2019, [abc.net.au/news/2019-09-18/federal-government-big-stick-energy-laws-explained/11516294](http://abc.net.au/news/2019-09-18/federal-government-big-stick-energy-laws-explained/11516294)

<sup>64</sup> Australian Competition and Consumer Commission, *Savings for those on default electricity contracts, but more needs to be done*, 16 September 2019, [accc.gov.au/media-release/savings-for-those-on-default-electricity-contracts-but-more-needs-to-be-done](http://accc.gov.au/media-release/savings-for-those-on-default-electricity-contracts-but-more-needs-to-be-done)

## EXPECTED RESIDENTIAL ELECTRICITY PRICES 2018-2022<sup>61</sup>



legislation gives the government the power to force the divestment of a company's assets.<sup>63</sup> As of the end of 2019, the big stick had yet to be wielded.

The other major electricity price policy to come out of the federal election was the establishment of a default market offer (DMO) in south-east Queensland, New South Wales and South Australia. From 1 July 2019, electricity retailers were required to switch customers on standing offers to the DMO and use the new price as a reference point to allow consumers to compare offers between retailers.

By September 2019, approximately 800,000 households and 160,000 small businesses had been moved from standing offers to the DMO, resulting

in savings of between \$130 and \$430 a year for households and \$2050 for businesses.<sup>64</sup> However, while the DMO brought significant savings for some consumers, critics warn that the majority of customers may not see any benefit because retailers will minimise revenue loss by reducing their discounts on other offers.

A common argument against renewables in recent years has been their supposed role in increasing electricity prices. However, this myth was resoundingly disproved in South Australia in 2019, with research finding that the state had the lowest monthly wholesale electricity prices in Australia in both October and November.<sup>65</sup>

The impact of renewables was also seen in the form of negative spot electricity prices occurring more frequently in 2019, with South Australia experiencing negative prices 8.4 per cent of the time between July and September<sup>66</sup> and spot prices falling to -\$1000/MWh in Queensland in September 2019.<sup>67</sup> While this isn't having a significant impact on electricity prices yet, it is evidence of the increasing influence of clean energy and the challenges facing the market and the grid as renewables penetration increases. It also improves the business case for battery storage, pumped hydro and renewable hydrogen, which can utilise low price windows to store energy and then discharge it when prices increase later in the day.

<sup>65</sup> A Morton, The Guardian, *South Australia's clean-energy shift brings lowest power prices on national grid, audit finds*, 24 December 2019, [theguardian.com/australia-news/2019/dec/24/south-australias-clean-energy-shift-brings-lowest-power-prices-on-national-grid-audit-finds](https://www.theguardian.com/australia-news/2019/dec/24/south-australias-clean-energy-shift-brings-lowest-power-prices-on-national-grid-audit-finds)

<sup>66</sup> G Parkinson, Renew Economy, *Negative pricing events hit record levels as solar takes big bite out of coal*, 12 November 2019, [reneweconomy.com.au/negative-pricing-events-hit-record-levels-as-solar-takes-big-bite-out-of-coal-70728/](https://reneweconomy.com.au/negative-pricing-events-hit-record-levels-as-solar-takes-big-bite-out-of-coal-70728/)

<sup>67</sup> A Macdonald-Smith & M Ludlow, Australian Financial Review, *Electricity prices hit minus \$1000 in Qld*, 5 September 2019, [afr.com/companies/energy/electricity-prices-hit-minus-1000-in-qld-20190904-p52nup](https://afr.com/companies/energy/electricity-prices-hit-minus-1000-in-qld-20190904-p52nup)

# TRANSMISSION

## The transmission network continues to be the single largest barrier to renewables development.

As the nature of electricity generation changes with the integration of smaller but more numerous renewable generators, the transmission network has not kept pace with the transition. 2019 saw a heightened focus on how the transmission network could be transformed for the evolving electricity system.

The Australian Energy Market Operator (AEMO) released its first Integrated System Plan (ISP) in July 2018. The ISP is a dynamic whole-of-system roadmap for the National Electricity Market for the next 20 years. Specifically, it outlines the optimal development pathway for transmission development under certain scenarios. Intended to be updated every two years, AEMO released a draft 2020 ISP in December 2019 that details tranches of transmission development that would need to happen now, next and in the future for a secure and reliable energy transition.

To support turning the ISP into action, the Energy Security Board (ESB) has developed a set of reforms to the National Electricity Rules intended to streamline the regulatory processes for key transmission projects identified in the ISP. The ESB consulted on these ‘actioning the ISP’ rules throughout 2019 and intends to present the rules package to the COAG Energy Council in March 2020 for approval.

Simultaneously with this work on the ISP, there are several regulatory approval processes recently completed or underway for transmission upgrades and new interconnectors. Regulatory approval processes have been completed for the Western Victoria

Transmission Network Project, a combination of works to address current limitations in the Western Victoria transmission network, and Project EnergyConnect, a new interconnector between South Australia and NSW. Regulatory approval processes are also currently underway for:

- minor updates to the existing Queensland to NSW interconnector (QNI) and Victoria to NSW interconnector (VNI)
- HumeLink, an augmentation to reinforce the NSW network and increase transfer capacity between Snowy Hydro and the state’s demand centres
- VNI West, a new interconnector between Victoria and NSW
- Marinus Link, a second cable connecting Victoria to Tasmania.

If all receive approval, these projects are expected to be constructed and operational throughout the 2020s.

Governments have also recognised the urgent need to build new transmission, with a number committing to new forms of support throughout the past year:

- The Commonwealth Government committed \$56 million to fast-track the development of Marinus Link.
- The Commonwealth Government announced a new \$1 billion Grid Reliability Fund to be administered by the Clean Energy Finance Corporation. The fund can be used to support transmission infrastructure, as well as new energy generation and storage.

- In a Memorandum of Understanding, the Commonwealth and NSW governments committed to jointly underwrite \$102 million for the QNI upgrade and \$66 million for HumeLink.

- The NSW Government released its NSW Electricity Strategy, which, amongst other things, outlines the state’s plans to deliver Australia’s first coordinated pilot renewable energy zone in Central West NSW.
- The Victorian Government has introduced legislation that will allow it to fast-track projects like grid-scale batteries and transmission updates. Its first step under this legislation is to ask AEMO to call for expressions of interest to increase the VNI capacity.

Regulatory reform aimed at the transmission network is also underway through the Australian Energy Market Commission’s (AEMC) coordination of generation and transmission investment (COGATI) review. The AEMC has developed a new access model and will be seeking approval by the COAG Energy Council in early 2020 to continue developing the detail of the model and implement it.

## CASE STUDY

### MLF VOLATILITY CAUSES HEADACHES FOR RENEWABLE DEVELOPERS

Until recently, marginal loss factors (MLFs) were a relatively obscure technical function of the National Electricity Market. However, significant cuts in the MLFs of several wind and solar farms in recent years have made them one of the main areas of concern for the renewable energy industry.

MLFs represent the loss of electricity as it travels from power generators along poles and wires to customers, and are influenced by a range of factors, including the quality and length of transmission infrastructure, the distance the electricity has to

travel and how much generation is in the same area.<sup>68</sup>

The main issue for generators is the volatility of MLFs, presenting a massive and unmanageable risk to investors that has undermined confidence in future clean energy projects.

Throughout 2019, the Australian Energy Market Commission (AEMC) consulted on a rule change request intended to reduce the volatility of the current MLF regime through the replacement of MLFs with average loss factors.

In early 2020, the AEMC decided to retain the existing MLF regime, claiming that the current methodology encourages generators to build in stronger parts of the grid and results in lower prices for consumers. The Clean Energy Council maintains that the current MLF regime is no longer fit-for-purpose and is undermining investor confidence in new clean energy generation. We will continue to work with the AEMC, the Australian Energy Market Operator and others on measures to reduce MLF volatility and improve generators' ability to manage MLF risk.



Image: Haughton Solar Farm, Queensland

# ENERGY RELIABILITY

The failure of two fossil fuel power stations increased the risk of blackouts in 2019, but widespread power outages were avoided as renewables stepped up to meet any shortfalls.

Unplanned outages at Victoria's Loy Yang coal-fired power plant and Mortlake gas-fired power station threatened to cause extensive blackouts in Victoria in 2019. The Australian Energy Market Operator (AEMO) was forced to procure additional supply to cover the shortfall under the Reliability and Reserve Trader mechanism, which, along with a strong contribution from rooftop solar, helped to ensure that Victoria's electricity demand was met, even on the hottest days of summer.

The outages at Loy Yang and Mortlake were part of a growing trend in 2019, with Australia's fleet of ageing coal and gas power plants becoming increasingly unreliable. Throughout 2019, there were more than 75 unexpected outages at coal and gas plants across the NEM.<sup>69</sup> This increases prices for consumers, threatens the stability of the grid and has the potential to cut power to millions of Australians.

In early 2020, a storm cut the interconnector between South Australia and Victoria, disconnecting South Australia from the NEM for three weeks. While the loss of the interconnector was a major contributor to the statewide blackout in South Australia in September 2016, this time renewables stepped up to fill the breach, with the state able to meet the bulk of its energy needs with its extensive wind, solar and battery resources.<sup>70</sup>

Energy reliability is often an issue in remote and regional areas, with distribution network service providers

required to maintain thousands of kilometres of poles and wires that are vulnerable to storms and bushfires. A solution to this is to use microgrids and stand-alone power systems to power remote communities, which both increases reliability and reduces costs for all energy users. Microgrids are not allowed under current rules, but the Australian Energy Market Commission is in the process of reviewing this decision. With many communities currently going through the process of recovery and reconstruction following the 2019-20 bushfires, the use of microgrids will allow for a safer, more reliable and more cost effective solution than if traditional infrastructure was rebuilt.

A proposal by the COAG Energy Council to increase the reliability standard in late 2019 was met with warnings from a coalition of business, energy and welfare groups. Seven groups ranging from the Business Council of Australia to the Australian Council of Social Service spoke out against the proposal, saying that 100 per cent reliability is an unattainable goal that is likely to lead to massive increases in energy costs.

The November 2019 announcement of a 50 MW/64.5 MWh expansion of the Hornsdale Power Reserve will allow the world's biggest battery to provide stabilising inertia services to the SA grid. This will be the first time a large-scale battery has provided inertia services to the Australian grid and is another important step on the transition to a renewable energy future.

69 The Australia Institute, *Gas & coal watch*, tai.org.au/gas-coal-watch

70 D Penberthy, The Australian, *Renewables save the day in interstate energy crisis*, 18 February 2020, theaustralian.com.au/nation/politics/renewables-save-the-day-in-interstate-energy-crisis/news-story/2de6aa0338d88f65aafdd869ecc646dc?btr=8f32a5206a36657dbbd96fb628b7d7dc

## CASE STUDY

### REDESIGNING ELECTRICITY MARKETS FOR CONSUMER CONTROL

The Australian Energy Market Commission (AEMC) is redesigning the electricity market to incorporate modern forms of electricity generation. The redesign could see consumers have more control over the use of their assets and energy.

These changes will bring benefits to consumers and the market by helping the market to manage peaks in demand and ensuring that infrastructure is available for a more secure power system.

Microgrids and distributed energy resources (DER) are the ones to watch and have been identified as important parts of the future energy mix by the AEMC and the Australian Energy Market Operator

(AEMO). AEMO is set to introduce a DER Register for solar systems and batteries on the grid to help improve planning and operation of our future electricity system.

Integration is key as new technologies come on board. Poor integration risks components of the energy system not being used to their full potential. The AEMC says by redesigning the electricity system and taking into account all generation components, the grid can increase efficiency and save money for consumers.

As a result, stand-alone power systems may be allowed in remote areas to reduce the need for expensive network investment. Remote communities are currently

subsidised by the wider customer network to fund the infrastructure needed, but allowing independent systems will reduce costs and allow consumers to benefit from a more resilient power supply, especially in times of natural disaster. Being outside the NEM, Western Australia has the greatest capacity to test this type of supply. But consultation, regulatory frameworks and consumer impact must be considered before implementation.

It's a welcome change to see regulators tabling these options. With proper planning, the use of microgrids and DER can result in a more stable energy environment and lower prices for consumers.



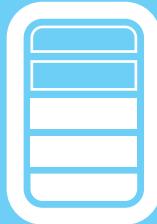


Image: Haughton Solar Farm, Queensland

# TECHNOLOGY PROFILES



# BATTERY STORAGE



As the penetration of renewable energy increases, storage will be the critical link between renewables and a reliable, affordable energy future. State government schemes are continuing to drive the uptake of household batteries, while 2020 will see the completion of several utility-scale batteries across Australia.

Australian households installed 22,661 batteries in 2019, taking Australia's household storage capacity past 1 GWh for the first time.<sup>71</sup>

State-based programs continue to drive this growth, with South Australia's Home Battery Scheme leading the way. Despite slower than expected uptake and claims that battery prices are still beyond the average homeowner's reach, the government remains confident that the scheme will reach its goal of 40,000 battery installations in four years. The scheme provides a subsidy of up to \$6000 towards the installation of a battery, which is approximately a quarter of the cost of a standard battery installation.<sup>72</sup>

The pilot of Victoria's Solar Battery Rebate was expanded to more than 100 postcodes in 2019 due to a sluggish initial response from consumers. Progress towards the Victorian Government's target of 10,000 subsidised battery systems installed via the Solar Homes program over 10 years is expected to ramp up as battery costs and barriers to ownership decrease.

One such barrier to ownership was the lack of a consistent national standard to provide battery installers with a consistent set of rules to work to. After

years of consultation and delay, the draft battery installation standard AS/NZS 5139 was accepted in July 2019. This is a significant milestone for the industry that will protect consumers and the reputation of the industry by putting an end to poor-quality battery installations.

The integration of batteries into virtual power plants (VPPs) will play a crucial role in the renewable energy future by providing better outcomes for consumers and supporting local and regional electricity grids. VPPs involve a network of distributed energy resources, including batteries, buying and selling energy in real-time to reduce electricity prices for participants and provide important services to the grid. The Australian Energy Market Commission and the Australian Energy Market Operator have already begun planning for a future in which VPPs play a key role in creating a two-sided national energy market that will enable increased consumer participation. Reforms to market design to allow for further integration of VPPs are expected from the Energy Security Board in 2020.<sup>73</sup>

Fifteen large-scale batteries were under construction at the end of 2019, many of which are co-located

with solar and wind farms. This is an increasingly common trend as developers look to maximise returns from their wind and solar projects.

When it comes to utility-scale batteries, they don't get any bigger than the Hornsdale Power Reserve. And this will continue to be the case for the foreseeable future, with Neoen announcing in 2019 that the size of the world's largest battery will be expanded by 50 per cent (50 MW/64.5 MWh). While the battery already provides important frequency control and ancillary services to help support the SA grid, the expansion will allow it to offer inertia services to improve stability and power quality and reduce the likelihood of blackouts. Supported by Tesla, the project is expected to further showcase the benefits that grid-scale batteries can provide to the National Electricity Market.

In January 2020, Vena Energy announced that it would construct a 100 MW/150 MWh battery at its Wandoan South Solar Farm in Queensland. When completed in mid-2021, the battery will be one of the largest in Australia, and Vena Energy has indicated that it may look to expand the battery to up to 450 MW of storage capacity in future.<sup>74</sup>

<sup>71</sup> SunWiz, media release, *NEW REPORT: Australia hits record-breaking energy storage capacity*, 10 March 2020, [medianet.com.au/releases/185115/](http://medianet.com.au/releases/185115/)

<sup>72</sup> R Davies, ABC News, *Home battery scheme off to sluggish start in SA, despite \$6,000 subsidy*, 31 October 2019, [abc.net.au/news/2019-10-31/slow-start-for-sa-home-battery-subsidy-scheme/11654962](http://abc.net.au/news/2019-10-31/slow-start-for-sa-home-battery-subsidy-scheme/11654962)

<sup>73</sup> K Murphy, The Guardian, *Australia told to prepare for 'completely new' two-sided energy market*, 14 November 2019, [theguardian.com/australia-news/2019/nov/14/australia-told-to-prepare-for-completely-new-two-sided-energy-market](http://theguardian.com/australia-news/2019/nov/14/australia-told-to-prepare-for-completely-new-two-sided-energy-market)

<sup>74</sup> Vena Energy, *Vena Energy Australia to power up Queensland's biggest battery*, 29 January 2020, [venaenergy.com/all\\_news/vena-energy-australia-to-power-up-queenslands-biggest-battery/](http://venaenergy.com/all_news/vena-energy-australia-to-power-up-queenslands-biggest-battery/)

**150 MW**

size of the Hornsdale Power Reserve after expansion

**15**

large-scale batteries under construction at the end of 2019

**100 MW**

battery proposed at the Wandoan South Solar Farm

### UTILITY-SCALE BATTERIES UNDER CONSTRUCTION AT THE END OF 2019<sup>75</sup>

STATE	PROJECT NAME	PROJECT OWNER	LOCALITY	SIZE OF SYSTEM
QLD	Wandoan South BESS	Vena Energy	Wandoan South	100MW/150MWh
SA	Hornsdale Power Reserve Stage 2	Neoen	Hornsdale	50MW/64.5MWh
WA	Chichester Solar Farm	Alinta Energy	Chichester	35MW*
SA	Lake Bonney Wind Farm Battery	Infigen Energy	Millicent	25MW/52MWh
VIC	Bulgana Green Power Hub	Neoen	Joel South	20MW/34MWh
NT	Katherine Solar Farm	Katherine Solar Pty Ltd	Cossack	6MW/3MWh
WA	Kalbarri Microgrid	Western Power	Kalbarri	5MW/4.5MWh
QLD	Bohle Plains	Ergon Energy	Bohle Plains	4MW/8MWh
NT	Darwin LNG Gas Generator Support Battery	Darwin LNG consortia	Wickham	4MW/2MWh
QLD	Kennedy Energy Park	Windlab	Hughenden	2MW/4MWh
WA	Garden Island PV-Battery Microgrid	Department of Defence	Garden Island	2MW/0.5MWh
WA	GMA Garnet Port Gregory Wind-Solar Hybrid	Advanced Energy Resources	Yallabathara	2MW/0.5MWh
NSW	Lord Howe Island Microgrid	Lord Howe Island Board	Lord Howe Island	3.2MWh
VIC	Mallacoota Area Grid Storage	Ausnet	Mallacoota	1MWh
WA	Onslow Microgrid	Horizon Power	Onslow	1MWh

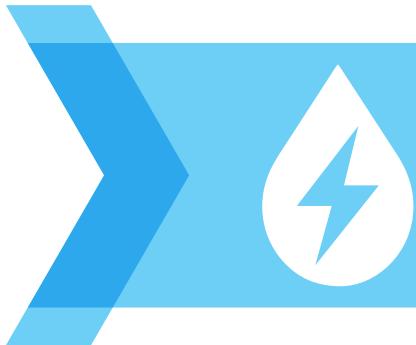
\* hours not disclosed



<sup>75</sup> Green Energy Markets

Image: Lake Bonney Battery Energy Storage System, South Australia

# HYDRO AND PUMPED HYDRO



The ongoing drought resulted in hydro making its lowest ever contribution to Australia's renewable energy generation. However, the huge growth of wind and solar also played a significant role in hydro losing its crown.

## 5000

jobs to be created during the lifetime of Snowy 2.0

## 26 km

of tunnels to be dug for Snowy 2.0

## 1500 MW

proposed capacity of the Marinus Link cable between Tasmania and the mainland

Exploratory work on Snowy 2.0 began in 2019, with geological studies underway to gain an understanding of the rock that more than 26 km of tunnels will have to pass through. The massive 2000 MW/350,000 MWh project is expected to create 5000 renewable energy jobs during its lifetime and firm up significant quantities of wind and solar, helping to increase clean energy investment while lowering emissions. However, the project also has its fair share of critics, who argue that its cost, environmental impact and effect on competition will outweigh the project's considerable benefits.<sup>76</sup>

Tasmania's Battery of the Nation project received some good news in December 2019, with TasNetworks finding that the Marinus Link connecting Tasmania with the mainland would be feasible at 1500 MW. This was important to the 2500 MW Battery of the Nation project as its business case depends on Tasmania being able to export excess hydro power to Victoria. While Marinus Link isn't expected to begin operation until 2027, this is an important first step in unlocking Tasmania's enormous renewable energy potential.

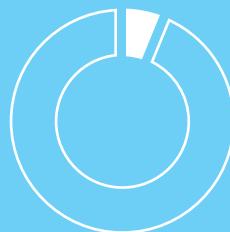
Genex Power's \$700 million Kidston pumped hydro project is back on

track after an unexpected decision by EnergyAustralia to pull out of an off-take agreement in November 2019. The aborted off-take agreement put crucial funding from the Northern Australia Infrastructure Facility (NAIF) in jeopardy, but Genex was able to extend its deadline with the NAIF until June 2020, which should give it enough time to secure a replacement off-take agreement so that it can continue with the 250 MW project.<sup>77</sup>

Queensland will make better use of its hydro generators after government-owned clean energy generator CleanCo took over the assets in October 2019. CleanCo controls trading at the Wivenhoe pumped hydro storage plant, the Swanbank E gas generator and three hydro plants in northern Queensland. The new generator is expected to increase competition in the state's energy market, lower electricity prices and ensure that Queensland gets the most out of its renewable energy resources. CleanCo is also responsible for the Queensland Government's Renewables 400 procurement program, which is tasked with delivering up to 400 MW of new renewable energy and storage projects in Queensland.



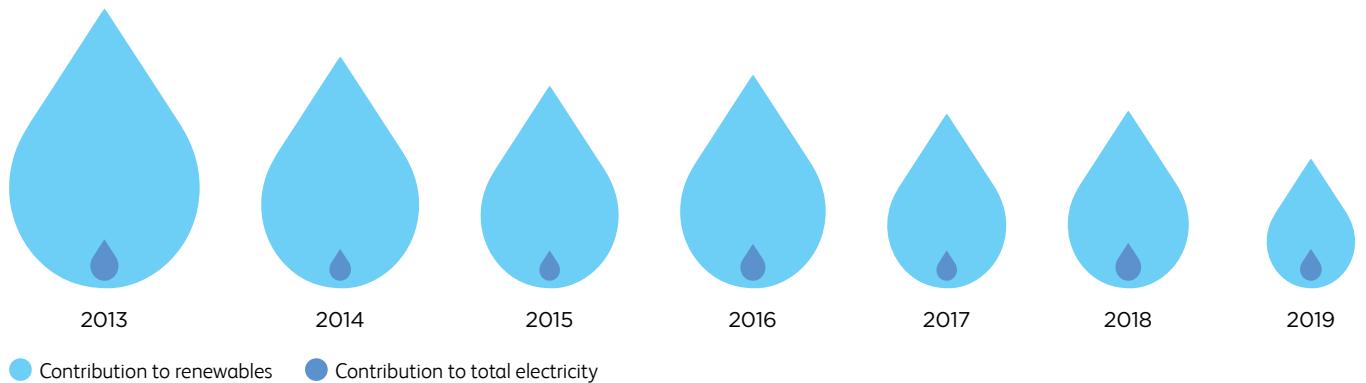
**25.7%**  
of total clean energy  
generated in Australia  
in 2019



**6.2%**  
of total Australian  
electricity generated  
in 2019

## HYDRO POWER'S CONTRIBUTION TO AUSTRALIAN ELECTRICITY GENERATION<sup>78</sup>

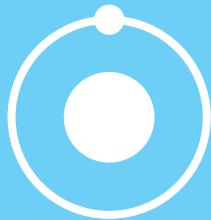
YEAR	GENERATION (GWh)	CONTRIBUTION TO RENEWABLES	CONTRIBUTION TO TOTAL ELECTRICITY
2013	19,243	55.4%	8.2%
2014	14,555	45.9%	6.2%
2015	14,046	40.1%	5.9%
2016	17,747	42.3%	7.3%
2017	13,331	34.6%	5.9%
2018	17,002	35.2%	7.5%
2019	14,166	25.7%	6.2%



<sup>76</sup> Snowy Hydro, *Snowy 2.0 - project update*, May 2019, [snowyhydro.com.au/wp-content/uploads/2019/05/SH1387\\_SQUARE-BOOKLET-Snowy-2-Project-Update\\_MAY-2019\\_v6\\_lowres\\_spread.pdf](http://snowyhydro.com.au/wp-content/uploads/2019/05/SH1387_SQUARE-BOOKLET-Snowy-2-Project-Update_MAY-2019_v6_lowres_spread.pdf)

<sup>77</sup> S Vorrath, Renew Economy, *Genex gets loan reprieve for Kidston pumped hydro project*, 13 November 2019, [reneweconomy.com.au/genex-gets-loan-reprieve-for-kidston-pumped-hydro-project-63393/](http://reneweconomy.com.au/genex-gets-loan-reprieve-for-kidston-pumped-hydro-project-63393/)

<sup>78</sup> Green Energy Markets



Significant R&D investment from the states and follow through on the National Hydrogen Strategy could see hydrogen become Australia's next energy export champion.

The COAG Energy Council launched the National Hydrogen Strategy in November 2019 as part of a commitment to energy security, reliability and affordability for all Australians. The strategy maps Australia's path to be an industry leader by 2030 by developing a clean, innovative, competitive and safe hydrogen industry for both domestic and export use. Under the strategy, large-scale domestic clusters of hydrogen-powered suburbs – hydrogen hubs – will help develop the skills and secure the investment to develop a globally competitive hydrogen export industry that could be worth up to \$26 billion a year by 2050.<sup>79</sup>

South Australia and Western Australia have both created their own hydrogen strategies and plans as part of their

renewable and emissions reduction targets. SA's abundant wind and solar resources mean the state is well positioned to embrace the opportunity presented by the use and export of 100 per cent renewable hydrogen. Renewable hydrogen is becoming increasingly cost competitive as new technologies emerge, with researchers from UNSW demonstrating in December a cheaper and more sustainable way to create hydrogen using low-cost metals as catalysts.<sup>80</sup>

While WA remains the only state without a renewable energy target, it did introduce a \$10 million Renewable Hydrogen Fund in 2019. The fund will kickstart hydrogen production as an export industry and finance projects in regional areas that mix hydrogen with gas or use it as a transport fuel.<sup>81</sup>

**\$26 B**

potential value  
of Australia's  
hydrogen export  
industry by 2050

<sup>79</sup> COAG Energy Council, *Australia's National Hydrogen Strategy*, 22 November 2019, [industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf](http://industry.gov.au/sites/default/files/2019-11/australias-national-hydrogen-strategy.pdf)

<sup>80</sup> UNSW Sydney, *Scientists find cheaper way to make hydrogen energy out of water*, 11 December 2019, [newsroom.unsw.edu.au/news/science-tech/scientists-find-cheaper-way-make-hydrogen-energy-out-water](http://newsroom.unsw.edu.au/news/science-tech/scientists-find-cheaper-way-make-hydrogen-energy-out-water)

<sup>81</sup> WA Department of Primary Industries and Regional Development, *Renewable Hydrogen Fund*, [drd.wa.gov.au/projects/EnergyFutures/Pages/Renewable-Hydrogen-Fund.aspx](http://drd.wa.gov.au/projects/EnergyFutures/Pages/Renewable-Hydrogen-Fund.aspx)





Despite Australia's position as a world leader in rooftop solar, the industry is showing no signs of slowing down. In another record year for rooftop solar, 2019 saw 2.2 GW of new capacity installed across Australia.

# 287,504

rooftop solar installations  
in 2019

# 7.62 kW

average system size

# 13,942

rooftop solar installations  
in Bundaberg, Queensland

There were 287,504 rooftop solar installations in 2019, which was the most installs since 2012 and the third-highest number ever. However, the continued growth in average system size, which again increased to 7.62 kW in 2019, meant that the industry's 2.2 GW of installed capacity was more than 35 per cent higher than last year's record.

Queensland again led the way, with four of the top five solar postcodes in Australia located in the sunshine state. Bundaberg retained its status as Australia's undisputed champion of solar with 13,942 installations providing 57,083 kW of clean energy capacity.

The positive impact that rooftop solar is having on the grid became increasingly apparent in 2019. On 17 December 2019, Australia experienced its hottest ever day, placing significant demand on the electricity system. Rooftop solar played a key role in taking the pressure off the grid, accounting for 30 per cent of demand in the middle of the day in South Australia and 17 per cent in Victoria. This helped to keep wholesale prices to a manageable \$300 per megawatt hour, far lower than the upper

threshold of \$14,700 per megawatt hour that they were forecast to reach earlier in the day.<sup>82</sup>

Despite the rooftop solar sector now boasting more than 10 GW of capacity, research by the Clean Energy Finance Corporation and Property Council of Australia found that this is just a drop in the ocean. The research estimated that Australia's total rooftop solar potential is 179 GW with an annual output of 245 TWh, which is more than Australia's current annual demand. Around half of the solar potential lies in residential zones, followed by primary and rural production zones (34 GW) and commercial and industrial zones (26 GW).<sup>83</sup>

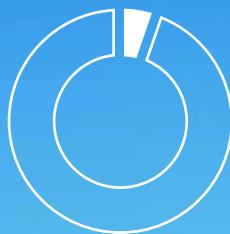
The Clean Energy Council's Approved Solar Retailer program grew from strength to strength in 2019, increasing to 686 companies at the end of 2019 following several government programs requiring companies to sign up to participate. The strong growth in the rooftop solar sector was mirrored in the number of Clean Energy Council accredited installers, which reached 6566, an increase of almost 12 per cent.

<sup>82</sup> G Parkinson, Renew Economy, *Rooftop solar takes the heat off ageing fossil fuel generators*, 18 December 2019, reneweconomy.com.au/rooftop-solar-takes-the-heat-off-ageing-fossil-fuel-generators-88782/

<sup>83</sup> M Maisch, PV Magazine, *Australia could install 179 GW of rooftop solar*, 13 June 2019, pv-magazine-australia.com/2019/06/13/australia-could-install-179-gw-of-rooftop-solar/



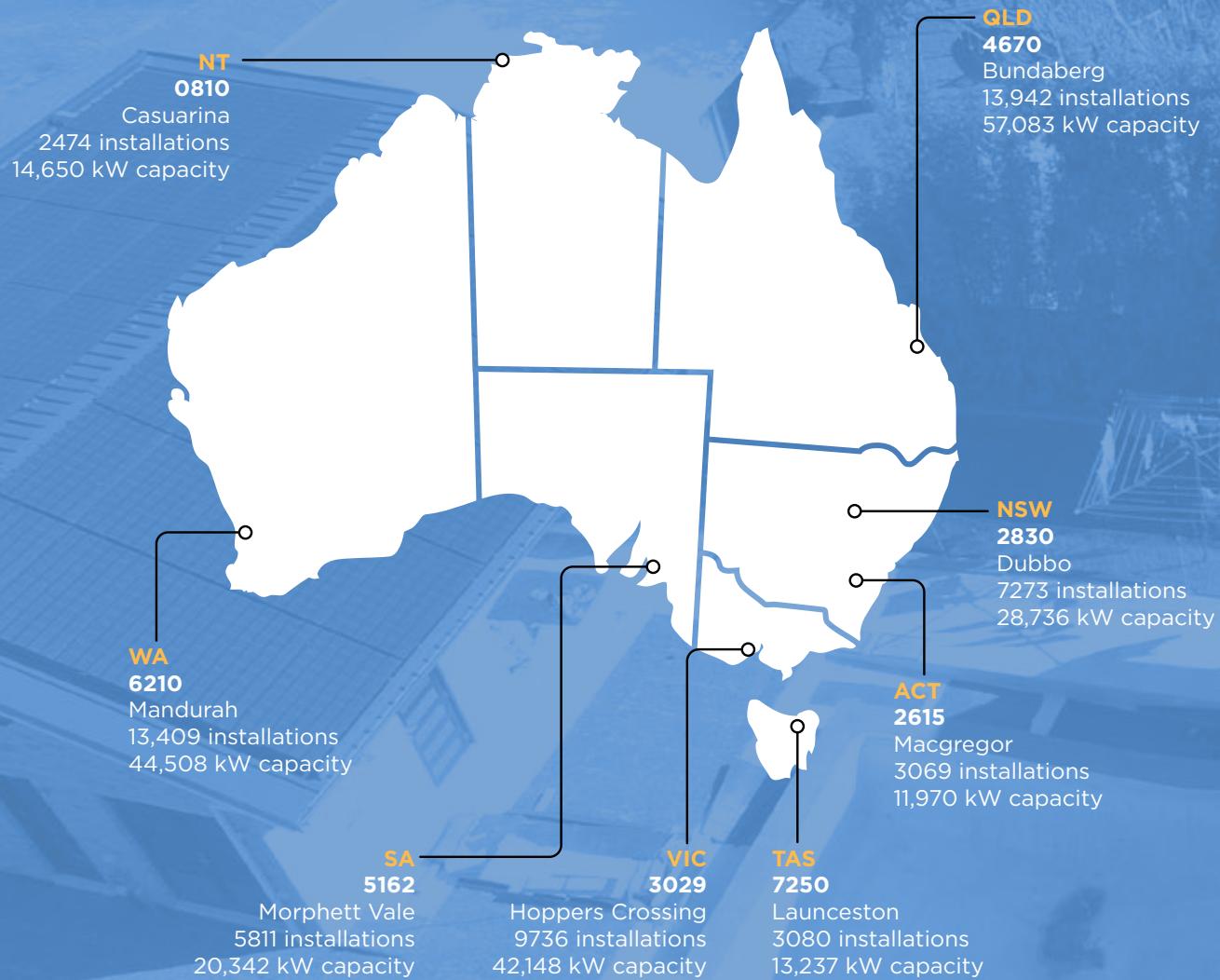
**22.3%**  
of total clean energy  
generated in Australia  
in 2019



**5.3%**  
of total Australian  
electricity generated  
in 2019



Image: Rooftop solar installation, Victoria

**TOP SOLAR POSTCODE IN EACH STATE BY NUMBER OF INSTALLATIONS<sup>84</sup>**

84 Clean Energy Regulator, Green Energy Markets

## TOP TEN SOLAR POSTCODES IN AUSTRALIA BY NUMBER OF INSTALLATIONS<sup>84</sup>

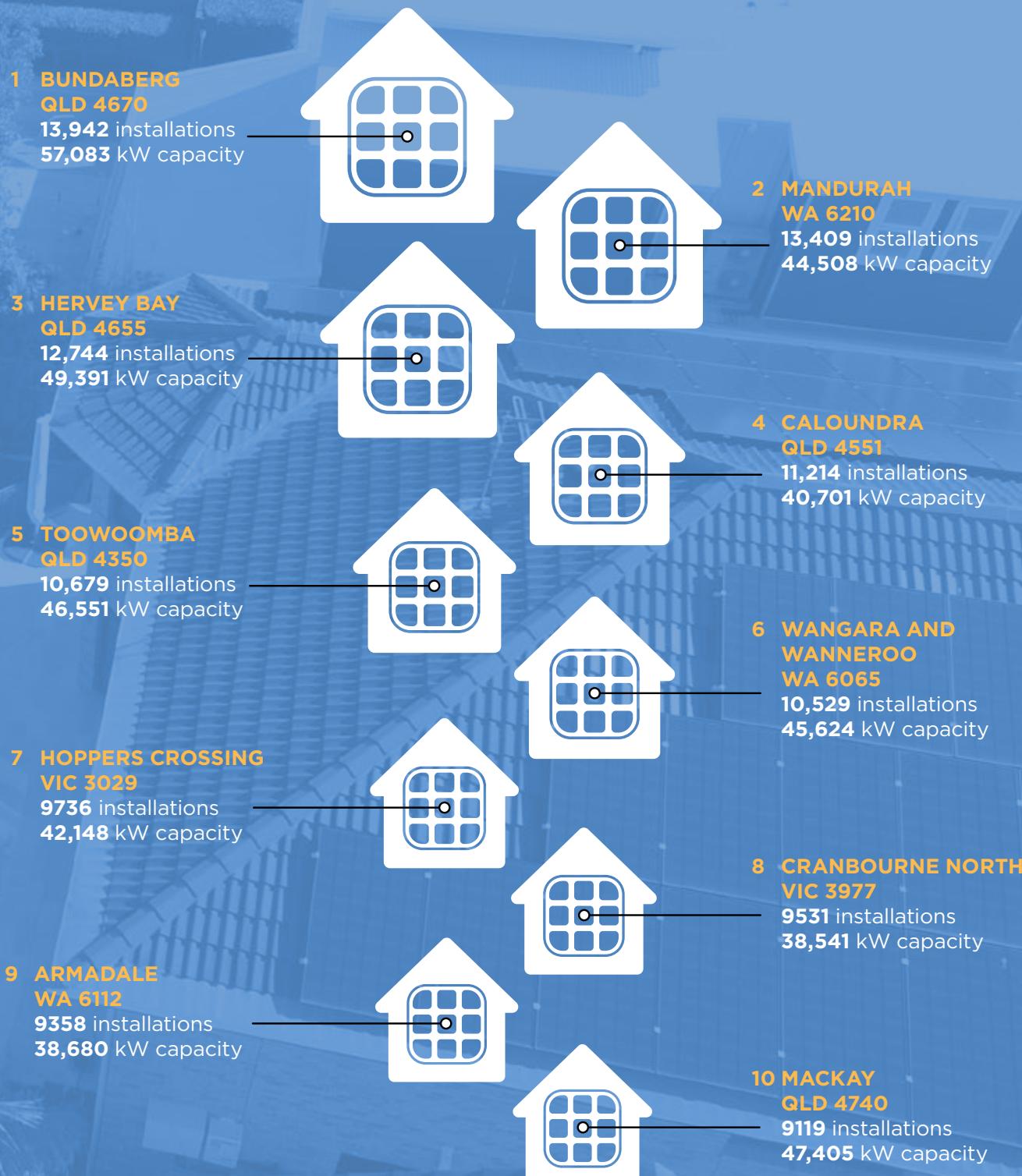
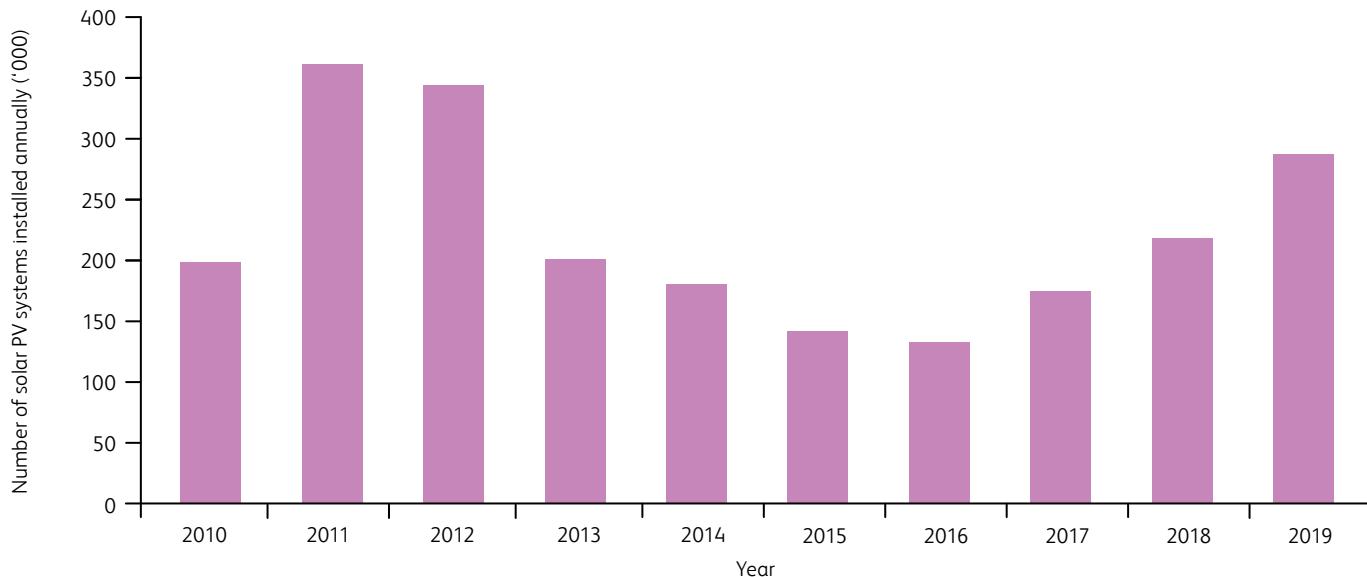


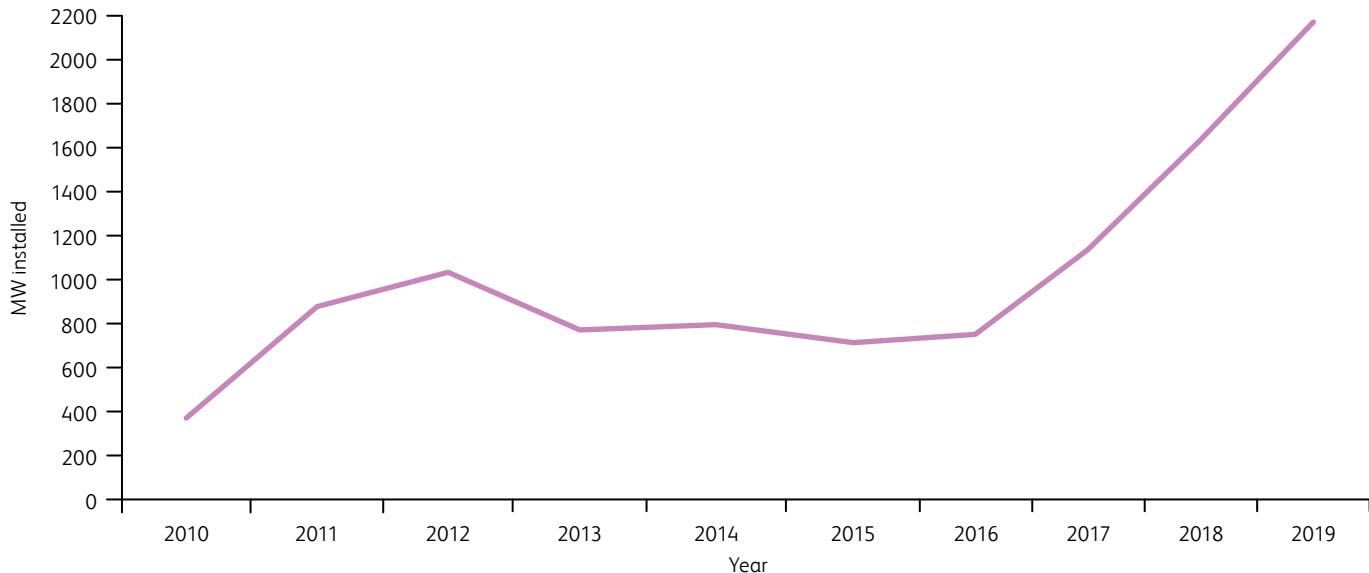
Image: Rooftop solar installation, New South Wales

**ANNUAL SOLAR PV INSTALLATIONS<sup>85</sup>**

INSTALLATION YEAR	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NATIONAL
2010	2323	69,988	637	48,697	16,705	1889	35,676	22,293	198,208
2011	6860	80,272	401	95,303	63,553	2475	60,214	51,667	360,745
2012	1522	53,961	513	130,252	41,851	6364	66,204	42,653	343,320
2013	2411	33,998	1024	71,197	29,187	7658	33,332	21,600	200,407
2014	1225	37,210	1026	57,748	15,166	4207	40,061	23,496	180,139
2015	1066	33,477	1197	39,507	12,081	2020	31,354	20,797	141,499
2016	1001	29,496	1745	34,422	12,604	2487	26,740	24,199	132,694
2017	1946	43,237	1950	46,448	16,190	2393	31,358	31,404	174,926
2018	3201	59,299	2365	55,056	21,889	2640	47,197	33,094	224,741
2019*	3610	78,931	3329	73,726	27,170	2980	59,610	38,149	287,504
TOTAL	26,313	538,457	14,620	675,317	270,945	36,795	443,777	323,063	2,329,286

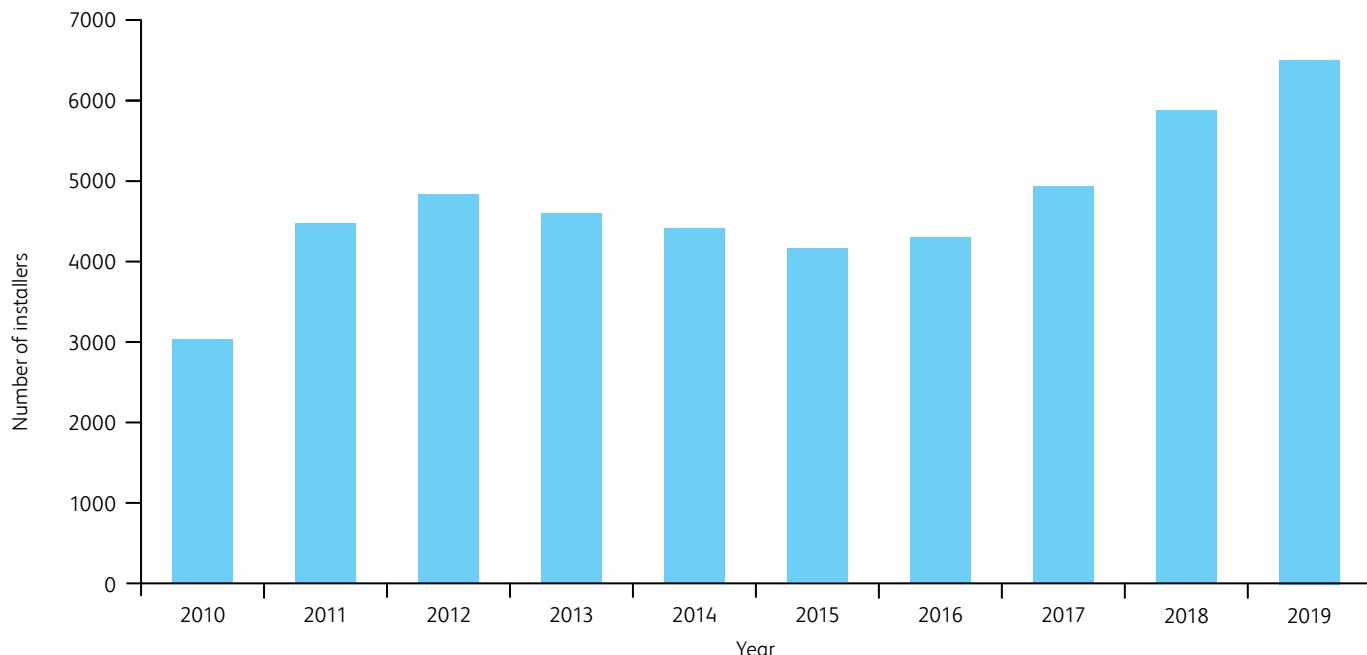
\* 2019 numbers are based on STC creation up to December 31 and then adjusted for lags in audit invalidation and then upwards based on historical patterns that 9.5% of installations only manage to create STCs in the subsequent year.

## ANNUAL INSTALLED CAPACITY OF SOLAR PV (MW)<sup>86</sup>



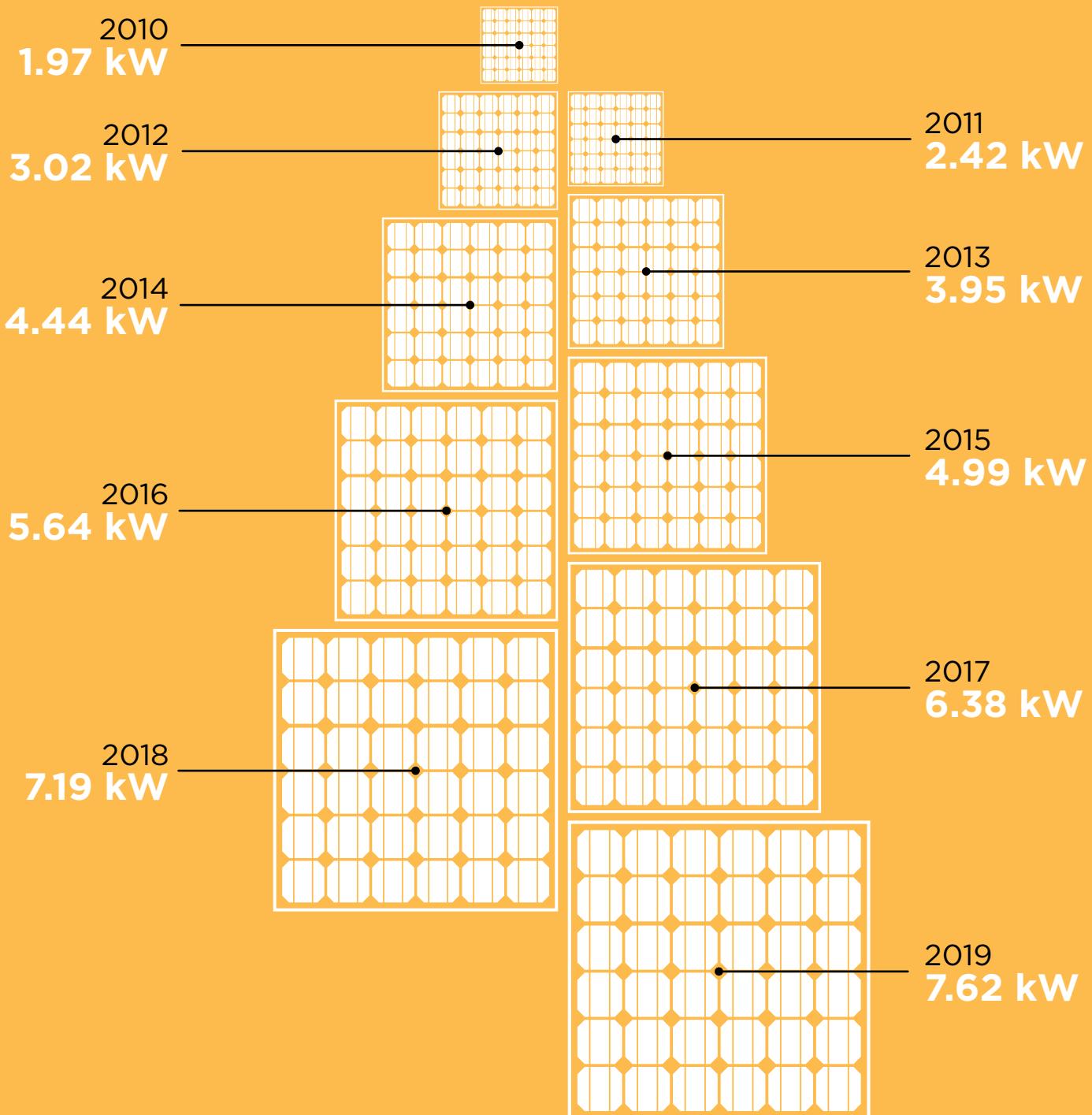
INSTALLATION YEAR	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	NATIONAL
2010	4.66	153.87	1.49	92.37	33.23	3.02	58.96	42.15	389.75
2011	15.86	196.52	1.80	225.19	163.52	5.91	140.41	123.01	872.24
2012	4.64	144.98	2.29	418.41	138.04	20.26	207.58	99.55	1035.75
2013	9.83	134.36	5.05	268.87	141.40	31.50	131.61	69.56	792.19
2014	4.51	172.35	6.12	248.79	82.54	18.96	171.70	95.30	800.26
2015	5.06	177.08	8.64	192.76	66.64	9.53	149.98	96.24	705.92
2016	6.21	167.35	12.70	199.53	77.67	11.84	144.46	128.05	747.82
2017	11.00	262.85	15.26	306.06	115.22	14.53	205.20	186.24	1116.37
2018	21.90	426.25	20.06	407.18	174.36	18.87	337.42	210.00	1616.03
2019	28.31	597.35	27.40	587.59	226.22	21.03	449.22	253.68	2190.81
TOTAL	113.60	2456.53	101.73	2975.42	1236.17	157.41	2009.80	1320.99	10,371.66

\* 2019 numbers are based on STC creation up to December 31 and then adjusted for lags in audit invalidation and then upwards based on historical patterns that 9.9% of capacity create STCs in the subsequent year to installation.

**TOTAL NUMBER OF ACCREDITED INSTALLERS AND DESIGNERS**

YEAR	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Intl	TOTAL
2010	46	879	16	675	252	45	754	414	3	3084
2011	53	1034	22	1187	593	71	1004	531	2	4497
2012	48	948	28	1391	650	120	1122	514	3	4824
2013	44	894	41	1336	604	144	1093	439	6	4601
2014	44	908	47	1263	521	137	1075	401	8	4404
2015	44	916	51	1151	490	109	998	384	7	4150
2016	56	951	70	1188	500	101	974	465	7	4312
2017	66	1085	72	1354	552	112	1059	612	7	4919
2018	91	1323	81	1571	653	112	1316	712	5	5864
2019	103	1539	86	1797	694	116	1510	716	5	6566

## NATIONAL AVERAGE SYSTEM SIZE (kW)<sup>87</sup>



<sup>87</sup> Clean Energy Regulator, Green Energy Markets



2019 was a record year for the medium-scale solar sector, with more than 162 MW of new capacity added throughout the year.

Medium-scale solar's impact on the Australian renewable energy industry continues to grow, with the sector responsible for 1.3 per cent of Australia's total renewable generation in 2019. And its influence is only expected to increase in the coming years as more businesses, schools and governments recognise the significant cost and emissions reductions benefits of solar.

Innovative installations continued to shine a spotlight on medium-scale solar in 2019. In Queensland, Autonomous Energy installed a 1 MW solar carpark shading at Maroochydore's Sunshine Plaza shopping centre. This is just the latest example of a solar carpark

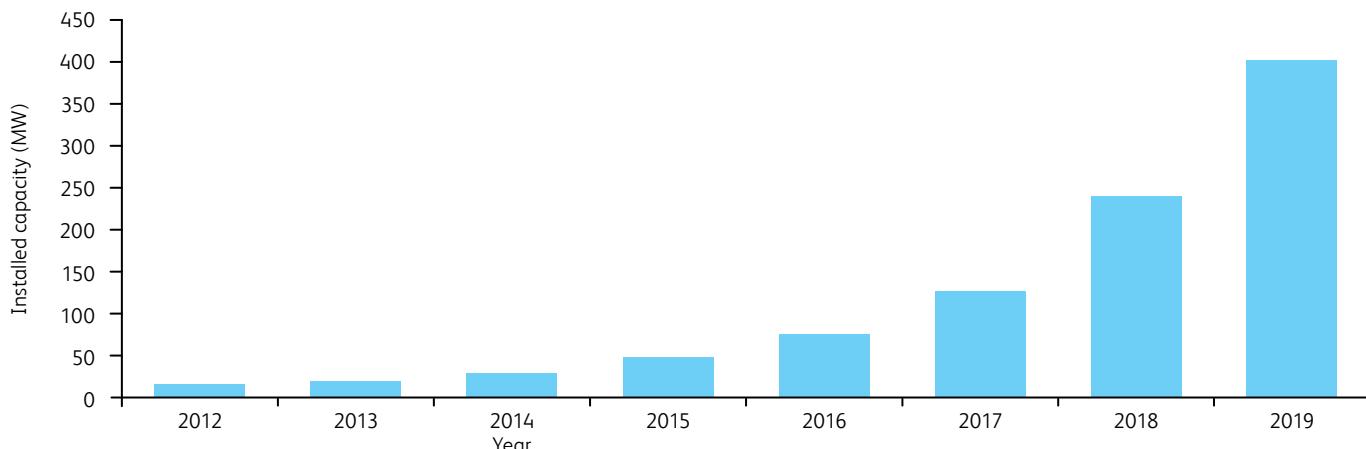
shading system that serves the dual purpose of shading cars from Queensland's abundant sunshine while generating significant amounts of clean energy for a local business.

Versatility is the name of the game for the 1.7 MW urban solar farm under construction at Epho's Bright Thinkers Power Station in western Sydney's growing logistics hub at Horsley Park. The solar array will be installed on the roof of a 31,457 sqm new warehouse at Goodman's Oakdale Industrial Estate, and will have the ability to switch from providing behind-the-meter electricity to tenants to acting as an independent, market registered

power station supplying power to the grid. The project, which is backed by the Australian Renewable Energy Agency, has the potential to unlock "tens of gigawatts" of solar potential.<sup>88</sup>

South Australia will be home to one of Australia's largest rooftop solar arrays, with a 2.34 MW system under construction at the end of 2019 on the roof of the Main Assembly Building at the Tonsley Innovation District. Powering tenants such as Sanjeev Gupta's SIMEC Energy Australia and Tesla, the solar system could be expanded to as much as 6 MW in the future and include extensive battery storage.<sup>89</sup>

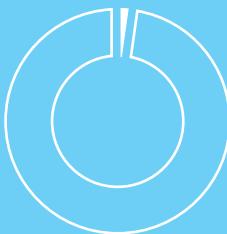
## CUMULATIVE INSTALLED CAPACITY (MW)<sup>90</sup>



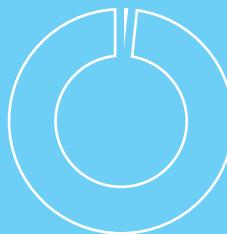
<sup>88</sup> S Vorrath, *One Step Off the Grid, New rooftop solar "urban power stations" to play both sides of the meter*, 4 December 2019, [onestepoffthegrid.com.au/new-rooftop-solar-urban-power-stations-to-play-both-sides-of-the-meter/](http://onestepoffthegrid.com.au/new-rooftop-solar-urban-power-stations-to-play-both-sides-of-the-meter/)

<sup>89</sup> Tonsley, *ZEN signs solar panel contract for Tonsley energy scheme*, 4 July 2019, [tonsley.com.au/news/zen-signs-solar-panel-contract-for-tonsley-energy-scheme/](http://tonsley.com.au/news/zen-signs-solar-panel-contract-for-tonsley-energy-scheme/)

<sup>90</sup> Clean Energy Regulator, Green Energy Markets



**1.3%**  
of total clean energy  
generated in Australia  
in 2019



**0.3%**  
of total Australian  
electricity generated  
in 2019



Image: Australia Zoo, Queensland

### CASE STUDY FROM CROCS TO KILOWATTS: AUSTRALIA ZOO'S AWARD-WINNING SOLAR ON SHOW

Heating crocodile pools doesn't come cheap. But Australia Zoo's solar installation project overcame challenging network and logistic hurdles to deliver 30 per cent of the zoo's electricity needs.

With 700,000 visitors annually and crocodile pools to keep heated all year round, electricity is one of Australia Zoo's biggest expenses. Looking for a sustainable way to offset the cost and its emissions footprint, the zoo considered installing a 99 kW solar system. But GEM Energy responded with a new idea – a much larger system built for long-term sustainability.

The 638 kW installation includes 1800 panels and earned Christopher Hackett and Dimitar Liev from GEM Energy a 2019 Clean Energy Council Solar Design and Installation Award in the Over 240 kW category. The project is expected to reduce the zoo's

emissions by 16,500 tonnes over 25 years.

Big changes can have their teething problems (pun intended). The network provider was concerned that the grid connection – crucial to ensuring the solar energy created could offset power use from the grid – would decrease power quality for the existing local network. It recommended reducing the project to 70 kW of AC capacity with zero import, which was far too small for Australia Zoo's energy needs.

Through research, data analysis and artful engineering solutions, GEM Energy and Australia Zoo proved that the network provider's power quality concerns were unfounded, allowing the project to proceed as planned.

Alongside worker safety, minimising disruption for animals and visitors was a top priority. Day to day, that meant

staying noise-free during midday croc shows and only working during daylight hours so animals could get their beauty sleep.

Highly visible on the cafeteria and Crocoseum roofs, the zoo was concerned the panels would distract from the main crocodile show. The team sourced materials designed to reduce glare and reflection so the solar didn't outshine the real stars of the show.

Now a benchmark for large-scale solar installation projects, the project provides opportunities for students to get hands-on with the system's monitoring and reporting equipment for an inside look at how the system works.

Solar installations at high-profile sites like this show Australian and international visitors what's possible with a commitment to clean energy.



After announcing its arrival in 2018 as a serious player in the Australian renewable energy sector, large-scale solar continued its upward trajectory in 2019. More than two-thirds of the new large-scale projects commissioned in 2019 were solar.

# 27

large-scale solar projects completed in 2019

# 1416 MW

new capacity added by these projects

# 2.8 GW

total large-scale solar capacity in Australia

# 150 MW

installed capacity at Edify Energy's Daydream Solar Farm in North Queensland

The large-scale solar industry continued its momentum in 2019, with 27 new projects adding 1416 MW of new capacity. This almost doubled the industry's total capacity in Australia, which is now over 2.8 GW, and its contribution to Australia's renewable energy generation increased from 3.9 per cent in 2018 to 9.3 per cent in 2019.

Queensland was home to the year's biggest solar project – Edify Energy's Daydream Solar Farm. Located near Collinsville in North Queensland, the solar farm has an installed capacity of 150 MW and created 200 jobs in the region. Another significant project was the 133 MW Finley Solar Farm in New South Wales, which began to output electricity to the grid in August 2019. The solar farm has a seven-year power purchase agreement with Bluescope Steel.

The Queensland solar industry faced significant challenges in 2019, when the state government introduced legislation making it compulsory for licensed electricians to install solar panels. This would

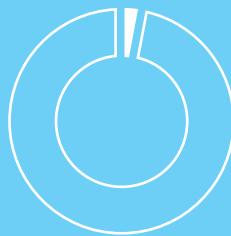
have increased the costs of constructing large-scale solar farms in Queensland and delayed projects due to a severe shortage of qualified electricians. After several court challenges and appeals, the legislation was repealed, allowing Queensland to maintain its position as Australia's large-scale solar leader.

In what would be a massive boost to the Australian large-scale solar industry, planning is underway on the world's biggest solar farm outside Tennant Creek in the NT. The \$20 billion Sun Cable project would involve a 10 GW solar array spread over 15,000 hectares of central Australian desert, supported by a 22 GWh battery to guarantee always-on power. The power generated by the solar farm will be exported to Singapore via a 3800 km undersea cable. While the project is still only in the earliest planning phase, with high-profile investors such as tech billionaire Mike Cannon-Brookes and mining magnate Andrew Forrest it will be one to watch over the next few years.<sup>91</sup>

<sup>91</sup> M Mazengarb & G Parkinson, *Renew Economy*, Some 'crazy folks' behind Mike Cannon-Brookes \$20B Sun Cable project, 10 December 2019, [reneweconomy.com.au/some-crazy-folks-behind-mike-cannon-brookes-20b-sun-cable-project-22944/](http://reneweconomy.com.au/some-crazy-folks-behind-mike-cannon-brookes-20b-sun-cable-project-22944/)



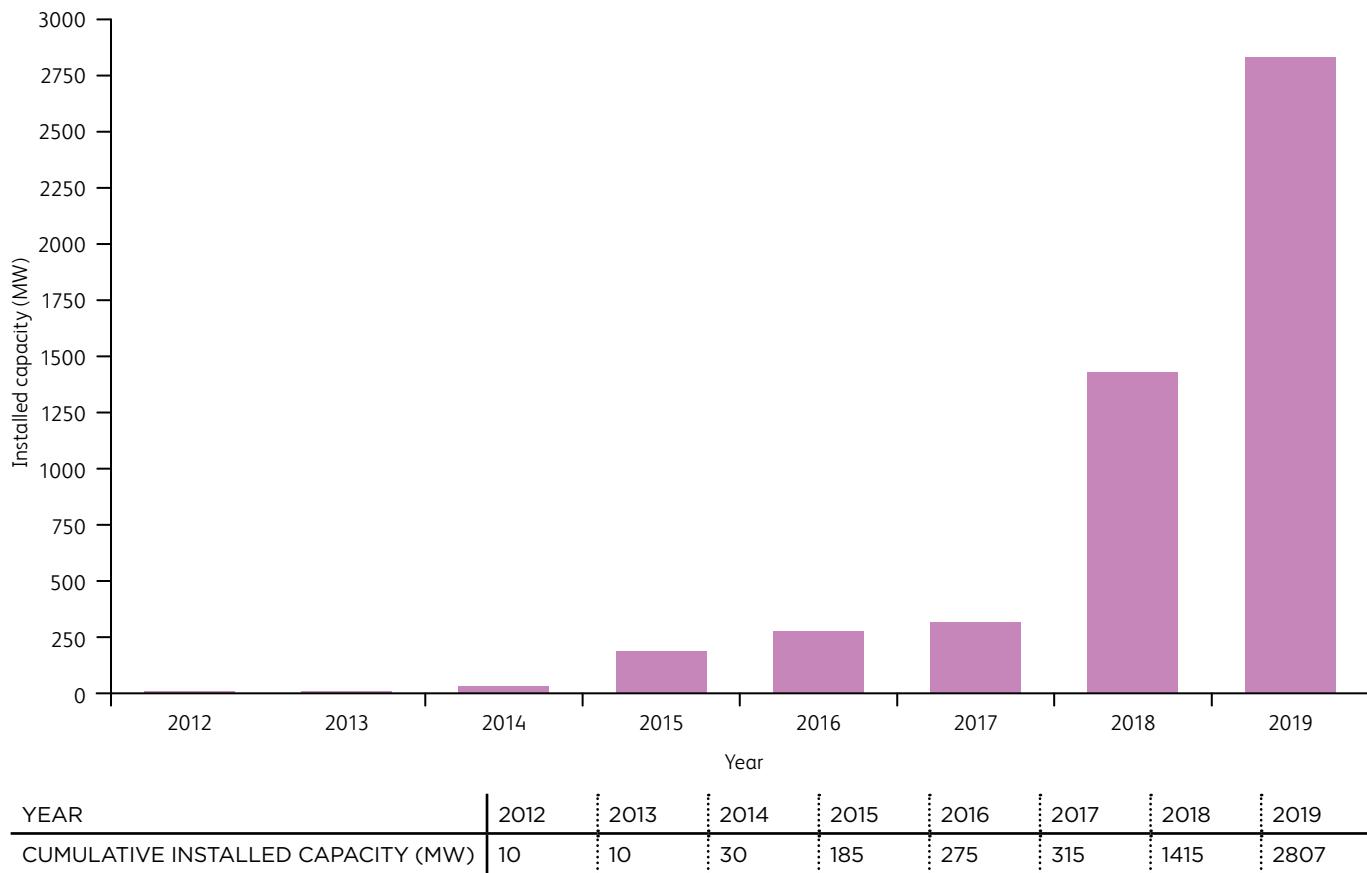
**9.3%**  
of total clean energy  
generated in Australia  
in 2019



**2.2%**  
of total Australian  
electricity generated  
in 2019

## LARGE-SCALE SOLAR PLANTS COMMISSIONED IN 2019<sup>92</sup>

PROJECT	OWNER	STATE	CAPACITY
Daydream Solar Farm	Edify Energy	QLD	150
Finley Solar Farm	John Laing	NSW	133
Ross River Solar Farm	Palisade Investment Partners	QLD	116
Darling Downs Solar Farm	APA Group	QLD	110
Numurkah Solar Farm	Neoen	VIC	100
Lilyvale Solar Farm	Lilyvale Asset Co	QLD	100
Haughton Solar Farm	Pacific Hydro	QLD	100
Tailem Bend Solar Farm	Arcadia Energy Trading	SA	95
Karadoc Solar Farm	BayWa r.e.	VIC	90
Beryl Solar Farm	New Energy Solar	NSW	87
Clermont Solar Farm	Clermont Asset Co	QLD	75
Rugby Run Solar Farm - Stage 1	Adani	QLD	65
Hayman Solar Farm	Edify Energy	QLD	50
Oakey Solar Farm - Stage 1	Diamond Energy	QLD	25
Chinchilla Solar Farm (Baking Board)	Chinchilla Solar	QLD	20
White Rock Solar Farm	ARENA	NSW	20
Badgingarra Renewable Facility	APA Group	WA	17.5
Northam Solar Farm	Bookitja/IBA Northam Solar	WA	10
Girgarre Solar Project	Diamond Energy	VIC	8
Waurn Ponds Microgrid Project	Deakin University/AusNet Services	VIC	7.3
Granny Smith Mine Hybrid Power Station	Aggreko	WA	7.3
Pirie Solar Farm	Pirie Solar Farm	SA	5
Mobilong Solar Farm	Terregra Renewables	SA	5
Kanowna Solar Farm	Meralli Solar	NSW	5
Summerhill Solar Farm	City of Newcastle	NSW	5
Mannum Solar Farm - Stage 1	Canadian Solar	SA	5
Bullarah Solar Farm	Kanowna Solar	NSW	5

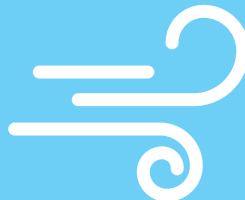
**CUMULATIVE INSTALLED CAPACITY (MW)<sup>93</sup>****TOP FIVE PLANTS BY SIZE**

<b>COLEAMBALLY, NSW</b>	<b>DAYDREAM, QLD</b>	<b>FINLEY, QLD</b>	<b>TOWNSVILLE, QLD</b>	<b>ROSS RIVER, QLD</b>
Owner: Neoen	Owner: Edify Energy	Owner: John Laing	Owner: Sun Metals	Owner: Elliott Green Power
Commissioned: 2018	Commissioned: 2019	Commissioned: 2019	Commissioned: 2018	Commissioned: 2019
<b>150 MW</b>	<b>150 MW</b>	<b>133 MW</b>	<b>124.4 MW</b>	<b>116 MW</b>

<sup>93</sup> Green Energy Markets, Clean Energy Council database



Image: Numurkah Solar Farm, Victoria



Wind had its best year yet in 2019, and in the process took over the mantle as Australia's clean energy leader, accounting for more than 35 per cent of renewable energy generation.

8

new wind farms  
commissioned in 2019

837 MW

of new wind capacity  
installed in 2019

The 837 MW of new wind capacity installed in 2019 was a new record for the wind sector, which continues to lead Australia's renewable energy transition. Of the eight new wind farms commissioned in 2019, the largest was AGL's 200 MW Silverton Wind Farm in north-western NSW. Other notable projects completed in 2019 include the 180 MW Mount Emerald Wind Farm in Queensland and APA Group's 130 MW wind farm that is part of the Badgingarra Renewable Facility.

At the end of 2019, 30 wind farms with a combined capacity of more than 5.5 GW were under construction or financially committed nationally. Construction was still underway on the Stockyard Hill Wind Farm in Victoria at the end of 2019, which at 536 MW will be Australia's largest wind farm. It is expected that this project will begin providing electricity to the grid in early 2020.

In 2019, the Australian Energy Regulator (AER) launched legal action against four wind farms caught up in the 2016 statewide

blackout in South Australia. The legal action caught the industry off guard as a previous AER investigation into the incident had found a high level of compliance by market participants under the extreme circumstances caused by the once-in-50-year storm. The industry will be watching the outcome of the AER's legal action carefully in the hope that it doesn't create a dangerous precedent for renewables.

The Star of the South offshore wind farm will further boost the wind sector's credentials, with feasibility studies underway to assess the viability of the wind farm off Port Albert near the Gippsland region of Victoria. With projections that the project will feed 2200 MW of clean energy into the grid, the project will require the installation of an undersea cable to link the wind farm to existing transmission infrastructure in the nearby Latrobe Valley, Victoria's coal power generation hub. The 200 wind turbines planned would generate up to one-and-a-half times the energy of the now-closed Hazelwood coal-fired power station.<sup>94</sup>

## TOP FIVE PLANTS BY SIZE

### MACARTHUR, VIC

Owner: HRL Morrison and Malakoff Corporation  
Commissioned: 2012

420 MW

### SNOWTOWN 2, SA

Owner: Tilt Renewables  
Commissioned: 2014

270 MW

### SAPPHIRE, NSW

Owner: Partners Group and CWP Renewables  
Commissioned: 2018

270 MW

### ARARAT, VIC

Owner: RES  
Commissioned: 2017

240 MW

### COLLGAR, WA

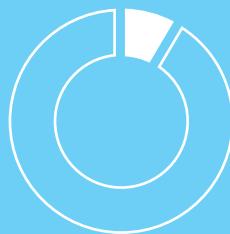
Owner: UBS IIF/REST  
Commissioned: 2012

206 MW

<sup>94</sup> M Mazengarb, *Renew Economy, Australia's first offshore wind project moves forward with labour market study*, 8 July 2019, [reneweconomy.com.au/australias-first-offshore-wind-project-moves-forward-with-labour-market-study-33139/](http://reneweconomy.com.au/australias-first-offshore-wind-project-moves-forward-with-labour-market-study-33139/)



**35.4%**  
of total clean energy  
generated in Australia  
in 2019



**8.5%**  
of total Australian  
electricity generated  
in 2019

## WIND FARMS COMMISSIONED IN 2019<sup>95</sup>

PROJECT	OWNER	STATE	CAPACITY (MW)
Silverton Wind Farm	Powering Australian Renewables Fund	NSW	200
Mount Emerald Wind Farm	RATCH	QLD	180
Badgingarra Renewable Facility	APA Group	WA	130
Willogoleche Wind Farm	Engie	SA	119
Bodangora Wind Farm	Infigen Energy	NSW	113
Crowlands Wind Farm	Pacific Hydro	VIC	80
Timboon West Wind Farm	BayWa r.e.	VIC	7.2
Yawong Wind Farm	BayWa r.e.	VIC	7.2

<sup>95</sup> Green Energy Markets, Clean Energy Council database

Image: Hallett Wind Farm, South Australia

PERCENTAGE OF WIND GENERATION BY STATE<sup>96</sup>

●  
SA  
**29.2%**  
5683 GWh

●  
VIC  
**27.8%**  
5408 GWh

●  
NSW  
**22.6%**  
4399 GWh

●  
WA  
**11.0%**  
2136 GWh

●  
TAS  
**6.3%**  
1237 GWh

●  
QLD  
**3.2%**  
625 GWh

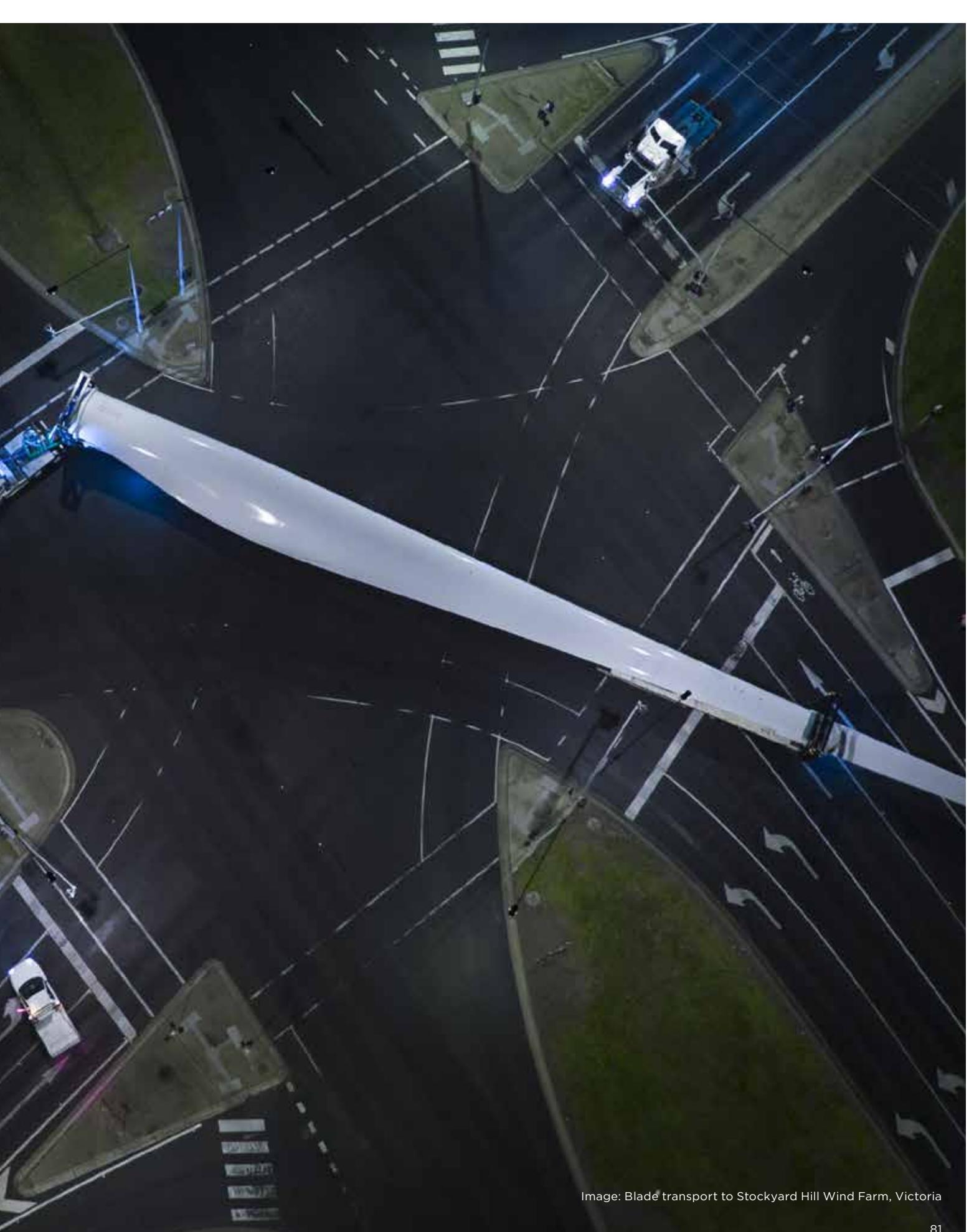
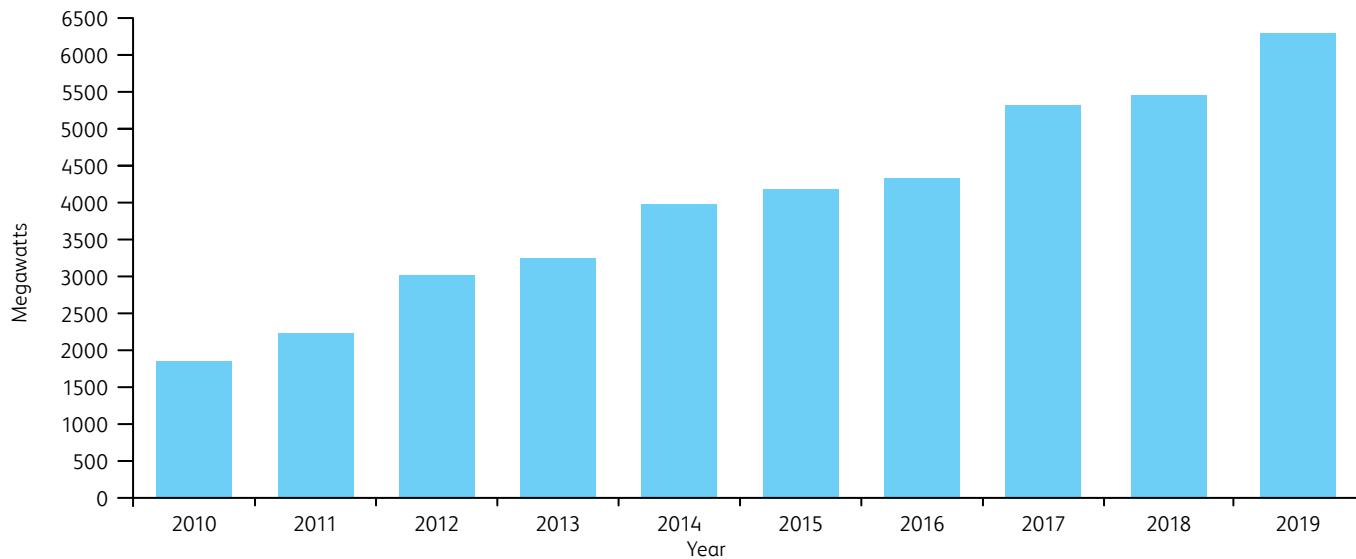


Image: Blade transport to Stockyard Hill Wind Farm, Victoria

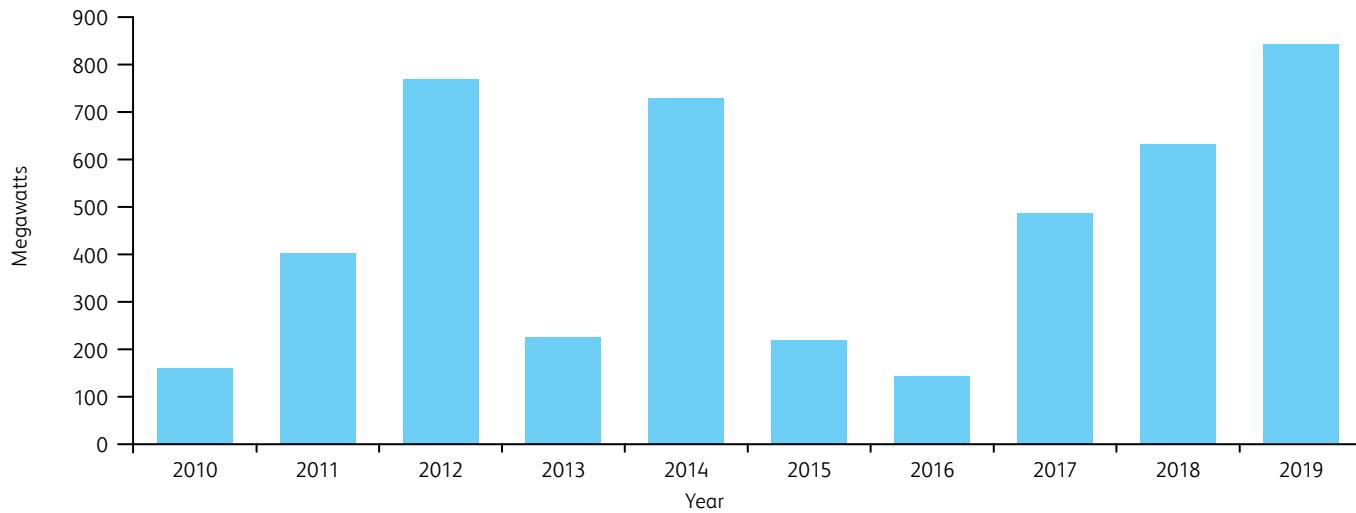
# WIND POWER (CONTINUED)

## CUMULATIVE INSTALLED WIND CAPACITY IN AUSTRALIA<sup>97</sup>



YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
CUMULATIVE INSTALLED CAPACITY (MW)	1840.1	2240.9	3009.2	3233.8	3961.5	4181.0	4324.10	4811.7	5442.3	6279.4

## ANNUAL INSTALLED WIND CAPACITY IN AUSTRALIA<sup>97</sup>



YEAR	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
ANNUAL INSTALLED CAPACITY (MW)	158.7	400.7	768.3	224.6	727.8	219.6	143.0	487.6	630.6	837.1

<sup>97</sup> Green Energy Markets

## CASE STUDY

### AUSTRALIA'S FIRST OFFSHORE WIND FARM COULD SOON BE A REALITY

An offshore wind farm could be part of the Australian renewables landscape soon, with the Star of the South project now in its feasibility phase. Planned for the south coast of Gippsland, the \$8 billion project will provide 2200 MW of clean energy to homes across Victoria and bring jobs to the area.

Capturing offshore wind for energy needs is common in the UK and Germany, but this project is the first of its kind in Australia. Offshore wind projects have a major advantage over onshore wind farms – they can be developed at a much larger scale, because there's a lot more ocean than land.

The proposed wind farm is situated approximately 10 km off the coast and will utilise the strong grid links in Victoria's Latrobe Valley and existing transmission infrastructure. It's a fitting location since the Latrobe Valley has for decades been the traditional home of Victoria's brown coal industry.

Site exploration to identify the best sites for the wind turbines began in March 2019, alongside local community engagement. The Star of the South project is also undertaking a labour market study to determine workforce needs and the specialised equipment and vessels to support construction and operation.

While some way off final approvals and build, it's another exciting development for Australia's renewable energy industry and a welcome new source of clean energy for our electricity grid.



The Clean Energy Council thanks the following members and industry stakeholders for providing some of the photographs in this report:

- Aggreko
- AGL
- Australia Wide Solar
- Axford Solar
- Canadian Solar
- Coffs Solar Energy
- CPS National
- Electrical Sensations
- GEM Energy
- Goldwind Australia
- Hydro Tasmania
- Infigen
- Neoen
- Pacific Hydro
- Solar Integrity





RECYCLED  
Paper made from  
recycled material  
FSC® C015144



MANUFACTURED  
CARBON NEUTRAL



BLEACHING PROCESS



ENVIRONMENTAL  
MANAGEMENT SYSTEMS



FOREST MANAGEMENT  
CERTIFICATION



RECYCLED CONTENT

Printed by Complete Colour Printing using stock produced from  
100% Recycled Forest Stewardship Council (FSC) post-consumer  
waste material, produced carbon neutral.

Design by indium design / [indiumdesign@gmail.com](mailto:indiumdesign@gmail.com)



Image: Hallett Wind Farm, South Australia



Phone      **+61 3 9929 4100**  
Email      **info@cleanenergycouncil.org.au**  
Web      **cleanenergycouncil.org.au**

Find us on

