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Key Findings

1. An estimated 32,500 on-grid and off-grid energy storage systems were installed in Australia up to the end of 2016.

2. Around 20,000 energy storage systems were installed in 2017.

3. Under a high growth scenario, around 450,000 energy storage systems could be installed by 2020.

4. The combination of residential and commercial energy storage could deliver 3 gigawatt hours (GWh) of distributed storage by 2020.

5. The report identifies 55 Australian large-scale energy storage projects which are either existing, planned or proposed. Excluding pumped hydro, these represent over 4 GWh of storage.

6. 120 large-scale solar projects totalling 9 gigawatts (GW) of capacity have been completed, planned or are in the pipeline. Of those, 19 have been completed and another 36 have reached financial close. Most of those projects have the capacity to add storage and represent an opportunity additional to the 4 GWh identified above.

7. Up to 35,000 Australians could be working in the energy storage industry by 2020.

GRID CONNECTED BATTERY INSTALLATIONS:

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<tr>
<th>State</th>
<th>Percentage</th>
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<tr>
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<td>39%</td>
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<td>QLD</td>
<td>20%</td>
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<tr>
<td>VIC</td>
<td>19%</td>
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<td>SA</td>
<td>9%</td>
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OFF GRID BATTERY INSTALLATIONS:

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<thead>
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<td>NSW</td>
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<td>QLD</td>
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<td>VIC</td>
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<tr>
<td>WA</td>
<td>14%</td>
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</table>

CER data 2010-2017
Key Findings

8. High or low growth influences for energy storage include:
   a) electricity prices;
   b) energy storage systems prices;
   c) Federal, State and Territory government policies;
   d) industry standards and industry perceptions of quality and safety;
   e) availability of trained installers; and
   f) public perceptions of safety and quality.

9. State Governments are driving energy storage policy through subsidies for batteries. The phase out of high feed-in tariffs for solar PV is also providing an incentive for behind the meter batteries.

10. The proposed National Energy Guarantee (NEG) includes a reliability guarantee and an emissions guarantee. Depending on how these are implemented they may boost storage uptake.

The high growth scenario concludes around 450,000 energy storage systems could be installed in Australia by 2020, representing 3 GWh of storage.
There is an opportunity for governments and industry to work together to build a strong, safe and sustainable storage industry to:

- increase consumer awareness of the benefits of storage and smart energy;
- reform the energy market to provide access to value that storage can deliver;
- support national training and skills development; and
- develop evidence-based standards for energy storage systems installation and performance.

The lack of accurate and complete data on the location, number, size and type of energy storage systems in Australia demonstrates the urgent need for an industry-led national energy storage systems database.
Energy Storage Now Ready

Solar photovoltaic (PV) and energy storage prices are falling rapidly, while energy security concerns become more acute and electricity prices continue to rise.

Customers want greater control over their electricity, and they want to cut their power bills. Increasingly the economics of energy storage make sense in a growing number of applications. An increasing proportion of electricity is coming from variable renewable energy. This is making household and small business solar coupled with storage, as well as large scale grid support solutions, increasingly necessary and viable.

Energy storage, long neglected in Australia, will be a priority this year.

Prime Minister, Malcolm Turnbull, National Press Club February 2017

The Smart Energy Council expects price reductions to flatten slightly, but downward pressure remains with significant manufacturing capacity investment underway.
Scope of the Report

This report is a comprehensive analysis of the Australian energy storage market, covering residential, commercial, large-scale, on-grid, off-grid and micro-grid energy storage.

The report assesses the current state of energy storage and makes projections for uptake from 2017 to 2020. Research methodology is set out in Appendix A.

THE REPORT’S FINDINGS ARE BASED ON:

- a survey by the Smart Energy Council;
- interviews with key energy storage market participants;
- data from the Clean Energy Regulator;
- data from the Smart Energy Council’s Battery Finder project http://www.energystorage.org.au/batteryfinder/
- research commissioned on large-scale solar and energy storage projects in Australia; and
- a literature review.

This analysis and report has been funded by the Australian Renewable Energy Agency (ARENA).

BATTERY TYPES

Products in Australia identified in Battery Finder

KEY
- Absorbed Glass Matt
- Aqueous hybrid Ion
- Lead Acid
- Lead Carbon
- Lead Crystal
- Lithium - Ion
- Sodium Nickel
- Vanadium
- Zinc Bromide

BATTERY FINDER -
an initiative of the Smart Energy Council and Global-Roam – identifies 184 battery storage products that are, or have been, available for purchase in Australia.

Of the 184 battery storage products, 62% are lithium-ion technologies. 177 of the 184 products are designed to safely be installed indoors.
**Forecast Data**

Tracking data on distributed small-scale energy storage installations in Australia is extremely difficult. There is no national, State or Territory record of installations and there is currently no requirement to register installations. The Council of Australian Governments is seeking to create a new register. Manufacturers and some utilities collect data, but it is not complete and is difficult to access.

**THERE IS AN URGENT NEED FOR AN INDUSTRY-LED NATIONAL ENERGY STORAGE DATABASE.**

This report outlines three scenarios for energy storage uptake to 2020:

- **HIGH GROWTH SCENARIO** - around 450,000 small scale distributed energy storage systems installed in Australia by 2020, representing 3 GWh of storage;
- **MEDIUM GROWTH SCENARIO** - around 300,000 small scale distributed energy storage systems installed by 2020, representing 2 GWh of storage;
- **LOW GROWTH SCENARIO** - around 150,000 small scale distributed energy storage systems installed by 2020, representing 1 GWh of storage.

In addition to the smaller scale distributed storage systems identified above, this report identifies 55 large-scale energy storage projects that are existing, under construction, planned or proposed, totaling over 4 GWh of storage.

### PROJECTS AND TECHNOLOGIES

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<tr>
<th>PROJECT</th>
<th>STATE</th>
<th>TYPE</th>
<th>PROPORENT</th>
<th>STAGE</th>
<th>SIZE (MW)</th>
<th>CAPACITY (MWh)</th>
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<td>AGL VPP</td>
<td>SA</td>
<td>Virtual power plant</td>
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<td>NT</td>
<td>Battery</td>
<td>Vector</td>
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</tbody>
</table>

**Total storage - excludes pumped hydro projects (in brackets) and projects for which a MWh capacity is not stated 4,146**

FULL REPORT

PG 6

AUSTRALIAN ENERGY STORAGE MARKET ANALYSIS SEPTEMBER 2018
Key drivers of growth include:

- the price of solar and energy storage systems;
- the cost of electricity;
- the availability of trained installers;
- perceptions of safety and quality; and
- incentives or barriers put in place by governments, utilities and regulators.

By 2020, if just one quarter of new and existing solar homes install batteries, almost 1 million could be installed.
# Government Policies

State and Australian Government policies and programs will be critically important in driving investment in energy storage. The ACT, South Australia, Queensland and Victoria are currently leading the way in terms of policy support.

<table>
<thead>
<tr>
<th>State/Territory</th>
<th>Policy/Incentive</th>
<th>Renewable energy target</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACT</td>
<td>$25 million Next Generation Battery Storage scheme aims to provide subsidised battery storage for 5,000 Canberra homes and businesses by 2020.</td>
<td>100% by 2020</td>
</tr>
<tr>
<td>New South Wales</td>
<td>No current policy.</td>
<td>Supports national Renewable Energy Target</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>No current policy. Home Improvement Scheme previously offered up to $4,000 vouchers for purchases including solar and batteries. Participants were required to fund at least 50%.</td>
<td>50% by 2030</td>
</tr>
<tr>
<td>Queensland</td>
<td>No interest loans and rebates to be provided in 2018 to drive uptake of batteries. 100 MW reverse auction for energy storage, which forms part of 400 MW renewables auction. $50 incentive for owners who register their storage system with a new State database.</td>
<td>50% by 2030</td>
</tr>
<tr>
<td>South Australia</td>
<td>100 MW/129 MWh lithium-ion battery operational. Proposed $100m grants program to facilitate batteries in 40,000 homes. Solar Thermal plant in Port Augusta to supply State Government electricity. $150 million Renewable Technology Fund to support a range of dispatchable renewable energy projects is fully allocated.</td>
<td>Supports national Renewable Energy Target*</td>
</tr>
<tr>
<td>Tasmania</td>
<td>Battery of the Nation pumped hydro feasibility study. Proposed $200,000 micro-grid pilot.</td>
<td>100% by 2022</td>
</tr>
<tr>
<td>Victoria</td>
<td>Building two large-scale battery storage plants: Tesla 25 MW/50 MWh battery integrated with Edify Energy’s Gannawarra Solar Farm; and Fluence 30 MW/30 MWh system at Ballarat. Supported by $25m grant from ARENA and $25m grant from Victorian Government.</td>
<td>25% by 2020 40% by 2025</td>
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<tr>
<td>Western Australia</td>
<td>No specific policy.</td>
<td>Supports a national target</td>
</tr>
</tbody>
</table>

* Renewables currently deliver around 50% of South Australia’s electricity and with approved solar and storage projects is likely to achieve 75% by 2025.
Our survey found that today more than 2,000 Australians are directly employed in the energy storage sector.

Under the high-growth scenario outlined in this report, more than 35,000 Australians could be working directly or indirectly in the energy storage industry in 2020.

Under the low-growth scenario outlined in this report, around 20,000 Australians could be working directly or indirectly in energy storage in 2020.

Jobs in the energy storage industry include engineers, installers, project developers, researchers, sales people and trainers.

35,000 Australians could be working in the energy storage industry in 2020.
Large-Scale Energy Storage

Solar

In addition to 55 Australian large-scale energy storage projects, the Smart Energy Council has identified more than 120 large-scale solar projects.

These large-scale solar projects, totalling more than 9 GW, have been completed, commissioned or are in the pipeline.

Many would be suitable for energy storage to be added. The survey and discussions with large-scale solar project developers indicated an acceptance that future large-scale solar projects will need to be matched with storage either on-site or on the grid.

Many external factors will boost or impede the growth of the energy storage market.

The Australian Government has allocated up to $110 million for a new concentrated solar thermal power plant in Port Augusta, South Australia.

Other Storage Technologies

The Australian Government is investigating the feasibility of increasing the Snowy Hydro Scheme pumped hydro energy capacity by up to 2000 megawatts.

A recent review of off river pumped hydro projects undertaken by the Australian National University identified 5,000 potential sites for 15,000 GWh capacity of pumped hydro in Australia.

The Finkel Review’s recommendation to require some new renewable generators to provide dispatchability could significantly increase the number of large-scale energy storage projects.

However by requiring storage to be provided by individual projects (rather than addressing dispatchability at the grid level), the measure could drive up the cost of large-scale renewable energy projects, potentially reducing their viability.
ENERGY STORAGE RESEARCH AND DEVELOPMENT IN AUSTRALIA

Australia is rapidly developing a strong energy storage research and development industry. New South Wales, Queensland and Victoria are leading the way.

Leading Australian battery manufacturer Ecoult was established in 2007 to commercialise a battery technology invented by the CSIRO.

Redback Technologies is an Australian company with a strong focus on research and development, employing 36 software engineers in Queensland.

Reposit Power and Solar Analytics are two companies developing solutions to monitor and trade energy from distributed storage over the grid.

INVESTMENT

Many Australian and international energy storage companies have or are establishing headquarters in Australia, with the breakdown as follows:

OFFICE LOCATIONS
Very few Australian energy storage companies are manufacturing products in Australia, or intend to manufacture in Australia by 2020.

As with much manufacturing in Australia, lack of economies of scale and labour costs make it difficult to compete with overseas manufacturing costs.

However, there are some notable exceptions.

Century Yuasa has been manufacturing batteries in Australia for 85 years.

Selectronic has been manufacturing battery inverters in Victoria since 1981.

Redback, Redflow, Reposit and Solar Analytics are four companies that are developing, or manufacturing, world-leading software and hardware in Australia.

Energy Renaissance has proposed to build a lithium-ion manufacturing plant in Darwin, which it says could produce 1 GW of lithium-ion battery cells each year. Boston Energy has proposed a very large 15 GWh manufacturing plant for Townsville. Vector Energy produces integrated energy storage solutions in Australia using Tesla and LG Chem batteries and has recently commenced construction on the Alice Springs Battery Energy Storage System project with Territory Generation.

Australian companies are world leaders in harnessing the power of energy storage and the development of software and control systems.

Governments should support this strategic opportunity.
The survey and analysis identified the following opportunities to build a strong, sustainable and safe energy storage industry:

- Better consumer awareness and education;
- Energy market reform for fair competition;
- Training and skills development; and
- A concerted focus on quality and safety.

**Education and awareness**

- Governments and industry should work together to provide consumer information highlighting the value of energy storage for reducing power bills, increasing energy independence and improving energy security.

**Energy market reform**

- Make action on climate change a key objective of the National Electricity Market and ensure that all climate change and energy policies are consistent with Australia’s international climate change obligations.

**Training and skills development**

- Require that all installers of household and small business energy storage systems undertake nationally accredited training.
- Governments should consider providing funding for students undertaking nationally accredited battery storage training.

**Quality and safety**

- Implement evidence based national standards for performance and installation of battery storage systems.
- Support testing of battery storage systems at the point of manufacture to ensure quality battery storage products enter Australia.
SECTION 1.
ABOUT THIS REPORT

THE REPORT:

- Outlines the global and national context for the increasing use of energy storage;
- Outlines how many energy storage systems have been installed in Australia and are likely to be installed over the next five years;
- Provides data on energy storage installations and expected installations for each State and Territory;
- Provides data on price projections for battery storage system components and total systems;
- Outlines likely investment by energy storage companies in Australia, including jobs, manufacturing and research and development; and
- Details policies and practices that could be implemented to build a strong, safe, sustainable storage industry.

SCOPE AND METHODOLOGY

The report’s findings are based on a survey completed by 630 people, interviews with 30 key energy storage market participants and a literature review. The report also utilises a comprehensive analysis of large-scale energy storage and solar projects, which was undertaken for this report, as well as the Smart Energy Council’s world-leading Battery Finder project and detailed engagement with the energy storage industry through the Queensland Energy Storage Summit and Roundtable.

Batteries in electric vehicles are outside the scope of this report. However it is important to note that a significant take-up of electric vehicles (EVs) would result in a large additional supply of energy storage connected to the electricity grid. As an example of the potential scale, if most of the 18m vehicles in Australia had 40-60 kWh batteries (which is typical of next generation EVs) this would equate to 900 GWh of storage, of which as much as half could be made accessible to the grid with optimum incentives and software control. Batteries in EVs will not be available for grid support 24/7 but they have the potential to be connected to the grid for 16-20 hours a day at either base or destination.

Smart Energy Council

The Smart Energy Council (SEC) combines the Australian Solar Council and the Energy Storage Council.

It has more than 1000 members, including solar and storage manufacturers, project developers, distributors and installers, as well as researchers and consultants. SEC members are actively involved in residential, commercial and large-scale solar and storage.
SECTION 1.
DEFINITION OF ENERGY STORAGE

Energy storage refers to a wide range of technologies that have the ability to store energy for use at a later time.

These technologies can be applied at various scales, from residential applications to utility-scale. They can be installed on-grid, off-grid and behind the meter.

In Australia, the market for energy storage is primarily for household battery technologies to complement solar photovoltaic installations, although the market for larger-scale energy storage is growing.

Battery Finder – an initiative of the Smart Energy Council and Global-Roam – identifies 184 battery storage products that are, or have been, available for purchase in Australia.

Of the 184 battery storage products, 62% are lithium-ion.

177 of the 184 products are manufactured to be installed indoors.

Chemical energy storage, including energy converted and stored as hydrogen

Mechanical energy storage, including pumped hydro

Electrochemical energy storage, including batteries

Thermal energy storage, including molten salt

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Product Types

- Absorbed Glass Matt
- Aqueous Hybrid Ion
- Lead Acid
- Lead Carbon
- Lead Crystal
- Sodium Nickel
- Vanadium
- Lithium-Ion
- Zinc Bromide

Figure 1: Battery type by chemistry

Detailed information on Battery Finder and battery storage products in Australia can be found in Chapter 7 and at http://www.smartenergy.org.au/batteryfinder
There is, however, a very significant shift underway as other forms of energy storage become increasingly economic.

The cost of battery storage, in particular, is falling dramatically as manufacturing and installation rates greatly increase with the mass scale-up of electric vehicles.

According to Bloomberg New Energy Finance, global installed capacity of battery storage will grow at a cumulative average rate of 44% from 2015 to 2024, as outlined below. It will grow from 6 GWh in 2015 to 29 GWh in 2020 and more than 81 GWh in 2024. Bloomberg New Energy Finance estimates that by 2020, solar batteries will be the dominant form of battery storage.
Battery prices are only one component of the total installation cost for a household or commercial solar battery. In its response to the Smart Energy Council survey, one energy storage company indicated that the battery was about 20% of the total installation cost.

The rapid increase in uptake of battery storage is driven largely by a commensurate reduction in the cost of battery storage. That reduction is in turn driven by economies of scale generated through the manufacture of electric vehicles in China.

The price of lithium batteries has fallen by 80% over the past five years.
Two global markets are of particular importance for Australian energy storage policy and markets – California and China.

CALIFORNIA

Historically, the Californian electricity crisis of 2000 and 2001 was an early incentive for the US state to find alternative energy sources. Rolling blackouts caused by aging power stations, limited hydro generation and transmission constraints brought utilities to the point of bankruptcy, and led to a demand for renewable power sources and innovation to improve energy reliability.

There is currently a mandate in place for 50% renewable energy by 2030. The battery market in California is developing strongly. This is partly due to a natural gas shortage, the result of a significant and unprecedented gas well leak.

In 2013 the Californian Government introduced requirements for the three largest privately owned utilities to purchase a total of 1,325 MW of energy storage by 2020 through a variety of methods, including behind-the-meter installations and a 400 MWh battery bank which will act as a “peaker plant”.

Additionally, there are US Federal Government incentives in place to compensate fast response for frequency regulation, and as batteries have faster response times than fossil-fuel generators, storage facilities stand to benefit the most.

CHINA

China has had an ambitious focus on renewables in the last few years, with generous solar feed-in tariffs and more than 140 GW of renewable energy already installed. However, this capacity does not contribute fully to the generation mix; clean energy is frequently constrained off the system due to network issues such as peak regulation.

Peak regulation essentially involves paying thermal generators to generate less overnight. Coal-fired generation takes several hours to start up or turn off, yet overnight much of this generation is not required. As a result, Chinese coal fired power stations are compensated when they ramp down to a minimum level of generation overnight.

In 2016, the Chinese Government introduced a new compensation scheme for energy storage; instead of curtailing wind energy overnight, excess wind generation is stored using batteries. The operators are paid for that overnight storage when it is used during peak periods in the daytime. This has helped reduce the number of coal-fired power stations.

China has significant incentive to reform its power market in this way. Already, around 100,000 electric cars are in use, with 10 million forecast to be on China’s roads by 2020. The demand these vehicles place on the electricity system will be substantial and its large network will need to be increasingly robust. With a 200 MWh battery bank in development and plenty of incentive to make the best use of all the country’s installed generation, China’s energy storage industry is likely to continue to boom.
The residential energy storage market in Australia is closely linked to the residential solar market, as solar families and businesses seek to add value to their solar systems by installing battery storage to increase use of household-generated solar.

As the Climate Council has noted, battery storage devices can reduce electricity costs for households in several ways:

- They can allow households to store electricity from the grid when prices are lowest and rely on battery power during the most expensive peak periods.
- They can almost double a household’s self-consumption from their solar panels.
- Adding a 4 kWh battery to a 5 kW solar panel system can increase the amount of self-generated solar electricity a household consumes from 30% to 60%.

A report by SunWiz in February 2017 found 70% of home owners with rooftop solar want batteries, although it was reported only 5% of new solar sales have storage.

Similarly, UMR found 69% of home owners with rooftop solar were interested in adding batteries to their solar systems (26% very interested, 43% fairly interested).

There are currently more than 1.7 million solar PV installations in Australia, with a combined capacity of 6 GW. Energy Networks Australia has estimated this rooftop solar capacity could almost double by 2020.

There was an unexpected boom in solar installations in 2017, with the combination of falling costs of solar and rising electricity prices seeing the highest rates of solar installations since 2012. These factors are also driving investment in battery storage.

Based on a comprehensive survey and interviews with energy storage market participants, the Smart Energy Council estimates at least 50% of all battery storage installations are retrofitted to existing solar installations. This may be a conservative estimate.
Australian Energy Storage Market

There is no national register of energy storage systems in Australia, making it difficult to estimate the number of energy storage systems.

This analysis is based on existing Clean Energy Regulator data, a national survey by the Smart Energy Council, interviews with energy market participants and a comprehensive literature review.

The Smart Energy Council surveyed 630 people through their database. In addition, they undertook phone interviews with leading energy storage companies, energy networks and consultants.

Battery storage 2010-2015

The Clean Energy Regulator recorded that 10,901 battery storage systems were installed in Australia between 2010 and 2015.

These are voluntary declarations of grid-connected and off-grid residential and commercial solar PV installations with batteries, where the residents are seeking small-scale technology certificates (STCs), an upfront Commonwealth Government discount on the capital cost of the solar system.

The Clean Energy Regulator estimates this could represent 33-50% of all household battery installations over that time.

These figures cannot be definitively verified as there is no requirement to register battery storage systems.

The Smart Energy Council estimates that 25,000 battery storage systems were installed in Australia from 2010 to 2015.

An analysis of Clean Energy Regulator data suggests up to 75% of these systems may have been off-grid installations.
Battery storage 2016

The Clean Energy Regulator recorded 3,458 battery installations (on and off-grid) in 2016. As registrations are not compulsory, that is likely to underestimate the number of installations by a factor of two or three.

Sunwiz estimated there were 6,750 battery storage installations in 2016, totalling 52 MWh. Approximately 33% of those installations were in New South Wales, 29% were in Queensland, 18% in Victoria, 10% in South Australia and 8% in Western Australia.

The analysis by the Smart Energy Council broadly confirms the SunWiz analysis of 2016 data, although some interviewees believed the figures were either too high or too low.

One interviewee, from a leading battery storage manufacturer, argued there was a significant overestimation of the size of the market, whilst another energy storage expert argued that a lot of the systems that had been installed were simply not visible to regulators.

One interviewee suggested there was a significant underestimation of the potential size of the battery storage market, arguing that by 2020 two thirds of customers getting solar panels will also be purchasing solar batteries.

We estimate around 7,500 energy storage systems were installed in Australia in 2016.

Battery storage 2017

The Clean Energy Regulator recorded 6,372 battery installations in 2017, an 84% increase over 2016.

This is the figure as at 20 March 2018 but will increase further as applications for solar installations claiming small-scale technology certificates (STCs) can be received up to 12 months after the installation.

Surveys and interviews with energy storage market participants indicate that the residential battery storage market only really started to take off in the second half of 2016. Many market participants reported a three-fold increase in installations from 2016.

We estimate that around 20,000 energy storage systems were installed in 2017.

This is consistent with the 20,789 battery installations in 2017 estimated in the SunWiz Australian Battery Market Report for 2018.

The methodological problems in estimating installation rates highlight the value of the proposed battery register in validating data.

![Figure 8: PV plus solar installations 2010-2017 (CER)](image)
SECTION 3.
AUSTRALIAN ENERGY STORAGE MARKET

Battery storage 2018-2020

There is no consensus amongst market participants or in the literature regarding the likely number of energy storage installations between 2018 and 2020.

The survey and interviews with energy storage market participants outlined a wide range of projections for energy storage in 2018, 2019 and 2020.

One energy storage company interviewed for this report suggested the battery storage market had been overestimated, arguing there could be a doubling of size in 2016 and 2017 before stabilising.

Other market participants have predicted a three-fold increase in the market each year to 2020.

A number of energy storage companies noted that the market for off-grid battery storage was likely to take off as solar and storage become more cost competitive than diesel.

The SunWiz Australian Battery Market Report for 2018, estimates that battery installation will double between 2017 and 2018, after trebling between 2016 and 2017. This is between the Smart Energy Council medium and high scenario below.

If, as one company suggested, one quarter of all households that currently have solar were to also get batteries, that would represent 400,000 battery storage systems. If, as one energy storage company argued, 66% of people who buy solar in 2020 are also likely to buy solar batteries, that could represent 100,000 battery storage systems (on top of the 400,000 above).

Morgan Stanley has estimated one million battery storage systems could be installed by 2020, with its high case suggesting two million systems by 2020.

CSIRO and Energy Networks Australia estimated that 1.5 million battery storage systems could be installed by 2020.

The Smart Energy Council has developed three scenarios for uptake of energy storage – high, medium and low scenarios.

We estimate that 150,000-450,000 energy storage systems could be installed by 2020.

The high growth scenario concludes there could be almost 450,000 energy storage systems installed in Australia by 2020, representing 3 GWh of storage.

The medium growth scenario concludes there could be around 300,000 energy storage systems installed by 2020, representing 2 GWh of storage.

The low growth scenario concludes there could be around 150,000 energy storage systems installed by 2020, representing 1 GWh of storage. This still represents substantial growth.

Estimates assume an average of 7 kWh for storage systems.

Battery storage 2018-2020

The Smart Energy Council’s assessment of battery storage projections to 2020 is based on the survey of, and interviews with, energy storage market participants.

The following charts compare a number of recent assessments of the likely uptake of battery storage systems.

![Figure 10: Forecasts of battery storage cumulative GWh 2015-2020 (various sources)](image1)

![Figure 11: Forecasts of battery storage cumulative installs 2015-2020 (various sources)](image2)
**State and Territory Installations**

**Information sources**

As stated previously, there is no comprehensive database of battery installations in Australia.

The Council of Australian Governments Energy Council has proposed the establishment of a national register of distributed energy resources, including small-scale battery storage systems and solar. It is proposed the register would be administered by the Australian Energy Market Operator (AEMO) and that information would be collected by electricity distribution businesses.

The Australian Energy Market Commission (AEMC) is currently running a consultation process on the establishment of the proposed register.

In the absence of such a comprehensive register, this report relies on a number of different sources. The Smart Energy Council has undertaken extensive work to develop an industry-led national battery register.

**Clean Energy Regulator data**

Data provided by the Clean Energy Regulator shows both the growth in battery installation and the location by State.

As noted previously, this data relies on voluntary declaration that batteries were installed in conjunction with solar PV for which small-scale technology certificates (STCs) were claimed.

The Smart Energy Council believes that this might understate actual installation by a factor of four. In addition, figures for 2017 are likely to be understated because applications for STCs can be lodged up to 12 months after installation. Additional analysis of Clean Energy Regulator (CER) data is in Section 8.

**Likely growth areas**

Energy Networks Australia and CSIRO have estimated that Queensland, South Australia and Victoria will lead the uptake of energy storage, possibly due to their specific energy security challenges.

New South Wales is, however, currently driving the uptake of residential battery storage as a result of the closure in December 2016 of the generous solar feed-in tariff scheme in that State. With the end of the feed-in tariff, those customers suddenly found their power bills had increased and the installation of batteries represented one way to reduce their power bills, albeit at significant upfront cost.
As part of this analysis of the energy storage market, the Smart Energy Council commissioned RenewEconomy to analyse large-scale energy storage and solar projects in Australia.

This analysis identified 55 large-scale energy storage projects that have been completed, financed or are in the pipeline, although this is likely to be an underestimate. Some companies prefer not to publicise their projects until finance, power purchase agreements and planning approvals have been finalised.

The 11 operational projects include three existing pumped hydro facilities. The remaining projects are at various stages of development. See Figure 14 and page 6 for more details.

Twenty three of the projects are in South Australia, with Queensland and New South Wales the next most common locations. See Figure 15.

A distinctive feature of the identified projects is the variety in both scale and the combination of technologies for generation and storage. While pumped hydro has the greatest proposed storage capacity (see page 6), batteries are the storage technology in the majority of projects (see Figure 16). Almost all battery projects are either part of a new project combining solar or wind generation with battery storage, or are co-located near existing wind or solar generation.

Bloomberg New Energy Finance has argued that grid-scale energy storage is now viable throughout Australia. Off-grid energy storage is also cost competitive with diesel, meaning that remote communities throughout Australia increasingly could go off the energy grid with solar and storage.

Many of the projects identified in the initial analysis, have been proposed or made public since. Earlier work by SunWiz concluded that in 2016 there were 11 MWh of installations from 17 major energy storage projects and rollout programs totalling 292 installations. These statistics have since been revised, in total to the end of 2016, SunWiz identified there had been 20MWh, from 48 projects with a total of 400 installations.
SECTION 5. EMPLOYMENT AND INVESTMENT

Employment

A comprehensive analysis of employment in the Australian solar industry provides a useful guide to potential employment numbers in the energy storage industry as there are parallels between the two.

In 2017, there were 4,500 accredited solar installers. For this analysis, we have assumed half of all solar installers work on battery storage and that the number of battery installers increases proportionally with the number of batteries installed in total.

Solar Business Services estimated that 96% of the 3,800 solar businesses in Australia are small to medium sized enterprises (SMEs) with less than 200 employees. Of these, 53% have less than four employees.

Using the same growth rates as calculated previously for the installers, the total direct and indirect employment extrapolation is shown in Figure 18.

If the geographic spread of solar battery installers mirrors solar installers, there will likely be strong representation through rural and regional Australia and outer metropolitan areas.

A total of 30 survey/interview participants indicated they conduct energy storage research and development in Australia. The majority of research and development takes place in Victoria, New South Wales and Queensland. Most companies conducting research in Australia also manufacture their products in Australia.

Survey respondents noted that there are only a small number of university grants for energy storage research. Examples of current areas of research include:

- Rotational energy storage development
- Financial research
- Redox flow and other battery systems
- The re-use of end-of-life batteries
- Grid storage and peak load

Office Locations

The survey and interviews with energy storage market participants sought information about office locations for energy storage companies.

Those enquiries showed strong representation in New South Wales and Victoria, almost exclusively in the capital cities. There are also a substantial number of energy storage companies with headquarters in Brisbane.
SECTION 6.
BARRIERS AND OPPORTUNITIES FOR GROWTH

Reasons for installing behind-the-meter batteries

The survey and interviews with battery storage companies revealed several reasons for families and small businesses wanting to install solar batteries.

Overwhelmingly, people want to save money and have greater control of their power use. With power costs expected to continue rising, it makes sense that families with solar would look to store the solar power they were producing and use it later in the day, reducing their power bills.

Families and businesses are also seeking back up power and resilience in the event of blackouts.

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Families and businesses are also seeking back up power and resilience in the event of blackouts.

Barriers to high growth

A range of factors influence installation rates for battery storage systems which will determine whether Australia will match the high, medium or low growth scenarios or fall outside those parameters.

THE SURVEY AND INTERVIEWS WITH MARKET PARTICIPANTS HAVE HIGHLIGHTED THE FOLLOWING FACTORS THAT MIGHT CONSTRAIN THE GROWTH IN THE ENERGY STORAGE MARKET:

- Lack of qualified installers;
- Concerns about quality and safety of energy storage products;
- Unfair regulations and standards over where battery storage systems may be installed;
- Artificial barriers implemented by governments or utilities.

Survey respondents repeatedly emphasized the need for training and skills development. Survey respondents also wanted quality products to be rewarded or disincentives to be put in place to reduce inferior products being installed. There was general support for subsidies being provided to support training and skills development.

State and Territory and Australian Government policies and national standards are discussed in more detail later in this report.

Since solar panels and batteries are effectively consumer products, sales will also be affected by the state of national and local economies between 2017 and 2020.
Barriers and Opportunities for Growth

Barriers to high growth

The Queensland Household Energy Survey 2016, released in February 2017, also outlined a number of barriers to the uptake of household battery storage as summarised in the following graph.

![Figure 23: Barriers to battery storage (Qld Household Energy Survey)](image)

Opportunities for high growth

The survey and interviews with market participants have highlighted the following factors that could drive up investment in battery storage systems:

- Significant reductions in the cost of storage and solar systems;
- Increasing cost of electricity;
- Concerns about blackouts;
- Specific financial incentives and policies from governments;
- Energy market reform, including a five-minute rule (see page 34).

There was strong support for evidence-based national performance and installation standards for battery storage systems.
### State Government Policies

As with renewable energy, State Government policies are likely to be major drivers of investment in residential, commercial and large-scale energy storage.

<table>
<thead>
<tr>
<th>State/Territory</th>
<th>Policy/Incentive</th>
<th>Renewable energy target</th>
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<tbody>
<tr>
<td>ACT</td>
<td>$25 million Next Generation Battery Storage scheme aims to provide subsidised battery storage for 5,000 Canberra homes and businesses by 2020.</td>
<td>100% by 2020</td>
</tr>
<tr>
<td>New South Wales</td>
<td>No current policy.</td>
<td>Supports national Renewable Energy Target</td>
</tr>
<tr>
<td>northern Territory</td>
<td>No current policy. Home Improvement Scheme previously offered up to $4,000 vouchers for purchases including solar and batteries. Participants required to fund at least 50%.</td>
<td>50% by 2030</td>
</tr>
<tr>
<td>Queensland</td>
<td>No interest loans and rebates to be provided in 2018 to drive uptake of batteries. 100 MW reverse auction for energy storage, which forms part of 400 MW renewables auction. $50 incentive for owners who register their storage system with a new State database.</td>
<td>50% by 2030</td>
</tr>
<tr>
<td>South Australia</td>
<td>100 MW/129 MWh lithium-ion battery operational. Proposed $100m grants program to facilitate batteries in 40,000 homes. Solar Thermal plant in Port Augusta to supply State Government electricity. $150 million Renewable Technology Fund to support a range of dispatchable renewable energy projects is fully allocated.</td>
<td>Supports national Renewable Energy Target*</td>
</tr>
<tr>
<td>Tasmania</td>
<td>Battery of the Nation pumped hydro feasibility study. Proposed $200,000 micro-grid pilot.</td>
<td>100% by 2022</td>
</tr>
<tr>
<td>Victoria</td>
<td>Building two large-scale battery storage plants: Tesla 25 MW/50 MWh battery integrated with Edify Energy’s Gannawarra Solar Farm; and Fluence 30 MW/30 MWh system at Ballarat. Supported by $25m grant from ARENA and $25m grant from Victorian Government.</td>
<td>25% by 2020 40% by 2025</td>
</tr>
<tr>
<td>Western Australia</td>
<td>No specific policy.</td>
<td>Supports a national target</td>
</tr>
</tbody>
</table>

* Renewables currently deliver around 50% of South Australia’s electricity and with approved solar and storage projects is likely to achieve 75% by 2025.

The 100 MW battery installed in regional South Australia by Neoen and Tesla was completed in less than 100 days from signing a grid connection agreement. This project has demonstrated both the capability of large batteries to provide grid services and the speed with which battery technology can be deployed.

Other recent state-based initiatives suggest there may be increasing emphasis on distributed storage projects that can provide additional services in specific locations. The Victorian Government has recently announced two battery projects to be located at Gannawarra and Ballarat which it says will “enhance system security, resilience and reliability, especially in peak demand periods.”

The commitments by South Australia, Victoria and Queensland have generated global interest and appear to be pushing down the price of large battery storage systems. Similarly, the ACT’s residential battery storage incentive has stimulated the residential market in that jurisdiction. The new South Australian Government’s commitment to provide subsidies for storage in 40,000 homes will also provide an important stimulus to the development of the storage industry.
**Australian Government Policies**

**Pumped Hydro** - In March 2017 the Australian Government announced a proposed expansion of the Snowy Hydro Scheme called "Snowy 2.0" to provide a substantial increase to the pumped hydro storage capacity of the Scheme.

ARENA contributed $8 million to a $29 million feasibility study for the expansion which commenced in May 2017. The results of the study were made public in December 2017 with the exception of the commercial and business analysis sections.

The study proposes a single underground power station linking the Tantangara and Talbingo reservoirs. This would provide 2,000 MW of additional generation capacity and 350,000 MWh of pumped energy storage. The feasibility study gives a current estimated project cost of $3.8 - $4.5 billion, not including required upgrades to the transmission network beyond the point of connection.

In March 2018 the Australian Government announced it will spend $6 billion buying the NSW and Victorian shares in Snowy Hydro Limited. This will give the Australian Government total control of the company.

**Solar Thermal** - The 2017/18 Federal Budget includes a commitment of up to $110 million for "an equity investment, if required, to accelerate and secure delivery of a solar thermal project in Port Augusta, South Australia."

ARENA and the Clean Energy Finance Corporation have committed to working together to promote concentrating solar thermal developments in Australia.

**Other Technologies** - ARENA has committed at least $20 million for flexible capacity and energy storage demonstration projects under the Advancing Renewables Program. Eligible projects include battery storage, pumped hydro, concentrated solar thermal, biomass and demand management.

ARENA has contributed $12 million towards Electranet’s 30 MW battery project at Dalrymple in South Australia.

The Australian Government, through ARENA, is supporting the development of two virtual power plants in South Australia to reduce power prices for South Australian households and help energy network companies improve reliability of the electricity grid.

In March 2018 ARENA announced it will provide up to $7.7 million to support Simply Energy to deliver up to 1200 batteries to homes with rooftop solar systems, providing 6 MW of capacity. A further 2 MW worth of demand response capacity will also be delivered via businesses.

This investment builds on $5 million of ARENA grant funding provided to AGL Energy for a $20 million 5 MW virtual power plant of 1000 households and businesses in Adelaide.

**Price reductions for solar PV and batteries.**

The cost of rooftop solar has fallen by 90% since 2009.

Lithium-ion prices could follow a similar trajectory, with prices for the battery component anticipated to fall from $300 to $70 per kilowatt hour by 2030.

The Survey results suggest we are likely to see a 15% average annual reduction in battery prices from 2017 to 2020.
SECTION 6.
Barriers and Opportunities for Growth

National Standards

There are currently no national standards for energy storage or battery storage systems, although there are related rules and regulations through State and Territory building codes and electrical safety regulations.

Standards Australia released a draft Standard (AS/NZS 5139) for public consultation, which received a significant number of industry and public submissions.

The draft Standard had the potential to significantly dampen demand for battery storage systems, potentially putting significant restrictions on the installation of household battery storage systems. Such restrictions could include banning the installation of battery storage systems inside a house or on a building attached to a house, or the requirement for a specific enclosure for a battery storage system.

The survey and interviews with energy storage companies indicated the battery storage industry supports an evidence-based approach to national standards, consistent with international experience.

Finkel Review

The Finkel Review (the Independent Review into the Future Security of the National Electricity Market, June 2017) made a significant contribution to the development of energy policy in Australia, with many of its recommendations relevant to the future of energy storage in Australia. All the Finkel recommendations, with the exception of a Clean Energy Target, have been accepted by the Australian Government.

The Finkel Review arguably underestimated the role small-scale energy storage will play in the energy market to 2020 and overestimated the contribution of large-scale energy storage.

The Finkel Review states “battery storage is poised to be the next major consumer-driven deployment of energy technology. Upfront costs for solar photovoltaic systems with storage are currently high, with long payback periods for most consumers. Bloomberg expects the average payback period for residential consumers to fall below 10 years in the early 2020s, with around 100,000 battery storage systems to support rooftop solar photovoltaic generation predicted to be installed by 2020.”

As noted in this report, there are likely to be 150,000 to 450,000 battery storage systems installed in Australia by 2020.

If the high growth scenario eventuates, the Finkel Review will be seen to have significantly underestimated the uptake of battery storage.

In relation to large-scale energy storage, the Finkel Review’s recommendation to require some new generators to have energy storage could significantly increase the number of large-scale energy storage projects up to and beyond 2020, although it may also drive up the cost of large-scale renewable energy projects, reducing their viability.

Research and data collected for this report has identified the need for evidence-based performance and installation standards for battery storage systems. This will be an important field of work to 2020.

National Energy Guarantee

Following the rejection of the proposed Clean Energy Target, the Australian Government is promoting a National Energy Guarantee (NEG) to address the need to reduce greenhouse gas emissions and increase the reliability of the national electricity market. The COAG Energy Council has released a discussion paper and conducted consultation on the proposed design. The reliability component of the NEG would allow the AEMO to identify a ‘reliability gap’ in a NEM region and require retailers in that region to contract ‘reliable’ generation in proportion to their share of peak load.
Settlements in the National Electricity Market

A proposed change to the National Electricity Rules would bring financial settlements (currently 30 minutes) into line with the pricing and despatch interval of 5 minutes. The AEMC considers that the benefits of this change would quickly outweigh the costs but proposes that the change be implemented over three years and seven months.

The Smart Energy Council has called for a rapid implementation of this change. This would provide an appropriate incentive for short-term energy storage and provide greater stability to the energy system.

The former Chief Executive Officer of the Clean Energy Finance Corporation, Oliver Yates, stated that “five-minute interval pricing, from our own analysis on battery projects, would change the revenue profile significantly and would then encourage batteries to come into the market and be available for short-term supply.”

Policy Implications

The energy storage market research and analysis outlined in this report, together with the outcomes of the March 2017 Queensland Energy Storage Summit, highlight a number of industry and policy priorities to help build a strong and sustainable energy storage industry:

- Increased consumer awareness of the benefits of battery storage;
- Energy market reform;
- Training and skills development; and
- Focus on quality and safety.

Community awareness

There is still poor community awareness of battery storage systems, and energy storage more generally. Governments should consider funding limited, community-based public education campaigns that explain the benefits of residential, commercial and utility-scale energy storage for consumers and the energy network.

Energy market reform

As the Finkel Review noted, the National Energy Market was designed for a world that was less complex than today, in which traditional generation (coal, gas and hydro) provided all of our electricity needs. Since then, the parameters have changed.

The Finkel Review noted that “we now have a once-in-a-generation opportunity to reform the NEM”. That is absolutely critical to level the playing field for energy storage.

Based on the findings of this report, the Smart Energy Council has identified the need for a blueprint for an energy system for the 21st Century – one that is smart, reliable, flexible and sustainable.

A smart energy system puts consumers at the centre, helps tackle climate change and is built to withstand the impacts of climate change.
Battery Finder is a searchable and filterable ready reference to the makes and models of battery storage currently available on the Australian market, and has been developed by the Smart Energy Council and Global-Roam.

Battery Finder is the world’s largest catalogue of battery storage products, with 184 battery storage products recorded.

Battery Finder is a key component of work being undertaken by the Smart Energy Council and Global-Roam to develop an industry-led national energy storage register.

Battery Finder can be found at https://www.smartenergy.org.au/batteryfinder

**KEY DATA FROM BATTERY FINDER**

- 184 products recorded.
- 172 products currently available in Australia.
- 9 products no longer available.
- 3 products coming soon.
- Of the 184 products, 177 could be installed indoors.

**Product Types**

- Absorbed Glass Matt
- Aqueous Hybrid Ion
- Lead Acid
- Lead Carbon
- Lead Crystal
- Lithium-Ion
- Sodium Nickel
- Vanadium
- Zinc Bromide

**Figure 24:** Battery products: percent of products by chemistry
Figure 25: Battery products: indoor operating temperature range by chemistry

Figure 26: Battery products: outdoor operating temperature range by chemistry
The 100 MW battery installed in regional South Australia by Neoen and Tesla was completed in less than 100 days from signing a grid connection agreement. This project has demonstrated both the capability of large batteries to provide grid services and the speed with which battery technology can be deployed.

Other recent state-based initiatives suggest there may be increasing emphasis on distributed storage projects that can provide additional services in specific locations. The Victorian Government has recently announced two battery projects to be located at Gannawarra and Ballarat which it says will “enhance system security, resilience and reliability, especially in peak demand periods.”

The commitments by South Australia, Victoria and Queensland have generated global interest and appear to be pushing down the price of large battery storage systems. Similarly, the ACT’s residential battery storage incentive has stimulated the residential market in that jurisdiction. The new South Australian Government’s commitment to provide subsidies for storage in 40,000 homes will also provide an important stimulus to the development of the storage industry.
Price reductions for solar PV and batteries.

The cost of rooftop solar has fallen by 90% since 2009. Lithium-ion prices could follow a similar trajectory, with prices for the battery component anticipated to fall from $300 to $70 per kilowatt hour by 2030.

The Survey results suggest we are likely to see a 15% average annual reduction in battery prices from 2017 to 2020.

**Source of this data**

This section presents information from the CER. The CER administers the Small-scale Renewable Energy Scheme (SRES) under which tradeable STCs are created when approved solar PV panels are installed. STCs can be sold to reduce the upfront cost of installing solar PV. The SRES applies to both on and off-grid solar installations for both residential and commercial installation up to 100 kW.

**Caveats**

Off-grid installations are assumed to include batteries. For on-grid systems, declaring to the CER whether batteries have been installed at the same time as solar PV is entirely voluntary. The CER does not have a mechanism for declaring batteries added to an existing PV system.

Due to these factors, and comparing the CER data with other sources, the Smart Energy Council believes that CER data probably represents between a half and a third of total battery installations.

In addition, claims for STCs can be lodged with CER up to 12 months after installation so the figures for 2017 will be subject to revision upwards.

Kilowatt capacity refers to the associated solar PV installation, not the battery. The CER does not collect information on battery capacity in kilowatt hours.

**Residential installations**

As shown in Figure 29, battery installations were relatively stable from 2010 to 2015. These were probably largely off-grid systems.

There was a substantial rise in installations in 2016 (mostly in the second half of 2016) as the price of lithium-ion batteries plummeted and new battery storage companies entered the Australian market.

From 2016 significantly more installations would have been grid connected.

There has been a general increase in the size of solar installations over time (as illustrated in Figure 30). This is likely to have been associated with increased sizes of battery storage systems.
SECTION 8.
CLEAN ENERGY REGULATOR DATA

Commercial systems

The number of commercial systems (10-100 kW) with batteries increased by 91% between 2016 and 2017 (see Figure 31).

![Commercial PV+battery installs by year](image1)

Figure 31: Number of installed commercial battery systems by year (on and off-grid)

Systems in the 10-15 kW range remained by far the most popular size as well as the size range with the biggest increase between 2016 and 2017 (113%). Systems in the 20-50 kW overtook those in the 15-20 kW range in 2017 and increased by 79% over 12 months (see Figure 32).

![Commercial PV+battery by year and size (CER)](image2)

Figure 32: Commercial battery installs by year and size (size is of the PV system not the battery)
There is still poor community awareness of battery storage systems, and energy storage more generally. Governments should consider funding limited, community-based public education campaigns that explain the benefits of residential, commercial and utility-scale energy storage for consumers and the energy network.

On-grid battery systems by size and location

The CER recorded that 7,224 grid-connected PV systems were installed with batteries between 2010 and 2017.

Figure 33 shows the size of the PV system for these installations. While the vast majority are in the range of 2 kW – 10 kW, it is notable that there were 91 installations in the 20 kW – 50 kW range and 24 in the 50 kW – 100 kW range.

Figure 33: On-grid systems with battery by size (size is of the PV system not the battery)

Figure 34 shows the location of these systems by state and territory. It is notable that although Queensland has slightly more PV installations than NSW, NSW has nearly twice as many grid-connected battery systems as Queensland.

Figure 34: On-grid systems with battery by location
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APPENDIX A

RESEARCH METHODOLOGY

This section provides an outline of the research approach and methods used to collect and analyse data on the energy storage market in Australia for this report.

RESEARCH AND DATA COLLECTION WAS CONDUCTED IN THREE CONCURRENT STAGES:

- a broad online survey on energy storage containing multiple-choice and open response questions;
- phone interviews with significant companies and organisations in the Australian energy market;
- a literature review of recent Australian and international energy market reports.

A quantitative research survey was conducted in March-April 2017. Qualitative interviews were conducted in April-May 2017. The Clean Energy Regulator provided data as at March 2018. Additional data was provided by the Clean Energy Regulator and from a number of utilities.

The online survey was designed using the SurveyMonkey website ( surveymonkey.com ) and was distributed to all members of the Smart Energy Council’s database, including but not limited to battery manufacturers, installers, wholesalers and utilities. The survey was voluntary and anonymous and was completed by 630 people.
Research Methodology

A further 35 in-depth voluntary and confidential phone interviews were conducted with key industry businesses identified by leaders in the energy storage market.

Questions were varied and based predominantly on the following topics:

- size of the battery market;
- sales and installations in 2016 and future likely sales up to 2020;
- drivers for battery purchasing;
- whether batteries were installed with new PV, retrofitted to existing PV or standalone;
- top-selling battery brands and battery chemistries;
- office locations and direct/indirect employment in storage (current and forecast to 2020);
- research and development.

Respondents were asked about their outlook on the Australian market over the next five years, as well as the forecast for their year-on-year business sales outlook. Both answers were used to construct year-on-year growth percentages for the Smart Energy Council market outlook of the Australian market to 2020.

As the respondents were from different industry segments, and sales were likely to flow between these segments (such as from manufacturer to wholesaler to installer), there was a risk of double-counting individual sales forecasts. To avoid overcounting, the overall market outlook of all respondents was used to contract the survey response curve.

The survey and phone responses indicated that the market would experience different growth levels each year. This was reflected in the literature review. These sources were combined to determine the Smart Energy Council low, medium and high growth scenarios from now until 2020.

Reported and forecast employment figures were used to estimate the total energy storage employment market in each state, noting that many solar companies are now also specialising in storage, but that the market of solar businesses and installers has, in the past, been subject to significant changes depending on government policy.

The information from the phone interviews was judged to be of a higher quality than the survey results and was therefore given greater weighting in developing forecasts.

The projections model calculates the market growth percentages of each forecast for each year. It then groups them and calculates the first quartile, the mean and the third quartile across the group. These results inform the annual growth percentages for the Smart Energy Council low, medium and high growth scenarios. These are manually adjusted to prevent unforeseen flow-on effects from any model changes.