AUSTRALIAN ENERGY COUNCIL

SOLAR REPORT

QUARTER 4, 2022

Australian Energy Council

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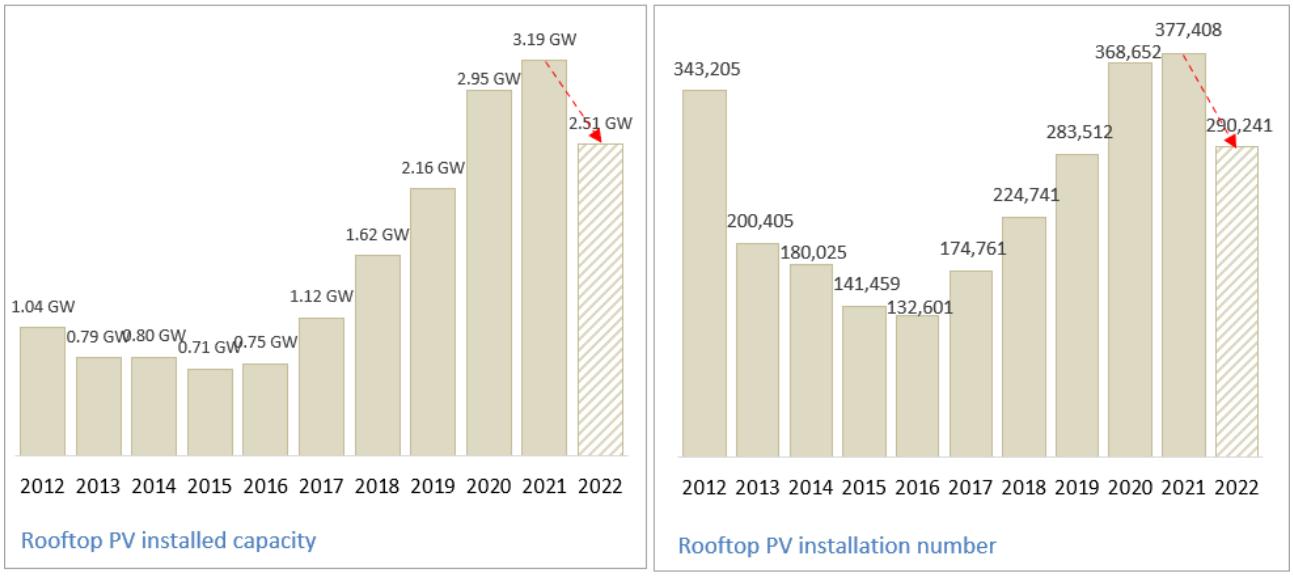
SECTION I: STATE OF SOLAR IN AUSTRALIA

Australian rooftop solar only systems saw a decline in installed capacity and the number of installations in 2022 after a run of five consecutive years of growth from 2017 (figure 1). The number of rooftop solar PV systems installations combined with a battery continued to increase with another record-breaking year. Updated data from the Clean Energy Regulator (CER) shows 2022 saw more than 290,000 rooftop installations added to the grid with a total capacity of 2.51 GW. However due to a 12-month lag in reporting[i], the final figures for 2022 are estimated to have been 320,000 new rooftop installations, with a total installed capacity of 2.8 GW. These numbers are, however, still the lowest since 2020 in terms of installed capacity and installation numbers.

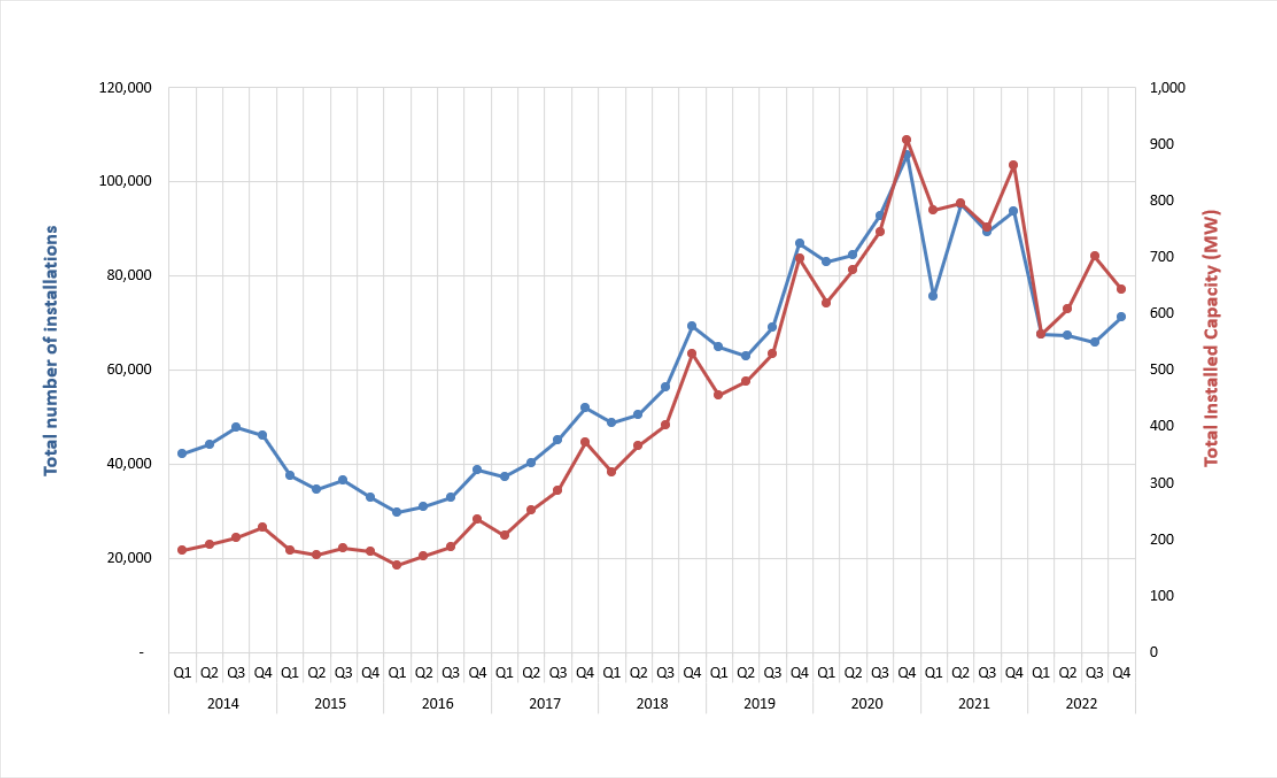
Figure 1: Yearly installed capacity and installation number of rooftop solar PV in Australia since 2012 (unadjusted data)



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 8 February 2023

Historically, the first quarter of the year generally sees a large dip in rooftop solar PV installations. This is due to the decrease in the deeming period in calculating the number of small-scale technology certificates (STC) at the start of each calendar year. Householders and businesses rush to install their systems before the year end in order to maximise the number of STC that their solar PV systems may be eligible for. In previous years, this first quarter dip has never fallen below the previous first quarter's dip. 2022 saw the number of rooftop installations dip below the previous two years' first quarter numbers for the first time (see figure 2, red line). Pleasingly, the figures also show signs of a bounce back in the number of rooftop installations and installed capacity in the second half of 2022.

Figure 2: Quarterly rooftop PV installations and installed capacity (unadjusted data)



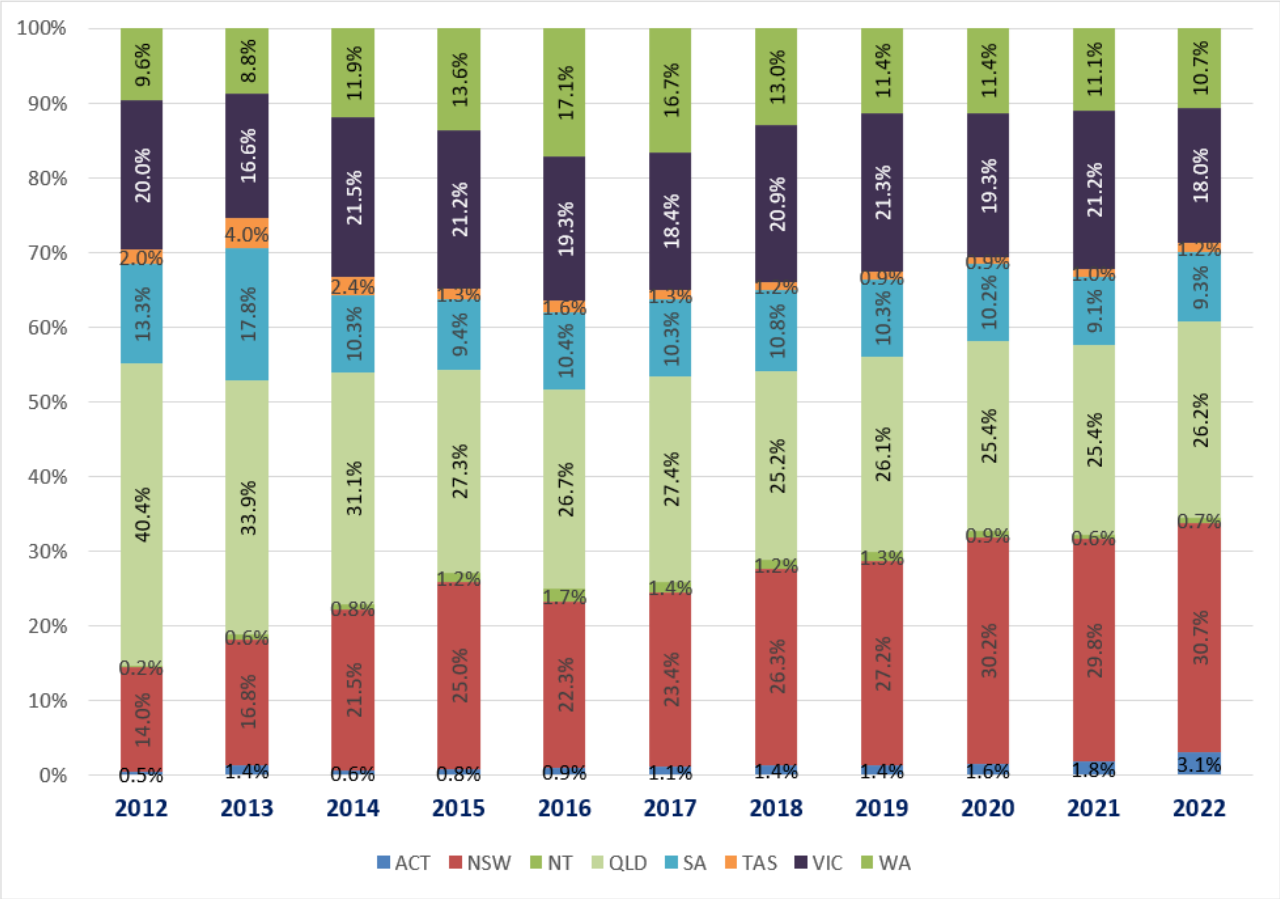
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 8 February 2023

Note: The most recent three months in figure 3 underestimates the data because of a time lag in collation of the data.[ii] Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 18 January 2023

Several factors have contributed to the decrease in installation numbers and installed capacity since early 2021. These include higher system prices stemming from higher panel and transport costs that emerged along with supply chain issues (see our previous Solar Reports). Emerging concerns about higher power bills and higher coal and gas prices internationally has helped motivate more customers to install rooftop solar. It is also likely to be a factor behind an increasing number of solar systems with home batteries being installed (discussed below) to help homes and businesses reduce their electricity bills. The outlook for solar, however, is complicated by rising interest rates, which will require households to consider their discretionary spending and may mean they are less likely to be able to afford the outlay on rooftop solar.

National Electricity Market (NEM) states accounted for 88.3 per cent of total installations in 2022 while Western Australia accounted for up 10.7 per cent of the total installations. New South Wales overtook Queensland in late 2017 in terms of total installations, and continues to lead the states with more than 86,300 new installations and 772MW of total installed solar capacity added during 2022.

Figure 3: Proportion of installed capacity of rooftop PV by states



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 8 February 2023

Battery installations with rooftop solar

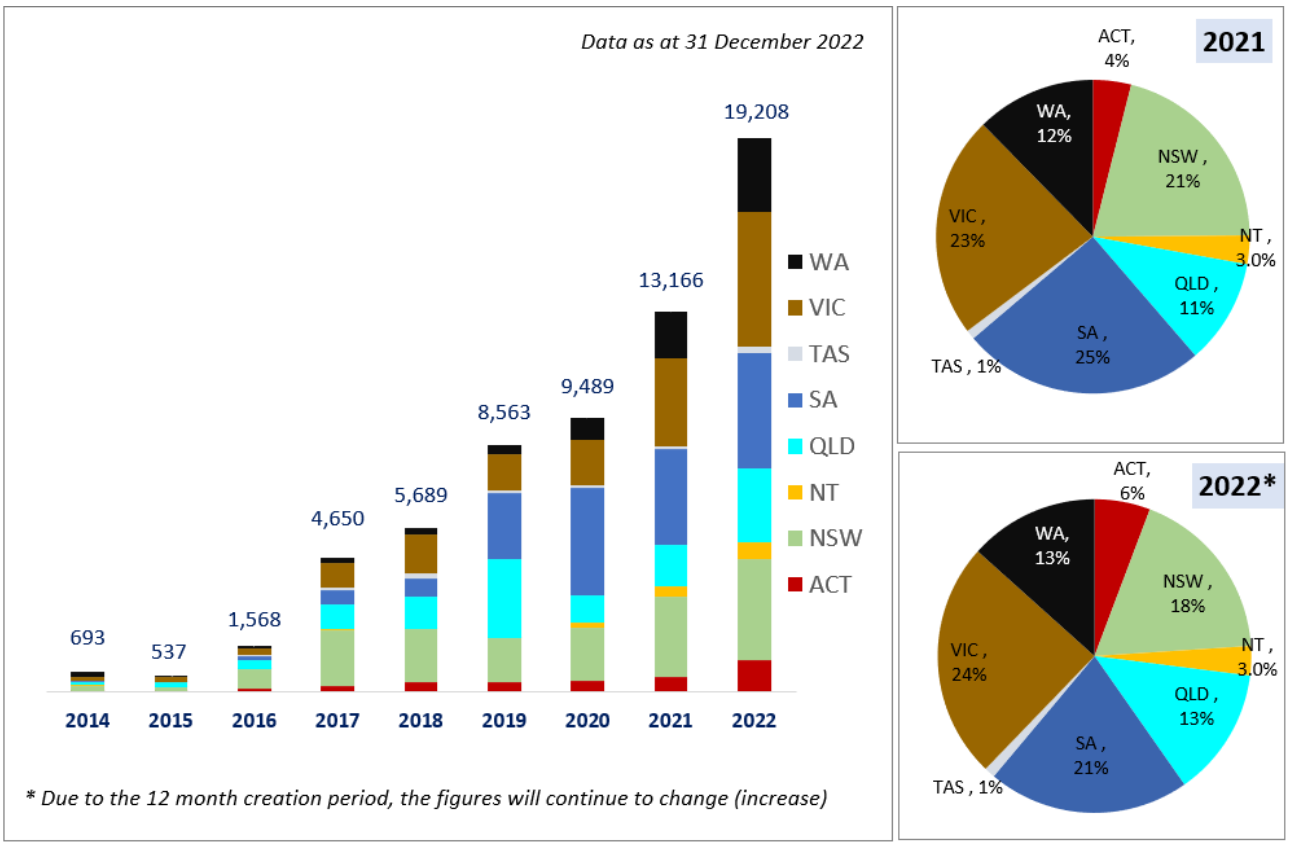
Despite 2022 showing a decline in the installation of rooftop solar PV systems, the number of rooftop solar PV systems installations combined with a battery continue to increase with another record-breaking year. Figure 4 shows that there was a total of 19,208 of rooftop PV with battery installations registered to the CER. This is a 46 per cent jump from previous year.

When comparing the uptake of battery installations with rooftop solar by state, Victoria beat South Australia's rooftop with battery market share for the first time. This change coincides with the closure of the SA Government's Home Battery Scheme last financial year. The market share of battery installation with a rooftop system for Victoria and South Australia is 24 and 21 per cent in respectively.

Similarly, even with a steady rate of rooftop installations, Queensland continues to see a slow uptake of solar with batteries, accounting for 11.8 per cent of the total solar-with-battery installations. The Queensland Government's incentive scheme for solar-with-battery installations was exhausted in

2019, highlighting the influence of state-based schemes in the adoption of storage technology. New South Wales householders were also the early adopters of the solar system with battery technology. Both Queenslander and New South Wales recorded the greatest combined market share of 64 per cent in 2016. Though the states' combined annual new installations have been increasing year-on-year, their market share of rooftop system plus battery has declined to 32 per cent in 2022.

Figure 4: Number of solar with concurrent battery installations per state since 2014



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 8 February 2023

Since the last Solar Report, there have been no new updates on State Government schemes or rebates on battery storage installation with solar systems.

Schemes and rebates around the country include:

- Victoria: The Solar Battery Rebate Program offers a rebate of up to $2,950 for a solar battery system starting 1 July 2022[iii]. There are 1,700 solar battery rebates available with less than 1,000 rebates remain for this financial year.
- Australian Capital Territory: The state's Next Generation Energy Storage Program offers a rebate of $3,500 (excluding GST) or 50 per cent of the battery price (excluding GST) – whichever is lowest[iv].

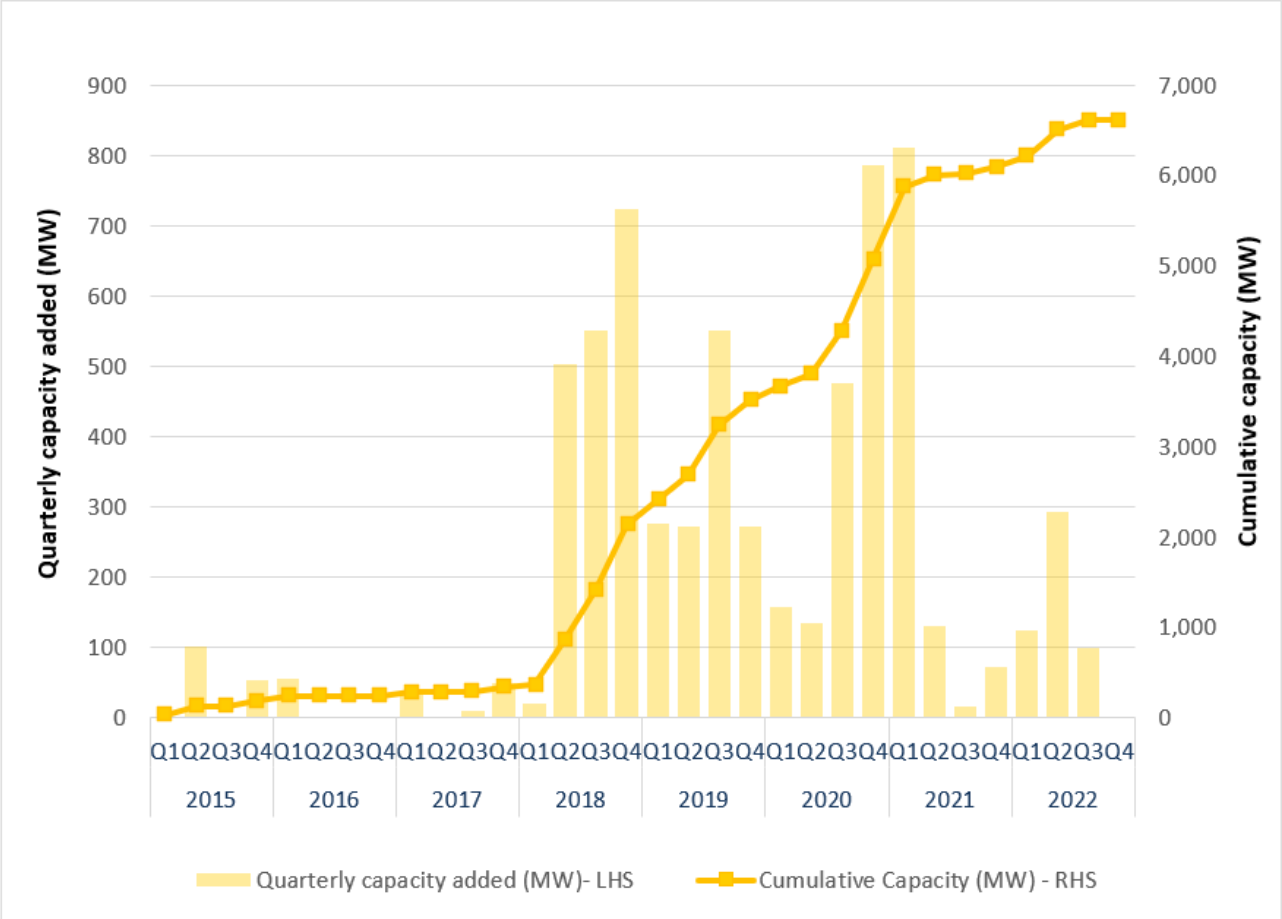
- Northern Territory's Home and Business Battery Scheme allows residents to buy and install batteries and inverters with a maximum grant of $6,000[v].

SECTION II: STATE OF UTILITY-SCALE SOLAR AND BATTERY

While there remains some uncertainty over household rooftop solar and battery trends for 2023 as a result of higher interest rates and the end of many state incentive programs, large utility-scale solar and battery investment is soaring.

By year-end 2022, Australia had installed 6.6 GW of large utility-scale solar (figure 1). A total of 8 solar farm projects completed and started feeding into the grid during the year, with most capacity (370MW) built in New South Wales (see table 1). There were no new commissioned projects in Victoria, Western Australia, Tasmania, or the Northern Territory during the year.

Figure 5: Australia utility-scale solar capacity commissioned by quarter.



Source: Australian Energy Council's analysis

In the last quarter of 2022, though no new completed projects started generating electricity, 8 utility-scale solar projects with a combined total capacity of 530MW were completed and will be ready for

commissioning in 2023. In addition, Wunghnu Solar Farm (Victoria, 90 MW) and Welling North Solar Farm (New South Wales, 450 MW) started construction in December 2022 and are expected to start commercial operation in 2024.

Table 1: List of projects and nameplate capacity commissioned during 2022.

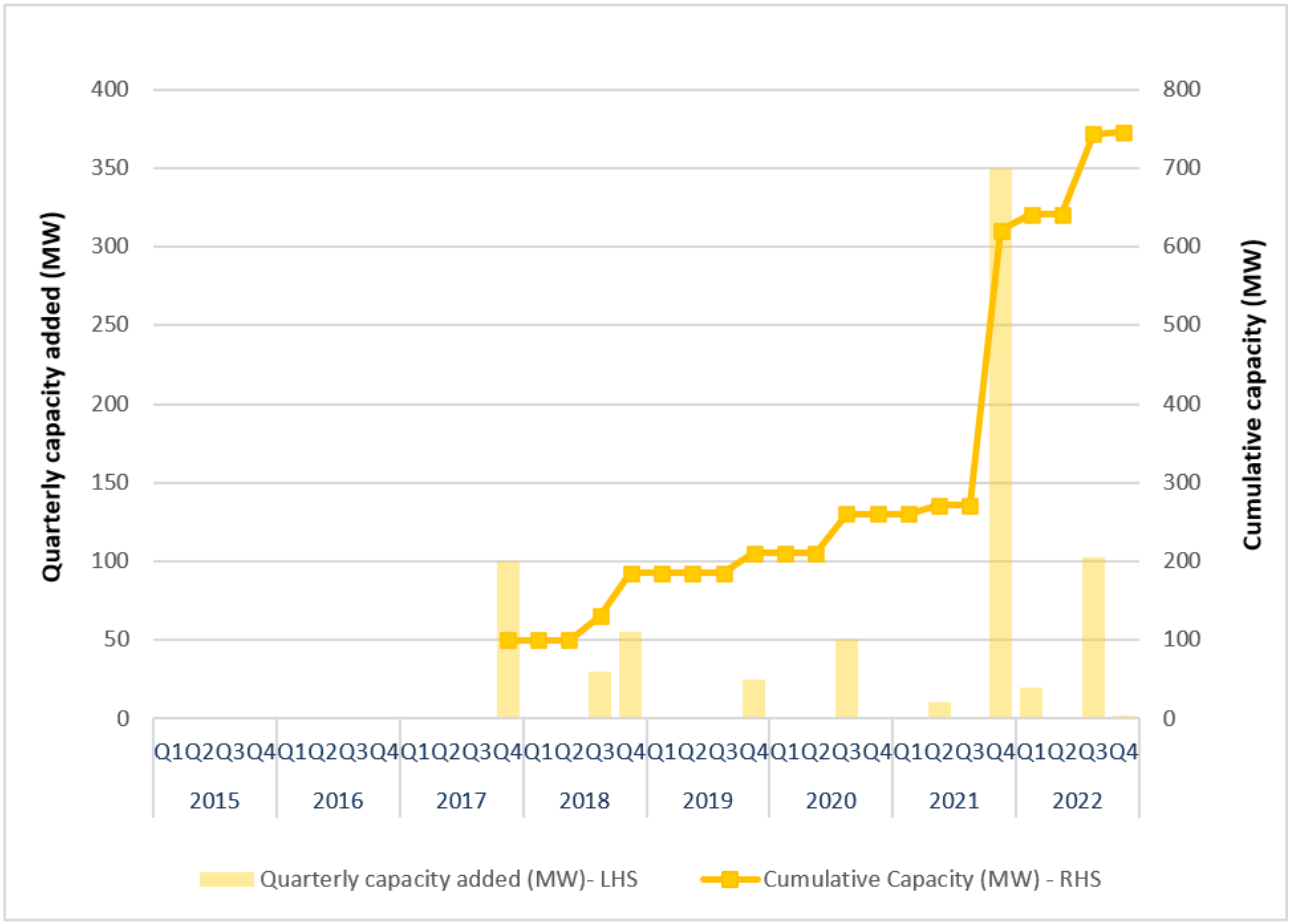
Region	Site Name	Nameplate Capacity (MW)	Commissioned quarter
NSW	Gunnedah Solar Farm	110.0	Q2 2022
NSW	Hillston Sun Farm	110.0	Q1 2022
NSW	Suntop Solar Farm	150.0	Q2 2022
QLD	Moura Solar Farm	99.0	Q3 2022
SA	Bolivar Wastewater Treatment	11.3	Q2 2022
SA	Happy Valley Reservoir	8.3	Q2 2022
SA	Mannum Adelaide Pumping Station No 3 - MAPL3 (Tungkillo)	12.4	Q2 2022
SA	Murray Bridge - Onkaparinga Pipeline Pump 2	13.7	Q1 2022

Source: Australian Energy Council's analysis

At the end of 2022, there are 14 battery-storage projects completed and commissioned, predominantly located in South Australia and Victoria, with a total of 1,058 MWh storage capacity (figure 6). In the last quarter of 2022, 7 large-scale battery storage projects were committed across the country and will be in commercial operation by the end of 2024.

The Northern Territory and Western Australia are building their first large-scale battery storage projects, to help support their electricity system and enable the uptake of more renewables. The Northern Territory's first big battery, the "Darwin-Katherine Battery Energy Storage System" (35 MW) commenced construction last August and will come online this year. The project takes the Territory one step closer to its 50 per cent renewables by 2030 target. Western Australia also began construction of its first large-scale battery storage project in Kwinana (100 MW) last August.

Figure 6: Australia battery storage capacity commissioned by quarter.



Source: Australian Energy Council's analysis

Generation from solar sources and increased storage capacity are expected to make a significant contribution towards achieving the Albanese Government's legislated emissions reduction target of 43 per cent over 2005 levels by 2030. The Government's aim of having renewables make up more than 80 per cent of Australia's electricity mix by 2030 will continue to encourage investment in clean energy sources such as large scale solar and batteries. Table 2 shows how investors are responding to the Government's reduction targets.

According to the Australian Energy Market Operator's (AEMO) January data, there are currently 361 proposed large-scale solar and battery storage projects with 20 are anticipated to start construction soon. A total of 1,324 MW of large scale solar and 3,009 MW of large-scale battery storage projects are in the pre-construction stage. These figures represent a year-on-year increase from 850 MW of large-scale solar and 1,208 MW of large-scale battery storage projects.

Table 2: Total capacity and number of projects which were committed; anticipated and proposed of utility-scale solar projects.

Large-scale solar

	Maximum Capacity (MW)		Number of projects	
	Aug-22	Jan-23	Aug-22	Jan-23
Committed	3,548	2,971	31	23
Anticipated	850	1,324	6	8
Proposed	38,685	39,041	194	200

Battery Storage

	Maximum Capacity (MW)		Number of projects	
	Aug-22	Jan-23	Aug-22	Jan-23
Committed	140	468	7	9
Anticipated	1,208	3,009	9	12
Proposed	32,218	35,782	139	161

Source: Australian Energy Council's analysis on AEMO data

Australia is continuing to move from large-scale fossil fuel generation to lower emissions generation and is currently going through the transition stage of shutting-down of major coal-fired power plants, with its ambitious planned pipeline and current installed capacity, looking further ahead to optimise operation and management of these new and planned renewable assets is becoming increasingly important. A range of measures are being considered by the market operator. The Australian Government has set aside a $20 billion fund to accelerate the rollout of new electricity transmission assets. The market penetration rate of utility-scale solar and battery storage power projects can be expected to continue growing rapidly as the energy transition progresses.

SECTION III: LEVELISED COST OF ENERGY

The Levelised Cost of Energy (LCOE) is the cost of energy per kilowatt hour (kWh) produced. When this is equal to or below the cost consumers pay directly to suppliers for electricity, this is called grid parity. Table 1 shows the LCOE for solar in Australia's major cities, indicative retail prices and current Feed-in tariff (FiT) rates. The detailed methodology can be found in the Appendix.

The retail comparison rates are representative variable rates and do not include supply charges. For all capital cities, excluding Perth and Hobart, retail prices are based on the implied usage charges from St Vincent de Paul's tracking of market offers, which was last updated in July 2022. Perth prices are regulated and obtained from Synergy. Hobart prices were obtained from Aurora Energy's Tariff 31, while Darwin prices are obtained from Jacana Energy's regulated residential usage charges. Tables 3, 4 and 5 show the LCOE across major cities at different discount rates.

Table 3: Central estimate: 4.96 per cent discount rate (ten-year average mortgage rate)

All figures in $/KWh	System Size						Retail prices	FIT
	3 kW	4 kW	5 kW	6 kW	7 kW	10 kW		
Adelaide	$0.09	$0.08	$0.08	$0.07	$0.07	$0.07	$0.38	$0.09
Brisbane	$0.10	$0.09	$0.08	$0.08	$0.08	$0.08	$0.23	$0.10
Canberra	$0.09	$0.08	$0.08	$0.08	$0.08	$0.08	$0.28	$0.08
Darwin	$0.11	$0.11	$0.10	$0.10	$0.10	$0.09	$0.27	$0.08
Hobart	$0.12	$0.11	$0.11	$0.11	$0.10	$0.11	$0.28	$0.09
Melbourne	$0.11	$0.10	$0.09	$0.09	$0.09	$0.09	$0.21	$0.08
Sydney	$0.10	$0.09	$0.09	$0.08	$0.08	$0.08	$0.35	$0.11
Perth	$0.08	$0.07	$0.07	$0.07	$0.07	$0.08	$0.30	$0.03

Source: Australian Energy Council analysis, January 2023

Table 4: Low cost of capital sensitivity: 5.49 per cent discount rate (low current standard variable rate)

All figures in $/KWh	System Size						Retail prices	FIT
	3 kW	4 kW	5 kW	6 kW	7 kW	10 kW		
Adelaide	$0.09	$0.08	$0.08	$0.07	$0.07	$0.08	$0.38	$0.09
Brisbane	$0.10	$0.09	$0.09	$0.08	$0.08	$0.08	$0.23	$0.10
Canberra	$0.10	$0.09	$0.08	$0.08	$0.08	$0.08	$0.28	$0.08
Darwin	$0.11	$0.11	$0.11	$0.10	$0.10	$0.09	$0.27	$0.08
Hobart	$0.13	$0.12	$0.11	$0.11	$0.11	$0.11	$0.28	$0.09
Melbourne	$0.11	$0.10	$0.09	$0.09	$0.09	$0.09	$0.21	$0.08
Sydney	$0.10	$0.09	$0.09	$0.08	$0.08	$0.08	$0.35	$0.11
Perth	$0.08	$0.07	$0.07	$0.08	$0.08	$0.08	$0.30	$0.03

Source: Australian Energy Council analysis, January 2023

Table 5: High cost of capital sensitivity: 11.16 per cent discount rate (indicative personal loan rate)

All figures in $/KWh	System Size						Retail prices	FIT
	3 kW	4 kW	5 kW	6 kW	7 kW	10 kW		
Adelaide	$0.13	$0.12	$0.11	$0.10	$0.10	$0.10	$0.38	$0.09
Brisbane	$0.14	$0.13	$0.12	$0.11	$0.11	$0.11	$0.23	$0.10
Canberra	$0.14	$0.12	$0.11	$0.11	$0.11	$0.11	$0.28	$0.08
Darwin	$0.17	$0.17	$0.16	$0.15	$0.15	$0.14	$0.27	$0.08
Hobart	$0.19	$0.17	$0.16	$0.16	$0.15	$0.15	$0.28	$0.09
Melbourne	$0.16	$0.14	$0.13	$0.12	$0.12	$0.12	$0.21	$0.08
Sydney	$0.15	$0.13	$0.12	$0.11	$0.12	$0.11	$0.35	$0.11
Perth	$0.11	$0.10	$0.10	$0.11	$0.10	$0.12	$0.30	$0.03

Source: Australian Energy Council analysis, January 2023

Small and large business - Levelised cost of electricity

Tables 6 and 7 show the estimated cost of electricity production for commercial-sized solar systems. As businesses look to reduce overhead costs, installation of larger-scale solar systems continues to increase.

Business tariffs differ to residential retail tariffs. Depending on the size of the customer and the amount of energy used, businesses can negotiate lower prices. If a business was to consume all electricity onsite, the electricity prices in Tables 6 and 7 would represent the cost per kWh of consumption from the energy generated from the different system sizes listed. For businesses, installation occurs if the benefits of installation outweigh the cost. The average electricity bill for industrial businesses in 2014-15 was 10.72 c/kWh[vi].

Table 4: Central estimate: 5.23 per cent discount rate, ten-year average small business interest rate

All figures in $/KWh	System Size				
	10kW	30kW	50kW	70kW	100kW
Adelaide	$0.08	$0.08	$0.08	$0.08	$0.08
Brisbane	$0.08	$0.08	$0.08	$0.08	$0.08
Canberra	$0.08	$0.08	$0.08	$0.08	$0.08
Hobart	$0.10	$0.09	$0.09	$0.09	$0.09
Melbourne	$0.09	$0.09	$0.09	$0.09	$0.09
Sydney	$0.09	$0.08	$0.09	$0.08	$0.08
Perth	$0.09	$0.08	$0.08	$0.08	$0.07

Source: Australian Energy Council analysis, January 2023

Table 5: Central estimate: 4.52 per cent discount rate, ten-year average large business interest rate

All figures in $/KWh	System Size				
	10kW	30kW	50kW	70kW	100kW
Adelaide	$0.10	$0.10	$0.10	$0.10	$0.10
Brisbane	$0.11	$0.10	$0.10	$0.10	$0.09
Canberra	$0.10	$0.10	$0.10	$0.10	$0.10
Hobart	$0.14	$0.12	$0.13	$0.12	$0.11
Melbourne	$0.13	$0.12	$0.12	$0.11	$0.11
Sydney	$0.12	$0.10	$0.11	$0.11	$0.10
Perth	$0.11	$0.10	$0.11	$0.10	$0.09

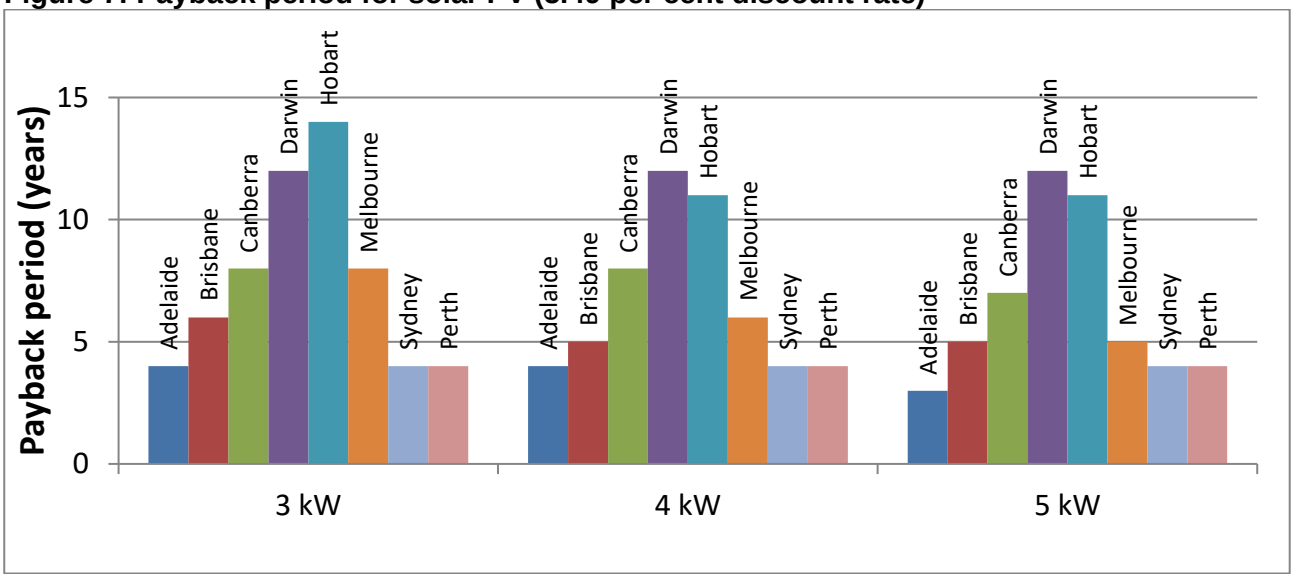
Source: Australian Energy Council analysis, January 2023

SECTION IV: PAYBACK PERIOD, DETAILED MODEL

The payback period is defined as the year when the cumulative savings are greater than the cumulative costs of a solar PV system. Savings represent the avoided cost of consumption and any revenue received from FiTs. The cumulative cost incurred represents the initial investment and the time value of money. A detailed methodology is contained in Appendix 2.

Figure 7 highlights the payback period for different system sizes across Australia. Note that electricity prices are subject to change with consumer price index (CPI) levels and therefore will affect the payback period. Many retailers offer higher solar FiTs, which help to offset the impact of higher prices in some states and deliver savings to customers with solar panels. The low payback periods across many cities further highlights the greater encouragement for customers to install solar PV.

Figure 7: Payback period for solar PV (5.49 per cent discount rate)



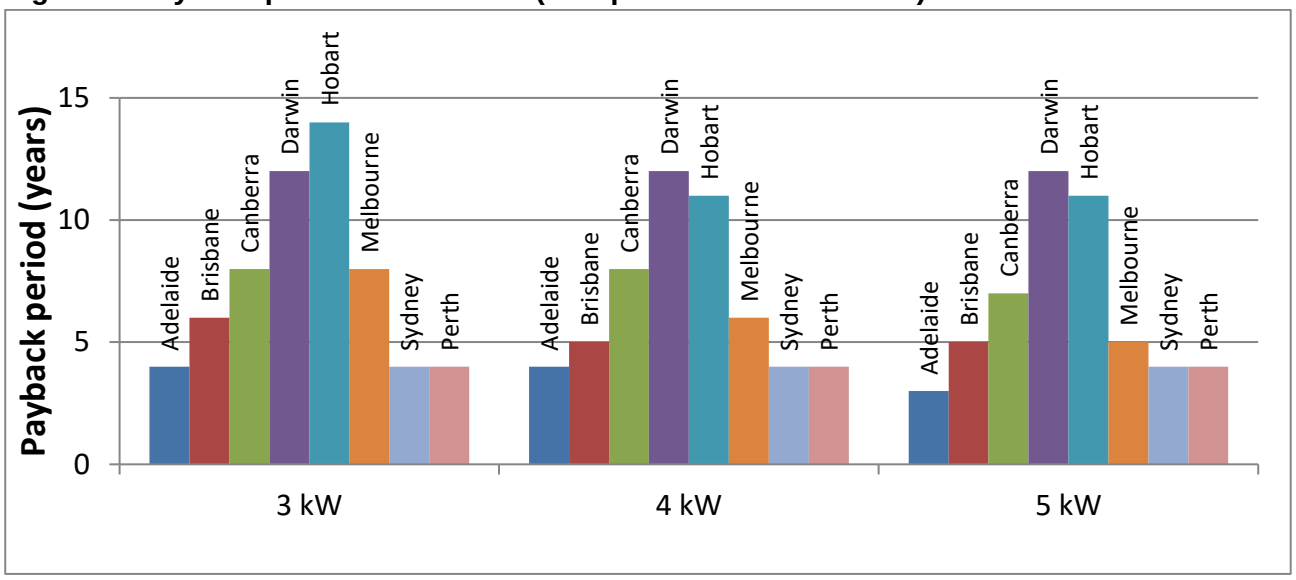
Source: Australian Energy Council analysis, January 2023

Compared to the previous quarter, the price of solar system sizes has dropped in Darwin and Hobart. Tasmania and the Northern Territory have the highest cost of installation, resulting in the highest payback period of more than 10 years with a 3kW, 4kW and 5kW system. Meanwhile, Melbourne's system costs remain relatively more expensive than Sydney, Adelaide and Perth. Those states see little decrease in system prices, a drop between $40 to $140.

Figure 8 shows the expected payback period for systems with a 4.96 per cent discount rate (10-year average home loan rate). Melbourne sees a strong incentive to install a 5kW system rather than a 3kW or 4kW unit size. This can reduce the payback time by three years for a 5kW system compared

to a 3kW system. Adelaide, Brisbane, Sydney and Perth show no change in payback periods with a higher interest rate.

Figure 8: Payback period for solar PV (4.96 per cent discount rate)



Source: Australian Energy Council analysis, January 2023

SECTION V: METHODOLOGY APPENDIX

1. Solar installations methodology

Analysis from the CER's monthly data allows us to estimate the amount of solar PV installed in Australia. Since November 2015, the CER has consistently released data dated as at the first of each month. The new consistent release date allows us to provide a more accurate estimate of the capacity of recent installations. Due to the lag in reporting of new installations, however, the CER data takes up to 12 months to be finalised.

2. Payback period methodology

This methodology outlines our approach in calculating the payback period for solar panels installed across capital cities in Australia. Our analysis includes the following:

- Initial investment
- Discount rate
- Efficiency
- System degradation rate
- Export rate
- Avoided usage cost
- FiT

Initial investment, discount rate, efficiency and system degradation rate are described in appendix 1. Key difference to LCOE calculation is the payback period assumes no annual maintenance cost.

Calculation

Payback period occurs when $\sum$ savings > $\sum$ cost

Where:

Savings = (usage cost x $(1+ CPI)^t$ x consumption / 100) + (Export x FiT)

Cost = investment x $(1 + \text{real discount rate})^t$

t = years

Avoided cost and FiT

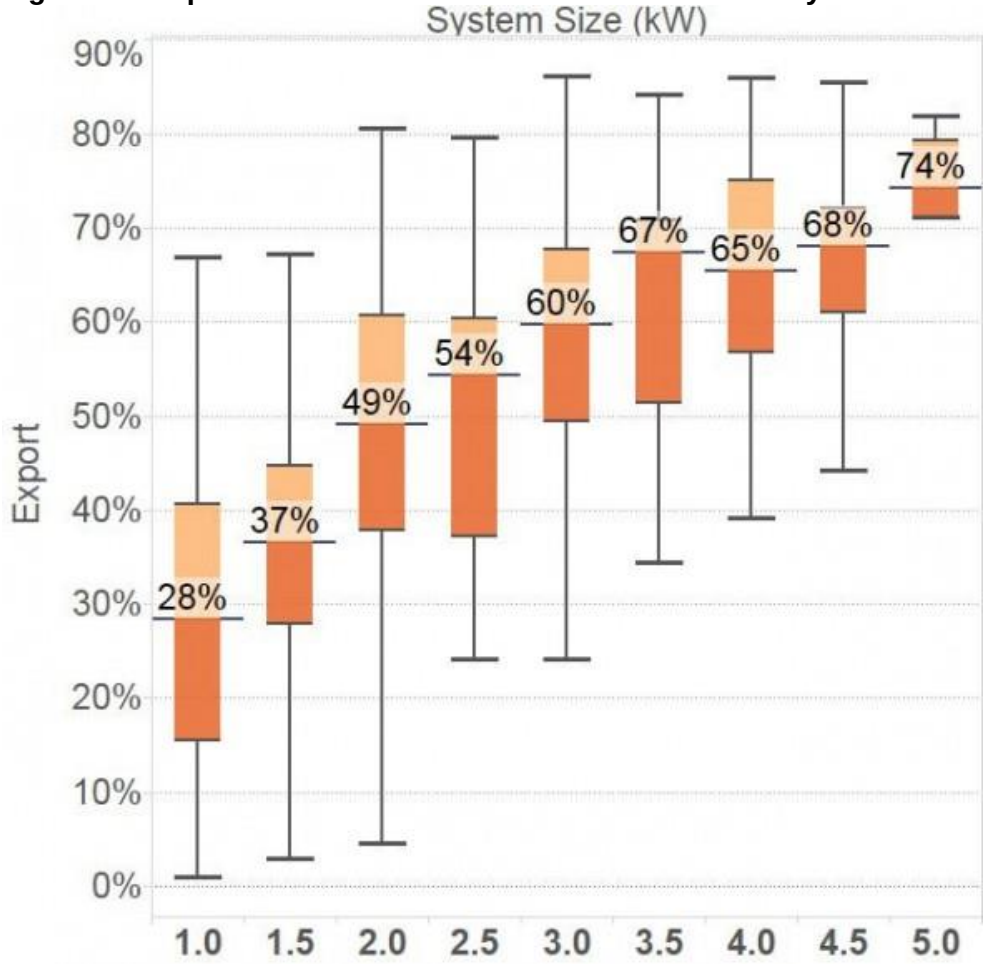
The onsite consumption is multiplied by the retailer's usage charges. CPI has been applied to the usage charge to allow for growth in retail prices. The excess energy is exported to the grid and the

customer is expected to receive the mandatory FiT or a realistic market offer where mandatory tariffs are not applicable.

Export rate

The percentage of onsite consumption and electricity which is exported to the grid is calculated using the median value from Sunwiz' analysis[vii]. See Figure 11 below.

Figure 11: Export rate of residential solar PV at different system sizes



Source: Sunwiz' analysis, 2015

[i] The most recent three months underestimates the data because of a time lag in data collation. The data represents all systems that have had certificates created against them. There is a 12-month period to create the certificates, so numbers of installations are expected to continue to rise.

[ii] Solar PV system owners have up to 12 months to report their data to the Clean Energy Regulator.

[iii] https://www.solar.vic.gov.au/key-dates-solar-homes

[iv] https://www.energy.gov.au/rebates/solar-battery-storage-rebates

[v] https://nt.gov.au/industry/business-grants-funding/home-and-business-battery-scheme

[vi] BCA, "Impact of Green Energy Policies on Electricity Prices", June 2014

[vii] Sunwiz, Solar Pays Its Way on Networks. Last accessed 17 June 2015.