AUSTRALIAN ENERGY COUNCIL

SOLAR REPORT

QUARTER 1, 2023

Australian Energy Council

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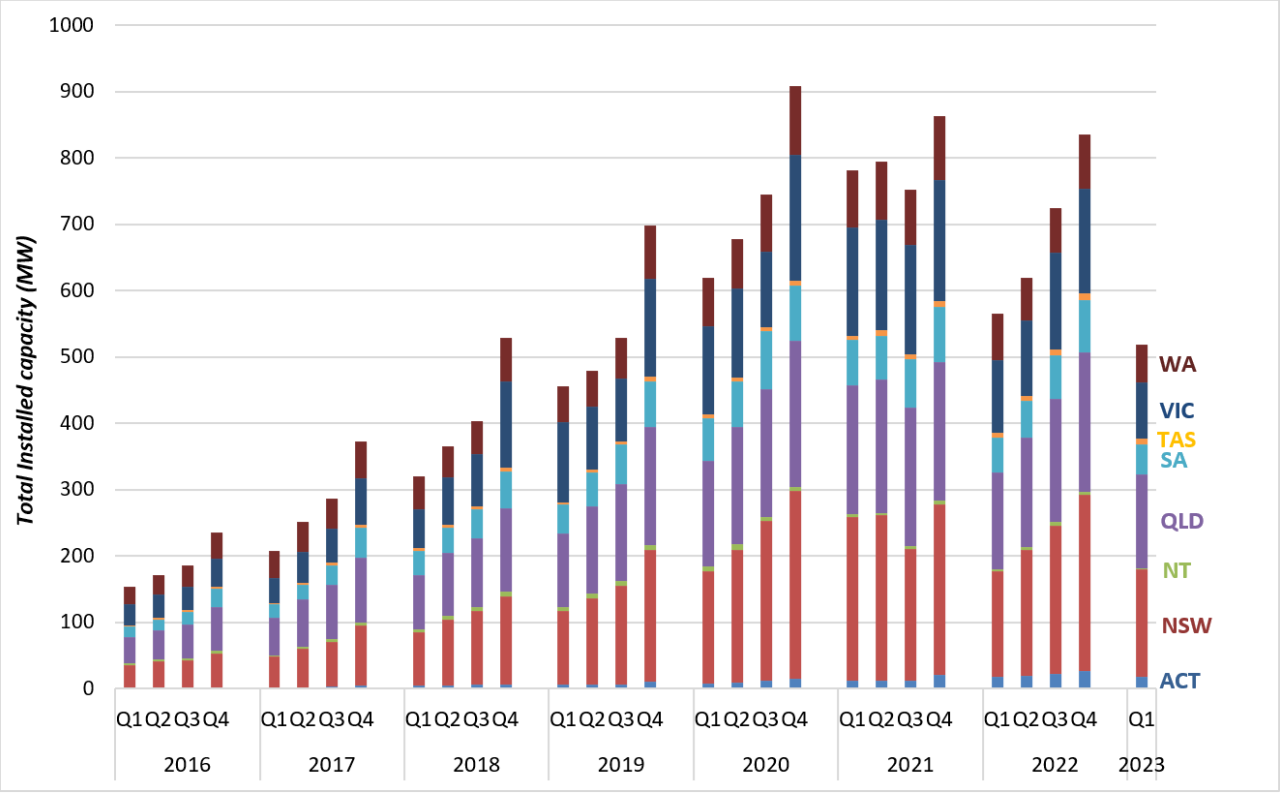
SECTION I: STATE OF SOLAR IN AUSTRALIA

Rooftop solar continues to be a growing part of Australia's energy transition and is fast catching up to coal as Australia's biggest generation source by capacity. At the end of the first quarter this year rooftop solar accounted for 19.8 GW of capacity, which compares to 23.3 GW for coal generation (following this week's closure of the Liddell Power Station in New South Wales).

Updated data from the Clean Energy Regulator (CER) shows that the first quarter of 2023 saw more than 62,000 rooftop installations added to the grid, with new capacity now totalling 520 MW (figure 1). However due to a 12-month lag in reporting[i], the final figures are expected to be 92,000 new rooftop installations, with a total installed capacity of 800 MW. This supports our previous January 2023 Solar Report that showed the rooftop PV industry has bounced back strongly, with many households recognising the benefits and taking action to reduce their carbon footprint and energy costs.

Figure 1: Quarterly installed capacity of rooftop solar PV in Australia since 2016 (unadjusted data)

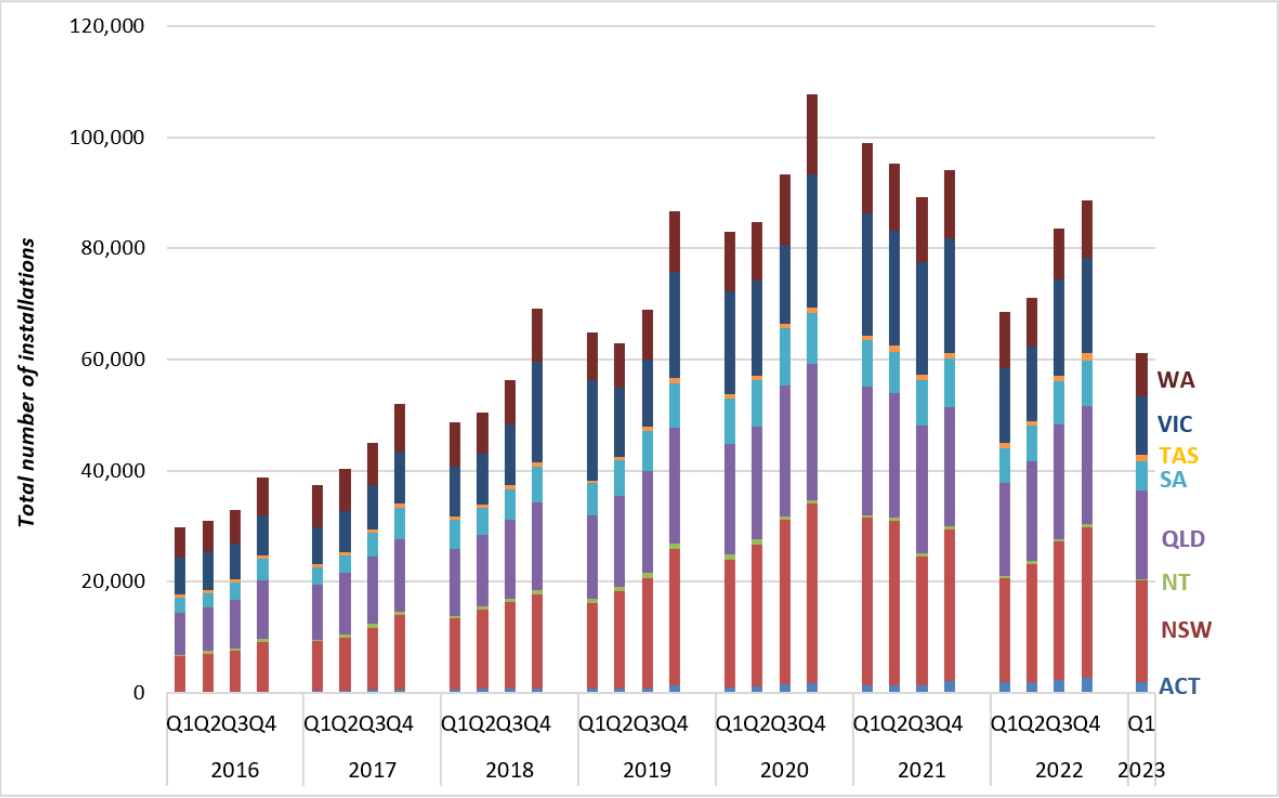


Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 21 April 2023

The first quarter of 2023 shows that New South Wales had the largest share of new installed rooftop solar capacity at 31 per cent of the national total, followed by Queensland (27 per cent), and Victoria (16 per cent). Western Australia and South Australia had shares of 11 per cent and 9 per cent respectively. It is important to note that the distribution of new installed rooftop solar capacity may vary over time depending on a variety of factors including policy decisions, market conditions, and technology trends.

New South Wales also had the highest share of new rooftop solar installations accounting for nearly 30 per cent of new solar panels nationally in the first quarter of 2023, with Queensland following closely behind with 26.2 per cent (figure 2). While Victoria and Western Australia had a significant proportion of households adopting rooftop solar PV systems with 17.2 per cent and 12.8 per cent respectively of new installations. Both states, however, were still well below the uptake rates of New South Wales and Queensland. The other states and territories had lower percentages, with the Northern Territory having the lowest uptake of 0.4 per cent or 229 new installations.

Figure 2: Quarterly installation numbers of rooftop solar PV in Australia since 2016 (unadjusted data)

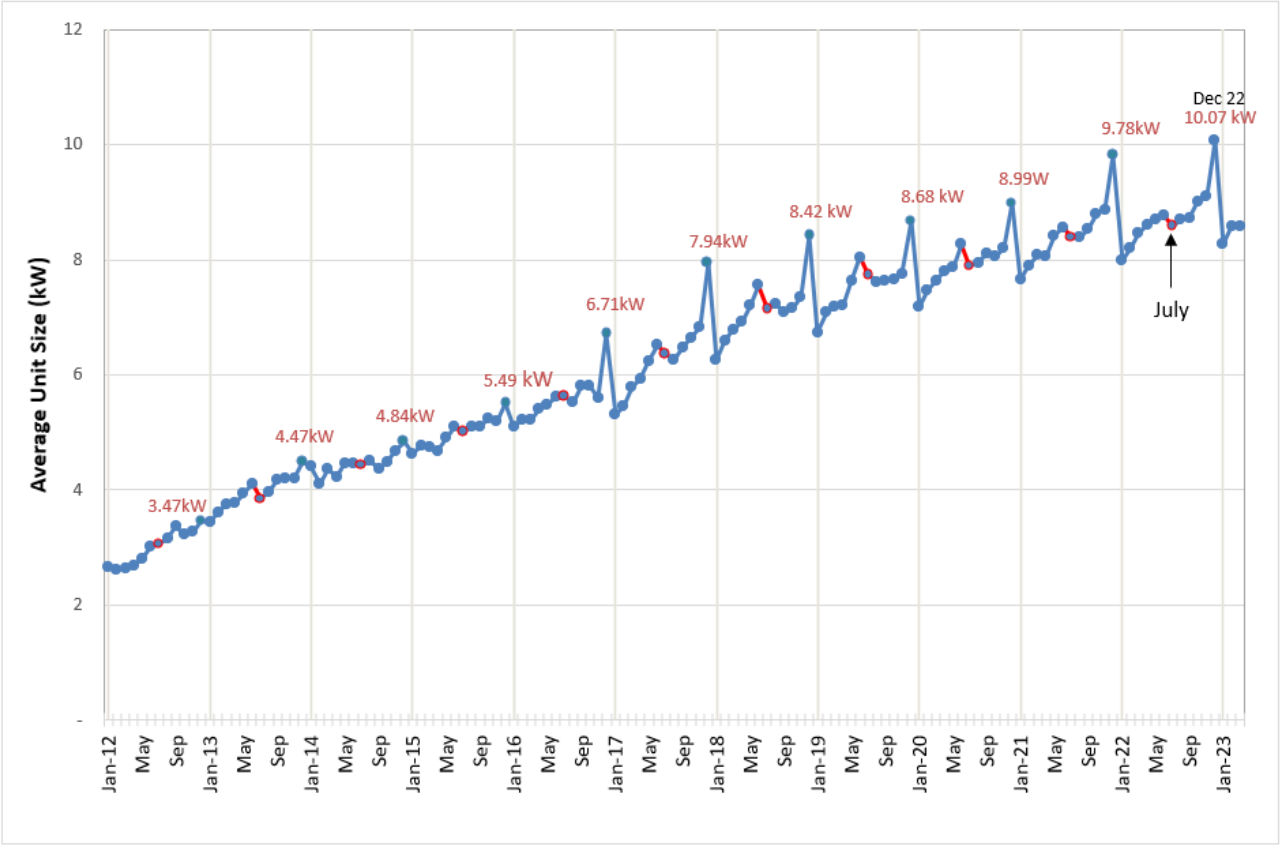


Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 21 April 2023

Ten years ago, Australia's average rooftop PV system size was 3.4kW and it has steadily increased to approximately 8.3kW today (figure 3). Historically, January typically shows a large dip in average

system size, 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. Households and businesses rush to install their systems before the year end to maximise the number of STCs that their solar PV systems may be eligible for, and as a result December 2022 shows a peak average size of 10.07kW for installed systems. While the optimal system size for households can vary greatly, figure 3 shows that homeowners appear motivated to install larger systems to generate more energy and achieve greater energy independence, particularly as electricity prices continue to rise.

Figure 3: Average unit size (kW) of rooftop solar system in Australia by month (unadjusted data)



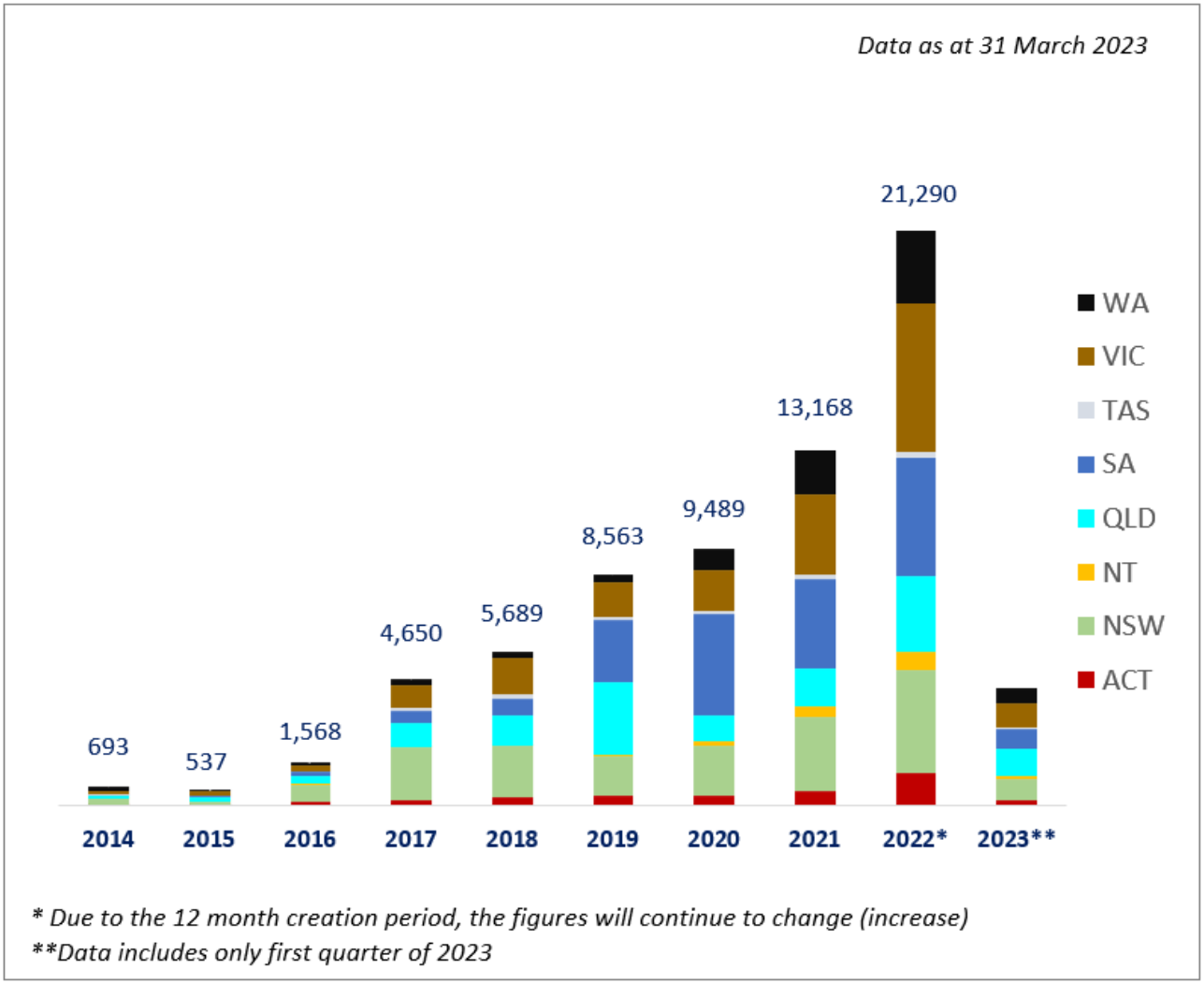
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 21 April 2023

Battery installations with rooftop solar

A total of 4,368 of new rooftop PV with battery installations were registered to the CER in the first quarter of 2023 (figure 4).

When comparing the uptake of battery installations with rooftop solar by state, Victoria beat South Australia's market share for the first time since 2022. This change coincides with the closure of the SA Government's Home Battery Scheme last financial year. However, current data shows that in the first quarter of 2023, Queensland is leading all states with 1,023 new PV with battery installations, while Victoria reported 903 new installations.

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



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 21 April 2023

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

Table 1: GOVERNMENT POLICIES

State/ Territory	Policy Incentive (Solar & Battery)	Energy target
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[ii].	• to deliver a 70% cut in emissions by 2035 compared to 2005 levels • net zero by 2050
New South Wales	• Rebate Swap for Solar: The program gives low-income homeowners to swap to a free 3kW solar system. • No specific policy for new solar or battery installations.	• net zero by 2050
Northern Territory	• Home and Business Battery Scheme allows residents to buy and install batteries and inverters with a maximum grant of $6,000[iii]	• 50% by 2030
Queensland	• No specific policy	• 50% by 2030
South Australia	• No specific policy	• 100% by 2030
Tasmania	• No specific policy	
Victoria	• Solar Homes Program: a rebate of up to $1,400 for solar panel system installation	• 65% by 2030 • 95% by 2035[1]
Western Australia	• No specific policy	

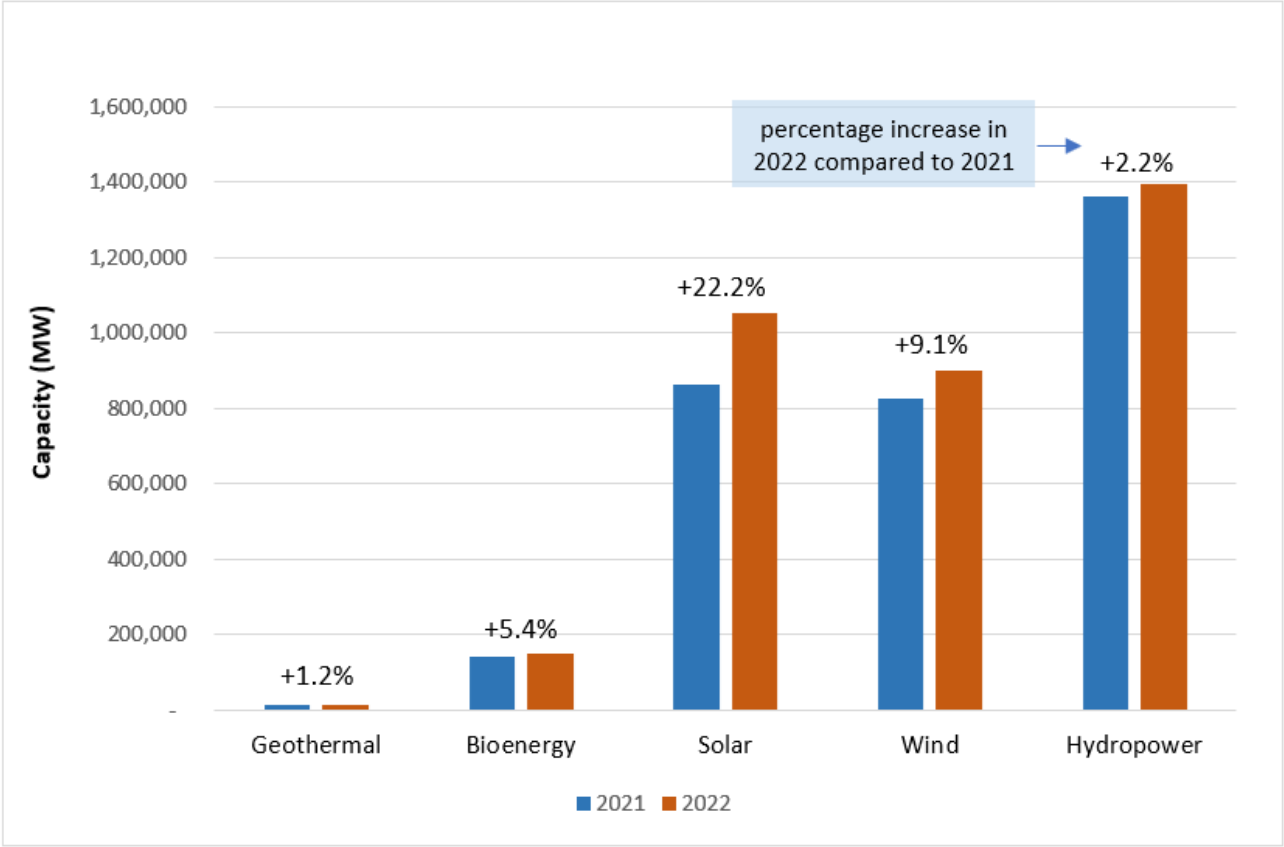
[1] Victorian renewable energy and storage targets, page last updated 15 February, 2023

SECTION II: GLOBAL SOLAR ENERGY SECTOR

The International Renewable Energy Agency's (IRENA) recent Renewable Capacity Statistics 2023 shows that 2022 was another historic year for the global solar energy sector. Approximately 191.6 GW of solar was installed, which is 60 per cent higher than the amount of wind power capacity added (74.6 GW) in 2022. Geothermal energy increased by a very modest of 1.2 per cent (181MW added capacity).

Figure 5 shows the total installed capacity globally of different renewable generation power. Compared to 2022, solar had the greatest jump of a 22.2 per cent increase in its capacity, while wind generation ranked second adding an additional 9.1 per cent.

Figure 5: Global renewable installed capacity in 2021 and 2022

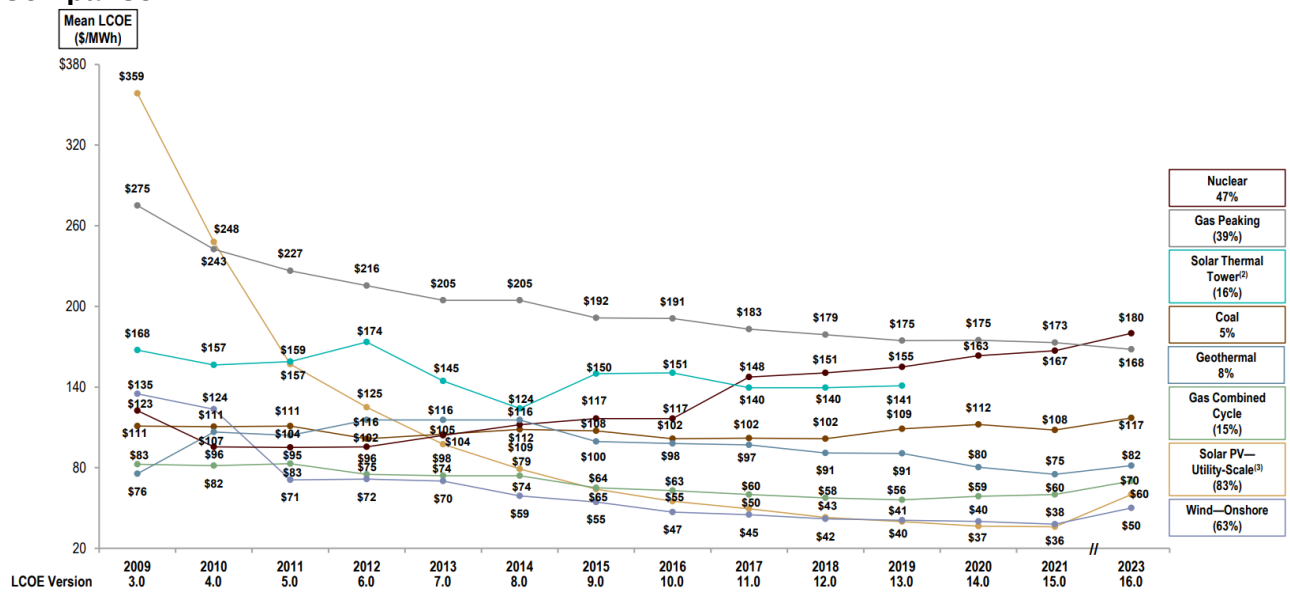


Source: AEC's analysis on IRENA RE Capacity Statistics (March 2023)

Solar power has emerged as one of the most cost-effective and efficient sources of renewable energy in recent years, driving a surge in the uptake of solar installations globally. It was once the most expensive sector to invest with an estimate of $359 per MWh installed in 2009 (figure 6). The falling cost of solar systems has been a major factor contributing to the boost in the solar sector. However, in the last two years the cost of solar installations has risen due to supply chain disruptions

and high demand post the pandemic. Despite the recent rise in utility scale solar cost in 2023 (from $36/MWh in 2021 to $60/MWh in 2023), solar energy remains cost-effective. Even though the wind sector rates the lowest cost in 2023, solar energy is a more viable option as it can be deployed on a smaller scale and across a wider range of locations, including urban and suburban areas, while wind energy is a less versatile energy source as it requires specific geographical and topographical conditions.

Figure 6: Levelised Cost of Energy Comparison—Historical Utility-Scale Generation Comparison



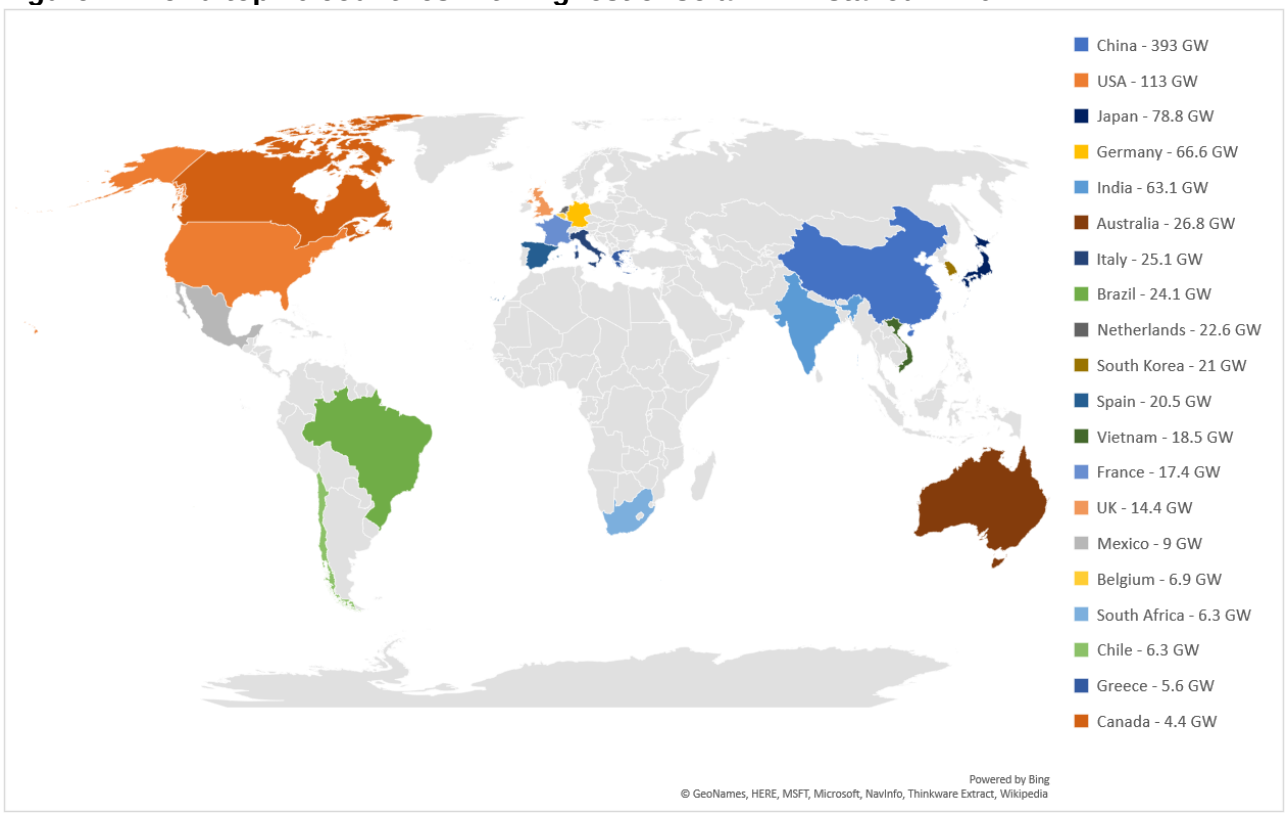
Source: Lazard (April 2023)

Top 20 countries with highest solar capacity in 2022

Asia continues to lead global solar capacity with China, Japan, and India accounting largely for the increase last year. China continues to dominate global solar market installations with a total of 393 GW of solar capacity and added the greatest solar capacity (86.1 GW) to its grid with an addition of 28 per cent. This is followed by India that added 13.5 GW of new solar capacity, and Japan 4.6 GW.

Australia continued to rank sixth in world solar capacity additions during 2022, adding an additional 3.9 GW of solar with most additions coming from residential rooftop PV. Utility-scale solar only accounts for 28 per cent of total solar capacity (7,551 MW of total solar capacity of 26,792 MW).

Figure 7: World top 20 countries with highest of solar PV installed in 2022

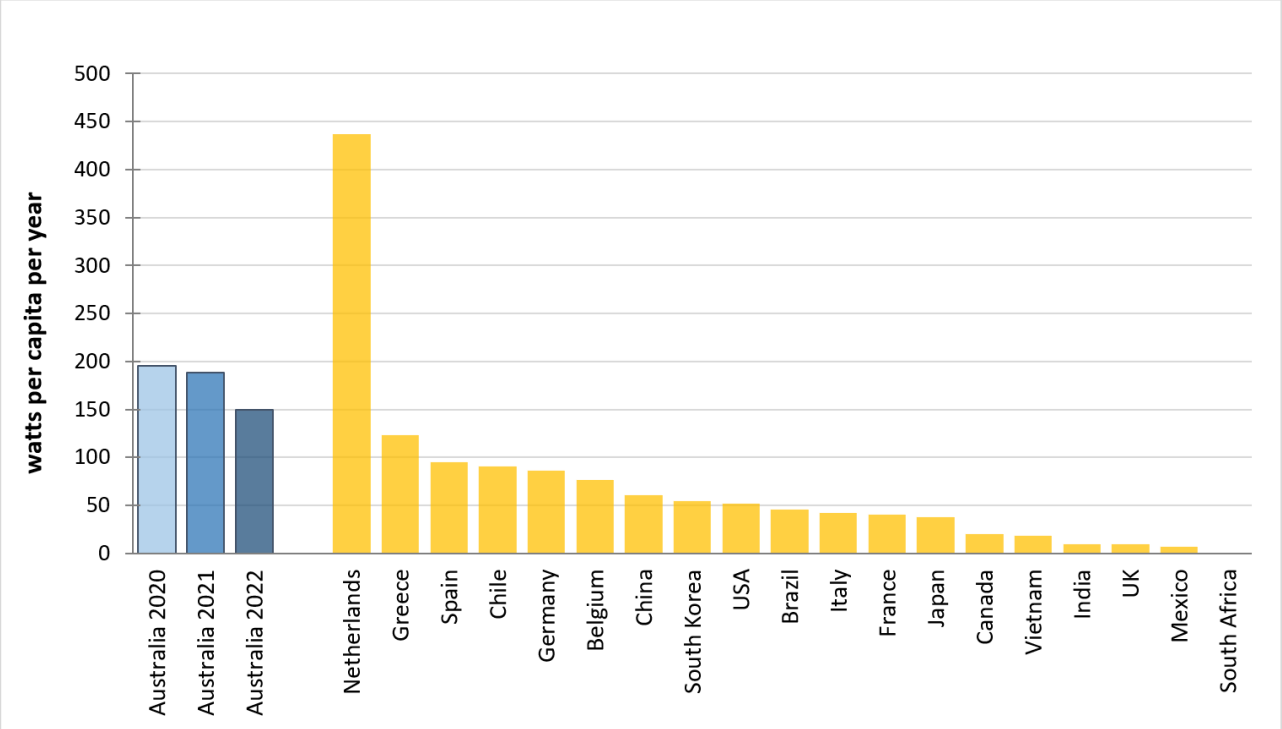


Source: Australian Energy Council analysis of IRENA RE Capacity Statistics (March 2023)

Globally, Australia ranks second in the deployment rate with the solar installation per capita, tracking at 150 watts per person in 2022.

Figure 8 shows the top 20 countries with the greatest solar deployment rate per capita. Solar deployment rate refers to the pace at which solar energy capacity is installed in a year and divided by the country's total population in that year. The Netherlands added 7.7 GW of solar in 2022, while Australia added 3.9 GW. With a smaller population size of under 18 million, The Netherlands leads the world in solar deployment rate per capita (tracking at 437 watts per person in 2022), followed by Australia, Greece, and Spain.

Figure 8: 2022 Global per capita solar deployment rate (watts per capita)

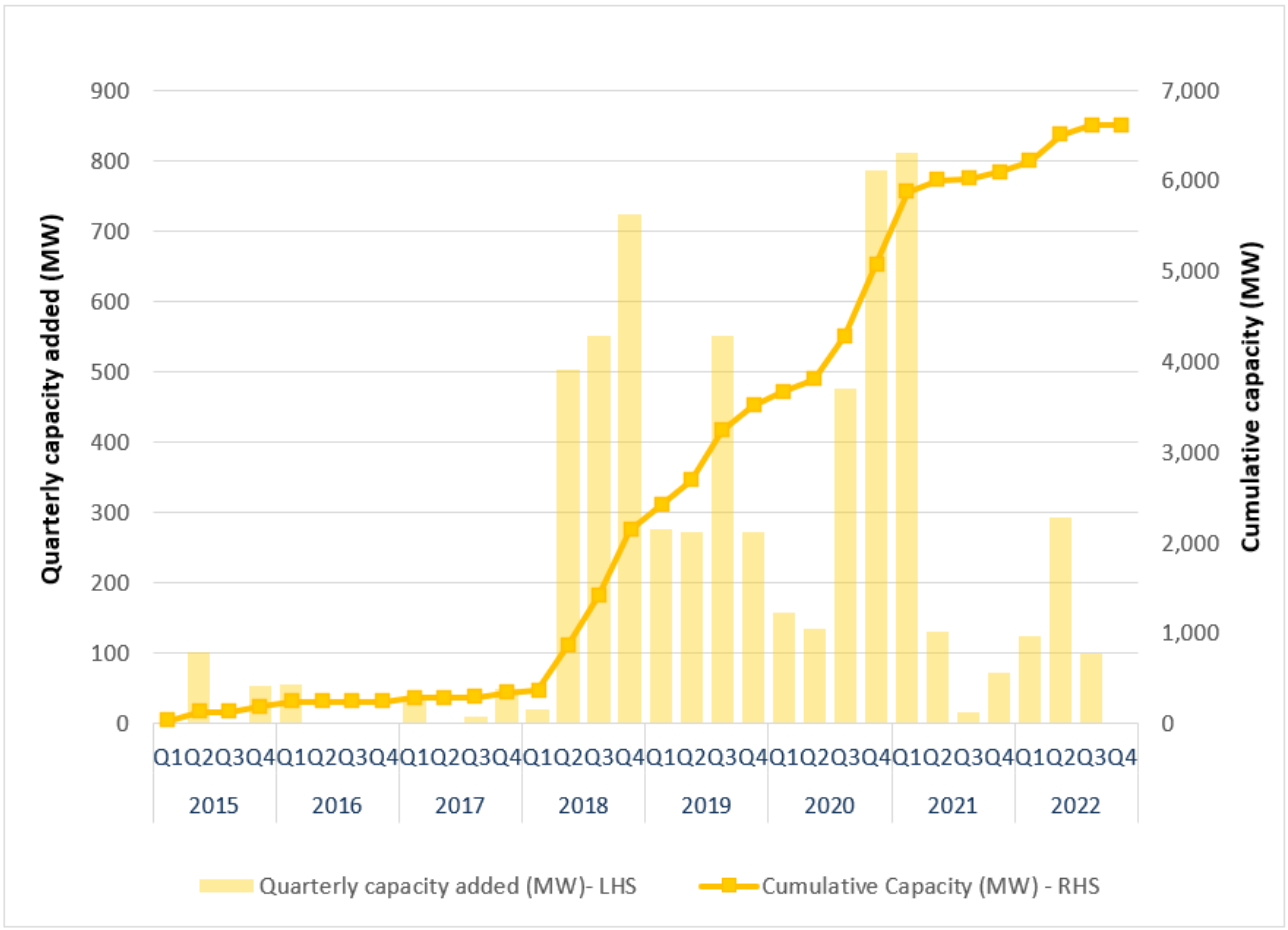


Source: Australian Energy Council analysis of IRENA RE Capacity Statistics (March 2023) & StatisticsTimes

Figure 8 also shows that Australia's solar deployment rate per capita has progressively decreased over the past three years (from 195 to 188 to 150 watts per person). This is due to the slowdown in utility-scale solar capacity added to the grid during 2021 and 2022 (figure 9). 2020 marks a record year for large-scale solar which added 1,553 MW during that year, while 2021 and 2022 saw an addition of 1,031 MW and 515 MW, respectively.

The world's top three countries by population - China, India and USA - are ranked 8th, 17th, and 10th respectively, in terms of solar deployment rate per capita.

Figure 9: Australia utility-scale solar capacity commissioned by quarter.



Source: Australian Energy Council analysis of IRENA RE Capacity Statistics (March 2023)

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 2 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 2, 3 and 4 show the LCOE across major cities at different discount rates.

Table 2: 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	$0.08	$0.08	$0.08	$0.07	$0.07	$0.08	$0.38	$0.09
Brisbane	$0.09	$0.09	$0.08	$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	$0.10	$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	$0.10	$0.09	$0.09	$0.09	$0.19	$0.08
Sydney	$0.10	$0.09	$0.08	$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, April 2023

Table 3: Low cost of capital sensitivity: 5.45 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	$0.08	$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	$0.12	$0.10	$0.10	$0.09	$0.09	$0.09	$0.19	$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, April 2023

Table 4: High cost of capital sensitivity: 14.37 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	$0.12	$0.11	$0.11	$0.10	$0.10	$0.11	$0.38	$0.09
Brisbane	$0.14	$0.13	$0.12	$0.11	$0.12	$0.11	$0.23	$0.10
Canberra	$0.14	$0.13	$0.12	$0.11	$0.12	$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	$0.17	$0.15	$0.14	$0.13	$0.13	$0.13	$0.19	$0.08
Sydney	$0.14	$0.13	$0.12	$0.11	$0.12	$0.11	$0.35	$0.11
Perth	$0.11	$0.10	$0.10	$0.10	$0.10	$0.11	$0.30	$0.03

Source: Australian Energy Council analysis, April 2023

Small and large business - Levelised cost of electricity

Tables 5 and 6 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 5 and 6 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[iv].

Table 5: Central estimate: 5.20 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	$0.08	$0.08	$0.08
Perth	$0.09	$0.08	$0.08	$0.08	$0.07

Source: Australian Energy Council analysis, April 2023

Table 6: Central estimate: 4.53 per cent discount rate, ten-year average large 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	$0.07
Canberra	$0.08	$0.08	$0.08	$0.08	$0.07
Hobart	$0.10	$0.09	$0.09	$0.09	$0.09
Melbourne	$0.09	$0.09	$0.09	$0.09	$0.08
Sydney	$0.09	$0.08	$0.08	$0.08	$0.08
Perth	$0.08	$0.07	$0.08	$0.07	$0.07

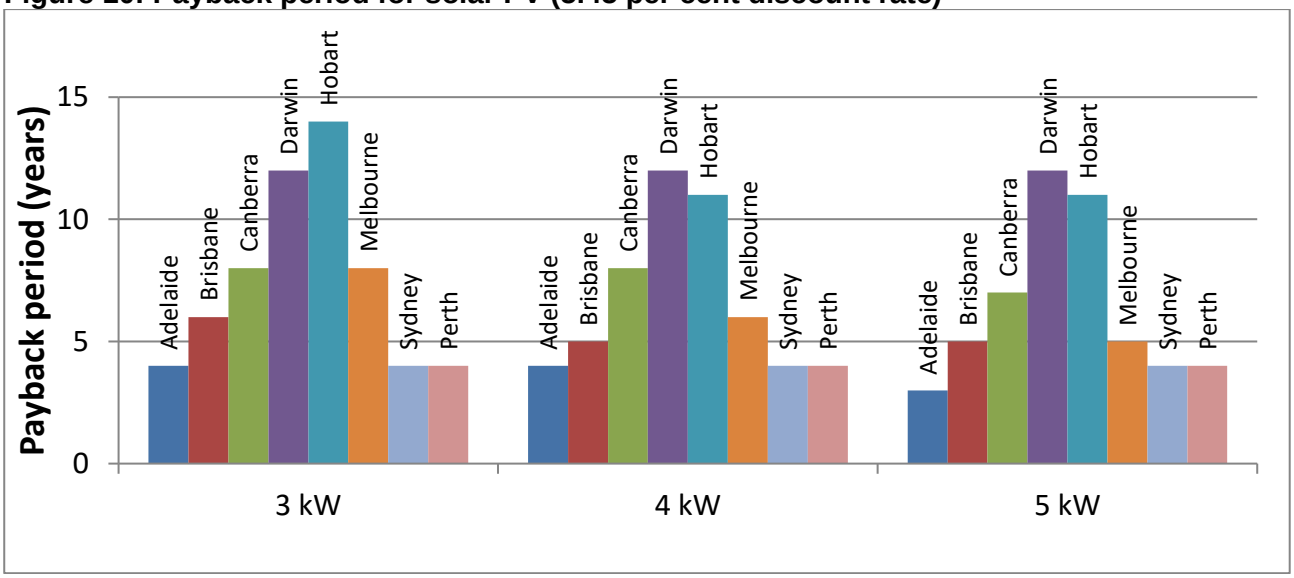
Source: Australian Energy Council analysis, April 2023

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 10 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 10: Payback period for solar PV (5.45 per cent discount rate)



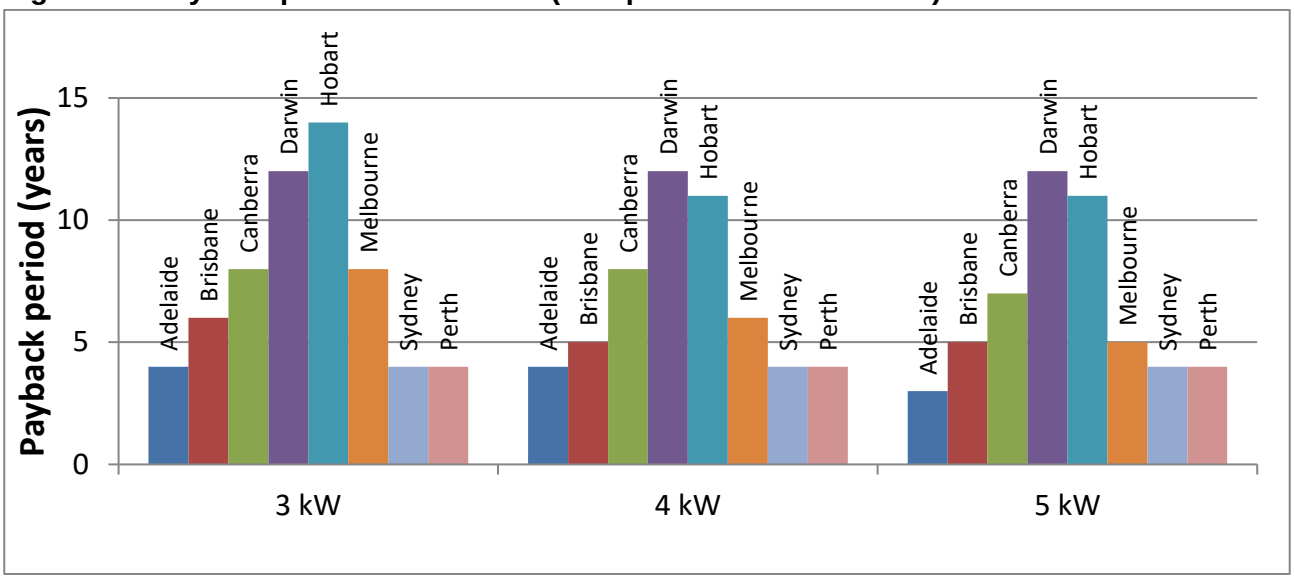
Source: Australian Energy Council analysis, April 2023

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.

Figure 11 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 11: Payback period for solar PV (4.96 per cent discount rate)



Source: Australian Energy Council analysis, April 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

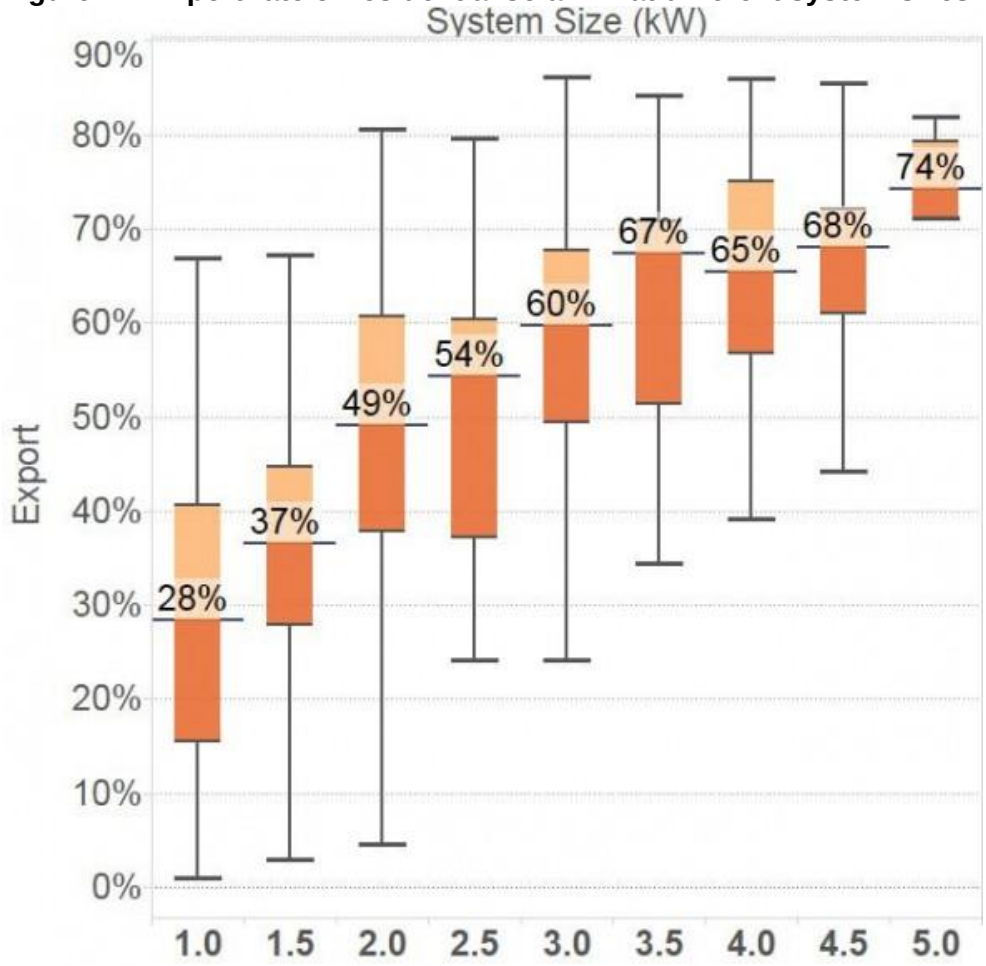
Avoided cost and FiT

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

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

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

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