AUSTRALIAN ENERGY COUNCIL

SOLAR REPORT

QUARTER 2, 2023

Australian Energy Council

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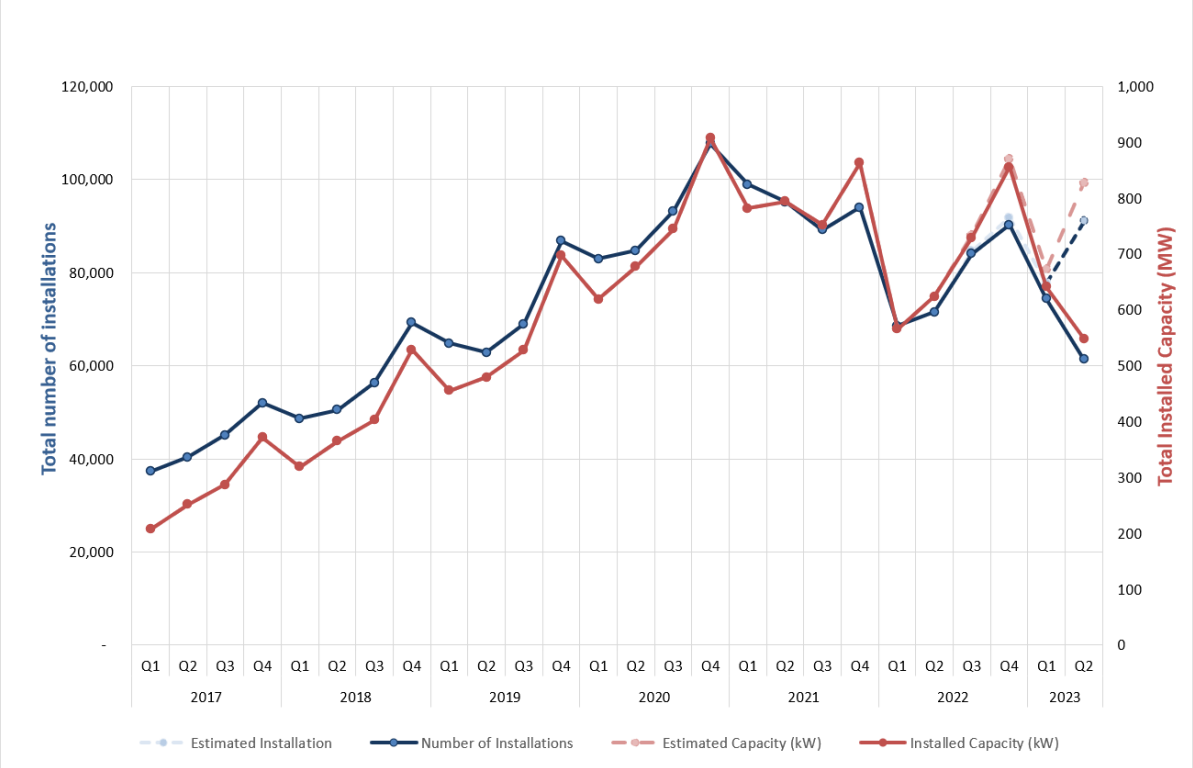
SECTION I: STATE OF SOLAR IN AUSTRALIA

According to the latest data from the Clean Energy Regulator (CER), a substantial increase in rooftop installations was recorded in the second quarter of 2023 with more than 61,000 new installations added to the grid. The total installed capacity of these new installations was 520 MW (see figure 1), taking total Australian rooftop solar capacity to 20.5 GW. However, it's important to note that the data reporting has a 12-month lag. Based on projections, the final figures are expected to be even higher, with approximately 91,000 new rooftop installations expected to be recorded by the end of the reporting period. This surge in installations is also projected to lead to a total installed capacity of 827 MW, further indicating the growing adoption of rooftop solar solutions in the second quarter of 2023.

Based on these projections there appears to have been more solar installations in Q2 than the previous fourth quarter. If confirmed this will be the first time the second quarter installations have exceeded those in a fourth quarter. That’s because the fourth quarter generally has the most installations because households and businesses rushing to install systems before the year end in order to maximise the number of small-scale technology certificates (STCs) that their solar PV systems may be eligible for. One factor encouraging solar installations in Q2 is likely to have been the discussion and reporting of increases in wholesale electricity costs leading to an expectation and announcement of significant rises in household power bills from July 2023. The improved take-up also came at a time of increasing interest rates which is estimated to have pushed out the payback period for solar systems by 12 months (this is discussed further in Section IV).

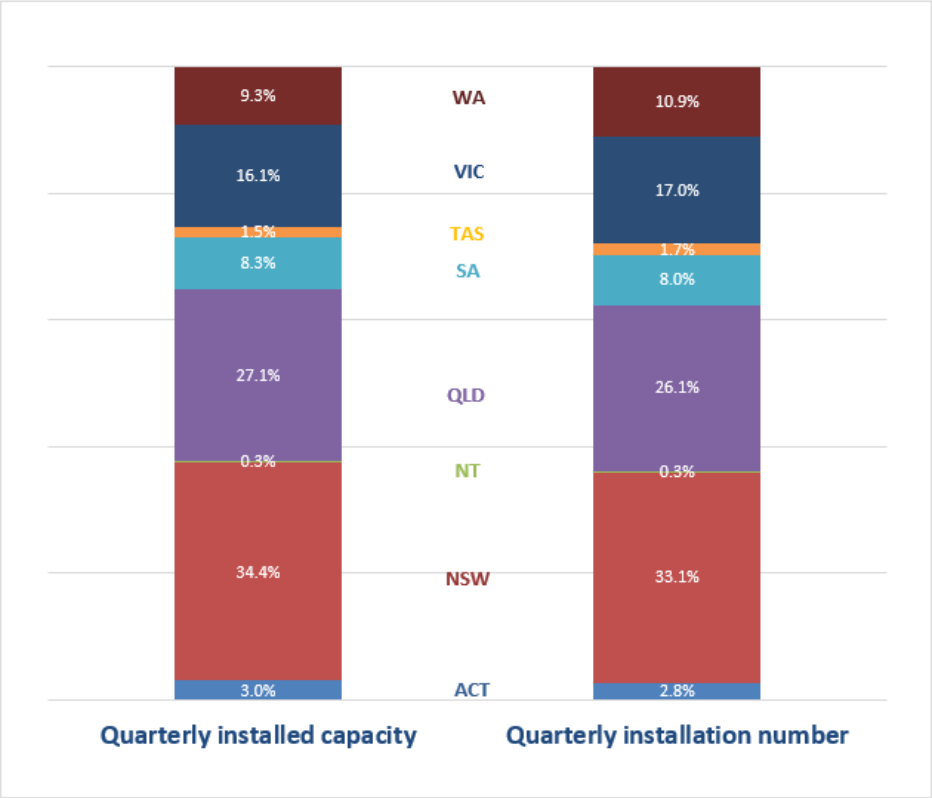
Figure 1: Quarterly installed capacity and installation numbers of rooftop solar PV in Australia since 2017 (unadjusted data)



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 25 July 2023

In the second quarter of 2023, New South Wales led the country in terms of newly installed rooftop solar systems, with 33.1 per cent of the national total. This significant level of installations also resulted in New South Wales installing the most solar capacity in the quarter, with 34.4 per cent, or 189 MW of the total 549 MW installed nationally during the quarter. It was closely followed by Queensland and Victoria with 26.1 per cent and 17 per cent respectively of the total installations. Western Australia accounted for 11 per cent of the country's total installed rooftop solar systems in Q2 2023, and South Australia accounted for 8 per cent indicating a continued interest in rooftop solar across the country.

Figure 2: Share of installed capacity and installation number of rooftop PVs across jurisdictions in Q2-2023



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 25 July 2023

The average system size of rooftop solar installations varies depending on geographical locations and individual preferences. In recent years, there has been a notable trend towards larger system sizes as technology advancements and decreasing costs take hold in the market.

As at the end of the second quarter of 2023, the average system size for rooftop solar installations is estimated to be around 9.3 kilowatts (kW) across Australia. However, it's important to note that this figure does vary by state as shown in table 1 below, with some areas reporting slightly higher or lower averages due to specific energy demands and policies. Nonetheless, the increasing popularity of rooftop solar and the desire for greater energy independence have contributed to the rise in average system sizes.

Table 1: Average unit size (kW) of rooftop solar system in Australia by states in Q2- 2023

	Average system size (kW)		
By states	**April**	**May**	**June**
ACT	9.6	12.5	9.8
NSW	9.7	9.6	9.4
NT	10.6	14.0	8.8
QLD	10.1	10.1	9.4
SA	9.1	10.1	9.5
TAS	7.9	8.2	7.7
VIC	9.0	9.2	8.5
WA	8.2	9.5	8.2
Average size (kW)	**9.3**	**9.7**	**9.0**

Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 25 July 2023

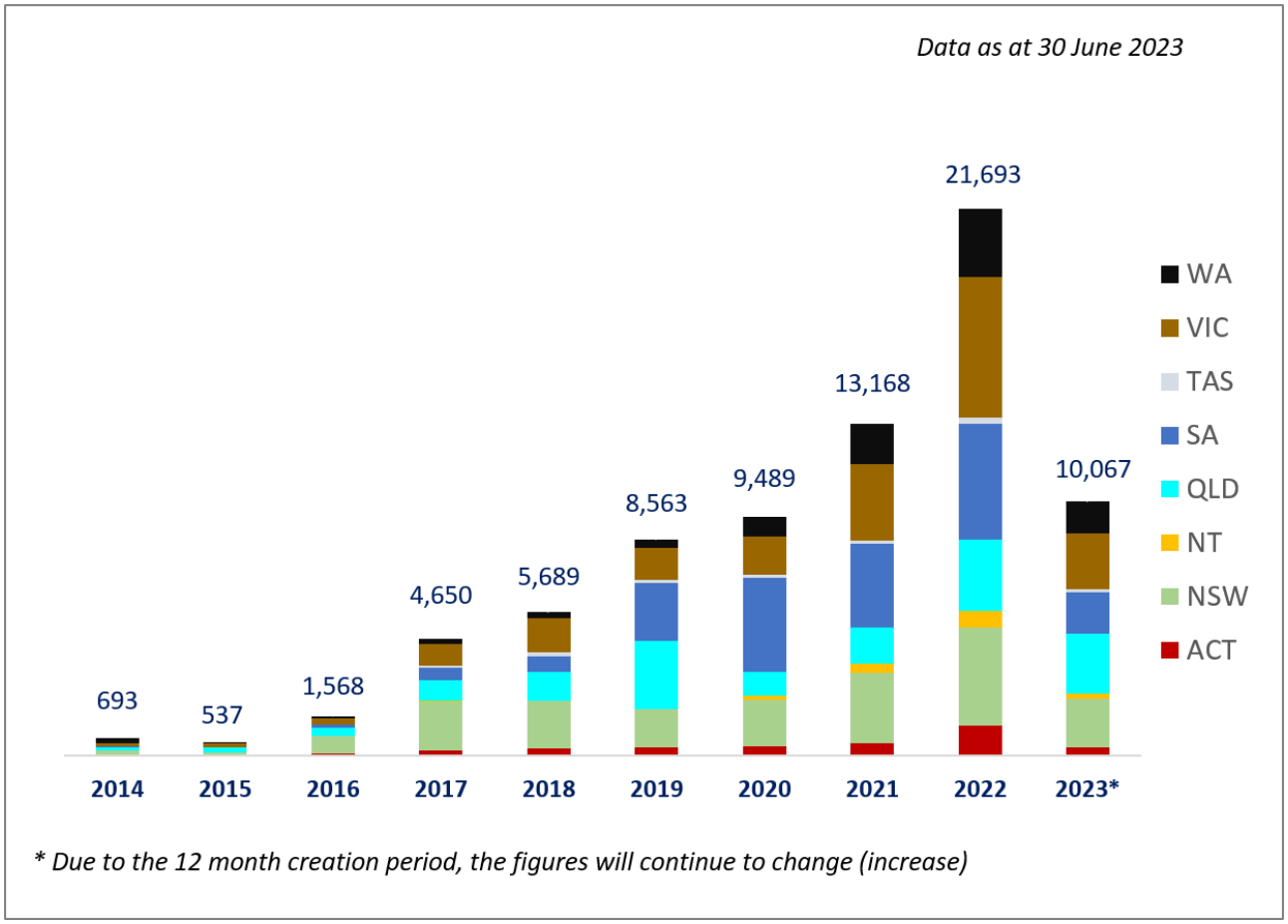
Battery installations with rooftop solar

By the end of the second quarter of 2023, there were 10,067 new rooftop PV installations equipped with batteries registered to the Clean Energy Regulator (CER) (see figure 3).

In the previous quarterly report, the total number of rooftop solar installations with batteries during the first quarter of 2023 represented 20 per cent of the total number of installations recorded in 2022. On a positive note, total storage capacity in the National Electricity Market (NEM) and WA's Wholesale Electricity Market (WEM), indicates that there continues to be an increase in battery with rooftop solar installations. In the latest data, which provides a half yearly overview, combined installations accounted for nearly half of the total number recorded in 2022 (46 per cent). These numbers are expected to increase further given that there can be a 12-month lag in reporting of data. Overall there has a significant uptake of solar and rooftop installations in the second quarter of 2023, again possibly encouraged by the expectation and announcement of increases in electricity prices from 1 July 2023.

Similar to the previous quarter, as a result of last financial year's closure of the South Australian Government's Home Battery Scheme there was a noticeable decline in households adopting rooftop solar and battery systems in South Australia. When comparing states, Queensland led the way in the second quarter with 2,381 new PV installations equipped with batteries, followed by Victoria with 2,220 new combined installations, and then New South Wales with 1,897 new installations. Collectively, the Eastern Australian states account for an impressive 85.5 per cent of the country's total installations of rooftop solar and batteries.

Figure 3: 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 25 July 2023

Since the last Solar Report, there have been updates to State Government schemes or rebates on solar and battery storage installation in Australian Capital Territory, Northern Territory and Victoria.

Table 2: Government policies

State/ Territory	Policy Incentive (Solar & Battery)	Energy target
Australian Capital Territory	• The state's Next Generation Energy Storage Program has ceased its offer of a rebate of $3,500 (excluding GST) or 50 per cent of the battery price (excluding GST) – whichever is lowest[i].	• to deliver a 70 per cent 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 $5,000 (reducing from $6,000) from 1 July 2023[ii]	• 50 per cent by 2030
Queensland	• No specific policy	• 50 per cent by 2030
South Australia	• No specific policy	• 100 per cent by 2030
Tasmania	• No specific policy	
Victoria	• 4,500 interest-free loans of up to $8,800 are available in 2023-24.	• 65 per cent by 2030 • 95 per cent by 2035[1]
Western Australia	• No specific policy	

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

SECTION II: ALL-ELECTRIC HOUSING

The decision by the Victorian Government to ban gas connections for new households from 1 January 2024 is an important step towards promoting the adoption of electricity usage and renewable energy sources. By implementing this ban, the government aims to encourage greater reliance on electricity, which can be generated from solar for residential householders. This move aligns with its broader goal of reducing carbon emissions and achieving a net-zero carbon footprint by 2045.

The surging costs of electricity bills have indeed become a pressing concern for many households across the country. By shifting the focus from gas to electricity, the government will incentivise more households to consider investing in solar and battery installations as an alternative to traditional energy sources. Solar panels can help generate electricity on-site, reducing dependence on the grid and potentially lowering electricity bills in the long run.

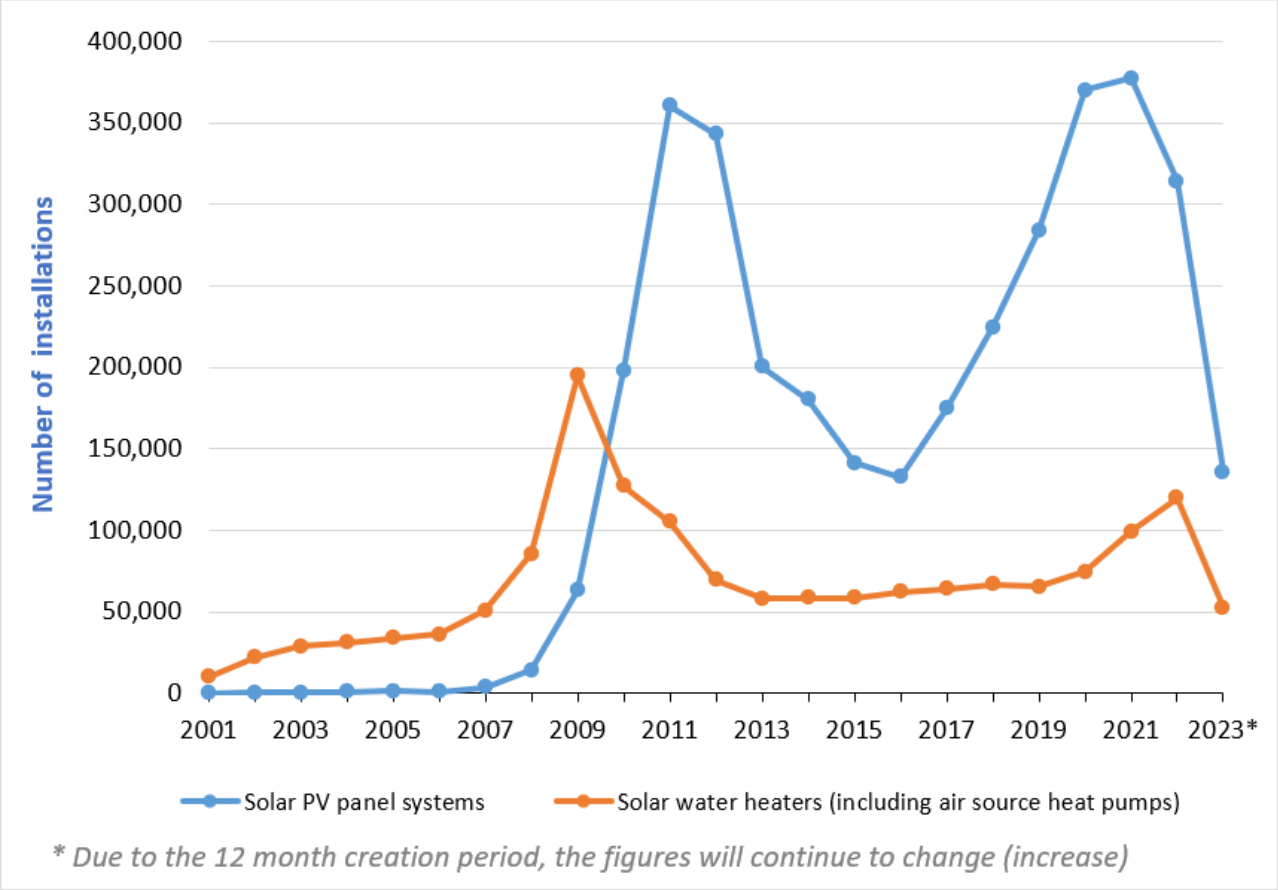
Moreover, battery installations can store excess energy generated from renewable sources during times of low demand, allowing households to use this stored energy during peak hours or when renewable sources are not available. This promotes energy self-sufficiency and contributes to a more stable and reliable power grid.

Simultaneously, the demand for solar water heaters (SWH) has risen, fuelled by the desire for energy-efficient and eco-friendly space heating and cooling solutions. By leveraging renewable solar power, both solar water heaters - solar and solar air source heat pumps can help users lower their energy consumption and utility costs.

Solar water heater trends

Despite the uptake of solar PV installations across the nation, to date there has not been a matching increase in the use of solar water heaters. Approximately 120,000 SWH systems were installed across Australia during 2022, taking the number of total installations to almost 1.5 million units.

Figure 4: Solar PV and solar water heater uptake in Australia since 2001



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as at 25 July 2023

Figure 4 shows that since 2010, the number of installations of solar panels has continued to increase sharply since overtaking SWH installations in Australia. There was a noticeable increase in the use of SWH from 2006 to 2009. The year 2009 saw a peak of 194,695 solar water and heat pump system installations - double compared to the previous year's 85,385 recorded installations. This was due to Government rebate programs to assist with the initial purchase cost.

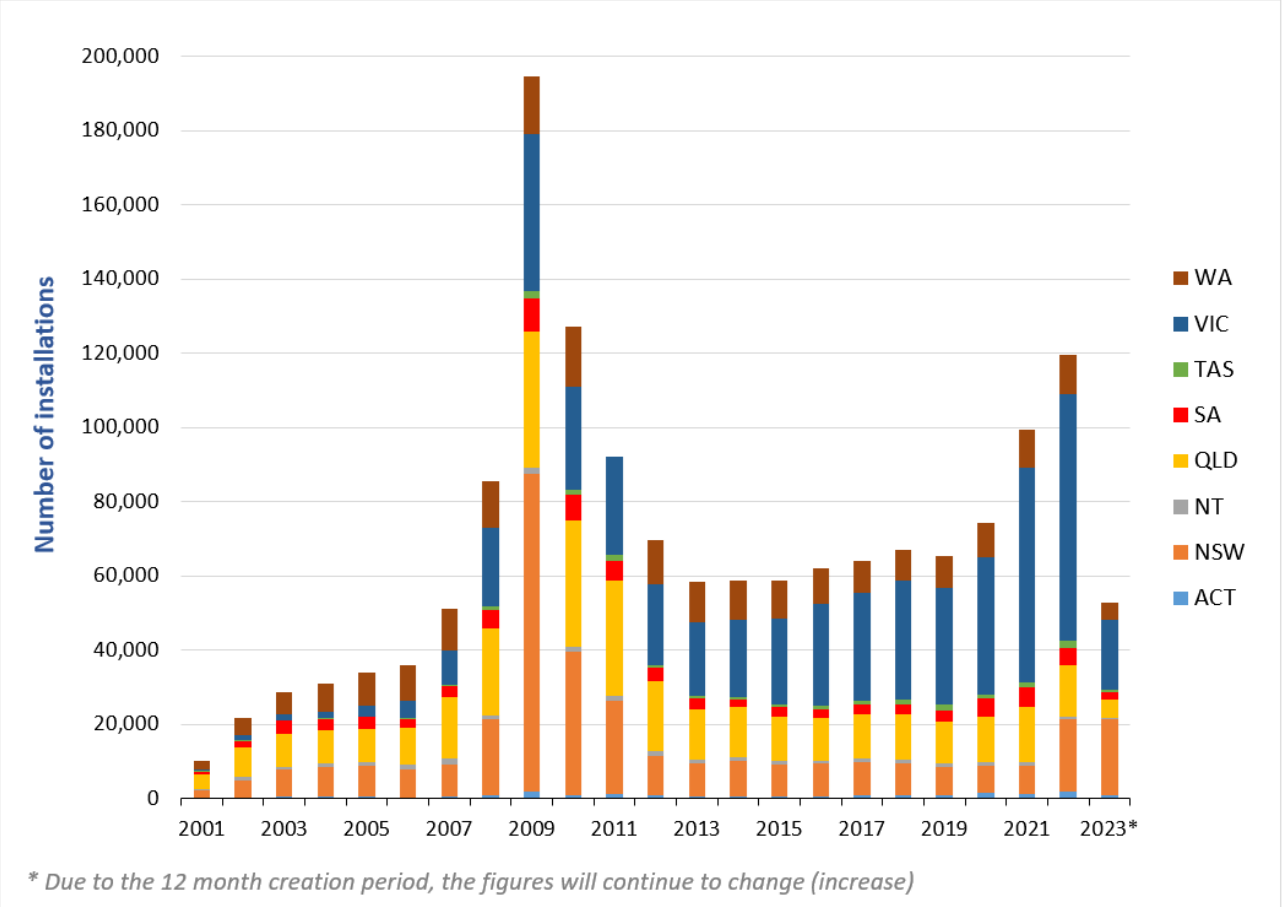
The Federal Government offered a rebate up to $1,600 per home for the installation of a PV system or $1,000 rebate for SWH system[iii], resulting in the installation of roughly 195,000 SWHs.
As shown in figure 5, in 2009 New South Wales, Queensland and Victoria had the greatest SWH uptake of the rebate, accounting for roughly 76 per cent of the total installations throughout Australia.

In early November 2009, the rebate was dropped to $1,200 for the installation of a system. Queensland and New South Wales experienced a sharp decrease in SWH installations, dropping from over 122,000 in 2009 to just 19,100 SWH installations in 2020.

Since 2021, the overall trend was picked up again, however, it is all thanks to the Solar Homes Program in Victoria. The state has a share of 56 per cent of the total installations in 2022, with its

uptake of SWH to reach new peaks of 57,744 and 66,510 new installations of SWH in 2021 and 2022 (42,120 installations in 2009). However, the market share of SWH by state is affected in inverse proportion by natural gas infrastructure. For example, Victoria has a high proportion of gas infrastructure, whereas the Northern Territory has a relatively small gas infrastructure coverage, hence its lower rate of uptake[iv].

Figure 5: Solar water heater uptake across jurisdictions since 2001



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as at 25 July 2023

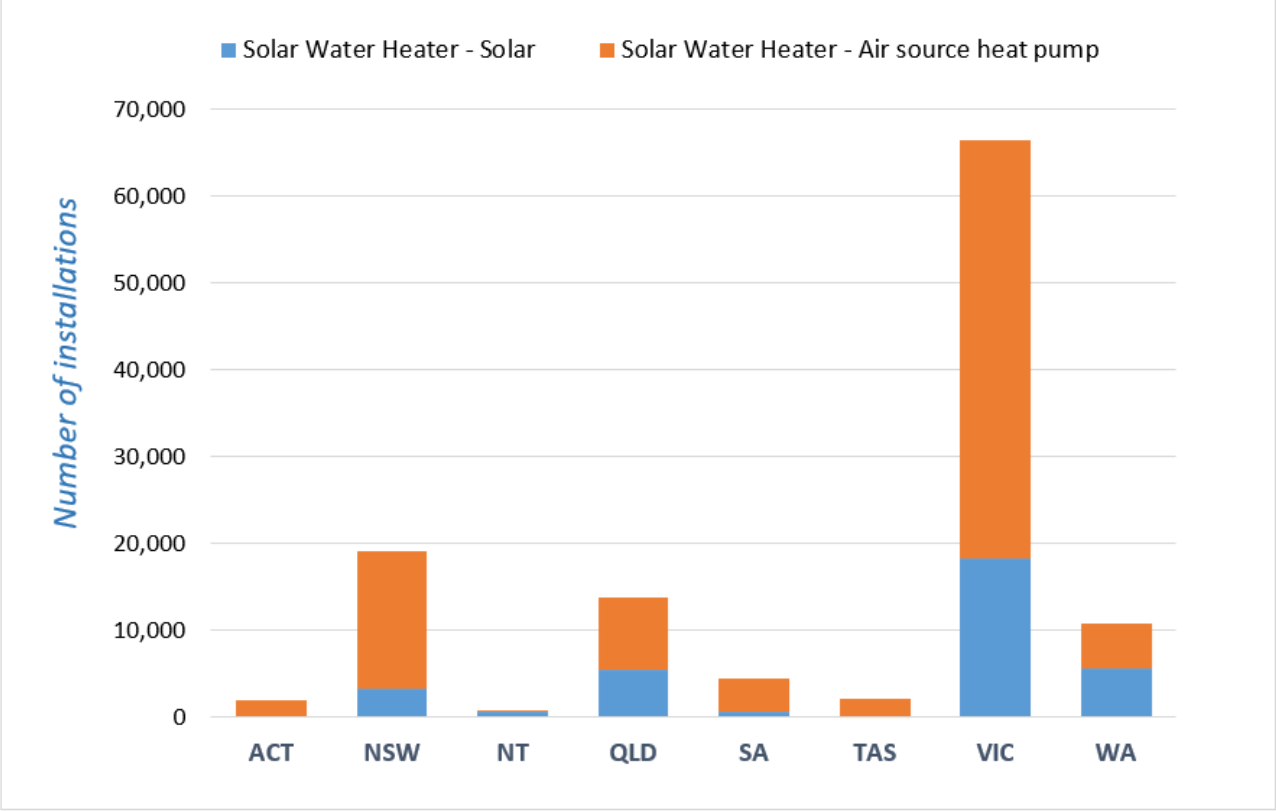
SWH can refer to either a stand-alone solar hot water system or heat pump water heater.

1. Stand-alone solar hot water system: This type of solar water heater directly captures heat from the sun using solar collectors (usually mounted on the roof). These collectors absorb sunlight and transfer the captured heat to the water circulating through the system. Stand-alone solar hot water systems are most effective when installed on an unshaded roof with direct exposure to sunlight.
2. Heat pump water heater: This is another type of solar water heater, but it operates differently from the stand-alone solar system. Instead of directly capturing heat from the sun, a heat pump water heater extracts heat from the ambient air (even in cooler conditions) and uses it to heat the water in the storage tank. This makes the heat pump water heater more suitable

for areas where direct sunlight may be limited or where shading is a concern, as it doesn't rely solely on direct sunlight for its operation.

Figure 6 shows that SWH with air source heat pump has been more favourable than an air source heat pump across all jurisdictions.

Figure 6: Solar water heater uptake across jurisdictions in 2022



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as at 25 July 2023

It is expected that the rising cost of electricity will continue to attract households to switch to solar hot water, however one study has found that there are a number of barriers to entry for consumer uptake of SWH systems. It states that raising customer awareness of SWH is vital as consumers currently lack knowledge of its benefits and are not aware of its efficient technology. Consumers also often experience issues when considering installing a new system, or maintaining and repairing old SWH systems because maintenance and repair costs can be perceived as high[v].

The transition to all-electric homes presents certain challenges; however, with adequate regulatory changes and diligent monitoring of its impact on households, jobs, and businesses, these challenges can be effectively managed. It is essential to recognize that fully electrifying existing housing will take time and cannot be achieved overnight. Nevertheless, by implementing supportive policies and gradually adopting renewable energy technologies will enable us to navigate these challenges and create a smooth and successful transition to all-electric homes in the long run.

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 3, 4 and 5 show the LCOE across major cities at different discount rates.

Table 3: Central estimate: 4.95 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	$0.07	$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	$0.07	$0.28	$0.08
Darwin	$0.10	$0.10	$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	$0.09	$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	$0.07	$0.30	$0.03

Source: Australian Energy Council analysis, July 2023

Table 4: Low cost of capital sensitivity: 6.38 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	$0.08	$0.08	$0.08	$0.38	$0.09
Brisbane	$0.10	$0.09	$0.09	$0.09	$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	$0.10	$0.27	$0.08
Hobart	$0.13	$0.12	$0.11	$0.11	$0.11	$0.11	$0.28	$0.09
Melbourne	$0.12	$0.11	$0.10	$0.10	$0.10	$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	$0.08	$0.08	$0.07	$0.08	$0.30	$0.03

Source: Australian Energy Council analysis, July 2023

Table 5: High cost of capital sensitivity: 15.02 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	$0.11	$0.11	$0.38	$0.09
Brisbane	$0.14	$0.13	$0.12	$0.12	$0.12	$0.12	$0.23	$0.10
Canberra	$0.15	$0.13	$0.12	$0.11	$0.11	$0.11	$0.28	$0.08
Darwin	$0.16	$0.17	$0.15	$0.15	$0.15	$0.14	$0.27	$0.08
Hobart	$0.20	$0.17	$0.16	$0.16	$0.16	$0.16	$0.28	$0.09
Melbourne	$0.18	$0.15	$0.14	$0.14	$0.13	$0.13	$0.19	$0.08
Sydney	$0.14	$0.13	$0.12	$0.11	$0.11	$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, July 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 6: Central estimate: 5.37 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	$0.07	$0.08	$0.07	$0.07

Source: Australian Energy Council analysis, July 2023

Table 7: Central estimate: 4.56 per cent discount rate, ten-year average large business interest rate

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

Source: Australian Energy Council analysis, July 2023

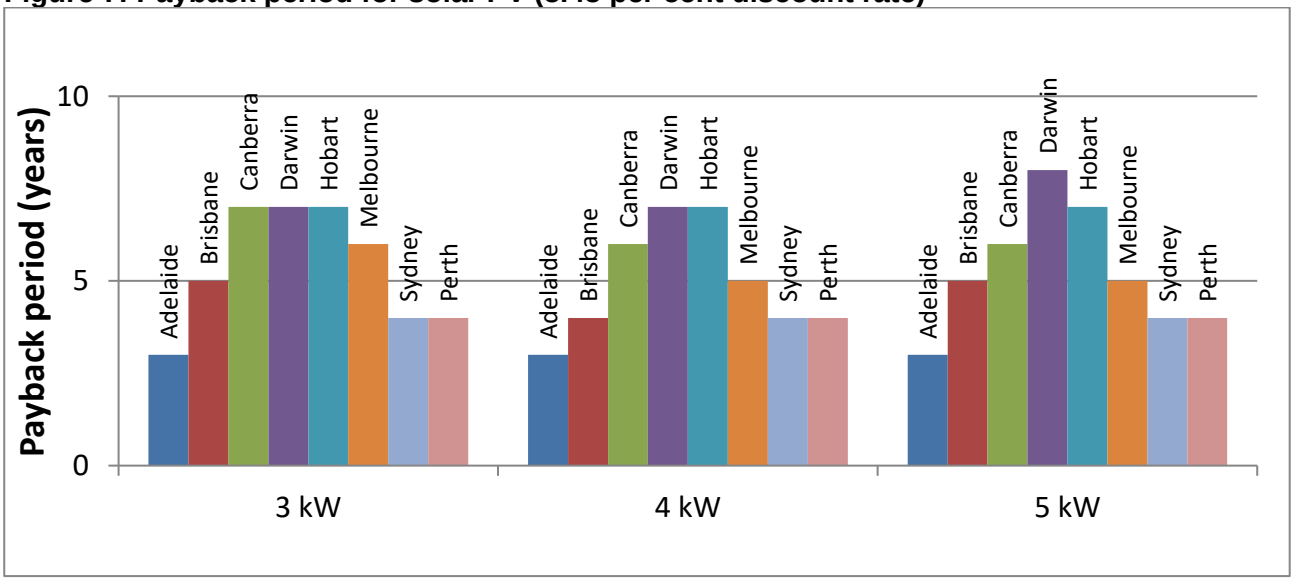
SECTION IV: PAYBACK PERIOD, DETAILED MODEL

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.

While installing solar panels usually requires an upfront investment, customers with solar panels have lower electricity bills by reducing their grid electricity consumption and exporting excess electricity to the grid in exchange for solar feed-in tariff credits. However, effective solar feed-in tariff rates declined in all regions across the country. When choosing an energy plan, customers with solar panels should compare energy plans using their historical electricity consumption and solar export volume. The energy plan with the highest solar feed-in tariff may not always be the best plan overall, as it may include higher supply and usage charges than other plans.

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 (5.45 per cent discount rate)

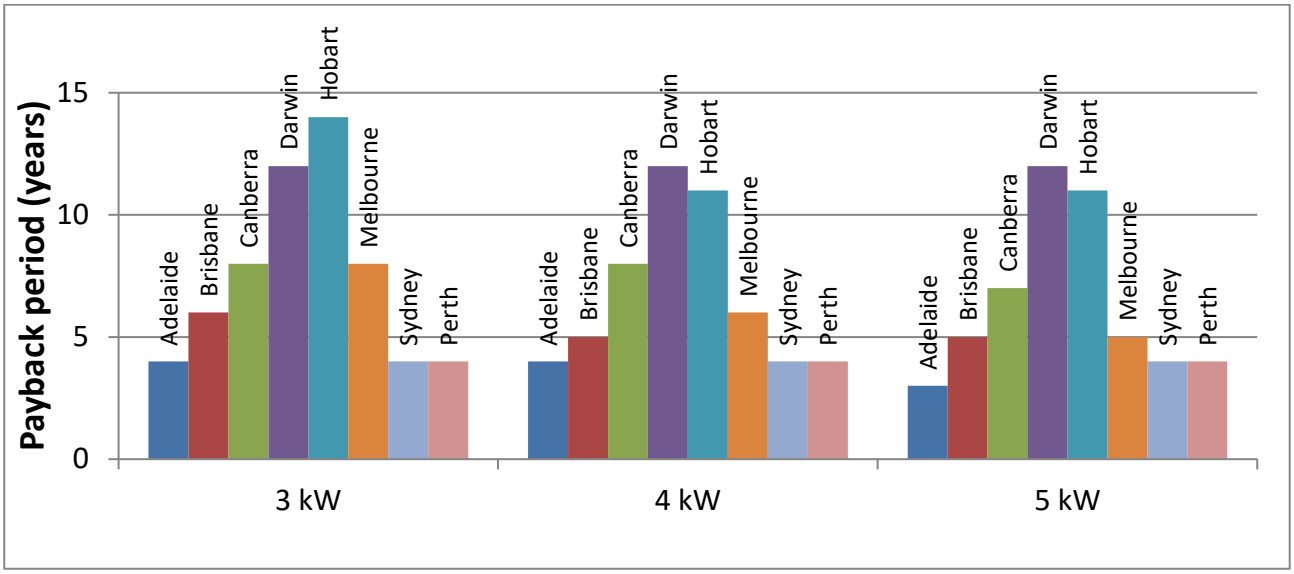


Source: Australian Energy Council analysis, July 2023

Compared to the previous quarter, the rapid rise in interest rates in Australia has added a year to the payback period in all states.

Figure 8 shows the expected payback period for systems with a 4.95 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 (4.95 per cent discount rate)



Source: Australian Energy Council analysis, July 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

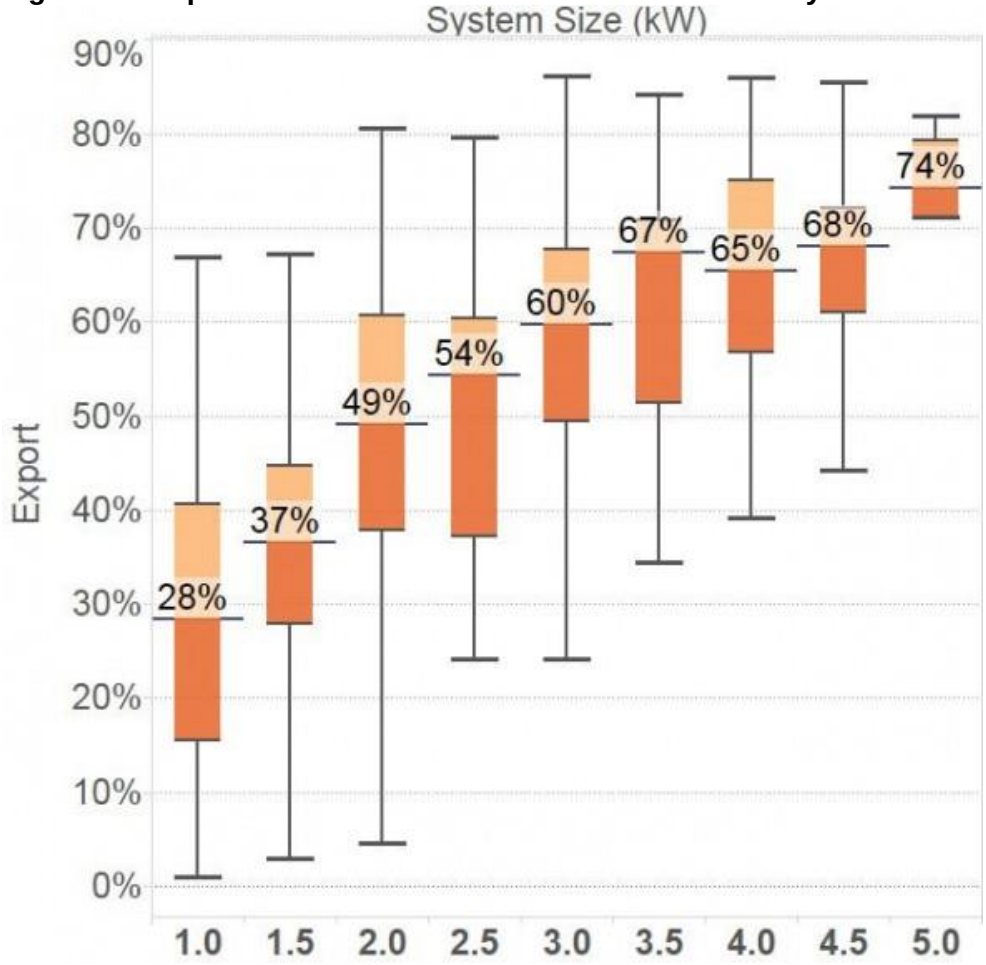
The onsite consumption is multiplied by the retailer's usage charges. CPI has been applied to the usage charge to allow for growth in retail prices. The excess energy is exported to the grid and the

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

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

[iii] https://www.abc.net.au/news/2009-11-01/home-insulation-rebate-slashed/1124352

iv Solar Hot Water & Heat Pump Study, Clean Energy Council, January 2011

v Solar water heaters uptake in Australia – Issues and barriers, ScienceDirect, 2018, page 21

[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.