SOLAR REPORT

YEAR OF 2024

Australian Energy Council

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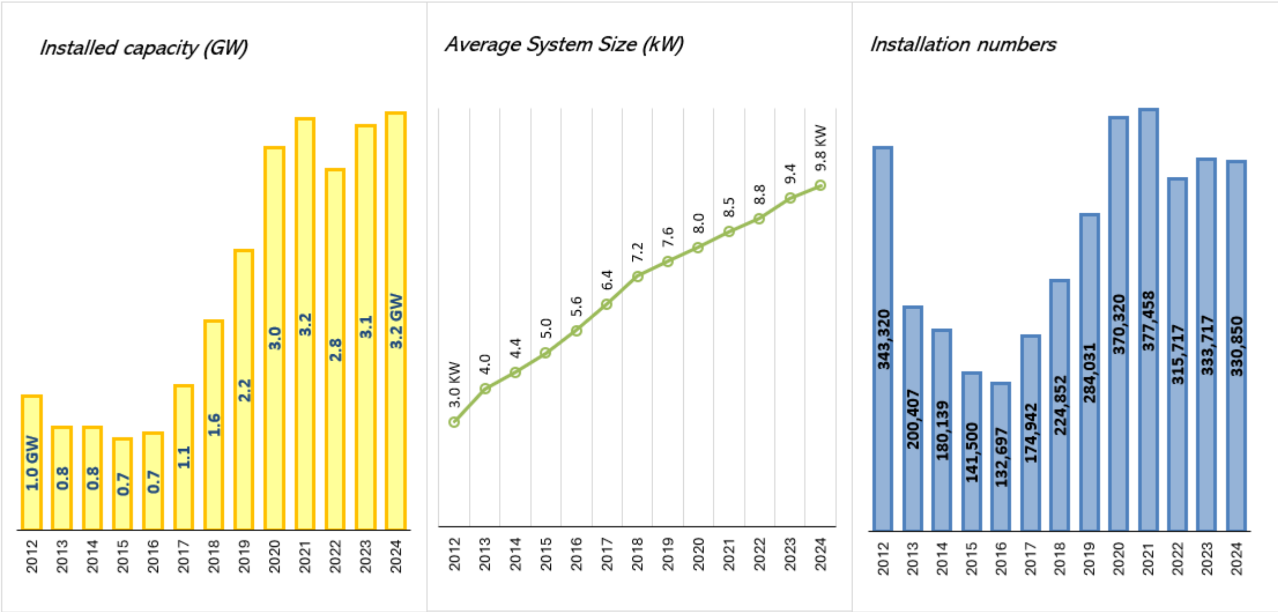
SECTION I: STATE OF SOLAR IN AUSTRALIA

The penetration of Australian rooftop photovoltaics (PV) in the energy market continues to rise and last year contributed 12.95 per cent (approximately 30,500 GWh) of the nation's total electricity generation. This is an increase from 11.72 per cent (around 26,900 GWh) in the previous year, reflecting the growing role of rooftop PV in Australia's renewable energy transition.

Recent figures from the Clean Energy Regulator (CER) reveal that by the end of 2024, the capacity of rooftop solar installations for homes and businesses had surpassed 25.3 GW, with over 4.018 million photovoltaic systems now operational across the country. While the number of installations and the installed capacity figures may be subject to adjustments due to a time lapse in when certificates have to be reported to the CER, based on historical trends, we estimate that the final numbers for 2024 could reach a cumulative total of around 4.054 million installations with a total capacity of 25.7 GW.

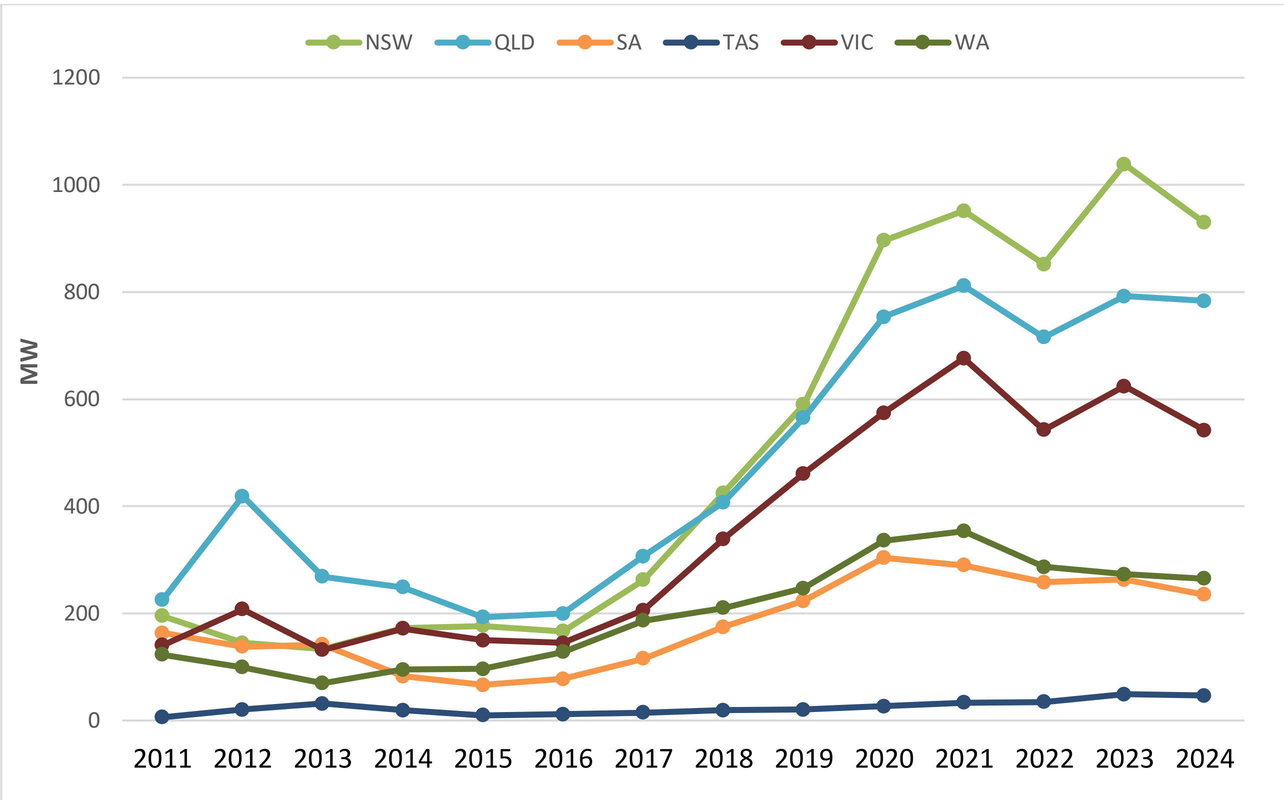
Figure 1 shows rooftop solar systems installed in 2024 reached 330,850, slightly below the 333,717 installations in 2023, while the total installed capacity for the year grew from 3.14 GW to 3.24 GW. While there were fewer stand alone PV installations in 2024 the average system size increased slightly to 9.8kW. The latest figures also show there was an increase in the number of households opting for rooftop systems with batteries. Overall, there is a slight deceleration in the speed of the growth rate for both the annual installation numbers and capacity growth compared to the rapid expansion observed in previous years.

Figure 1: Yearly installed capacity, average system size and installation numbers of rooftop PV in Australia (adjusted data)



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 29 January 2025

Figure 2: Yearly installed capacity of rooftop PV in Australia by states (unadjusted data)



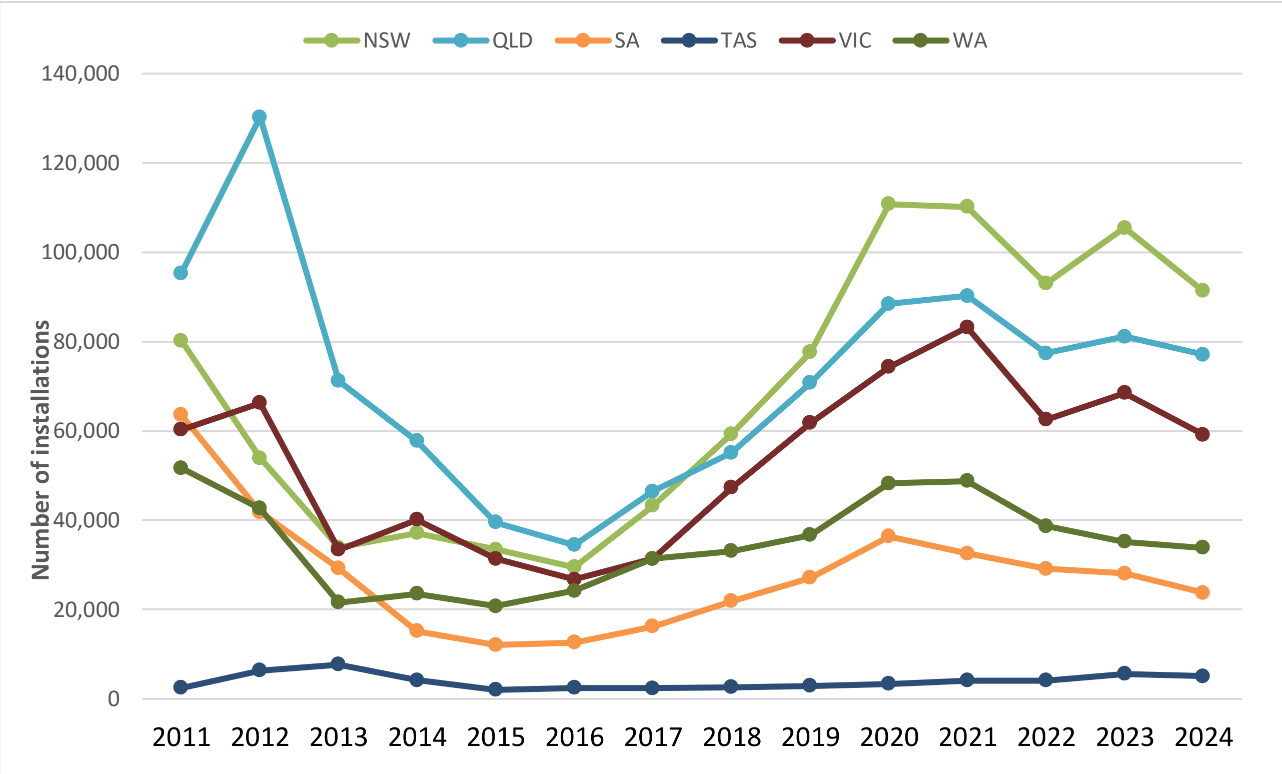
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 29 January 2025

Figure 2 shows yearly installed capacity by state, highlighting the stronger growth in solar installations in New South Wales, Queensland and Victoria. New South Wales continued to be the state installing the largest capacity in 2024, with over 929 MW or 32 per cent of the country's total installed capacity. In the past two years it has seen strong growth with 2023 peaking at 1,038.41

MW (33 per cent of Australia's total capacity). New South Wales boasts the highest total installed capacity of rooftop PV, with a cumulative 6.93 GW installed since 2011—roughly 27.9 per cent of the Australia's total capacity. Queensland is consistently the second highest state for installed capacity and accounted for 27 per cent of the total installed capacity in 2024.

In contrast, Victoria seems to be experiencing a slowdown. The state's share of installed capacity declined from 19.9 per cent in 2023 to 18.9 per cent in 2024. The share of the national capacity installed in the smaller markets of Western Australia and South Australia remained in line with the previous year at a combined 17 per cent.

Figure 3: Yearly number of installations of rooftop PV in Australia by states (unadjusted data)



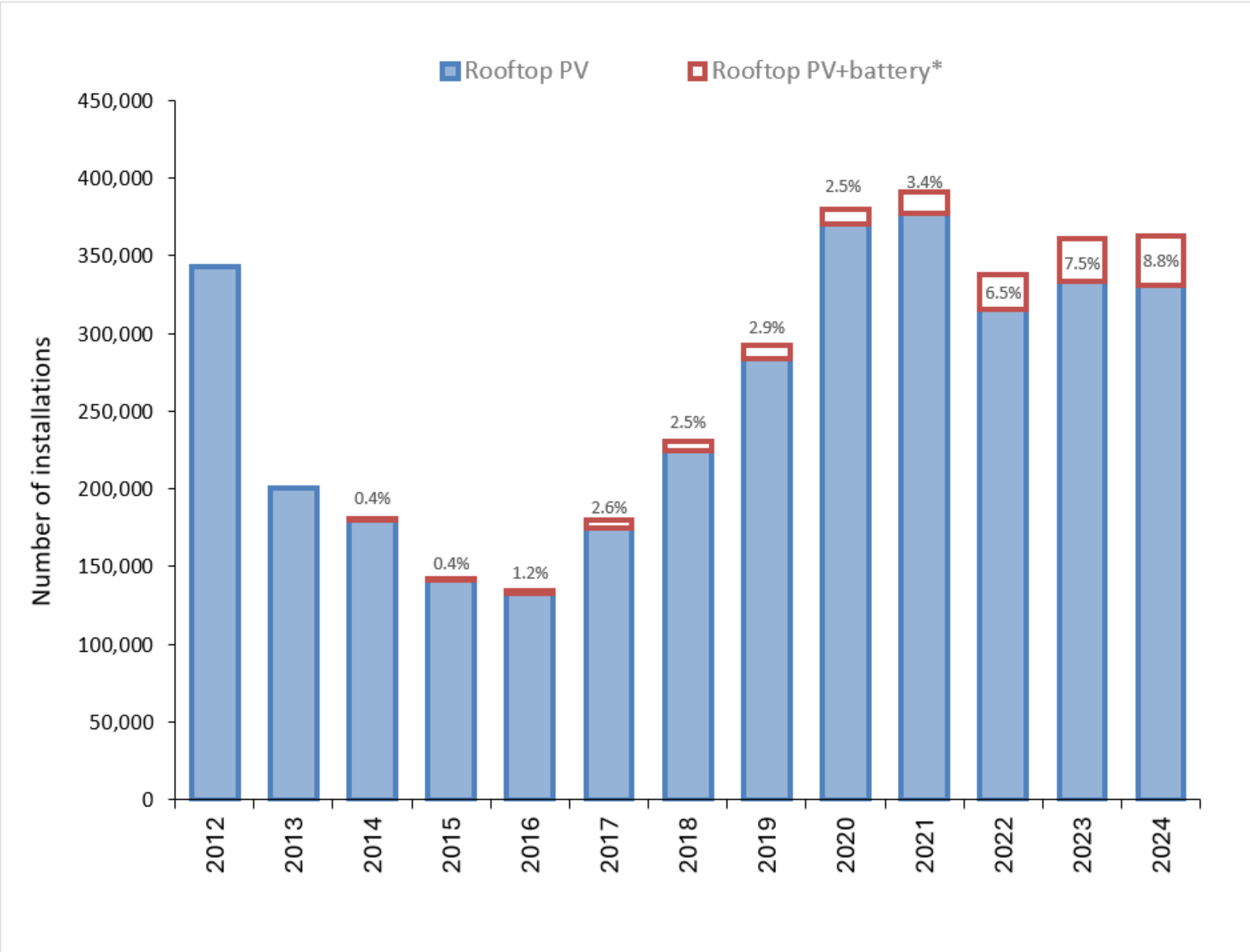
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 29 January 2025

In 2024, New South Wales also surpassed 1 million rooftop solar installations, the second state to reach the milestone after Queensland, which hit 1 million installations in 2023.

Battery installations with rooftop solar

The share of rooftop solar installations with battery storage is steadily increasing, rising to 8.8 per cent of the total installations in 2024, compared to 7.5 per cent in 2023. This growth highlights the growing trend of homeowners seeking greater energy independence and aiming to maximise the benefits of their solar systems. The demand for combined rooftop solar and storage solutions is expected to keep growing, further driving the uptake of renewable energy technologies across the country.

Figure 4: Annual home battery attachment rate to households with rooftop PV (adjusted data)



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 29 January 2025

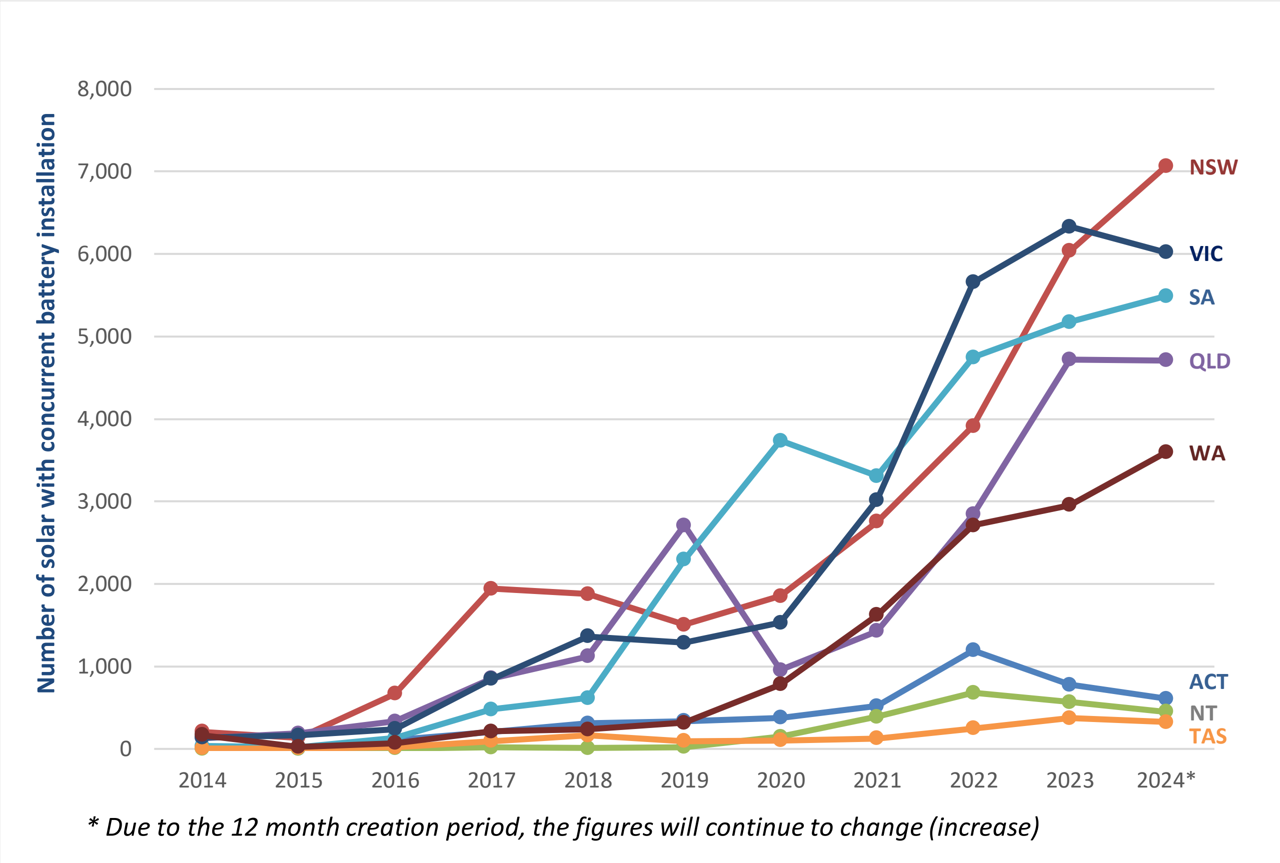
In 2024, we estimated roughly 32,000 new rooftop PV installations paired with batteries were registered with the CER. As noted in previous reports, New South Wales has been overtaking Victoria in battery-equipped rooftop solar installations and is now the leading jurisdiction with 8,019. After a significant 54 per cent increase in installations in 2023 PV and battery installations increased 33 per cent per cent in 2024.

The strong growth in NSW is expected to continue into 2025, especially after the launch of the NSW solar battery rebate on 1 November 2024, as part of the Peak Demand Reduction Scheme (PDRS). This program helps homes and businesses with solar systems increase energy efficiency and reduce electricity costs by installing batteries, with eligible applicants receiving rebates of $1,600 to $2,400 depending on the battery size.

Victoria held the top spot for solar and battery installations in 2022 and 2023 and recorded three years of growth from 2021. The state ranked second in 2024 with roughly 6,800 new solar PV and battery installations, representing 21.3 per cent of the national total. However, the state shows signs of slowing down in adoption rates after three consecutive years of growth from 2021 to 2023. South Australia was close behind Victoria last year with 5,491 new installations, accounting for 19.4 per cent of the national total.

Western Australia led the country in 2024 in terms of percentage growth in new rooftop PV installations paired with batteries, rising 22 per cent. The Australian Capital Territory, Tasmania, and the Northern Territory collectively recorded 1,383 installations, making up 4.9 per cent of the national total.

Figure 5: 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 29 January 2025

Since the last Solar Report, there have been no changes to state policies regarding solar and battery storage installations (see Table 1).

Table 1: Government policies

State/ Territory	Policy Incentive (Solar & Battery)	Energy target

Australian Capital Territory	• No specific policy	• to deliver a 70 per cent cut in emissions by 2035 compared to 2005 levels • net zero by 2050
New South Wales	• NSW Government Solar Battery Rebate[1] (starting 1 November 2024): Discount range $770 and $1150 for a 6.5 kWh battery; or $1600 and $2400 for a 13.5 kWh battery	• NSW's emissions by 70% by 2035 and achieve 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[i]	• 50 per cent by 2030
Queensland	• Battery Booster program[2] closed to new conditional approval applications on 8 May 2024.	• 50 per cent by 2030
South Australia	• No specific policy	• 100 per cent by 2030
Tasmania	• No specific policy	
Victoria	• Solar Battery Loans[3]: Interest-free loans of up to $8,800 are available for eligible households.	• 65 per cent by 2030 • 95 per cent by 2035[4]
Western Australia	• No specific policy	

[1] NSW Government Battery Rebate

[2] Battery Booster Rebate

[3] Solar Battery Loans for financial year 2024-25

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

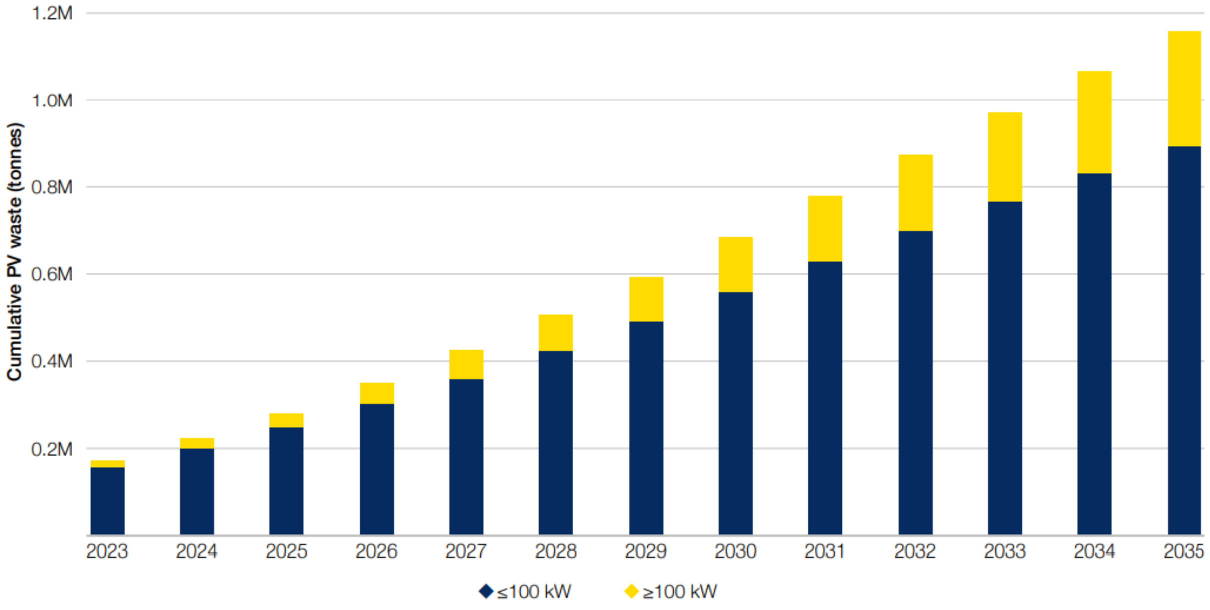
SECTION II: SOLAR PANELS GROWING WASTE

In Australia, the rapid growth of solar energy adoption has been a sign of the country's commitment to cleaner, more sustainable energy sources. With one of the highest solar penetration rates in the world, it is clear that solar power has a crucial role to play in the nation's transition to renewable energy. However, as solar panels near the end of their lifespan, the issue of solar waste is emerging as a significant challenge. Solar panel waste amounts will inevitably begin to increase drastically in Australia in the coming decade. This solar waste problem was identified as a priority waste management issue by the Federal Government back in 2016 – has become larger and more urgent.

Queensland's first solar panel recycling plant was opened in October 2024 which it is capable of processing 240,000 panels annually[ii]. There are however still an estimated 800,000 more panels in Queensland at risk of ending up in landfills. This issue is also being faced by other states with the volume of discarded panels expected to become a challenge if much of the waste generated from decommissioned panels is not properly recycled and thereby contributing to environmental concerns. The average lifespan of a solar panel is around 20 to 30 years, after which its efficiency declines, and for utility-scale solar installations may no longer be economically viable to operate. In Australia, this means that millions of solar panels are approaching or will soon reach the end of their useful lives.

The University of New South Wales partnered with the Australian Centre for Advanced Photovoltaics to undertake a scoping study on the end-of-life management of Australian solar panels and published their research last year. The report indicates that solar panel waste from small-scale (blue) and large-scale (yellow) projects in Australia is projected to reach 685,000 tonnes by 2030 and 1.157 million tonnes by 2035 (see figure 6). The early growth of the country's residential solar market will see most of the waste come from residential solar panels, but by 2035, the proportion of waste from large-scale solar projects will increase, accounting for 22.9 per cent of the total waste, up from 9.8 per cent in 2023, as panels from solar farms reach the end of their lifespan[14].

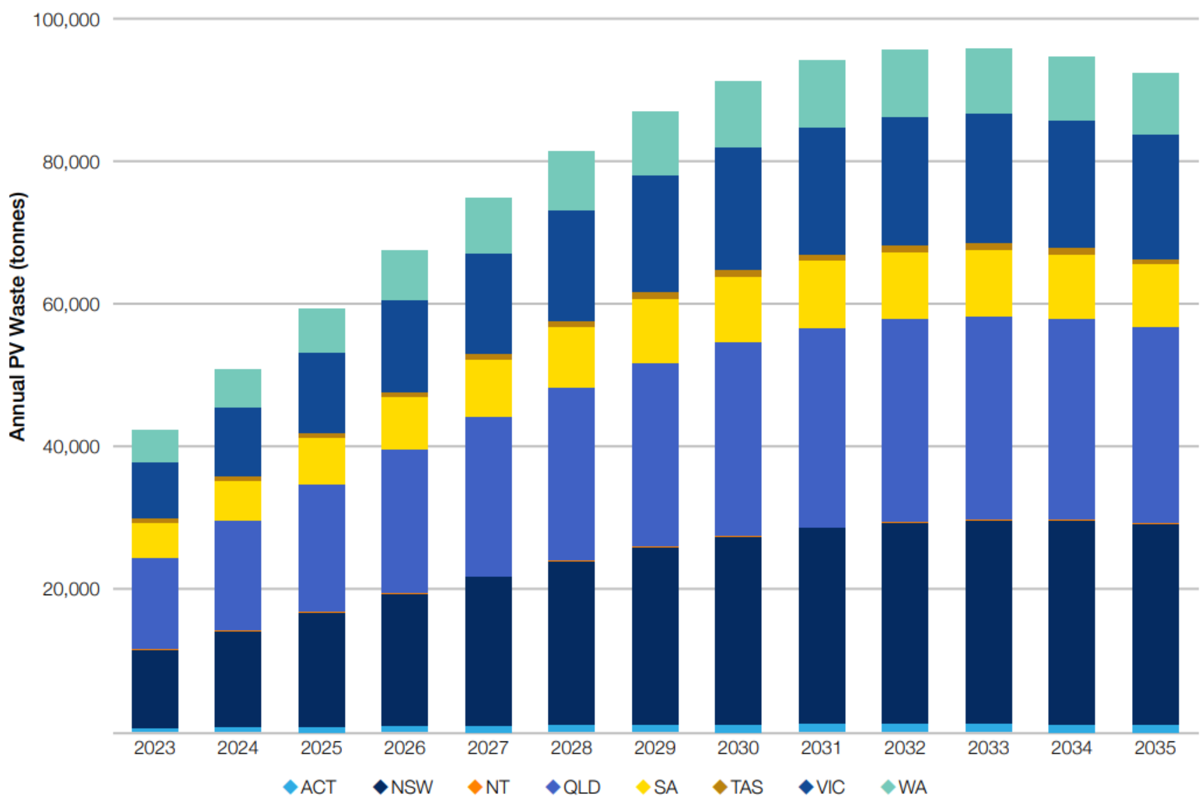
Figure 6: Projected cumulative PV waste in tonnes in Australia from 2022 to 2035, comparison between small and large-scale systems.



Source: Scoping Study: Solar Panel End-of-life Management in Australia, March 2024[iii]

Figure 7 shows the projected cumulative PV waste across the states and territories. The largest volumes of solar panel waste will come from major metropolitan areas in New South Wales, Victoria, and Queensland, with these states contributing 79 per cent of the nation's total end-of-life solar waste by 2035. South Australia and Western Australia will account for about a fifth of the total, while the Northern Territory and Tasmania are anticipated to produce only minimal amounts of waste.

Figure 7: Annual PV waste in tonnes in each state and territory in Australia.



Source: Scoping Study: Solar Panel End-of-life Management in Australia, March 2024[iv]

Australia is uniquely positioned when it comes to managing solar panel waste. With one of the highest per capita rates of rooftop solar installations in the world, the country is poised to experience a more concentrated surge in solar panel waste compared to nations with lower adoption rates. Rather than being seen as waste, solar panels could be regarded as valuable resources, with a typical 20-kg panel containing over $22.6 worth of recyclable materials[v]. By 2035, Australia can potentially unlock a cumulative material value of $1 billion.

The vast distances and widely scattered population across the country also pose logistical challenges for efficiently collecting and transporting waste from remote areas to recycling facilities According to the study, the cost of recycling solar panels currently ranges from $500 and $1,000 per tonne, covering transportation and before accounting for the revenue from recycled materials. This highlights the urgent need for more innovative recycling solutions in Australia, focusing on local recycling or reuse, as landfill disposal and exporting panels become less viable options.

The Department of Climate Change, Energy, the Environment and Water is currently leading a redesign of the National Television and Computer Recycling Scheme to broaden the parameters of e-stewardship regulation to small electrical and electronic equipment and solar photovoltaic (PV) systems. The revised scheme is set to come into play by the end of 2025 and will mean solar manufacturers, importers and all parties bringing solar panels to the Australian market must take responsibility for the end-of-life management of those panels[vi]. The scheme will aim to reduce landfill waste, especially from electronic and solar panels, increase the safe recovery and reuse of valuable materials, provide accessible recycling services across Australia, promote responsibility in waste management, and support the transition to a circular economy.

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 2024. 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: 5.07 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	$0.11	$0.10	$0.09	$0.09	$0.09	$0.08	$0.43	$0.08
Brisbane	$0.11	$0.10	$0.09	$0.09	$0.09	$0.09	$0.31	$0.08
Canberra	$0.11	$0.10	$0.09	$0.09	$0.09	$0.08	$0.26	$0.09
Darwin	$0.12	$0.13	$0.12	$0.12	$0.11	$0.11	$0.28	$0.08
Hobart	$0.15	$0.14	$0.13	$0.12	$0.12	$0.12	$0.30	$0.09
Melbourne	$0.13	$0.11	$0.11	$0.10	$0.10	$0.10	$0.28	$0.05
Sydney	$0.12	$0.11	$0.10	$0.10	$0.10	$0.09	$0.32	$0.07
Perth	$0.09	$0.09	$0.08	$0.08	$0.08	$0.08	$0.45	$0.07

Source: Australian Energy Council analysis, January 2025

Table 3: Low cost of capital sensitivity: 6.39 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	$0.12	$0.10	$0.10	$0.09	$0.09	$0.09	$0.43	$0.08
Brisbane	$0.12	$0.11	$0.10	$0.09	$0.09	$0.09	$0.31	$0.08
Canberra	$0.12	$0.10	$0.10	$0.09	$0.09	$0.09	$0.26	$0.09
Darwin	$0.13	$0.14	$0.13	$0.13	$0.12	$0.11	$0.28	$0.08
Hobart	$0.16	$0.15	$0.14	$0.13	$0.13	$0.13	$0.30	$0.09
Melbourne	$0.14	$0.12	$0.11	$0.11	$0.11	$0.10	$0.28	$0.05
Sydney	$0.13	$0.11	$0.11	$0.10	$0.10	$0.09	$0.32	$0.07
Perth	$0.10	$0.09	$0.08	$0.08	$0.08	$0.08	$0.45	$0.07

Source: Australian Energy Council analysis, January 2025

Table 4: High cost of capital sensitivity: 16.94 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	$0.18	$0.15	$0.14	$0.13	$0.13	$0.13	$0.43	$0.08
Brisbane	$0.18	$0.16	$0.15	$0.14	$0.14	$0.13	$0.31	$0.08
Canberra	$0.19	$0.16	$0.14	$0.14	$0.14	$0.13	$0.26	$0.09
Darwin	$0.20	$0.21	$0.20	$0.20	$0.19	$0.17	$0.28	$0.08
Hobart	$0.25	$0.23	$0.21	$0.20	$0.19	$0.19	$0.30	$0.09
Melbourne	$0.21	$0.18	$0.17	$0.16	$0.16	$0.15	$0.28	$0.05
Sydney	$0.20	$0.17	$0.16	$0.15	$0.15	$0.14	$0.32	$0.07
Perth	$0.15	$0.13	$0.12	$0.12	$0.12	$0.12	$0.45	$0.07

Source: Australian Energy Council analysis, January 2025

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 7 and 8 would represent the cost per kWh of consumption from the energy generated from different system sizes listed. For businesses, installation occurs if the benefits of installation outweigh the cost.

Table 5: Central estimate: 4.88 per cent discount rate, ten-year average small business interest rate

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

Source: Australian Energy Council analysis, January 2025

Table 6: Central estimate: 6.43 per cent discount rate, ten-year average large business interest rate

	System Size

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

Source: Australian Energy Council analysis, January 2025

SECTION IV: PAYBACK PERIOD, DETAILED MODEL

The payback period for rooftop solar photovoltaic (PV) systems in Australia is an important consideration for homeowners, as it determines how long it takes to recoup the initial investment. It 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

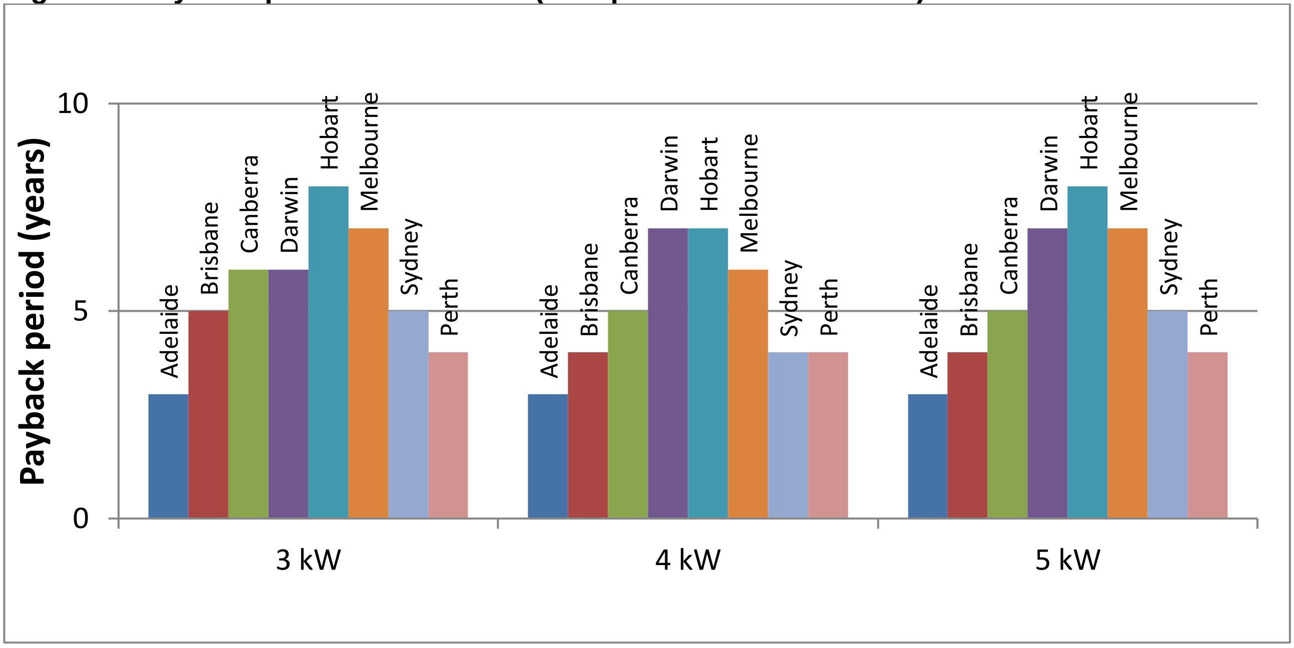
FiTs. The cumulative cost incurred represents the initial investment and the time value of money. A detailed methodology is contained in Appendix 2.

While solar panel installation requires an upfront investment, homeowners benefit from lower electricity bills by relying less on grid power and selling surplus electricity back to the grid for FiT credits. Recently, as wholesale electricity prices have dropped, many retailers have reduced their FiT offerings, making solar installations less attractive. Many retailers now offer time-varying tariffs, which offer higher rates during peak demand periods, usually in the late afternoon. This is particularly beneficial for homeowners with west-facing panels, as these systems generate more electricity during high-demand hours, maximizing savings.

Each household's energy consumption patterns play a crucial role in determining the actual savings. Homes with higher electricity usage during peak generation times will benefit more from their solar investments compared to those with lower consumption. Therefore, while rooftop solar can yield significant financial benefits, the specific payback period is influenced by system size, tariff structures, and individual energy usage. An energy plan offering the highest solar feed-in tariff may not always be the most cost-effective choice overall, as it could involve higher supply and usage charges compared to other plans. So, it is essential to select an energy plan subject to householders' historical electricity consumption and the amount of solar energy they export.

Here we only use simple average FiT when estimating payback periods to get a clearer understanding of potential savings for households. Figure 8 and 9 highlights the payback period for different system sizes across Australia. The short payback periods in many cities provide strong incentives for customers to adopt solar PV installations.

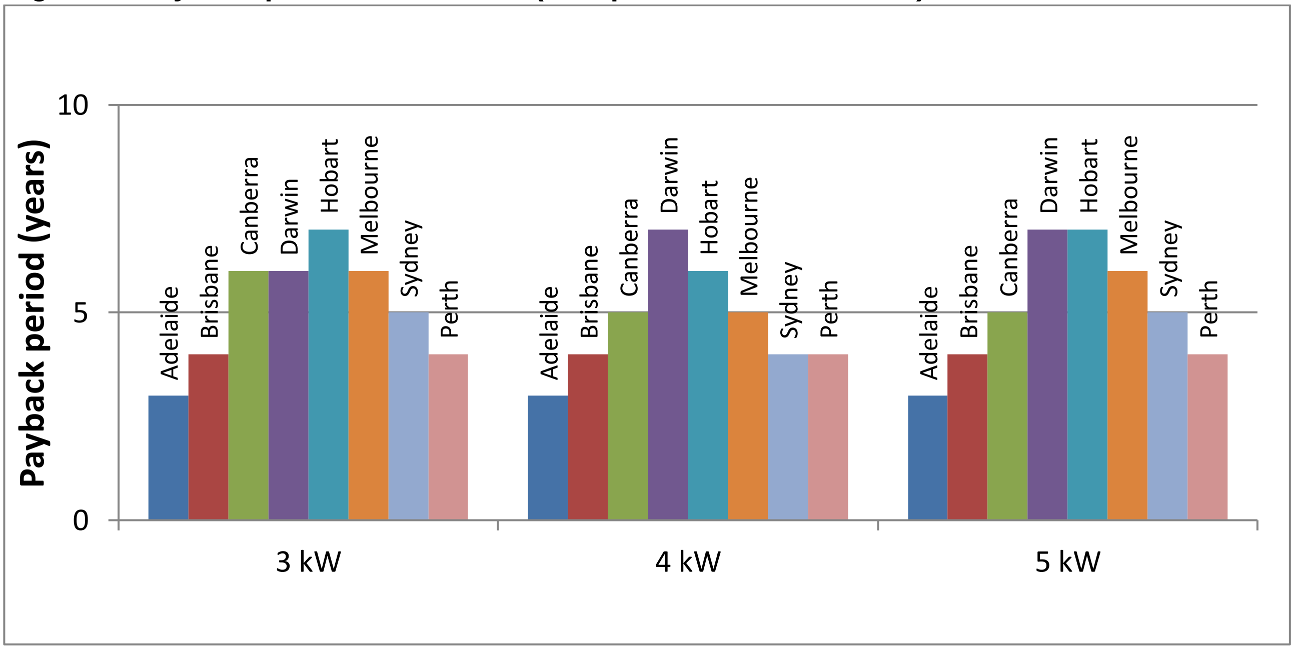
Figure 8: Payback period for solar PV (6.39 per cent discount rate)



Source: Australian Energy Council analysis, January 2025

Figure 9 shows the expected payback period for systems with a 5.07 per cent discount rate (10-year average home loan rate). In Adelaide, homeowners can expect a rapid payback period of just 3 years for all system sizes, reflecting a strong return on investment. Brisbane follows closely, with a consistent payback period of 4 years across all system sizes. However, in Hobart and Darwin, the recovery of solar investment is expected to take longer.

Figure 9: Payback period for solar PV (5.07 per cent discount rate)



Source: Australian Energy Council analysis, January 2025

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 ∑ savings > ∑ cost

Where:

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

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

t = years

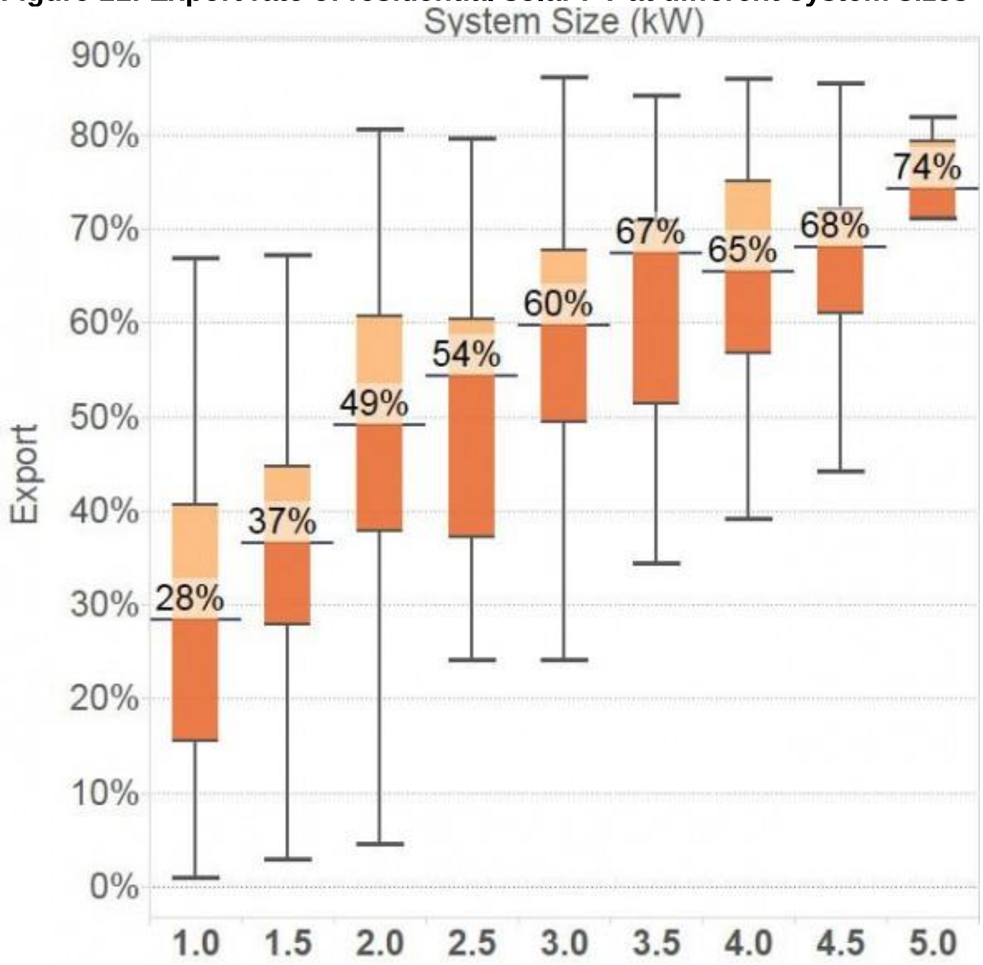
Avoided cost and FiT

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

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

[ii] https://www.abc.net.au/news/2024-10-07/solar-panel-recycling-plant-landfill-glass-precious-metals-/104440218

[iii] Scoping Study: End of life management in Australia, *ACAP and UNSW*, March 2024

[iv] Scoping Study: End of life management in Australia, *ACAP and UNSW*, March 2024

[v] Scoping Study: End of life management in Australia, *ACAP and UNSW*, March 2024

[vi] Australian Government Proposes National product stewardship scheme for solar photovoltaic systems and small electrical and electronic equipment, June 2023

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