SOLAR REPORT

QUARTER 1, 2021

Australian Energy Council

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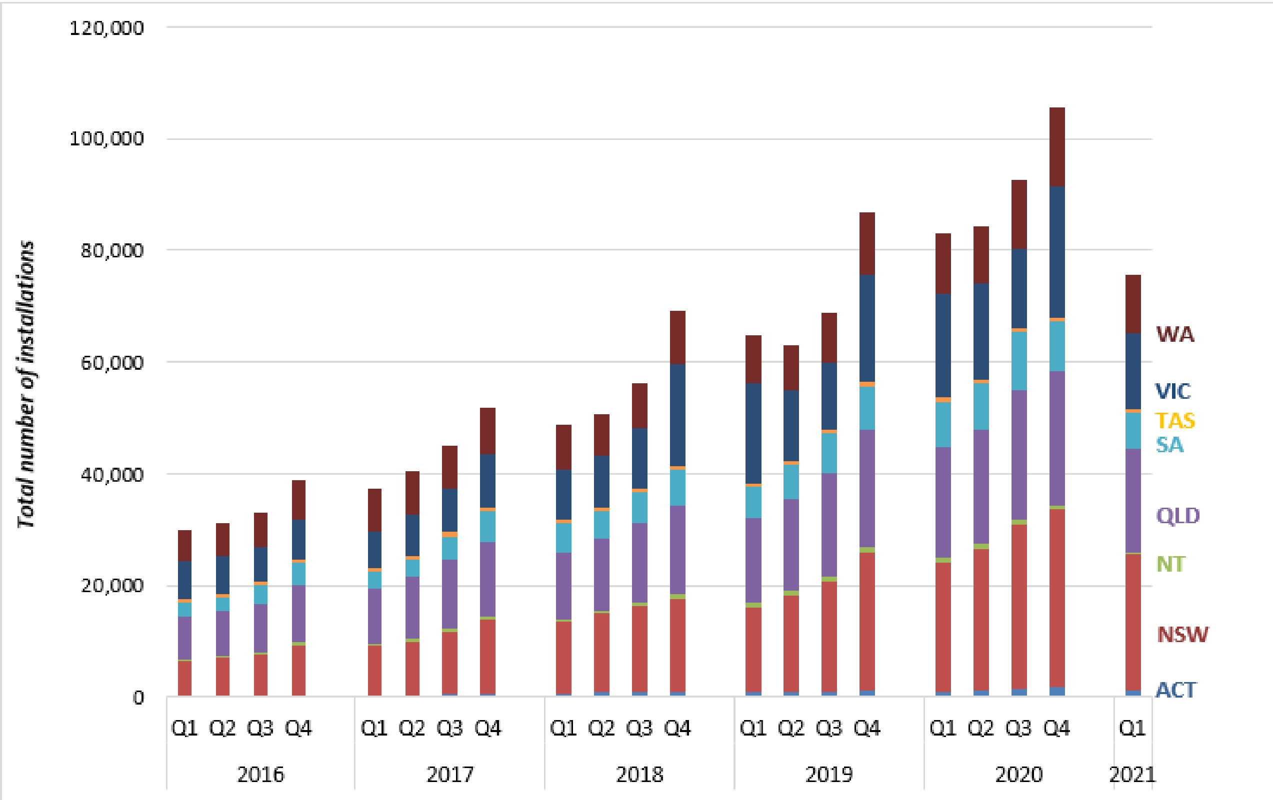
SECTION I: STATE OF SOLAR IN AUSTRALIA

Latest data from the Clean Energy Regulator[i] (CER) shows more than 76,000 new installations of rooftop solar PV was added in the first quarter of 2021, increasing capacity by 580 megawatts (MW). However due to a 12-month lag in reporting[ii], it is anticipated the number of new monthly installations actually exceeds 85,000 for the January to March 2021 quarter.

Figure 1: Quarterly rooftop PV installations by states (unadjusted data)



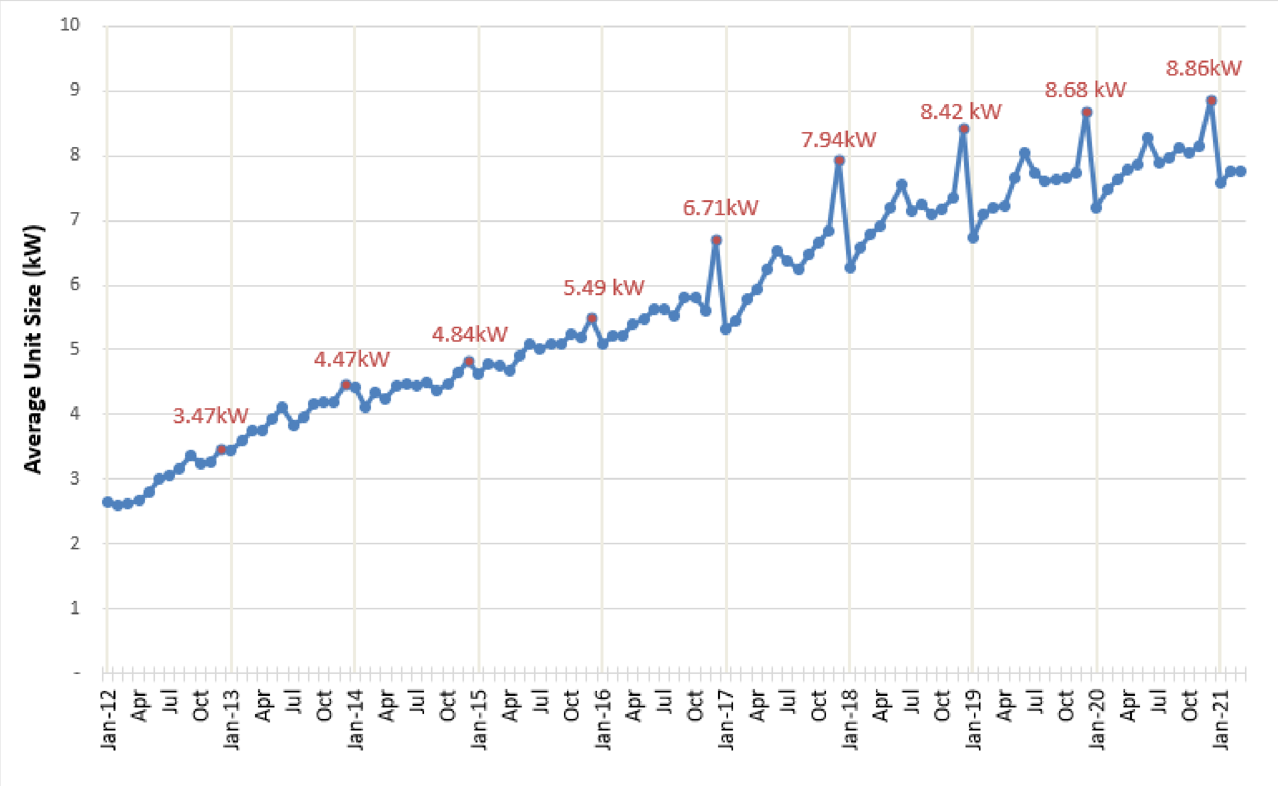
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 28 April 2021
Note: The most recent three months in figure 3 underestimates the data because of a time lag in collation of the data.[iii] Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 28 April 2021

Figure 1 shows the total number of solar PV installations by quarter. National Electricity Market (NEM) states account for 86 per cent of total installations in the first quarter of 2021, while Western Australia makes up 14 per cent of the total installations.

New South Wales overtook Queensland in late 2017 and continues to lead the states with more than 24,400 new installations and 194MW of total installed solar capacity added in the first quarter of 2021.

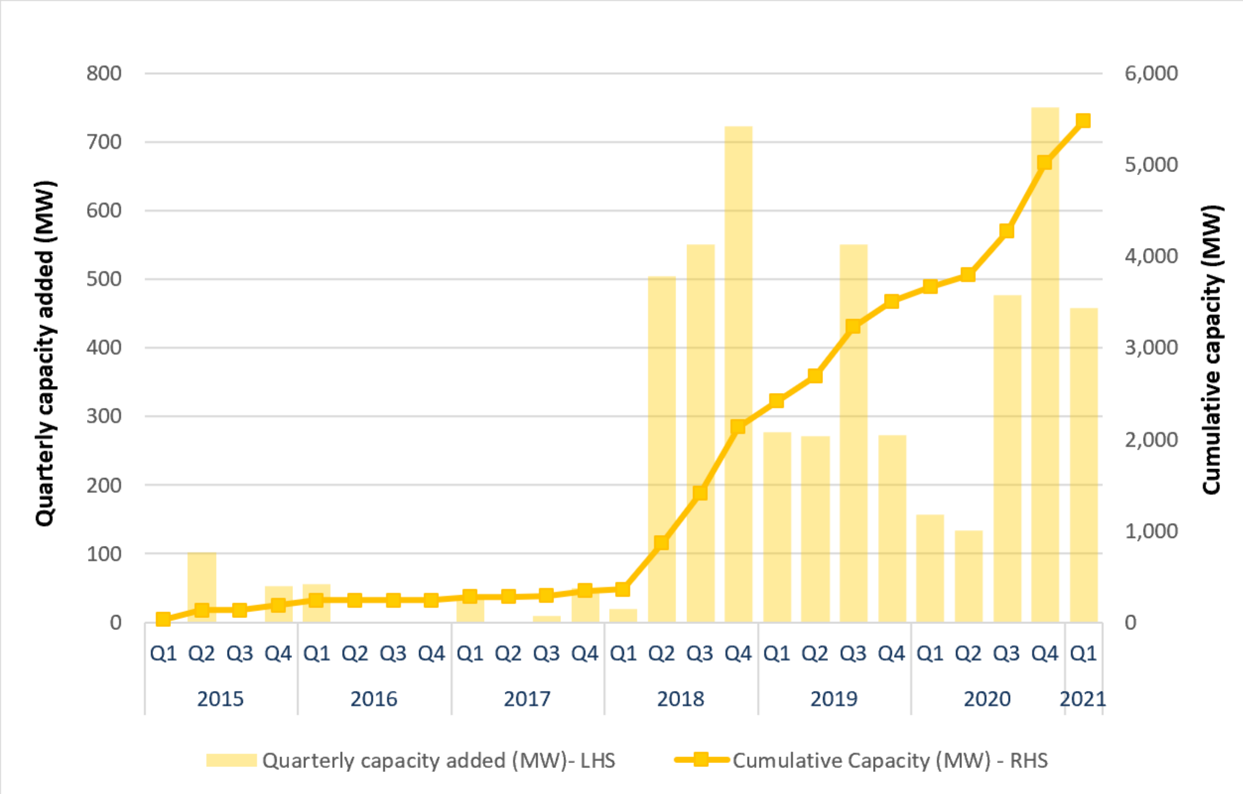
Figure 2 below shows the average installed solar system size for residential and small businesses; the average size steadily increased from 2.65kW in January 2012 to a peak of 8.86kW in December 2020. Historically, December has been the peak month for each calendar year in terms of a rise in average installed system size, followed by a seasonal fall in January.

Figure 2: Monthly average system size (kilowatts) since 2012



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 28 April 2021

Figure 3: Australia utility-scale solar capacity commissioned by quarter.



Source: Australian Energy Council's analysis

Australia's large-scale solar capacity increased to a total of 5.4GW across 69 solar farm projects. In the first quarter of 2021, an additional of 450MW of new utility-scale solar capacity connected to the grid from Glenrowan West Sun Farm (132MW), Kiamal Solar Farm (200MW), Yatpool Solar Farm (106MW) in Victoria, and from Robertson Barracks Solar (12.5MW) in the Northern Territory.

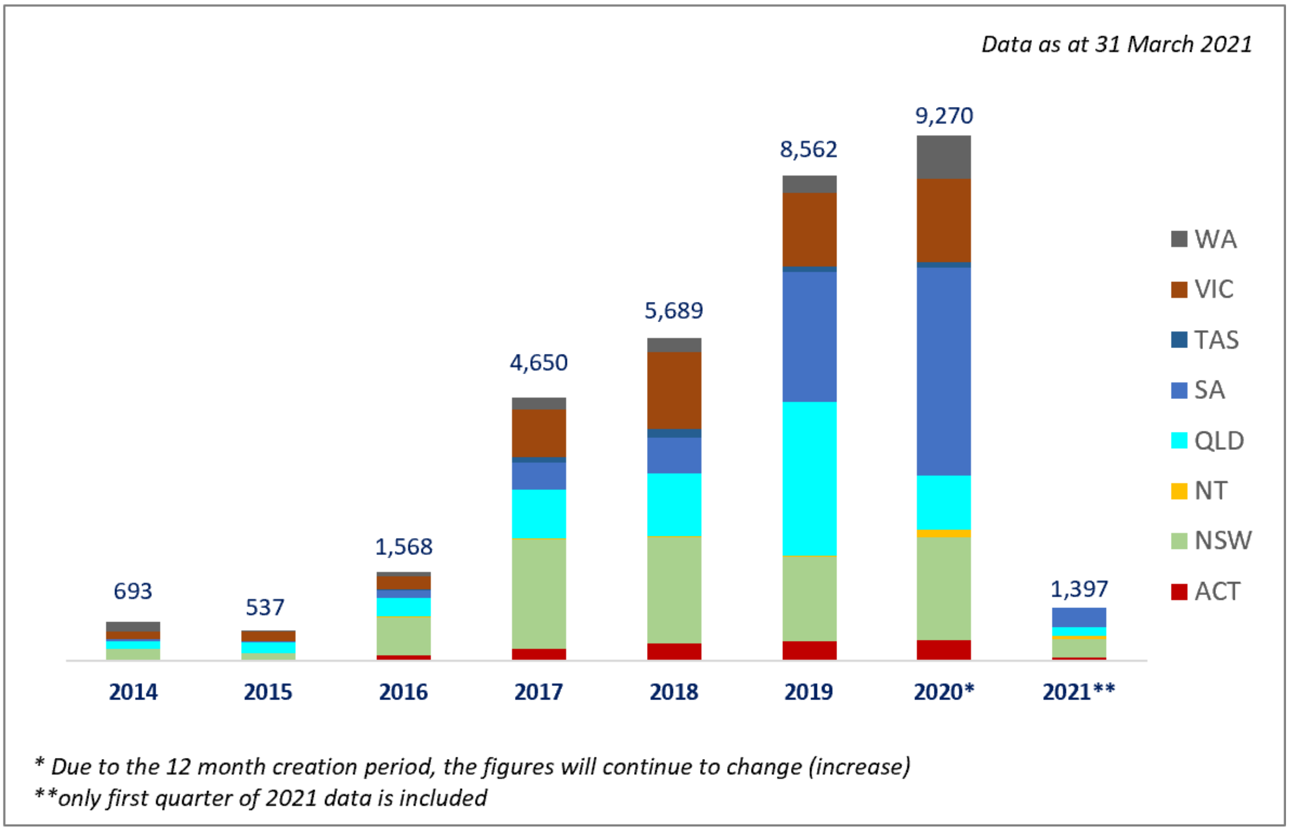
Battery installations with rooftop solar

Australia's rapidly rising share of rooftop solar continues to support the adoption of storage technologies.

When comparing the uptake of battery installations with rooftop solar by state (figure 4), South Australia and New South Wales lead, accounting for around 25 and 23 per cent of total installations.

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.

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 28 April 2021

Since the January 2021 Solar Report there has been no update on state government schemes or rebates for battery-with-solar installations; except for Western Australia, which is outlined below.

Schemes and rebates remain as:

- New South Wales: The Empowering Homes Program which supports the installation of up to 300,000 households across the state with zero interest loans to purchase solar and battery systems[iv]. At the end of February 2020, this program was extended to allow residents in the Hunter region.
- Victoria: The Solar Homes Program offers a rebate of up to $4,174 for a solar-battery system in 2020-21 and a rebate of up to $1,850 for rental properties installing solar PV[v].
- South Australia: The Home Battery Scheme has decreased its grant of up to $3,000 for a home solar battery, starting 15 September 2020 [vi]. This subsidy cap is expected to reduce over time due to increasing competition in the market along with the continued cost reductions of home battery systems.
- Western Australia: The Distributed Energy Buyback Scheme starting from 6 November 2020 offers 10c/kWh for those exporting to the grid between 3pm to 9pm or 3c/kWh any other time[vii].

SECTION II: NEW PROPOSED SOLAR EXPORT CHARGE

Australia's substantial growth in distributed energy resources, such as rooftop solar and battery storage systems, means the nation's network is facing increased challenges. Australia's grid is shifting from matching supply and demand, to keeping up with demand for grid stability.

With the dramatic growth in household rooftop solar the challenge of minimum demand periods or grid constraints, particularly in South Australia, have emerged along with the need to find ways to address them equitably.

According to the Australian Energy Market Operator (AEMO) on 14 March 2021 more than 10,000 rooftop solar and large distribution-connected systems were switched off remotely in South Australia due to demand being too low to keep up with the minimum requirement of 400MW scheduled demand for system security[viii]. AEMO's Quarterly Energy Dynamics report shows an estimated 71MW of distributed PV (large distribution-connected and residential solar) output was curtailed, including around 14MW of residential distributed PV, through the South Australian Government's Smarter Homes' initiative[ix]. Impacted households were not compensated and were required to purchase electricity from the grid to maintain the grid demand stays above 400 MW.

The need to address how rooftop solar is managed by the grid is not new with solar export curtailment events previously foreseen. The latest initiative to try to manage the growth of solar, and its interaction with a grid that was established to deliver power one-way, is an Australian Energy Market Commission (AEMC) draft determination. One of the proposed changes involves the removal of a prohibition on charging for energy exported into the grid.

Recovering costs for system upgrades

To accommodate the growth in rooftop PV exports, distribution networks need to be able to manage the two-way flow of electricity. The AEMC's report outlines two scenarios and the potential impact for consumers from not making the proposed change. These were:

1) Base case scenario is no upgrade to the distribution network; however, this will limit solar PV rooftop export and bigger investment in large systems for export is disincentivised. Over time, wholesale prices will be higher which is passed onto customers' electricity bills.
2) The distribution network is upgraded by electricity distributors; however, the costs will be added to all type of customers' electricity bill even with or without solar PV.

How export charges are determined and applied

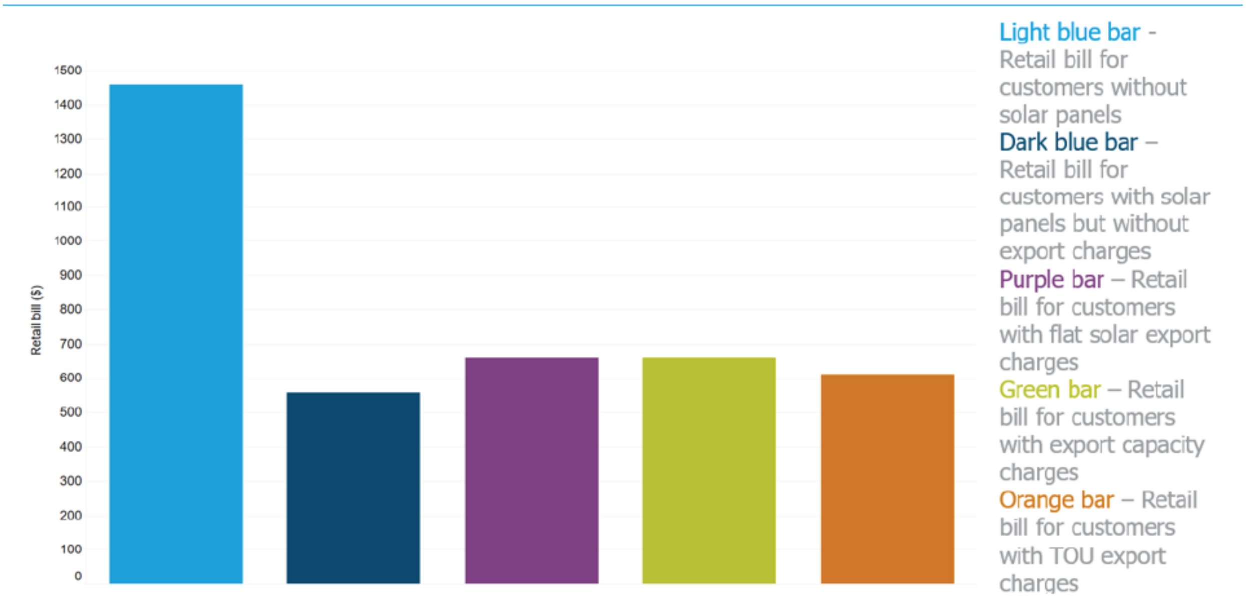
The AEMC draft recommendation considered three different approaches to determine and apply the charge based on:

- Volumetric (c/kWh)
- Time of exporting with rebates during the day and evening
- Demand charges ($/kW) based on maximum output

These charges were applied with a target recovery from each solar exporting customer of $10-$100 annually, based on what it was estimated it would cost to upgrade the networks. The rule change would allow networks to develop pricing options to encourage exports when needed and charging when the network is congested.

The following figures show different scenarios of what a bill would cost for a 5kW system with and without battery on the Ausgrid network with a flat retail tariff.

Figure 5: Customer bills with and without PV and three export charge approaches



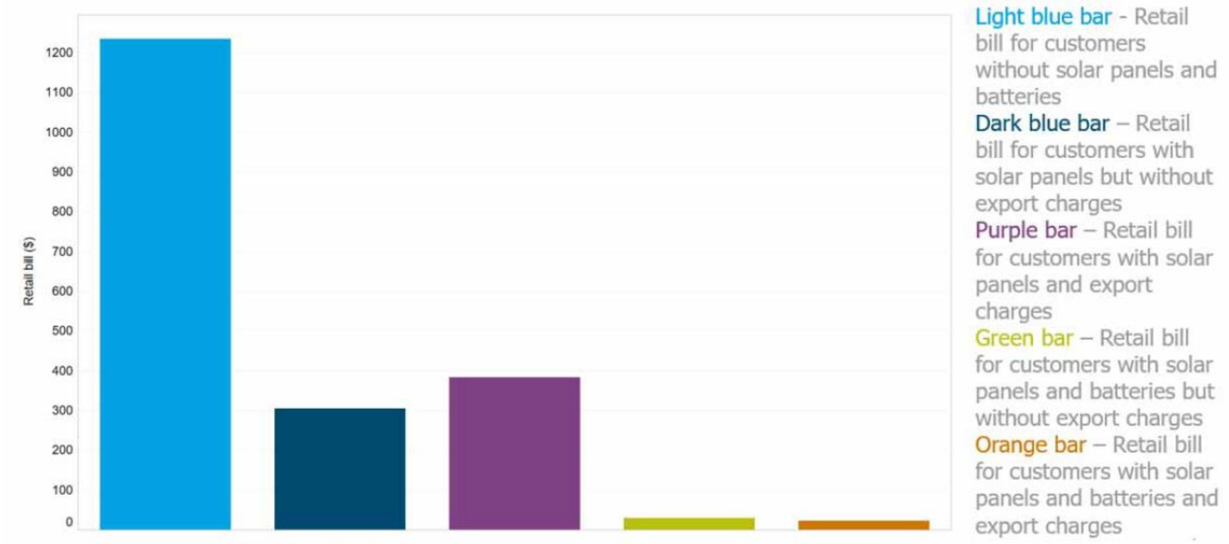
Source: AEMC analysis, AEMO, Ausgrid and SAPN data

For a 5kW system without battery storage, an annual retail bill is $100 higher for customers with flat solar export (purple) or maximum export capacity (green), or $60 higher than the current case with no charges at all for a time-of-use export (orange) with an assumption of a rebate of 30 per cent of network tariff for each kW exported outside daytime period (10am to 4pm).

Export charges under the three different approaches have an impact on the customer's retail bill, however this is relatively small compared to what customers save from installing a rooftop PV system (figure 5).

In a different case-study of a 5kW system with battery storage, rooftop solar households with the capability to manage their export profile with the help of the battery (green bar in figure 6) or export during off-peak hour (purple, outside 10 am to 4 pm) can maximise their bill cost saving further.

Figure 6: The impact of export charges on customer bills for a 5kW system



Source: AEMC analysis, AEMO, Ausgrid and SAPN data

Since the grid, on occasion, has more electricity generation than what is required during the day, the proposed export charge scenarios show a greater financial incentive for customers to consider new technologies like batteries which would give customers more control over their own usage profile.

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 2020. 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 1, 2 and 3 show the LCOE across major cities at different discount rates.

Table 1: Central estimate: 5.49 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	$0.09	$0.33	$0.15
Brisbane	$0.12	$0.11	$0.10	$0.09	$0.10	$0.10	$0.22	$0.15
Canberra	$0.11	$0.11	$0.10	$0.10	$0.10	$0.09	$0.22	$0.11
Darwin	$0.15	$0.14	$0.13	$0.13	$0.13	$0.11	$0.26	$0.24
Hobart	$0.17	$0.15	$0.14	$0.13	$0.13	$0.13	$0.27	$0.09
Melbourne	$0.14	$0.12	$0.11	$0.11	$0.11	$0.11	$0.23	$0.15
Sydney	$0.12	$0.11	$0.10	$0.10	$0.10	$0.09	$0.27	$0.15
Perth	$0.09	$0.09	$0.08	$0.08	$0.08	$0.09	$0.29	$0.07

Source: Australian Energy Council analysis, April 2021

Table 2: Low cost of capital sensitivity: 3.45 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	$0.10	$0.10	$0.09	$0.08	$0.09	$0.08	$0.33	$0.15
Brisbane	$0.11	$0.10	$0.09	$0.09	$0.09	$0.09	$0.22	$0.15
Canberra	$0.10	$0.10	$0.09	$0.09	$0.09	$0.09	$0.22	$0.11
Darwin	$0.14	$0.13	$0.12	$0.12	$0.11	$0.10	$0.26	$0.24
Hobart	$0.15	$0.14	$0.12	$0.12	$0.12	$0.12	$0.27	$0.09
Melbourne	$0.13	$0.11	$0.10	$0.10	$0.10	$0.10	$0.23	$0.15
Sydney	$0.11	$0.10	$0.09	$0.09	$0.09	$0.09	$0.27	$0.15
Perth	$0.09	$0.08	$0.07	$0.07	$0.08	$0.08	$0.29	$0.07

Source: Australian Energy Council analysis, April 2021

Table 3: 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	$0.14	$0.13	$0.12	$0.11	$0.11	$0.11	$0.33	$0.15
Brisbane	$0.15	$0.13	$0.12	$0.11	$0.12	$0.12	$0.22	$0.15
Canberra	$0.14	$0.14	$0.12	$0.12	$0.12	$0.12	$0.22	$0.11
Darwin	$0.20	$0.18	$0.17	$0.17	$0.16	$0.14	$0.26	$0.24
Hobart	$0.22	$0.19	$0.17	$0.17	$0.16	$0.16	$0.27	$0.09
Melbourne	$0.18	$0.15	$0.14	$0.13	$0.13	$0.13	$0.23	$0.15
Sydney	$0.15	$0.13	$0.12	$0.12	$0.12	$0.11	$0.27	$0.15
Perth	$0.12	$0.10	$0.10	$0.09	$0.10	$0.10	$0.29	$0.07

Source: Australian Energy Council analysis, April 2021

Small and large business - Levelised cost of electricity

Tables 4 and 5 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 4 and 5 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[x].

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	$0.11	$0.10	$0.11	$0.10	$0.10
Brisbane	$0.11	$0.10	$0.10	$0.10	$0.10
Canberra	$0.10	$0.10	$0.10	$0.10	$0.10
Hobart	$0.14	$0.13	$0.13	$0.13	$0.12
Melbourne	$0.13	$0.12	$0.12	$0.12	$0.11
Sydney	$0.12	$0.11	$0.11	$0.11	$0.10
Perth	$0.12	$0.10	$0.11	$0.10	$0.09

Source: Australian Energy Council analysis, April 2021

Table 5: Central estimate: 4.78 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

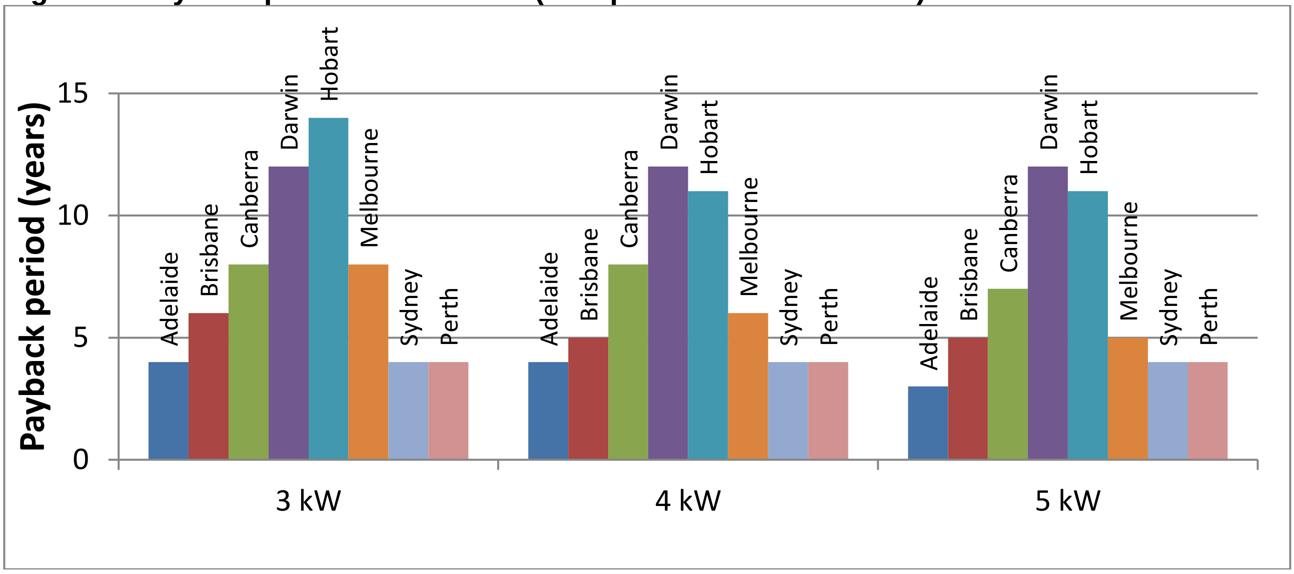
Source: Australian Energy Council analysis, April 2021

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 (3.45 per cent discount rate)



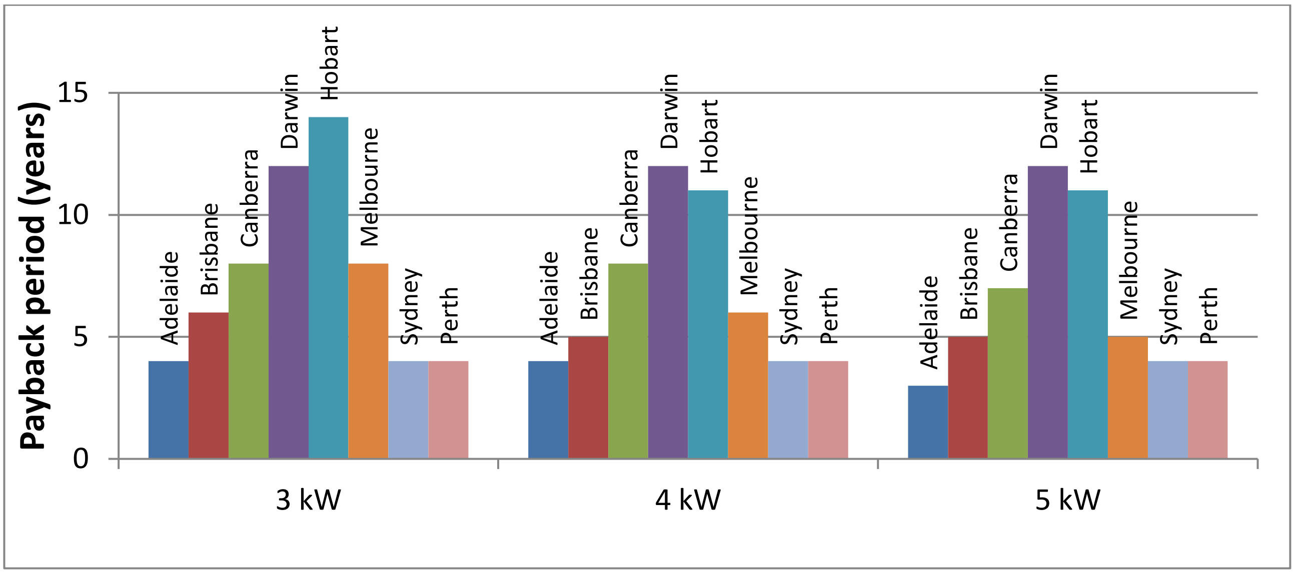
Source: Australian Energy Council analysis, April 2021

Compared to the previous quarter, the price of solar system sizes has not change in Darwin and Hobart. The two states have the highest cost of installations, 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, the state has the greatest discount of $120 for a 3kW PV system, $350 for a 4kW system, $640 for a 5kW system compared to the last quarter. Other states see little decrease in system prices, a drop between $40 to $140.

Figure 8 shows the expected payback period for systems with a 5.49 per cent discount rate (10-year average home loan rate). Melbourne sees 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 compares 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 (5.49 per cent discount rate)



Source: Australian Energy Council analysis, April 2021

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

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

t = years

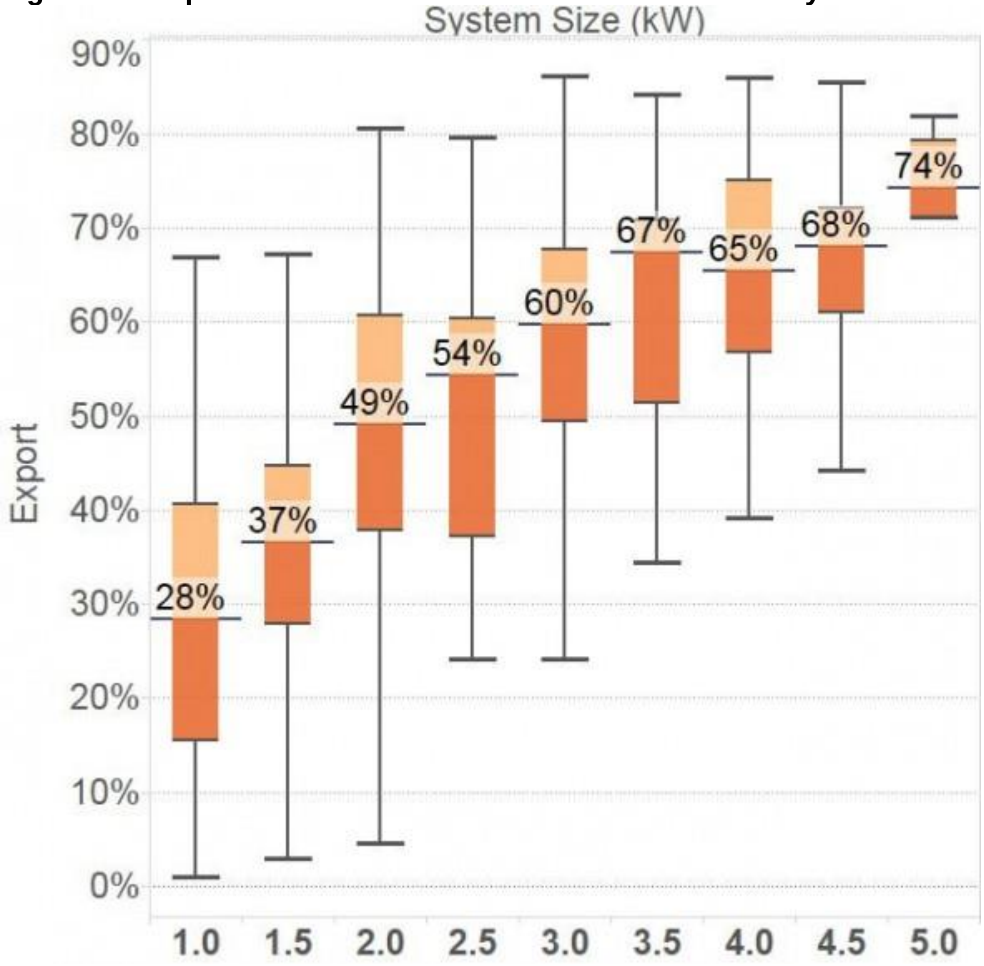
Avoided cost and FiT

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's analysis[xi]. 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] Clean Energy Regulator, Small-Scale Renewable Energy Scheme data
[ii] 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.
[iii] Solar PV system owners have up to 12 months to report their data to the Clean Energy Regulator.
[iv] New South Wales Government, Empowering homes solar battery loan offer
[v] Victorian Government Helping Victorians Pay Their Power Bills, 17 November 2020
[vi] South Australian Government, Solar photovoltaic systems and battery storage, page last updated 31 March 2021
[vii] https://www.wa.gov.au/organisation/energy-policy-wa/energy-buyback-schemes
[viii] Australian Energy Market Operator, Quarterly Energy Dynamics – Q1 2021, page 8
[ix] In August 2020, the South Australian Government announced all new solar installed after 28 September 2020 will need to use a compliant inverter and customer needs to appoint an agent to manage turning off and on of their system in an emergency. Existing solar customers would not be affected, while replacing and upgrading an inverter will be applied to new rule.
[x] BCA, "Impact of Green Energy Policies on Electricity Prices", June 2014
[xi] Sunwiz, Solar Pays Its Way on Networks. Last accessed 17 June 2015.