AUSTRALIAN ENERGY COUNCIL

SOLAR REPORT

QUARTER 1, 2019

Australian Energy Council

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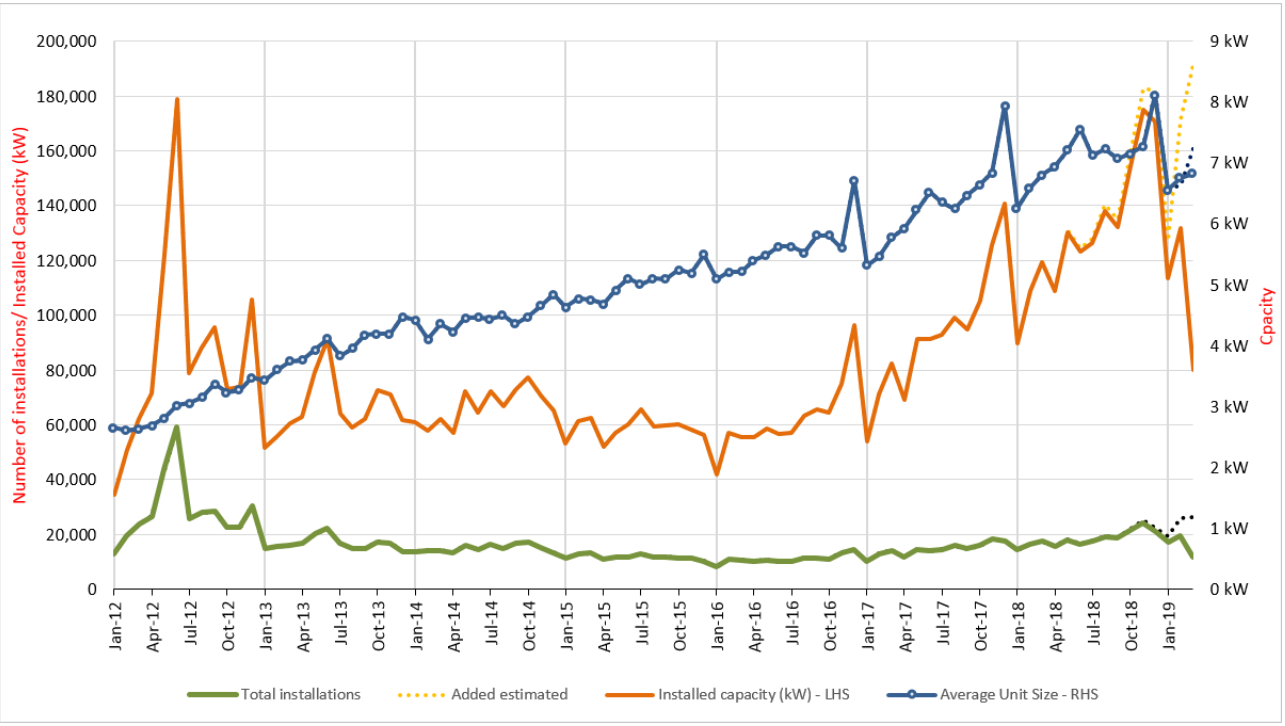
SECTION I: STATE OF SOLAR PV IN AUSTRALIA

Latest data from the Clean Energy Regulator (CER, 17 April 2019) shows that Australia reached 2.09 million solar PV installations in the first quarter of 2019. Between January and March 2019, Australian rooftops added nearly 500 megawatts (MW) of new solar PV, while the previous corresponding period added 318 MW.

Figure 1 below shows the number of monthly installations and installed capacity, along with the average monthly system size, installed across Australia. January has consistently been a softer month in the number of rooftop PV installations and installed capacity - a trend that has again been seen this year - however, the average unit capacity in January 2019 has broken previous records when compared to corresponding periods.

Figure 1: Monthly installations, installed solar PV capacity and average system size January 2012 – March 2019



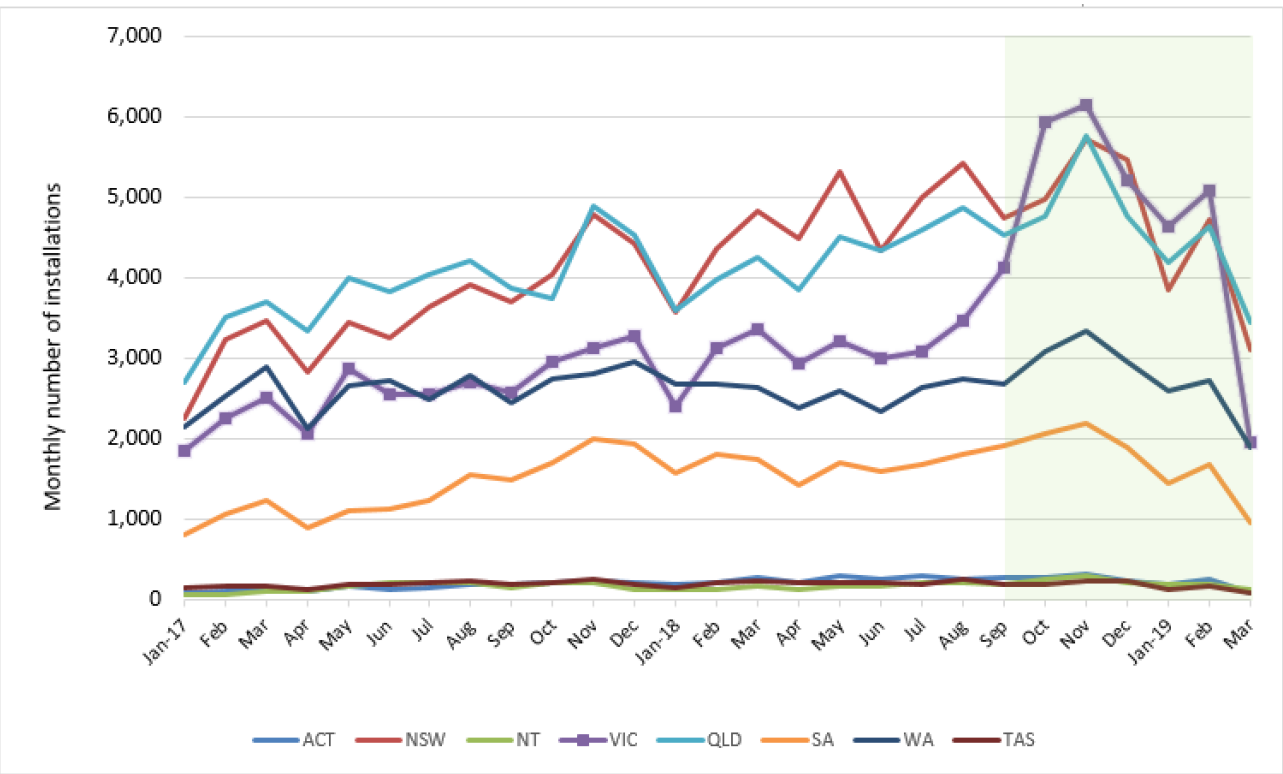
Source: Clean Energy Regulator (adjusted data), Australian Energy Council analysis, data as at 31 March 2019

The monthly average unit capacity for December 2018 reached over 8.1 kW, compared to 7.9 kW in December 2017. However this is not a significant change compared to the previous corresponding period when the average unit size increased by 18.5 per cent (6.7 kW in 2016 compared to 7.94 kW in 2017.)

The Victorian Government's Solar Home Program rebate, which came into effect from 19 August 2018, has seen the state's monthly rooftop installation numbers grow.

Victoria led the states with the highest number of monthly of rooftop installations. Under the State Government program, Victorian solar homeowners can apply for a 50 per cent rebate with a maximum of $2,225 on the cost of solar PV system[i]. Shown in figure 2, besides the drop in the recent months due to the 12-month reporting lag, the monthly rooftop PV installations in Victoria since August has increased faster than New South Wales and Queensland[1].

Figure 2: Monthly rooftop PV installations by states

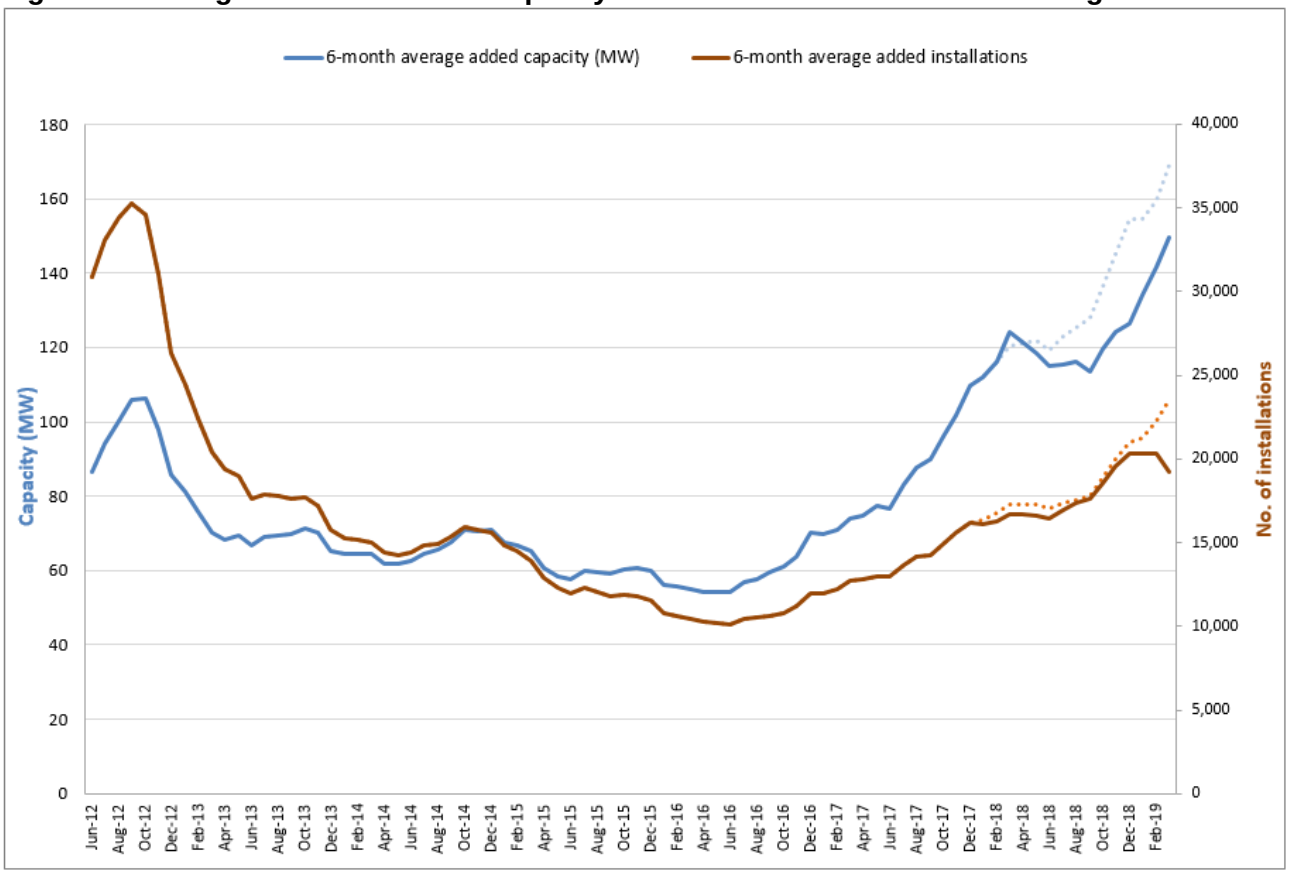


Source: Clean Energy Regulator (unadjusted data), data as at 31 March 2019

Similar to previous Solar Reports since late 2016, the two trend lines in figure 3 continue to widen - showing that bigger PV system units are being installed across the nation. Specifically, the rolling average installed capacity (blue line) has steadily grown, to reach an estimated six-month average of 149.4 MW on rooftops as of March 2019[ii].

[1] Solar PV system owners have up to 12 months to report their data to the Clean Energy Regulator, so the reported data for the most recent months is likely to understate the number of actual installations, as well as the installed capacity.

Figure 3: Rolling 6-month installed capacity and number of installations average



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as at 31 March 2019

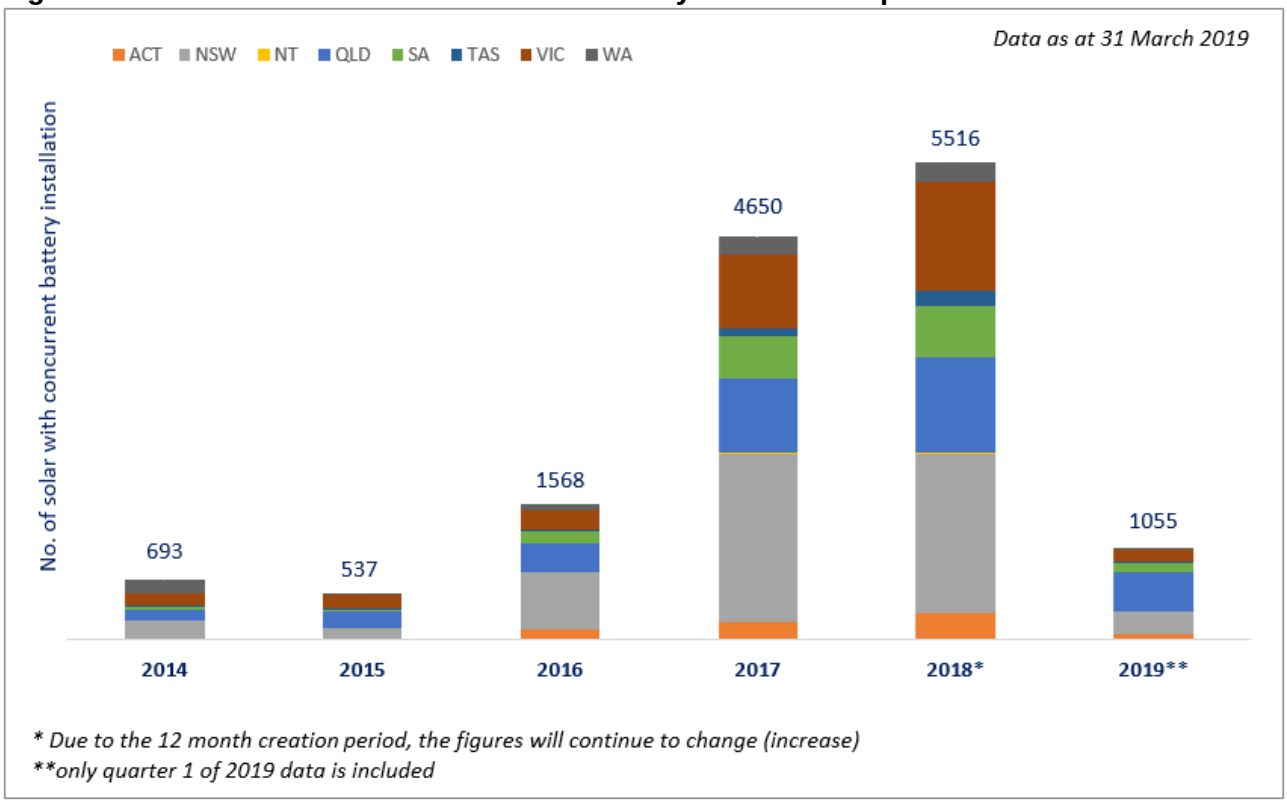
Figure 3 also shows a drop in the 6-month average added capacity from April 2018 to September 2018. This is the first time the rolling average of added capacity has dipped in September (usually this occurs in June). As such, this September estimate will be confirmed in the next Solar Report by which time we estimate at least 98 per cent of households will have reported installations to CER (based on the historical monthly CER data).

Battery installations with rooftop solar

There has been continued growth in home battery installations with rooftop solar PV (figure 4). In the first quarter of 2019, 1,055 solar PV systems with batteries were installed – although this is only higher than the number reported in 2014 and 2015.

In 2018, currently data shows New South Wales and Victoria continue to lead the way with their market shares accounting for 33.4 and 22.9 per cent of total battery storage installations in Australia respectively.

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



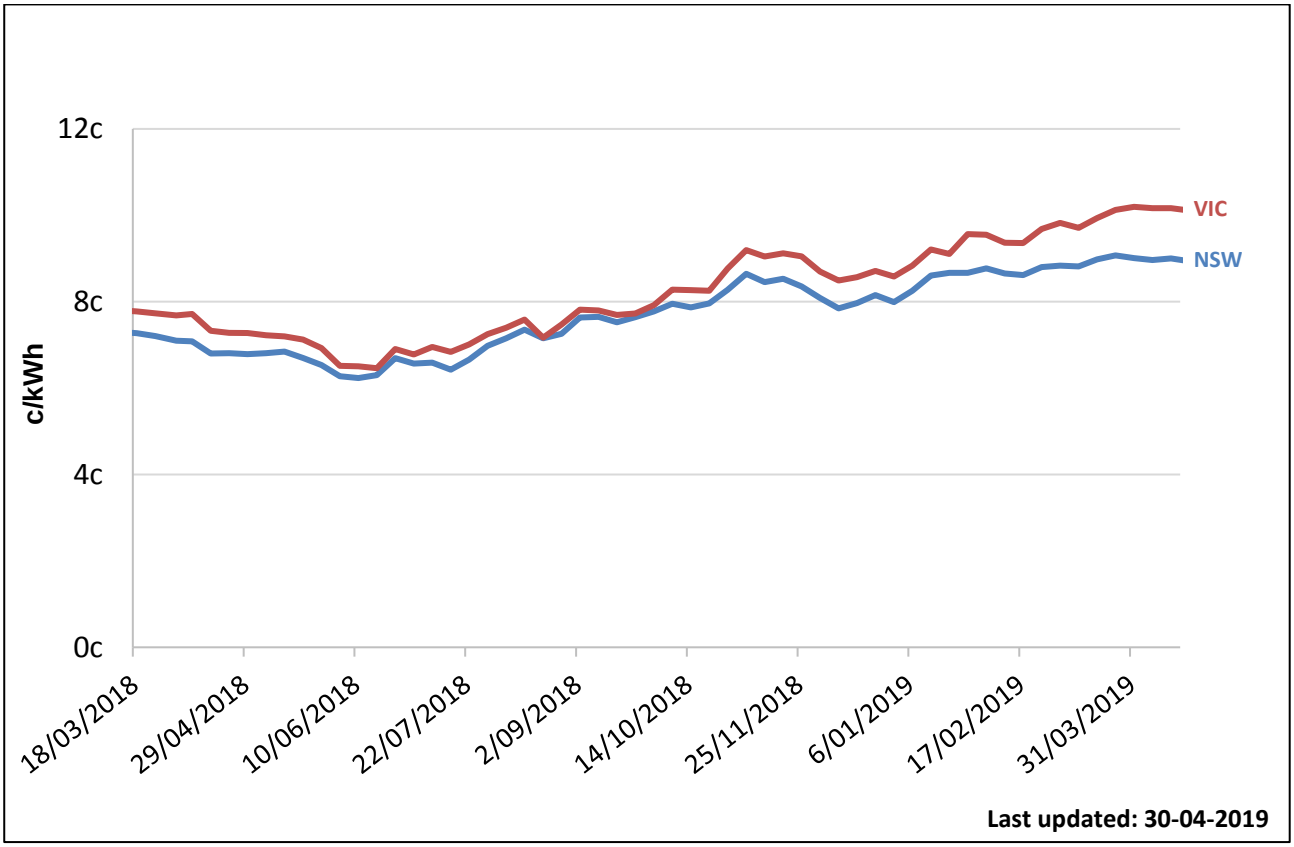
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as at 31 March 2019

Solar feed-in tariff update: 2019-20

The Essential Services Commission (ESC) has set the new retail solar feed-in tariff (FiT) rate for customers feeding solar power back into the grid, to a minimum of 12 cents per kilowatt hour (c/kWh) for a single rate tariff starting from 1 July 2019[iii]. This minimum rate has increased from 9.9 c/kWh because the future wholesale electricity price is expected to increase in the next financial year (see figure 5).

The new time-varying tariffs are now required to offer a minimum of 9.1c/kWh (previously 7.1 c/kWh) for exports between 10pm - 7am; 11.6 c/kWh (previously 10.3c/kWh) between 7am - 3pm and 9pm - 10pm; while the peak afternoon period from 3pm - 9pm is decreased from 29c/kWh to 14.6 c/kWh.

Figure 5: Future Baseload Wholesale Prices FY2019-20



Source: NEM-Futures data, Global Roam

The New South Wales Independent Pricing and Regulatory Tribunal (IPART) also recently released the recommended benchmark rate for retailers for the 2019-20 financial year[iv]. The state's all-day solar FiT benchmark was raised from the 2018-19 range of 6.9-8.4c/kWh, to 8.5-10.4c/kWh (similar to Victoria, see figure 5). IPART also introduced recommended time-varying tariffs (as in Victoria):

- 6am to 3pm: 8.4 -10.2 c/kWh;
- 3pm to 4pm: 8.8 - 10.7 c/kWh;
- 4pm to 5pm: 9.6 - 11.7 c/kWh;
- 5pm to 6pm: 11.6 – 14.2 c/kWh;
- 6pm to 7pm: 13.5 – 16.5 c/kWh;
- 7pm to 8pm: 10.6 – 12.9 c/kWh.

The recommendation's main purpose is to provide a guide and it is voluntary for retailers to offer customers.

The new benchmark rate has increased to match the price it would cost retailers to buy electricity from large generators. However the saving to retailers (at the recommended rate of 8.5 to 10.4 c/kWh) from solar energy is less than the retail price (households in New South Wales are paying around 20 to 30 c/kWh for their electricity usage). The benchmark rate is said to be fair for retailers since IPART expects the wholesale component to account for around one-third to one-half of the

total costs of supply. Once retailers purchase the amount of electricity exports to the grid, they still incur network and green scheme costs for supplying these exports to other customers.

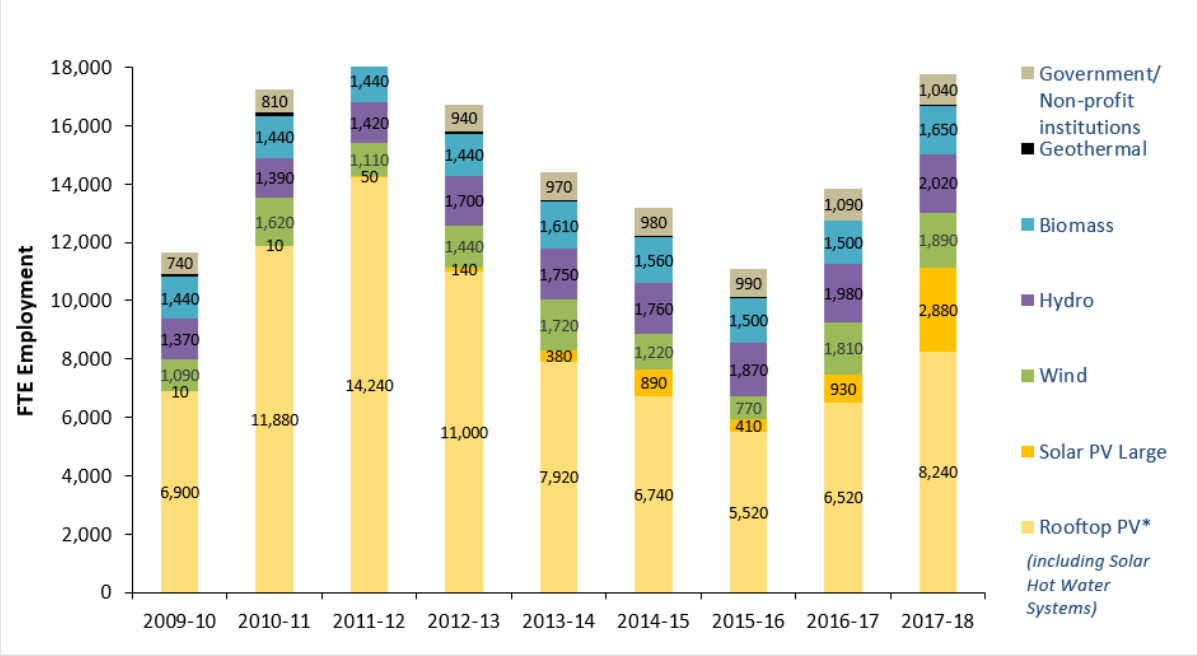
SECTION II: EMPLOYMENT GROWTH IN SOLAR

Recent data from the Australian Bureau of Statistics (ABS) shows that annual full-time equivalent (FTE) employment in the renewable energy sector continued to increase by 28 per cent in 2017-18 to reach 17,740 FTE employees (compared to 13,850 in the previous financial year).

Figure 6 shows the breakdown of direct FTE employment in the renewable sector. Rooftop solar PV is the greatest contributor to growth in every year of published ABS figures. Its share peaked in 2011-12 when employment in rooftop solar PV made up 74 per cent of total direct FTE employment in renewable energy. The early adoption of small-sized solar PV (less than 2.5 kW) was greatest in June 2011, due to a solar rebate at and before that time (a multiplier was placed on the number of small-scale technology certificates that could be created for the first 1.5 kW of solar installed[v]).

The share of rooftop solar PV then declined by 61 per cent in 2015-16, which coincided with the decrease in the number of rooftop solar PV systems.

Figure 6: Breakdown of direct FTE employment in renewable by types



Source: Australian Bureau of Statistics, April 2019

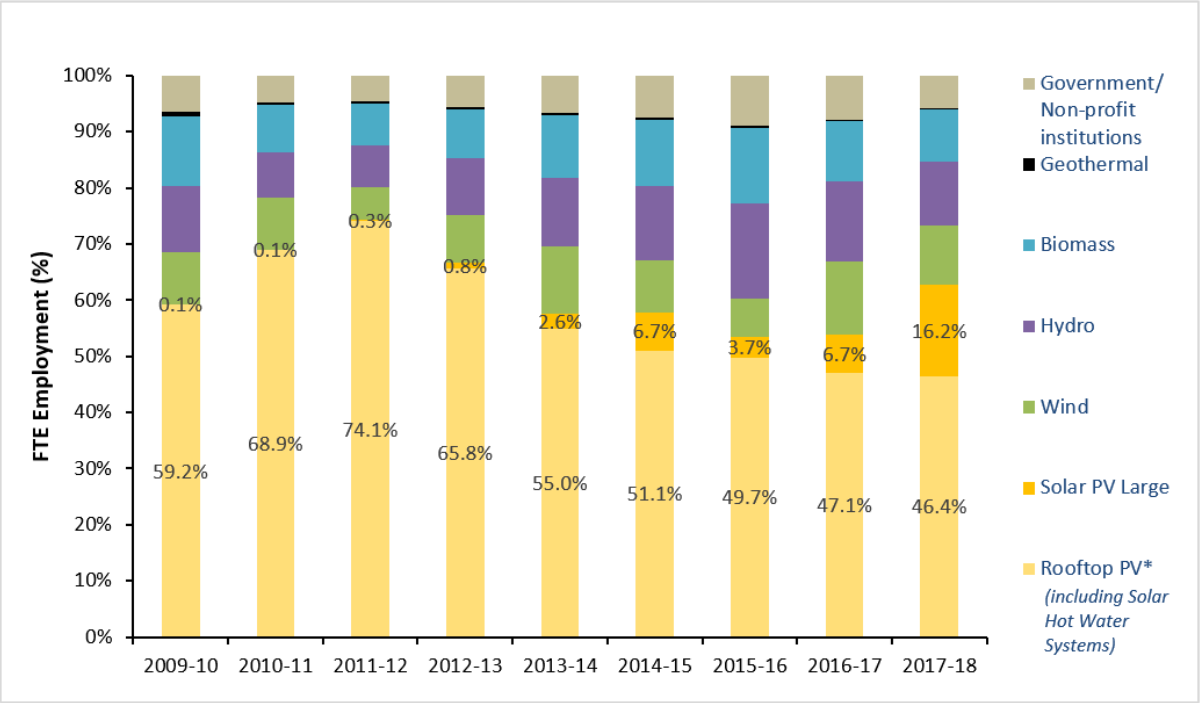
Since the exit of Northern and Hazelwood power stations in 2016-17, an increase in electricity prices has seen a corresponding increase in households opting for rooftop solar PV to help ease their electricity costs[vi]. This increase in systems, including solar hot water systems, has led to a similar increase in FTE employment.

Beside rooftop solar PV, in 2017-18 overall employment numbers overtake the previous peak of 17,240 direct FTE in 2011-12, due to a boom in large-scale solar projects (figure 7). During 2018,

28 large-scale solar farms were completed with a total of 1,442MW installed capacity, which explains the proportion of direct FTE employment in the sector growing to 16.2 per cent.

Construction in large-scale solar PV and rooftop solar PV (including solar hot water systems) accounts for 62 per cent of direct FTE employment in renewable energy activities, increasing from 7,450 to 11,120 direct FTE during 2017-18.

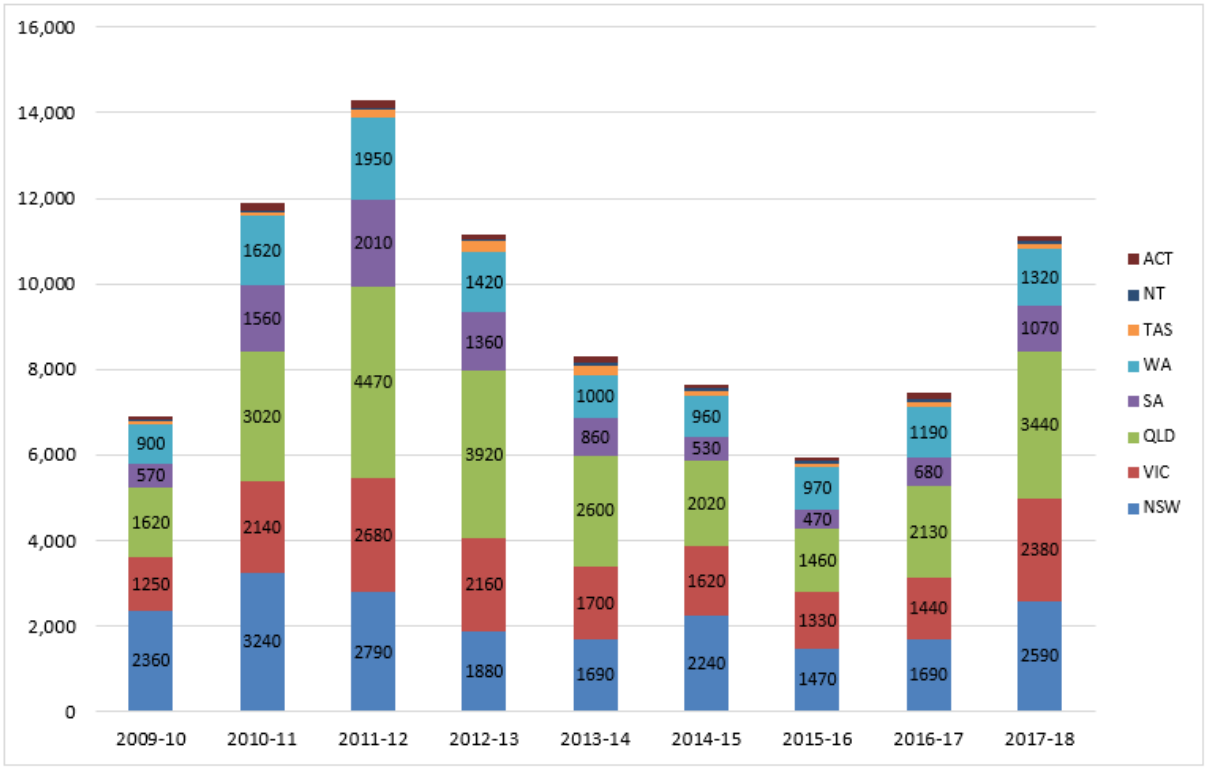
Figure 7: Proportion of direct FTE employment in renewable by types since 2009-10



Source: Australian Bureau of Statistics, April 2019

Looking at the employment by state (which is shown in figure 8 below), Queensland recorded the highest level for a second consecutive year in terms of annual direct FTE employment in solar installations with 3,440 FTE employees (or 67.7 per cent of total employment) in renewable energy activities during 2017-18. This is a 61.5 per cent increase compared to 2016-17, when there were 2,130 FTE employees.

Figure 8: Direct FTE employment in rooftop solar PV installations by states



Source: Australian Bureau of Statistics, April 2019

New South Wales is second, recording 2,590 FTE employees during 2017-18 (or 57.9 per cent) of total employment in renewable energy activities. While Victoria had 2,380 (74.8 per cent of those were employed in rooftop solar installations); Tasmania 110 (8.1 per cent rooftop PV); Western Australia 1,320 (94.3 per cent rooftop PV); and South Australia 1,070 (68.6 per cent rooftop PV). The ACT recorded 120 FTE (20.7 per cent rooftop PV) while the NT recorded 90 (81.8 per cent rooftop PV).

SECTION III: LEVELISED COST OF ENERGY

The Levelised Cost of Energy (LCOE) is the cost of energy per 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 2018 for most states, with Victorian offer was last updated in January 2019. 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.

The tables on the next page use the highest offer of the lower range of FiTs among retailers in different states. For example, in Canberra, Energy Locals is one of the four retailers offering FiTs ranging from 9 c/kWh to 16 c/kWh for consumers exporting back to the grid. Energy Locals has the best lowest FiT offer, in other words, other retailers offer lower than 9 c/kWh. This however does not mean it is the best deal of FiT, other retailers in Canberra are offering up to 20 c/kWh for their maximum FiT. This FiT rate is offered depending on household consumption and exporting rates.

Table 1: Central estimate: 6.14 per cent discount rate (ten-year average mortgage rate)

All figures in $/KWh	System Size							Retail prices	FIT
	1.5 kW	2 kW	3 kW	4 kW	5 kW	7 kW	10 kW		
Adelaide	$0.15	$0.13	$0.11	$0.10	$0.10	$0.10	$0.10	$0.48	$0.16
Brisbane	$0.18	$0.16	$0.13	$0.12	$0.11	$0.11	$0.10	$0.31	$0.16
Canberra	$0.15	$0.13	$0.11	$0.10	$0.10	$0.10	$0.09	$0.23	$0.13
Darwin	$0.24	$0.21	$0.18	$0.16	$0.16	$0.14	$0.13	$0.26	$0.24
Hobart	$0.22	$0.18	$0.16	$0.15	$0.14	$0.14	$0.16	$0.26	$0.09
Melbourne	$0.20	$0.17	$0.15	$0.14	$0.12	$0.13	$0.13	$0.28	$0.15
Sydney	$0.18	$0.16	$0.13	$0.12	$0.11	$0.12	$0.11	$0.27	$0.15
Perth	$0.14	$0.12	$0.10	$0.09	$0.08	$0.09	$0.10	$0.28	$0.07

Source: Australian Energy Council analysis, April 2019

Table 2: Low cost of capital sensitivity: 5.27 per cent discount rate (low current standard variable rate)

All figures in $/KWh	System Size							Retail prices	FIT
	1.5 kW	2 kW	3 kW	4 kW	5 kW	7 kW	10 kW		
Adelaide	$0.15	$0.13	$0.11	$0.10	$0.09	$0.10	$0.10	$0.48	$0.16
Brisbane	$0.17	$0.15	$0.12	$0.11	$0.10	$0.10	$0.10	$0.31	$0.16
Canberra	$0.15	$0.13	$0.11	$0.10	$0.09	$0.10	$0.09	$0.23	$0.13
Darwin	$0.23	$0.20	$0.17	$0.15	$0.15	$0.13	$0.12	$0.26	$0.24
Hobart	$0.21	$0.18	$0.15	$0.14	$0.13	$0.14	$0.15	$0.26	$0.09
Melbourne	$0.19	$0.16	$0.14	$0.13	$0.12	$0.13	$0.13	$0.28	$0.15
Sydney	$0.18	$0.15	$0.13	$0.11	$0.10	$0.11	$0.11	$0.27	$0.15
Perth	$0.13	$0.12	$0.10	$0.09	$0.08	$0.09	$0.09	$0.28	$0.07

Source: Australian Energy Council analysis, April 2019

Table 3: High cost of capital sensitivity: 13.56 per cent discount rate (indicative personal loan rate)

All figures in $/KWh	System Size							Retail prices	FIT
	1.5 kW	2 kW	3 kW	4 kW	5 kW	7 kW	10 kW		
Adelaide	$0.22	$0.18	$0.15	$0.14	$0.12	$0.13	$0.13	$0.48	$0.16
Brisbane	$0.26	$0.22	$0.17	$0.16	$0.14	$0.14	$0.14	$0.31	$0.16
Canberra	$0.21	$0.18	$0.15	$0.14	$0.13	$0.13	$0.11	$0.23	$0.13
Darwin	$0.35	$0.31	$0.26	$0.23	$0.22	$0.19	$0.17	$0.26	$0.24
Hobart	$0.31	$0.26	$0.22	$0.20	$0.19	$0.19	$0.21	$0.26	$0.09
Melbourne	$0.28	$0.24	$0.21	$0.18	$0.16	$0.18	$0.18	$0.28	$0.15
Sydney	$0.26	$0.22	$0.18	$0.16	$0.14	$0.15	$0.15	$0.27	$0.15
Perth	$0.19	$0.17	$0.13	$0.12	$0.11	$0.11	$0.13	$0.28	$0.07

Source: Australian Energy Council analysis, April 2019

Small and large business - Levelised Cost of Electricity

Tables 4 and 5 show the estimated cost of electricity production for commercial-size solar systems. As businesses look to reduce overhead costs, installation of large-scale solar panels continue to increase.

Business tariffs differ to residential retail tariffs. Depending on the size of the customer and the amount of energy used, businesses have the ability to 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. For comparison, the average electricity bill for industrial businesses in 2014-15 was 10.72 c/kWh[vii].

The CER sets out guidelines for the redemption of small-scale certificates. There are two criteria that can exclude a system from receiving STCs: systems cannot exceed 100 kW in capacity or generate more than 250 MWh per year[viii].

Table 4: Central estimate: 6.89 per cent discount rate, ten-year average small business interest rate

All figures in $/KWh	System Size				
	10kW	30kW	50kW	70kW	100kW
Adelaide	$0.12	$0.12	$0.12	$0.12	$0.12
Brisbane	$0.13	$0.12	$0.13	$0.12	$0.12
Canberra	$0.12	$0.11	$0.11	$0.11	$0.11
Hobart	$0.17	$0.15	$0.15	$0.15	$0.14
Melbourne	$0.15	$0.14	$0.15	$0.14	$0.14
Sydney	$0.14	$0.13	$0.13	$0.13	$0.12
Perth	$0.13	$0.12	$0.12	$0.12	$0.11

Source: Australian Energy Council analysis, April 2019

Table 5: Central estimate: 4.83 per cent discount rate, ten-year average large business interest rate

All figures in $/KWh	System Size				
	10kW	30kW	50kW	70kW	100kW
Adelaide	$0.11	$0.11	$0.11	$0.11	$0.11
Brisbane	$0.11	$0.11	$0.12	$0.11	$0.11
Canberra	$0.11	$0.10	$0.10	$0.10	$0.10
Hobart	$0.15	$0.14	$0.14	$0.14	$0.13
Melbourne	$0.14	$0.13	$0.13	$0.13	$0.13
Sydney	$0.12	$0.12	$0.12	$0.12	$0.11
Perth	$0.12	$0.11	$0.11	$0.11	$0.10

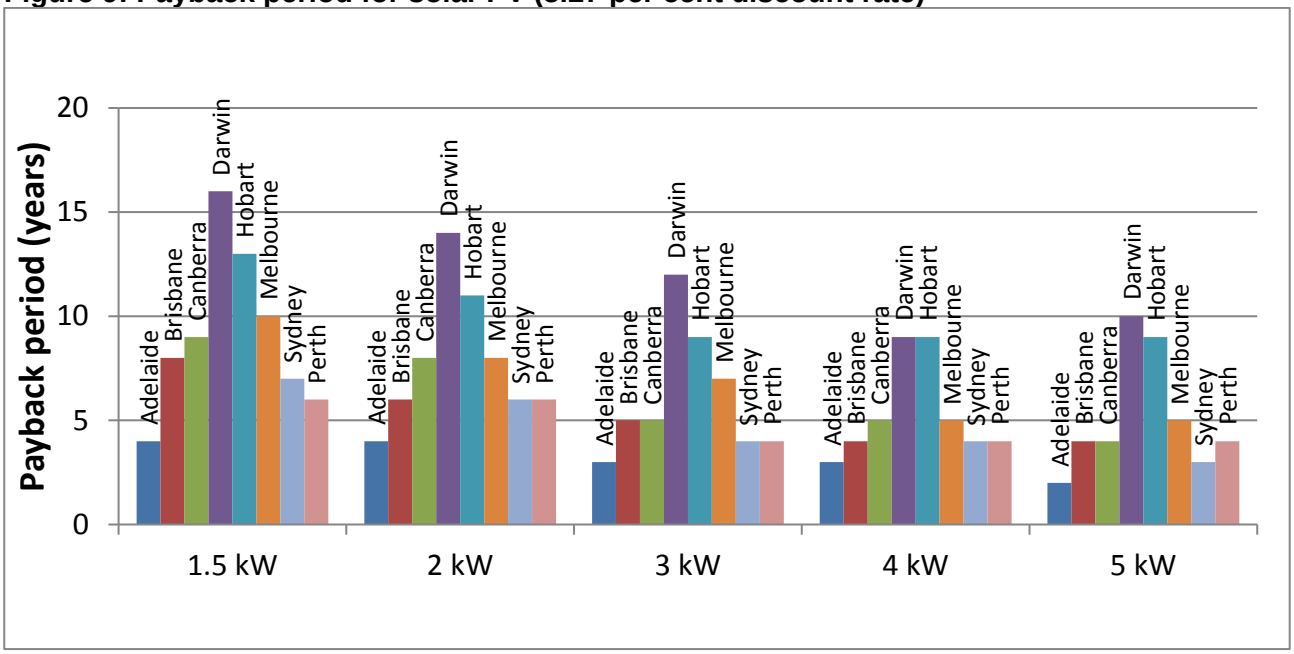
Source: Australian Energy Council analysis, April 2019

SECTION IV: PAYBACK PERIOD, DETAILED MODEL

Using a similar methodology to that used to calculate the LCOE of solar PV in Australia (see Section 4); the Australian Energy Council has calculated the payback period for residential solar PV systems. 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 8 highlights the payback period for different system sizes across Australia. Note that electricity prices are increased at consumer price index (CPI) levels (currently 1.3 per cent, last updated March 2019 according to the Reserve Bank of Australia) and any changes to CPI 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, for example, in Darwin, the offered FiT is 23.6 c/kWh.

Figure 9: Payback period for solar PV (5.27 per cent discount rate)

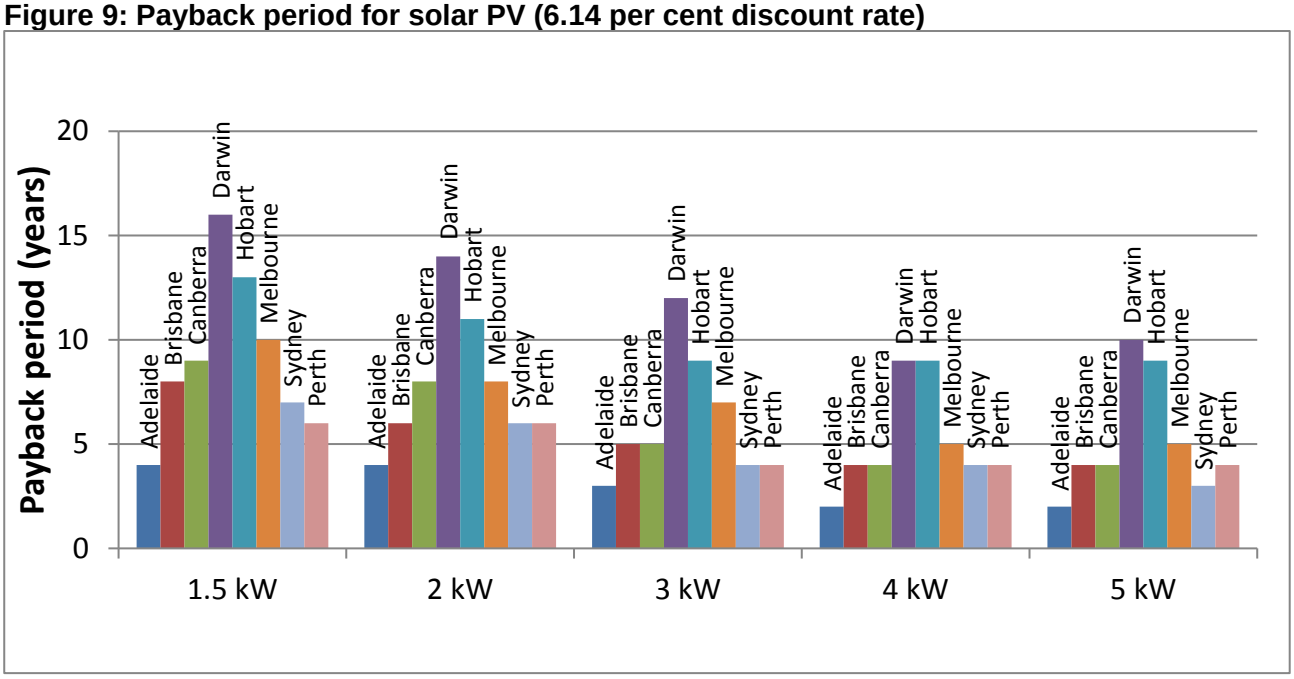


Source: Australian Energy Council analysis, April 2019

Figure 8 shows though a bigger system unit will cost more initially with the range of FiTs offered from retailers, the cost will be recovered faster than a 1.5 kW system, hence lowering the payback periods through the credits from the energy export back to the grid. Across different system sizes, the payback years in Darwin and Hobart are longer compared to other cities due to the high prices of solar system.

Figure 9 shows that the expected payback period for systems with a 6.14 per cent discount rate (10-year average home loan rate).

Figure 9: Payback period for solar PV (6.14 per cent discount rate)



Source: Australian Energy Council analysis, April 2019

As many residential customers are now considering a larger PV system size, the trends in both figures 8 and 9 show that the bigger the system, the lower the number of years a customer will have to pay back the costs of installation.

SECTION V: METHODOLOGY APPENDIX

1. Solar installations methodology

Analysis from the Clean Energy Regulator's (CER) monthly released 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 [t] 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. Levelised Cost of Electricity Methodology

Introduction

The methodology outlines our approach in calculating the Levelised Cost of Electricity (LCOE) for solar panels installed across capital cities in Australia. Our analysis includes the following:

- Initial investment
- Annual costs
- Discount rate
- Efficiency
- System degradation rate

Initial investment

The initial investment plays a major role in the LCOE calculations. The initial investment represents the cost of buying and installing solar panels all values are inclusive of Federal small-scale technology certificate (STC) discounts.

The initial investments in this report are obtained from the Solar Choice website. Solar Choice takes prices from over 125 installers across Australia and updates pricing data monthly.

Annual costs

We have estimated the annual cost to clean a solar panel at $12.50[ix], and the average sized solar panel in our calculations to be 200 W.

Discount rate

The discount rate represents the risk nature of the consumer. For this exercise, three different discount rates have been used and will be updated each quarter. The central estimate is based on the 10-year average home loan, as presented by the Reserve Bank of Australia (6.14 per cent).

The low discount rate sensitivity is based on the minimum variable home loan mortgage rate offered by the Big Four banks (currently 5.27 per cent).

The high discount rate sensitivity is based on personal loans offered by the Big Four banks as the assumption has been made that a personal loan will include all costs including the initial start-up of the loan (13.56 per cent).

Small business and large business discount rates are based on the 10-year average of the variable weighted average rate on credit outstanding. The large business discount rate is 4.83 per cent and the small business discount rate is 6.89 per cent.

The discount rate also takes into account the Consumer Price Index (CPI); this has been given a constant value of 1.3 per cent (according to Australian Bureau of Statistics, March 2019).

Efficiency

The kWh/kWp represents the average daily production of solar panels. The number was obtained from the Clean Energy Council's consumer guide to installing household solar panels[x]. The efficiency figure represents the average daily output for a 1 kW system.

System degradation rate

The system degradation rate is used to show the reduced output of a system from year to year. Numbers vary from approximately 0.1 per cent to 1 per cent depending on the system. The Australian Energy Council has used 0.5% as a constant degradation rate for all LCOE calculations.

Formula

$$LCOE\ \$/kWh = \frac{Initial\ Investment + \sum_{N=1}^{N} \frac{Annual\ Costs}{(1+Discount\ Rate)^n}}{\sum_{N=1}^{N} \frac{Initial \frac{kWh}{kWp} * (1-System\ Degradation\ Rate)^n}{(1+Discount\ Rate)^n}}$$

Retail comparison rates

St Vincent de Paul tracks market offers on a bi-annual basis. New South Wales, Queensland, South Australia and Victoria implied usage charge of electricity have been obtained from these reports.

A single rate tariff was analysed to calculate the implied usage charge in Victoria, South Australia, New South Wales and the ACT. Tariff 11 in Queensland. Tasmania's usage charge was obtained for Aurora Energy tariff 31 and Synergy the sole retailer in Western Australia was used.

3. 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 $(1+ CPI)^t$ x consumption / 100) + (Export x FiT)

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

t = years

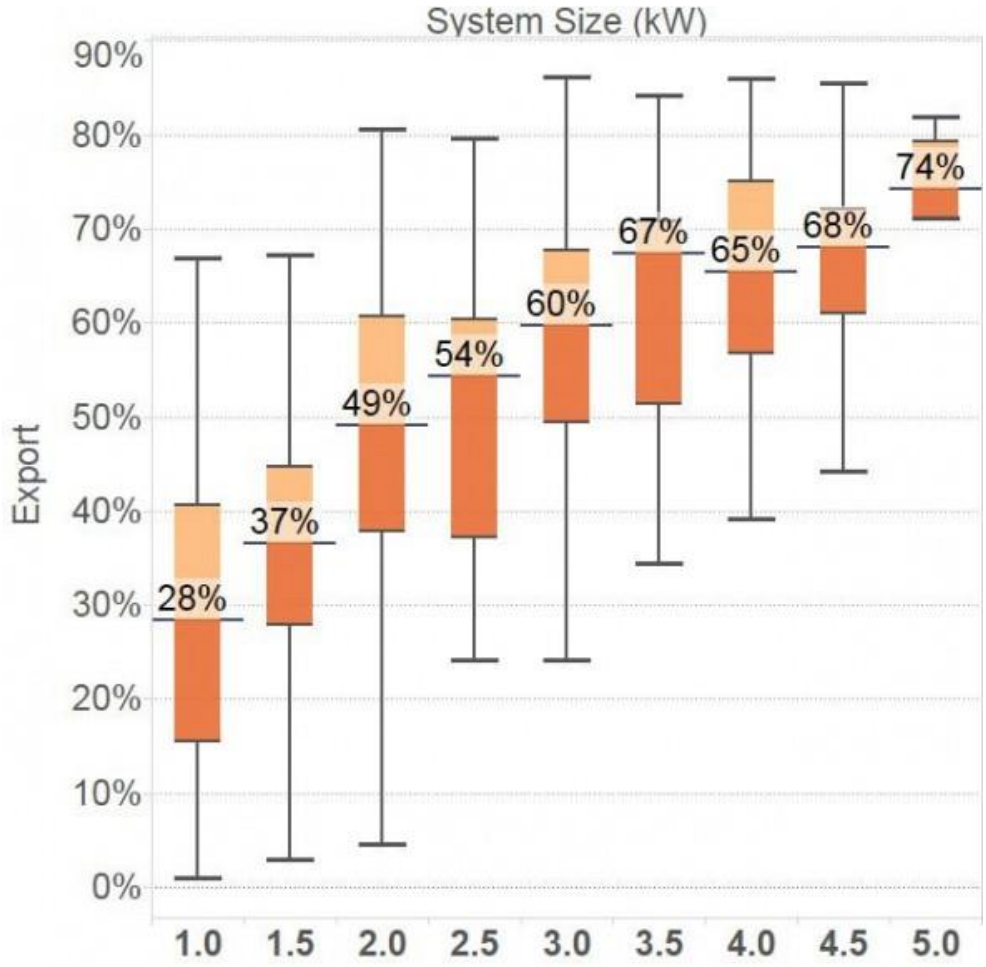
Avoided cost and FiT

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 10)

Figure 10: Export rate of residential solar PV at different system sizes



Source: Sunwiz analysis, 2015

[i] Australian Energy Council Solar Report, Quarter 3 of 2018
[ii] This is based on estimations of capacity, allowing for the lag in reported data
[iii] Feed-in tariffs to apply from 1 July 2019 to 30 June 2020, Essential Commission Service
[iv] Solar Feed-In Tariff Benchmark 2019-20, IPARR, 26th April 2019
[v] Green Energy Option, "Solar Rebates", http://www.greenenergyoptions.com.au/solar-rebates1/
[vi] Australian Energy Council Solar Report, March 2017
[vii] BCA, "Impact of Green Energy Policies on Electricity Prices", June 2014
[viii] Clean Energy Regulator, How to have STCs assigned to you as a Registered Agent, http://ret.cleanenergyregulator.gov.au/For-Industry/Agents/Having-STCs-assigned-to-you/stcs-assigned-to-you
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