AUSTRALIAN ENERGY COUNCIL

SOLAR REPORT

MARCH 2016

Australian Energy Council

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31 March 2016

Level 14, 50 Market Street, Melbourne VIC 3000

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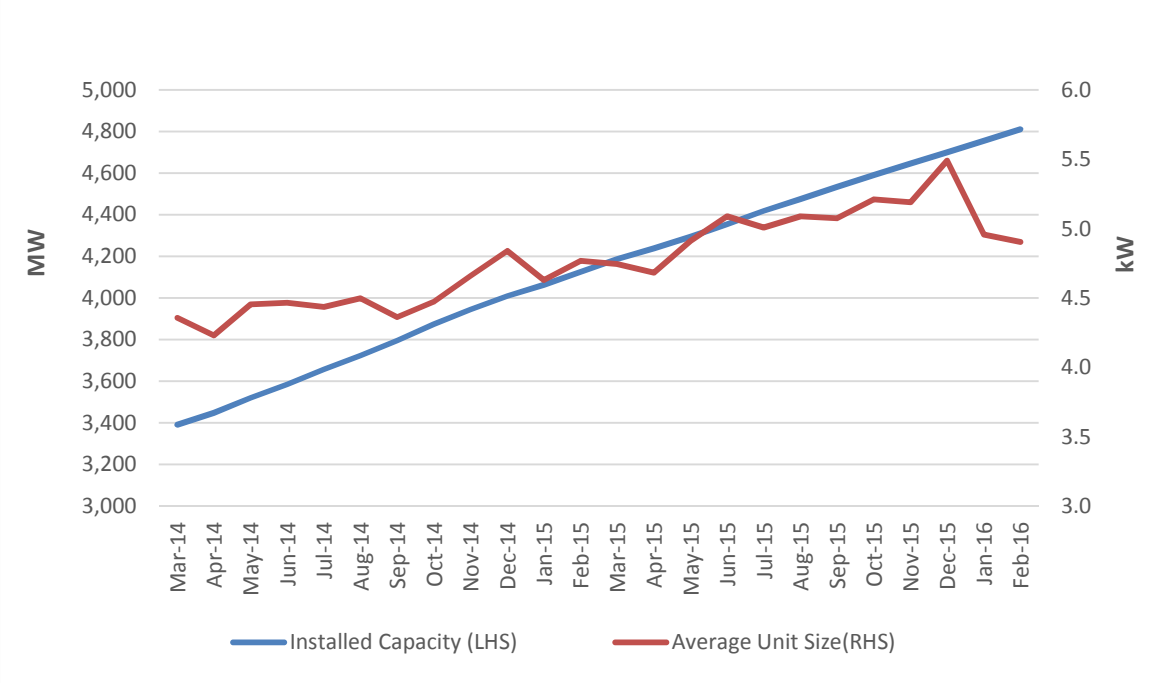
SECTION I: OVERVIEW OF SOLAR PV IN AUSTRALIA

Solar installations are starting to slow across Australia as generous government schemes continue to close and uncertainty remains around the future of existing ones. All premium FiTs have now been removed, while schemes such as the Small-scale Renewable Energy Scheme (SRES) have recently been reviewed. The six month rolling average has dropped from 67 MW in January 2015 to an estimated 58 MW in January 2016. Figure 1 shows the cumulative capacity over the last two years and the average monthly system size installed across Australia.

Figure 1: Installed solar PV and average system size



Australia exceeded the 1.5 million solar PV installations, reaching 1.53 million as at 1 March 2016. Between January and December 2015, the average system size increased from 4.63 kW to 5.49 kW per installation. January and February 2016 experienced against the trend decreases in the average system size with 4.96 kW and 4.90 kW respectively.

In this report we look at the draft report by the Queensland Productivity Commission on Solar Feed-in Pricing (see Chapter 3).

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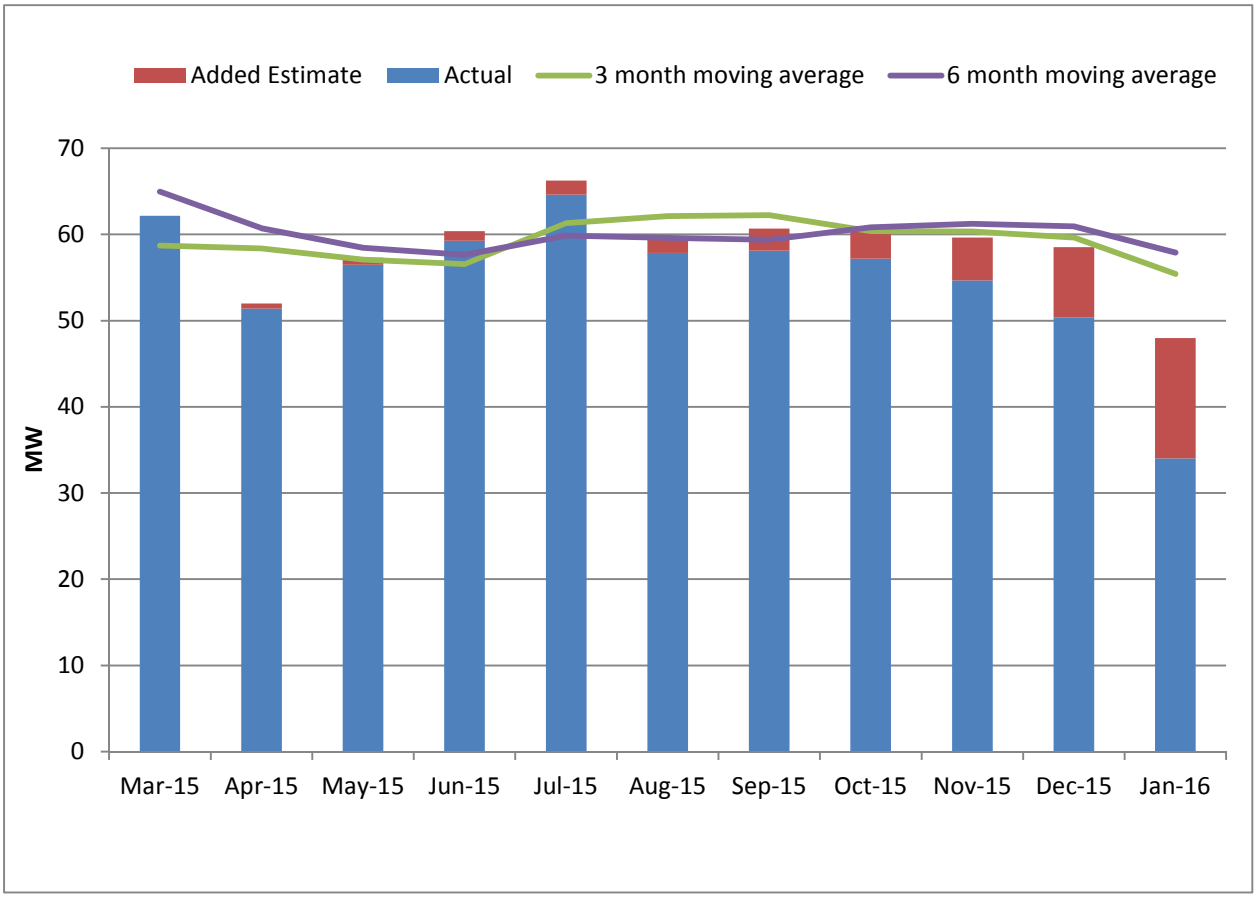
SECTION II: RECENT INSTALLATION RATES OF SOLAR PV

Analysis from the Clean Energy Regulator's (CER) most recent data allows us to estimate the amount of solar PV installed in Australia and the rolling average for new installations. Due to the lag in reporting of new installations, the CER data takes up to 12 months to be finalisedi.

The release of the CER data in the past has been sporadic with no set date for release. With no set date in the month for release and months missing from the data, estimates of installed capacity have been hard to keep consistent and accurate. Thankfully, since December 2015, the CER has released data which is relevant as of the 1st of each month. If this is consistent going forward, the industry will be able to forecast more accurately on recent installation rates of small scale solar PV.

Figure 2 – Estimated monthly solar PV installations



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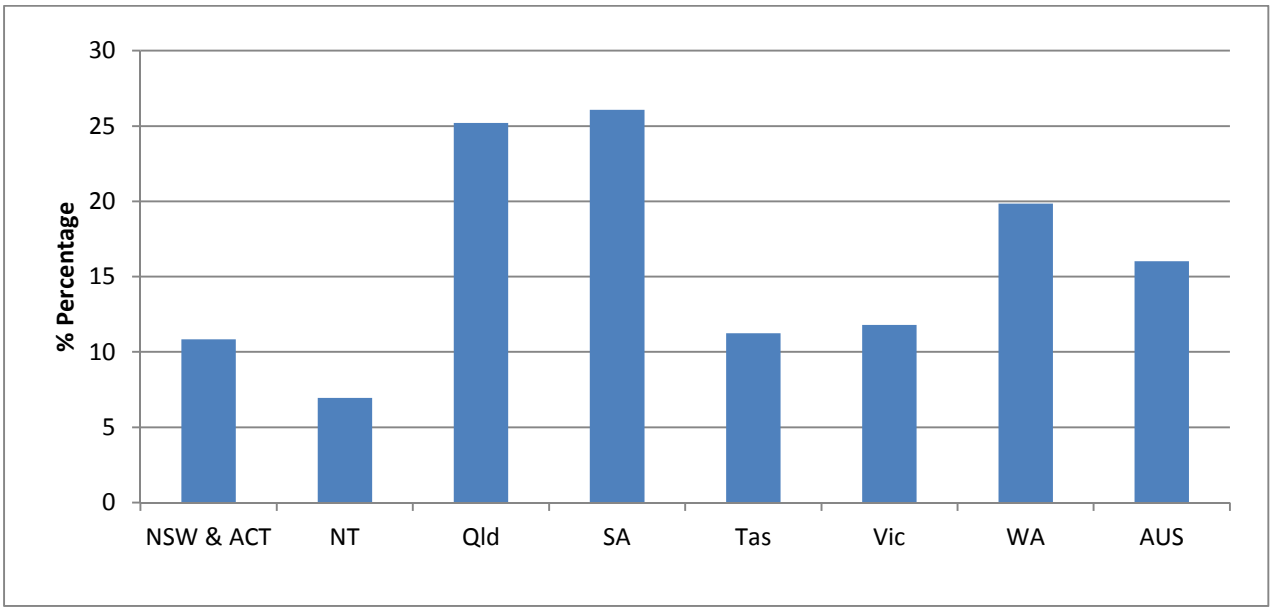
Western Australia is on the cusp of becoming the third jurisdiction to reach a penetration rate of 20 per cent (South Australia and Queensland have penetration rates of 25 and 26 per cent respectively). The popularity of solar PV in Western Australia has led the Chairman of government-owned gentailer Synergy to call for reform to the way electricity is priced, to ensure that total bills better reflect the impact households have on the grid. Figure 3 shows the penetration rate in each jurisdiction across Australia.

Figure 3: Penetration rate by jurisdiction



Western Australia is the fourth state to flag the possibility of increasing fixed charges for households with solar panels[ii]. With distributors in South Australia, Victoria and New South Wales all previously entertaining the idea of introducing a similar increase recently[iii].

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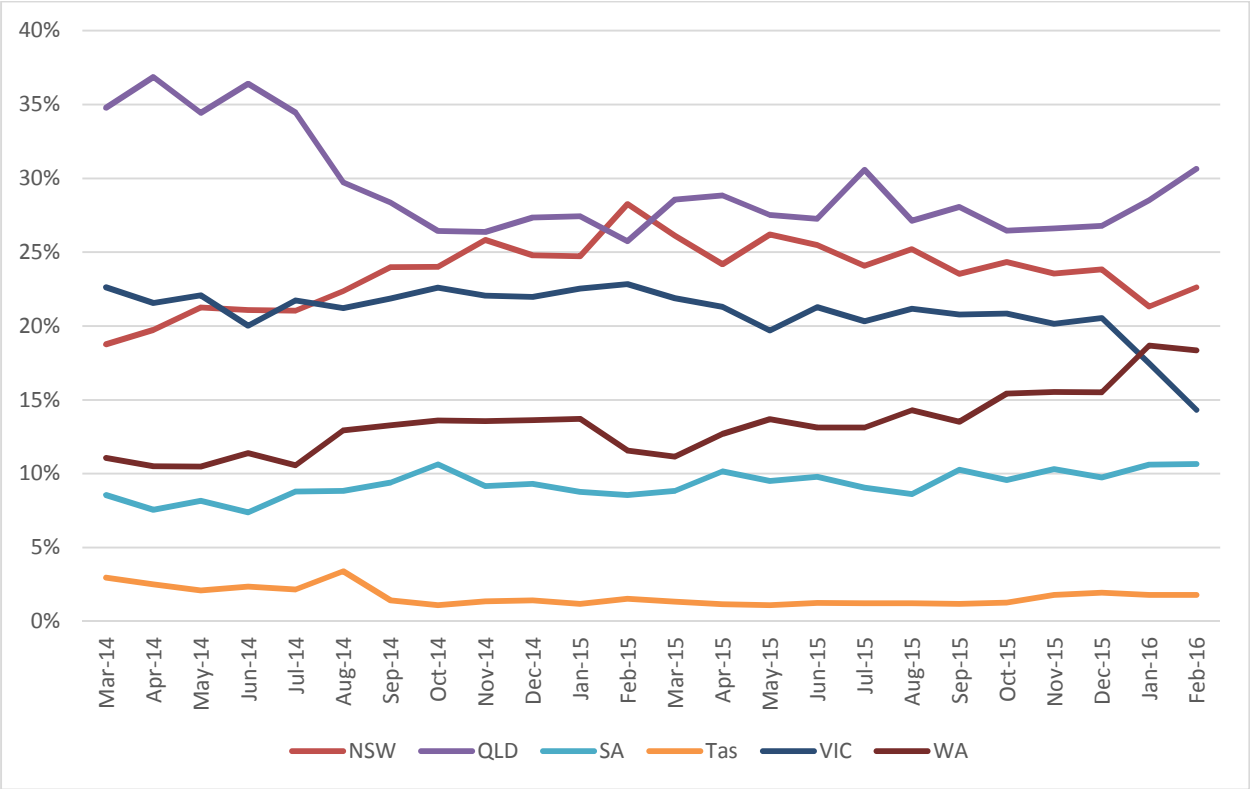
Drilling further into the data allows us to consider how uptake is shifting in each state and territory. Figure 4 shows the proportion of each month's solar PV capacity that has been installed in each state. We have excluded the Northern Territory and the ACT due to their small population size.

Figure 4: Proportion of monthly installed solar PV capacity by state



Queensland remains the most popular location for solar PV installations, with nearly 30 per cent of capacity installed each month. Western Australia accounted for over 20 per cent of solar installations in January 2016. The increasing popularity is in part driven by the economics of solar panels in Western Australia as highlighted in Sections 3 and 4 where the payback period and the LCOE is extremely favourable in Perth.

SECTION III: QUEENSLAND PRODUCTIVITY COMMISSION REPORT

The Queensland Productivity Commission (QPC) released the Solar Feed-in Pricing in Queensland draft report this month for public consultation. The report had been produced following the Queensland Government's inquiry into the fairness of solar feed-in pricing produced by small customers. Small customer solar photovoltaics (PV) has the potential to make a significant contribution to electricity generation in Australia over the coming decades. Today, Queensland has one of the highest penetration rates of small-scale solar PV in the world. Specifically, solar PV in Queensland has grown exponentially, to almost 400,000 systems in 2015.

Aim of the report

To investigate and report on a fair price for solar exports produced by small customers. 'Fair price' here means that it is set to be fair for all Queenslanders, including solar PV owners, the Queensland economy, electricity businesses and customers.

Recommendations and conclusions

The report concludes that solar Queenslanders are being compensated fairly for solar exports from a combination of renewable energy schemes, market contracts in South-east Queensland (SEQ) and the regional FiT. In SEQ, retailers compete for solar export customers through feed-in-tariffs with offers ranging from 4c/kWh to 11c/kWh. Additionally, the Small-scale Renewable Energy Scheme (SRES) aids solar PV investors in reducing the up-front cost of purchasing and installing a solar system by around 30-40 per cent. Thus, all of these lead to a conclusion that the Queensland Government should not increase feed-in-tariffs, as the price is said to be 'at least fair' for reducing carbon emissions.

Key findings

1) The existence of sufficient business competition is a crucial factor driving fair feed-in tariffs for consumers. The rate at which customers switch retailers in fact can demonstrate how effective the competition is in a market. In SEQ, the AEMC reported that 63 per cent of residential and 67 per cent of small businesses will switch retailers for a better price. However, there are also other reasons to explain the switching rates. For example, low switching rates may be the result of greater customer satisfaction levels and retentions, or moderate prices, while high switching rates can indicate customer expectations were not met.

Figure 5: Monthly small customer switching since the introduction of FRC in Queensland

Since the introduction of full retail competition (FRC), which allows Queensland customers the right to choose their own energy retailer, customer switching fluctuated highly between 2008-2010 and then stabilised around 17,000 to 21,000 customers per month. The figure provides an overview of customer switching rates in Queensland. Though this is just one indicator, it does show how the energy market has matured since the introduction of FRC.

2) There were 61 supply offers available to residential customers, with 39 suppliers offering discounts to customers compared to notified prices. The degree of discounting provides an effective measure for market competitiveness. On average, the median discount rate was 8.6 per cent in 2015, compared to 7.3 per cent in 2013. QPC, QCA and AEMC consistently suggested that there was a reasonable level of competition in services and price benefits, and price discounting remained strong in the market.

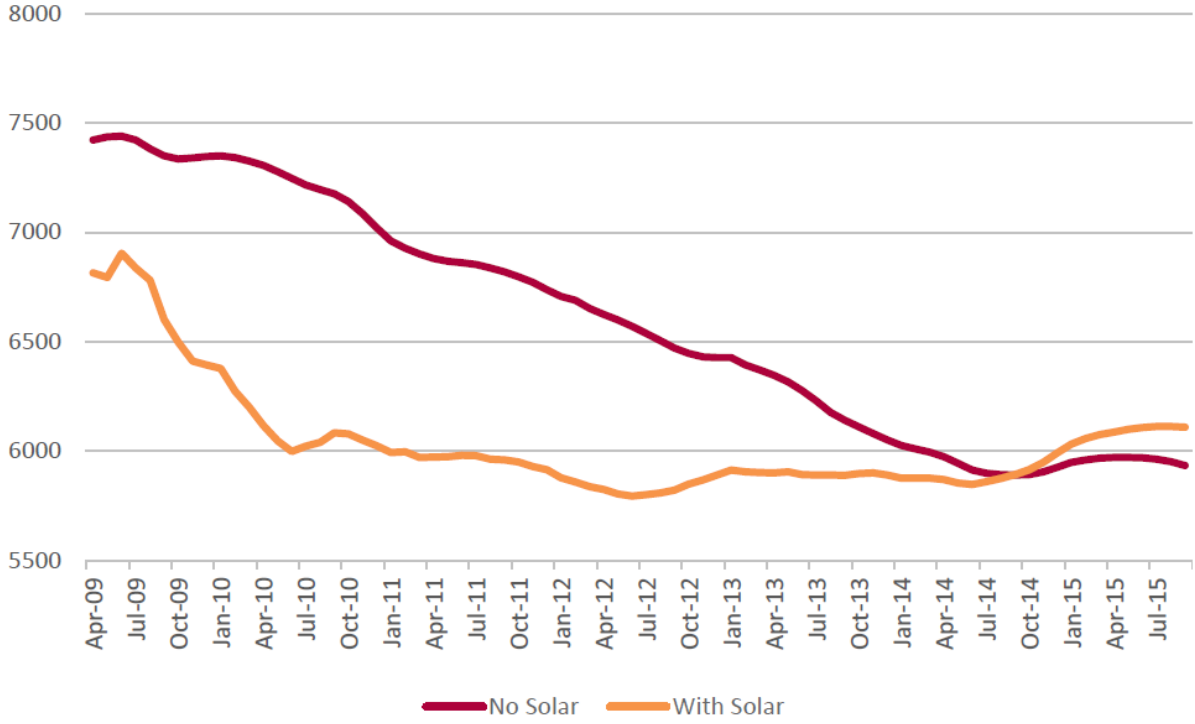
3) Market offers (feed-in tariffs) are another indicator of a healthy state of competition. Retailers that do not offer attractive feed-in tariffs risk losing their customers to other retailers. Currently, a solar PV exporter would earn 5.49c/kWh or 6.348c/kWh in

Queensland's regional areas. It found that an electricity contract with a higher feed-in tariff does not necessarily deliver a better overall deal to solar customers, because it might be accompanied by a relatively higher electricity tariff as well.

4) The objective of the SRES scheme is to reduce CO_2 emissions by increasing electricity generation derived from renewable energy sources. This scheme provides the subsidy directly to the investors installing small-scale renewable energy systems. It was stated that the level of SRES subsidy is between 2.8-2.9 c/kWh generated (assuming a 20-year system life). At an export rate of 40 per cent, the household receives an additional 7.1 c/kWh through the SRES. Accordingly, PV solar investors are found to be compensated fairly for emissions reductions.

5) A subsidised feed-in tariff would boost the rate of investment in Queensland. However, analysis reveals that different feed-in tariff scenarios (10 cents (real); 15 cents (real) plus the market buyback rate) will have an incremental impact on electricity prices by between 1.8 and 8.4 per cent by 2034-35. Thus, an additional subsidy is not feasible.

Figure 6: Average annual residential consumption (kWh)



Since 2009, Energex data reveals that both solar and non-solar households have decreased their electricity usage overall. There could be several causes for this – bill shock or the increased awareness of energy efficiency could have also impacted usage rates. It can also be seen that households without solar installations drop at a faster rate over a five year period before flattening out.

Five years ago, there was a big gap between the energy used by solar and non-solar households. This gap widens until June 2014 as non-solar households continue to decrease their usage and solar households increase theirs. Since June 2014, households with solar have been consuming on average more electricity than non-solar households.

Those who do not have solar installations are forced to worry about their electricity usage and bills while those with solar panels have less incentive to be energy efficient and leave their air conditioners on[iv].

Overall the QPC found that the premium feed in tariff is a perverse incentive and one that would require some clever thinking to get around. A recent suggestion by the QPC to simply end them was dismissed straight away by the Queensland Government.

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SECTION IV: 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. We have calculated the LCOE for solar in Australia's major cities and compare the below to indicative retail prices and current FiT rates. The detailed methodology can be found in Appendix 1.

The retail comparison rates are representative of the variable rates and do not include supply charges. For all capital cities excluding Perth and Hobart, charges are based on the implied usage charges from St Vincent De Paul's tracking of market offers which is released on a bi-annual basisv. Perth prices are regulated and obtained from Synergy. Hobart prices were obtained from Aurora Energy's Tariff 31.

Table 1: Central estimate: 7.02 per cent discount rate (ten year average mortgage rate)

All figures in c/kWh	System Size (kW)						Retail prices	FIT
	1.5	2	3	4	5	10		
Adelaide	$0.18	$0.16	$0.14	$0.14	$0.13	$0.12	$0.32	$0.05
Brisbane	$0.17	$0.16	$0.14	$0.13	$0.13	$0.13	$0.25	$0.06
Canberra	$0.19	$0.17	$0.15	$0.14	$0.13	$0.13	$0.17	$0.08
Hobart	$0.24	$0.21	$0.19	$0.19	$0.17	$0.17	$0.25	$0.06
Melbourne	$0.22	$0.19	$0.17	$0.16	$0.16	$0.15	$0.26	$0.05
Sydney	$0.21	$0.19	$0.17	$0.16	$0.15	$0.14	$0.29	$0.06
Perth	$0.15	$0.13	$0.12	$0.12	$0.11	N/A	$0.26	$0.09

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Table 2: Low cost of capital sensitivity: 5.56 per cent discount rate (low current standard variable rate)

	System Size						Retail prices	FIT
All figures in c/KWh	1.5	2	3	4	5	10		
Adelaide	$0.17	$0.15	$0.13	$0.12	$0.12	$0.12	$0.32	$0.05
Brisbane	$0.16	$0.15	$0.13	$0.12	$0.11	$0.12	$0.25	$0.06
Canberra	$0.18	$0.16	$0.14	$0.12	$0.12	$0.12	$0.17	$0.08
Hobart	$0.23	$0.21	$0.19	$0.18	$0.17	$0.16	$0.25	$0.06
Melbourne	$0.21	$0.18	$0.16	$0.15	$0.14	$0.14	$0.23	$0.05
Sydney	$0.19	$0.17	$0.15	$0.14	$0.13	$0.13	$0.29	$0.06
Perth	$0.12	$0.11	$0.11	$0.10	$0.10	N/A	$0.26	$0.09

Table 3: High cost of capital sensitivity: 13.69 per cent discount rate (indicative personal loan rate)

	System Size						Retail prices	FIT
All figures in c/KWh	1.5	2	3	4	5	10		
Adelaide	$0.25	$0.21	$0.19	$0.18	$0.17	$0.18	$0.32	$0.05
Brisbane	$0.23	$0.22	$0.19	$0.17	$0.16	$0.17	$0.25	$0.06
Canberra	$0.27	$0.23	$0.20	$0.18	$0.17	$0.17	$0.17	$0.08
Hobart	$0.34	$0.31	$0.28	$0.26	$0.24	$0.23	$0.25	$0.06
Melbourne	$0.31	$0.27	$0.23	$0.22	$0.20	$0.20	$0.23	$0.05
Sydney	$0.28	$0.25	$0.21	$0.20	$0.18	$0.18	$0.29	$0.06
Perth	$0.17	$0.16	$0.15	$0.15	$0.14	N/A	$0.26	$0.09

Small and Large business LCOE

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 large-scale solar panels continue to increase.

Business tariffs differ from 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, installations should result when the benefits of installation outweigh the cost. The average electricity bill for industrial businesses in 2014-15 was 10.72c/kWh[vi].

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

Table 4: Central estimate: 7.81 per cent discount rate, ten year average small business interest rate

	System Size			
All figures in c/KWh	10	30	50	100
Adelaide	$0.14	$0.13	$0.14	$0.13
Brisbane	$0.13	$0.13	$0.13	$0.12
Canberra	$0.13	$0.13	$0.12	$0.12
Melbourne	$0.15	$0.15	$0.14	$0.14
Sydney	$0.14	$0.14	$0.13	$0.13
Perth	$0.14	$0.13	$0.13	$0.12

Table 5: Central estimate: 5.89 per cent discount rate, ten year average large business interest rate

All figures in c/kWh	System Size (kW)			
	10	30	50	100
Adelaide	$0.13	$0.11	$0.12	$0.11
Brisbane	$0.12	$0.12	$0.12	$0.11
Canberra	$0.12	$0.12	$0.11	$0.11
Melbourne	$0.15	$0.14	$0.14	$0.13
Sydney	$0.14	$0.13	$0.12	$0.12
Perth	$0.13	$0.12	$0.12	$0.12

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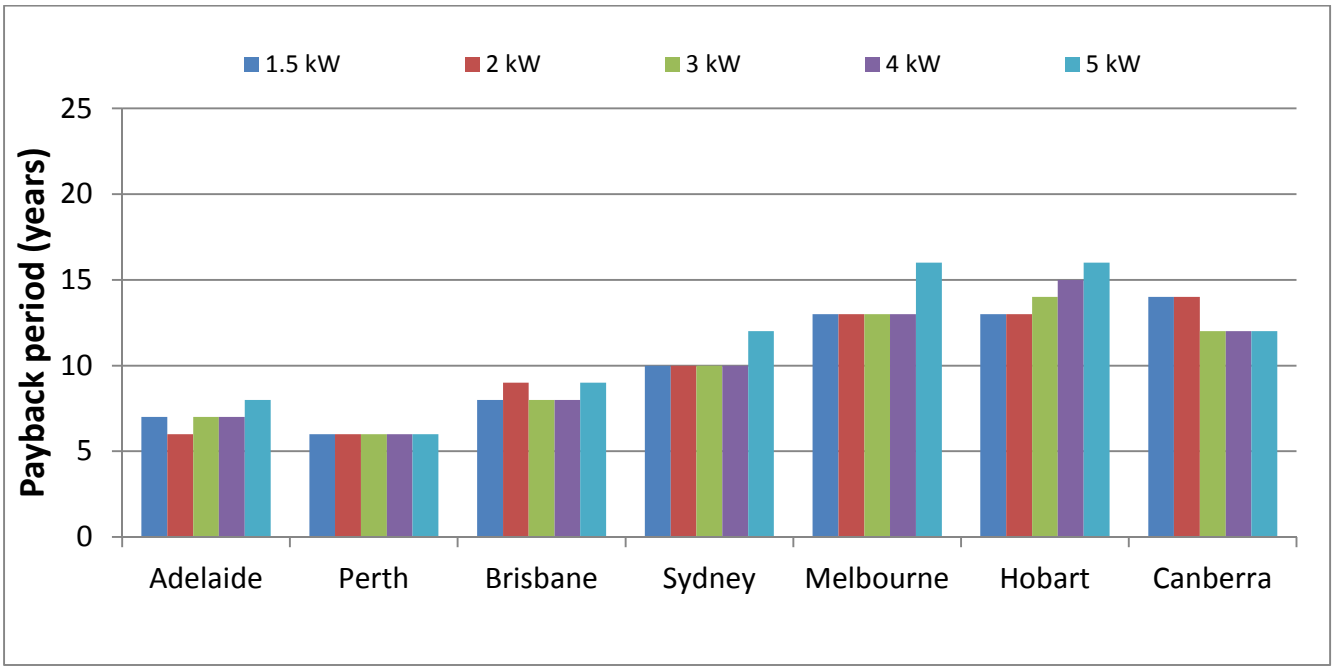
SECTION V: PAYBACK PERIOD, DETAILED MODEL

Using a similar methodology to that used to calculate the Levelised Cost of Energy (LCOE) of solar PV in Australia (see Chapter 4), the 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 at Appendix 2.

Figure 7 highlights the payback period for different system sizes across Australia. Note that electricity prices are held constant. To the extent these rise, the payback period may be shorter, and conversely if they fall it could be longer.

Figure 7: Payback period for solar PV (5.56 per cent discount rate)

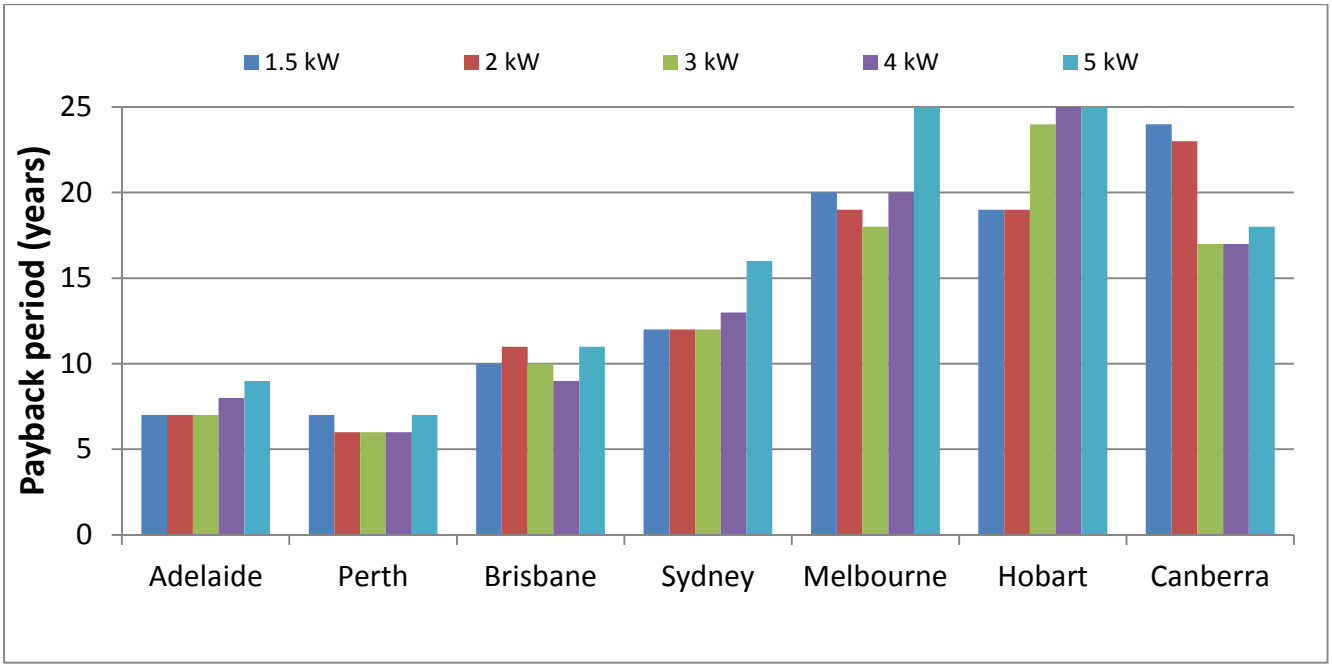


Adelaide, Perth and Brisbane all have consistently low payback periods. These three cities have high output rates with 4.2, 4.4 and 4.2kWh produced on average each day for each kW of installed capacity (kWh/kW/day). Although Canberra sees similar rates of output (4.3kWh/kW/day), electricity costs are the lowest in Australia. The calculated usage charge is 6 cents lower than the second lowest price in Australia and 15 cents lower than the highest.

Our model does not include the Northern Territory due to the lack of information on the cost of installing a PV system there. However due to its 1:1 FiT and sunny weather, the Northern Territory would be expected to have a very short payback period.

Payback periods are extremely sensitive to the discount rate applied. Figure 8 shows the expected payback period for systems with a 7.02 per cent discount rate (10 year average home loan rate). This scenario suggests that Hobart's payback period exceeds 25 years for many large system sizes including 4 kW; 5kW and Melbourne's 5 kW systems have payback periods exceeding 25 years.

Figure 8: Payback period for solar PV (7.02 per cent discount rate)

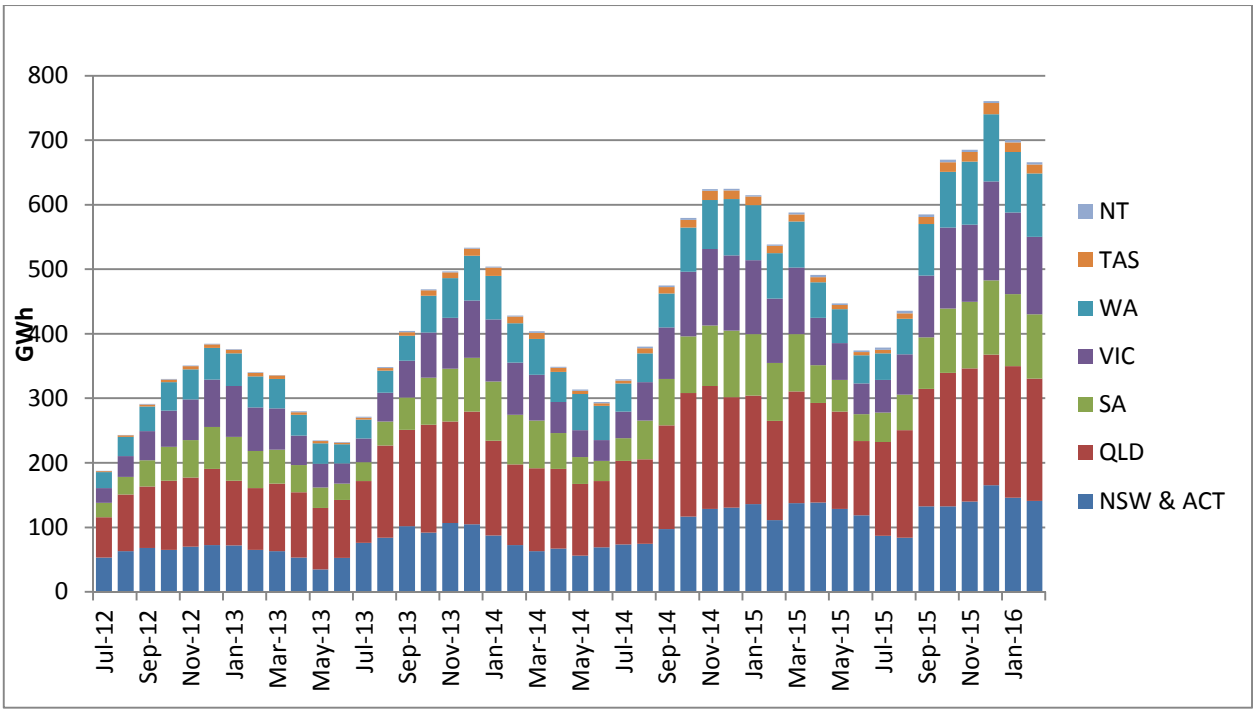


Under the scenario where customers are buying a solar system with a personal loan where the minimum of the big 4 banks is currently 13.69 per cent, no payback period is less than 25 years.

SECTION VI: ESTIMATED RESIDENTIAL PV GENERATION

Figure 9 shows the estimated total output of solar systems in each jurisdiction since July 2012. The PV output is obtained by multiplying the efficiency factor of systems with the estimated MW capacity in each state as described in Section 2 of the report.

Figure 9: Estimated PV generation (GWh) for systems up to 100 kW



The efficiency factor is calculated from PVoutput.org where self-selecting solar systems enter data into a database and their registered teams which have been chosen on a jurisdictional basis. Due to self-selection, the estimate may have an upward bias as self-selecting clients are more likely to maintain solar systems and therefore have a higher efficiency factor. Sample sizes for the Northern Territory and Tasmania are very small. The CER data may not accurately capture the rooftop PV generating capacity due to systems that have failed, and are no longer generating, or have upgraded without notifying the CER.

The month of February shows a large decrease due to having just 28 days in the month.

SECTION VII: SOLAR NEWS ROUND UP

Moree Solar Farm starts powering Australian homes and businesses

Moree Solar Farm in Northern New South Wales has successfully achieved its first generation. It is now feeding 56 MW of renewable solar energy into the National Electricity Market.

Source: Clean Energy Finance Corporation

Study details US rooftop solar PV potential at 1,118 GW plus

A study from the National Renewable Energy Laboratory in the US has used detailed light detection and ranging to analyse 128 cities and their potential for solar PV capacity. The findings estimate a total installed capacity of 1,118 GW and 1,432 TWh of annual energy was possible from rooftop solar PV.

Source: PVTECH

Toowoomba Regional Council approves Australia's largest solar farm

Toowoomba Regional Council approved the staged construction of a 2,000 MW solar farm. The farm has approval to build on 5,000 hectares of land and will be built in stages over an 8 year period.

Source: ABC

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SECTION VIII: APPENDICES

1. Appendix 1: LCOE 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 $12.50viii, and the average sized solar panel in our calculations to be 200W.

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 (7.06 per cent).

The low discount rate sensitivity is based on the minimum variable home loan mortgage rate offered by the big four banks (currently 5.56 per cent).

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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 (14.26 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 5.89 per cent and the small business discount rate is 7.81 per cent.

The discount rate also takes into account the Consumer Price Index (CPI); this has been given a constant value of 2.5 per cent.

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 panelsix. The efficiency figure represents the average daily output for a 1kW 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's 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 was used in Queensland. Tasmania's usage charge was obtained for Aurora Energy tariff 31 and Synergy was used for Western Australia.

2. Appendix 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+ 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).

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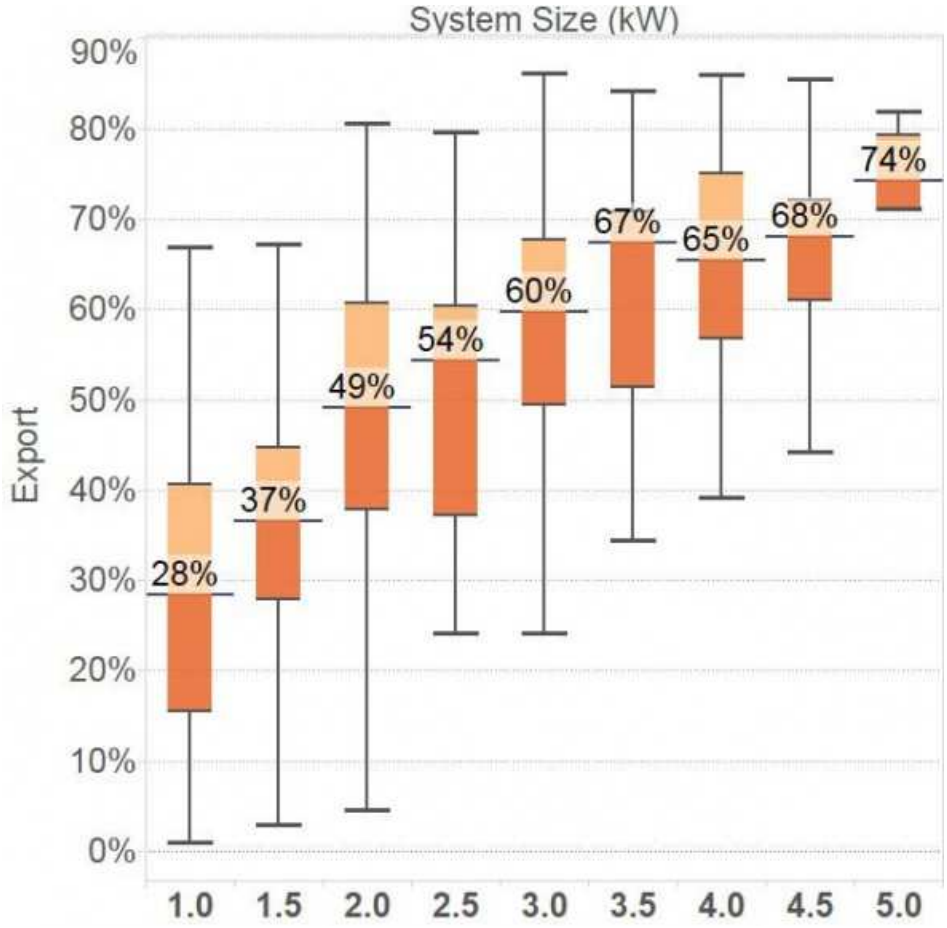
Export rate

The percentage of onsite consumption and electricity which is exported to the grid is calculated using the median value from Sunwiz's analysisx. See Figure 6 below.

Figure 6: Export rate of residential solar PV at different system sizes



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[i] The Clean Energy Regulator (CER) provides monthly updates on the number and capacity of solar panel installations by postcode around Australia. Due to the Renewable Energy Target legislation allowing a 12 month creation period for registered persons to create their certificates, this number is not finalised until 12 months after the initial release. As a result, data for recent months tends to be incomplete and regularly revised upwards.
[ii] Perth Now, "WA's solar households decry 'unfair' tax", http://www.perthnow.com.au/technology/was-solar-households-decry-unfair-tax/news-story/d481f0c74dd9ba4425d128d53ac24783
[iii] Reneweconomy, "NSW networks canvass "solar tax" for households, as well as storage and EVs ",http://reneweconomy.com.au/2015/nsw-networks-canvass-solar-tax-for-households-as-well-as-storage-and-evs-79150
[iv] http://www.theguardian.com/environment/2016/feb/25/queensland-solar-homes-are-using-more-grid-electricity-than-non-solar-says-energex-boss
[v] St Vincent de Paul Society, "Energy Reports", https://www.vinnies.org.au/page/Our_Impact/Incomes_Support_Cost_of_Living/Energy/

[vii] 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
[viii] Australian Energy Council estimate based on, RenewEconomy, 26 August 2013, http://reneweconomy.com.au/2013/hidden-cost-of-rooftop-solar-who-should-pay-for-maintenance-99200
[ix] Clean Energy Council, http://www.solaraccreditation.com.au/dam/cec-solar-accreditation-shared/guides/Guide-to-installing-solar-PV-for-households.pdf
[x] Sunwiz, Solar Pays Its Way on Networks. Last accessed 17 June 2015.

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