SOLAR REPORT

QUARTER 1, 2020

Australian Energy Council

Table of contents

SECTION I: STATE OF SOLAR PV IN AUSTRALIA

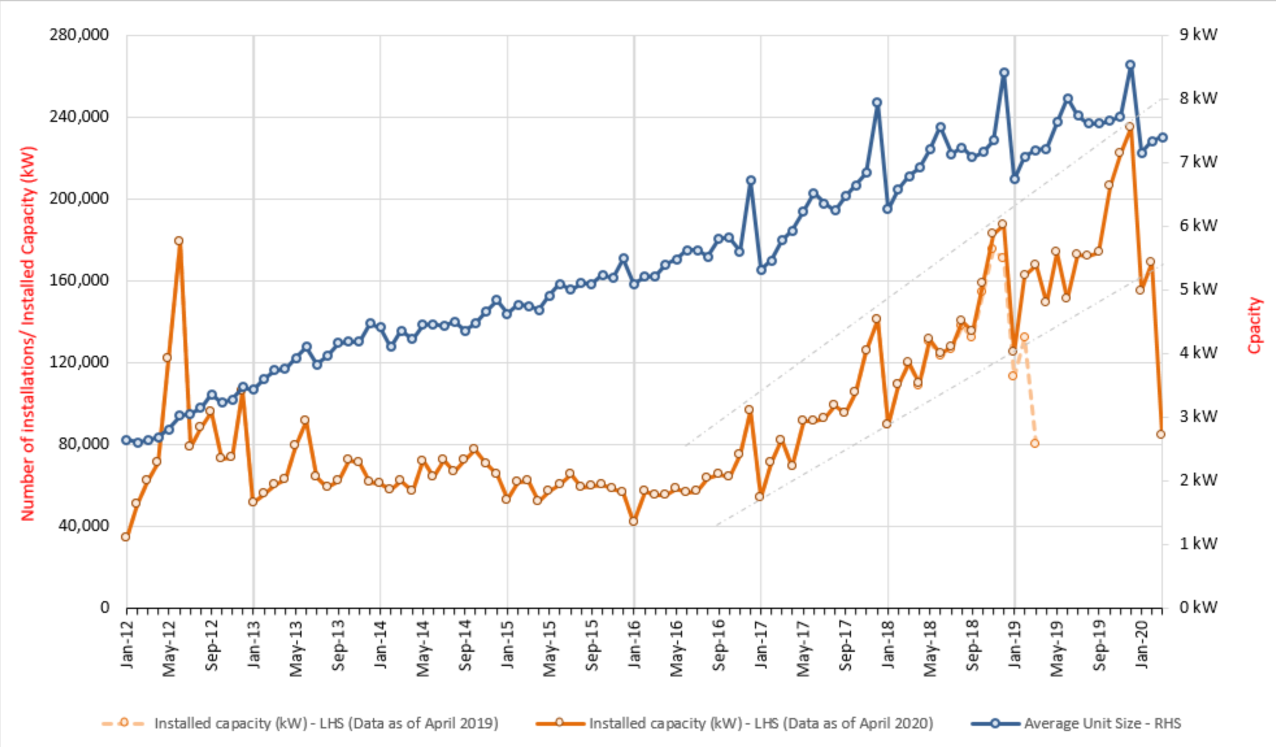
Updated data from the Clean Energy Regulator (CER) shows that over 2.38 million PV solar systems have now been installed around Australia, with the estimated total for rooftop solar reaching 10.7 gigawatts (GW).

Figure 1 below shows the historical trends in total installed capacity of rooftop PV annually since 2012. According to the most recent data[i], Australia's rooftop PV market remained healthy, growing in the first quarter of 2020. More than 56,000 rooftop installations were registered in the first three months of 2020 with 408 megawatts (MW) of newly installed capacity. This is up from 48,500 installations, and a total of 325 MW, in the corresponding quarter last year[ii].

However, the COVID-19 lockdown, which came into effect around 20-March 2020, seems to have had an impact on installations with a slowing in the uptake of rooftop solar systems becoming evident when we consider March 2020 and March 2019.

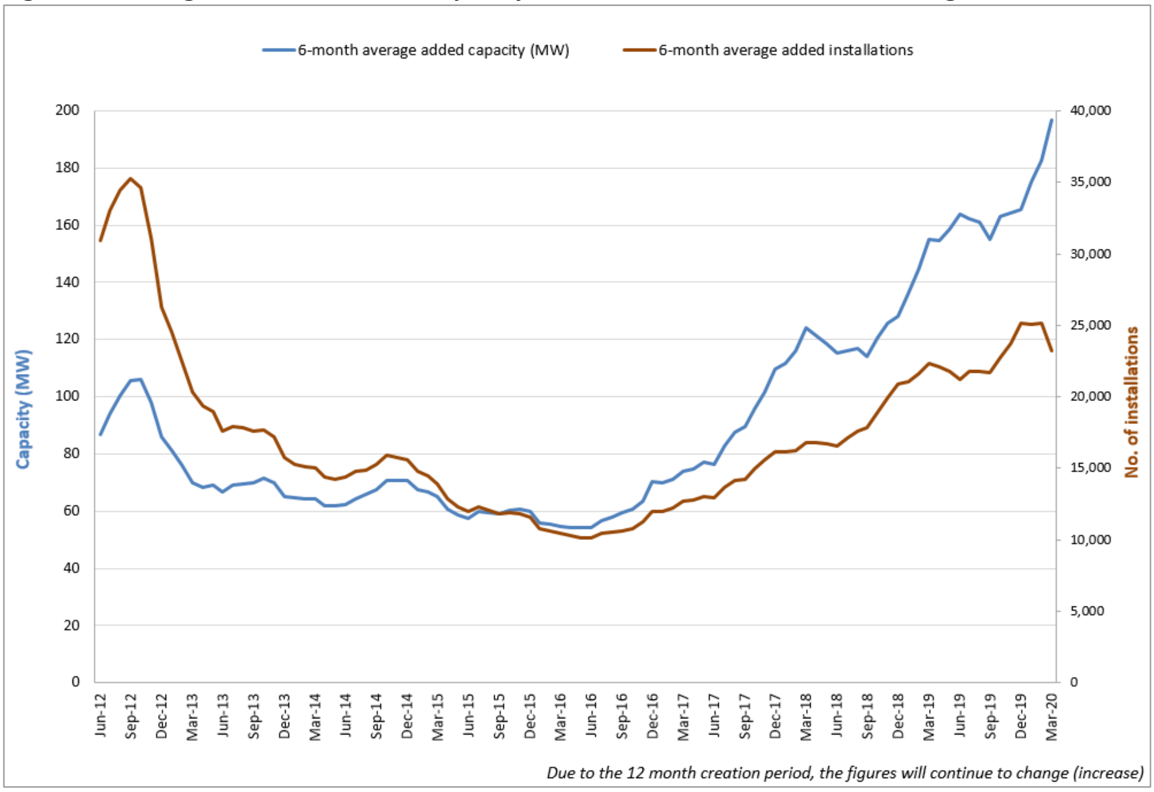
The unadjusted data for March 2019 saw a drop of 40 per cent installations when compared to February 2019. While the March 2020 data shows a drop of 50 per cent when compared to February 2020. This will remain an ongoing point of interest in the next quarterly Solar Report when the CER's July data reflects at least 93 per cent of all registered installations for the first quarter.

Figure 1: Monthly installations, installed solar PV capacity & average system size Jan 2012 – Mar 2020



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 31 March 2020

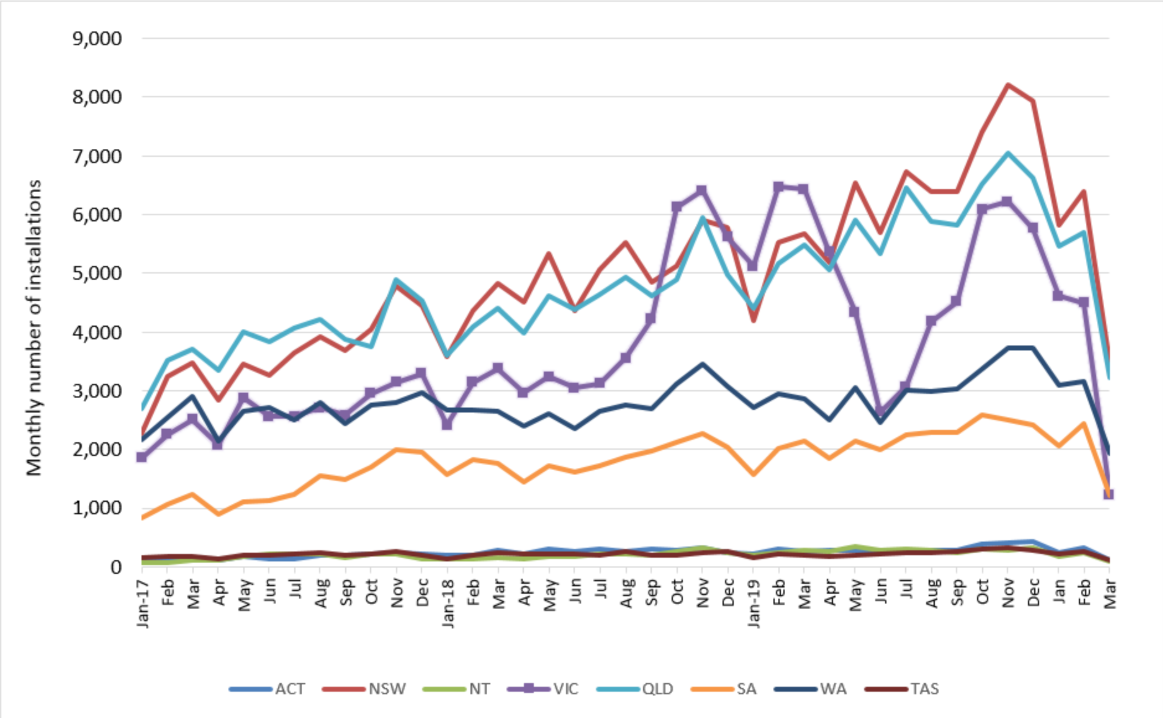
Figure 2: Rolling 6-month installed capacity and number of installations average



Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 31 March 2020

Figure 2 again highlights the continued strong growth in Australian rooftop solar installations. The two trend lines continue to widen as bigger solar units are installed, specifically, the rolling average for installed capacity (blue line) has been growing at an estimated six-month average rate of 215 MW.

Figure 3: Monthly rooftop PV installations by states



Note: The most recent three months in figure 3 underestimate the data due to the time lag in collating data.
Source: Clean Energy Regulator data, Australian Energy Council analysis, data as of 31 March 2020

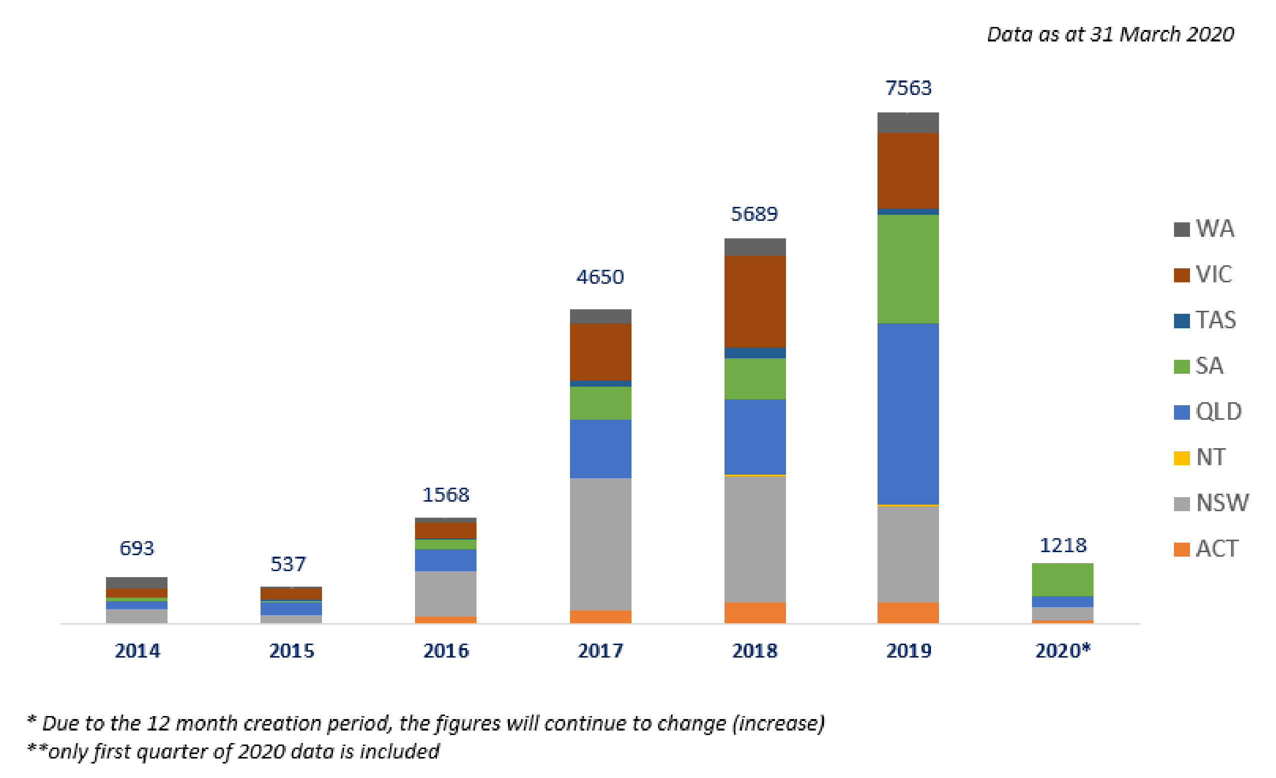
The Eastern states account for three quarters of total monthly rooftop installations in Australia. New South Wales and Queensland led with 30,000 total installations (224 MW added) in the first quarter of 2020, followed by Victoria with 10,300 installations (72 MW).

On 5 April 2020 the Northern Territory Government announced that Feed-in Tariffs (FiT) on new solar installations have been cut by 66 per cent[iii], which will help pave the way for an increase in battery storage uptake. The Territory's FiTs decrease from 24 cents/kWh (c/kWh) to a flat rate of 8.3 c/kWh for any installation or upgrade after 5 April. It is still expected that local interest in buying rooftop solar will continue to rise in the Northern Territory, where there is a current average of 220 new installations each month (data as of March 2020).

Battery installations with rooftop solar

When comparing the uptake of battery installations with rooftop solar by state (figure 4) it is clear that South Australia overtook New South Wales to rank second in 2019. And in the first quarter of 2020, South Australia has experienced a strong surge, accounting for 46 per cent of total installations during that period. New South Wales has a total share of 16 per cent; followed by Victoria and Queensland with 11.6 per cent each in the first quarter.

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 31 March 2020

Installation of battery storage with solar systems is being supported by various state government schemes and rebates. Currently these include:

- New South Wales: The Empowering Homes Program which will support installation for 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 has expanded to 250 postcodes (an addition of 143 postcodes) with offers up to 1000 rebates of up to $4,838 for a solar-battery system in 2019-20[v]. The new postcodes now include regional Victoria.
- South Australia: The state's Home Battery Scheme has decreased its grant of up to $6,000 to $4,000 for a home solar battery, starting 15 April 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.
- Queensland: The Queensland Government's scheme, introduced in November 2018, allows residents to apply for interest-free loans of up to $10,000 and grants of $3000 to purchase batteries or combined solar-battery systemsvii. Approved applicants have six months to install an eligible system.

SECTION II: THE ENERGY BLOCKCHAIN

In March 2020 the Swiss Federal Office of Energy's funded project, *Quartierstrom,* announced it had successfully completed its one-year microgrid trial, which saw locally produced solar energy traded between neighbours[viii]. The project was deployed in a small community of 37 households in Walenstadt, and deployed technology called blockchain. Digital blockchain technology sparks great interest in energy sector as Blockchains are shared and distributed data structures that can securely store digital transactions without using a central point of authority. It allows consumers to participate in the new distributed renewable energy market and gain better value for their unused solar power.

Published this month, the International Renewable Energy Agency's *Global Renewables Outlook: Energy Transformation 2050* highlights key technology solutions for a global energy pathway to 2050 through accelerating different technology. Blockchain technology is said to have a role to play in complex power systems because it can decrease transaction costs by managing data more openly, is secured, and automates transactions in real time.

How does blockchain work?

Simply, blockchain uses a decentralised network of nodes to store lists of transactions in a public database which cannot be tampered with or modified in any way. Each transaction is stored in a list of blocks, encrypted with algorithms to store digital information. Any new transaction will append to an existing block to make a new one, adding continuously. Once the block is recorded and verified, the entire network will accordingly receive a copy of the updated information.

Using the Swiss *Quartierstrom* example, the group of neighbours trade their excess solar energy between each other with a blockchain used to record the transactions every fifteen minutes. Under the project each household installs a computer with a built-in electricity meter and blockchain software. Households with excess solar energy set their preferred minimum price while local neighbours set the maximum price they are willing to pay via a portal. In this process, cryptography is adopted to ensure data transmission and access security. This use of blockchain technology helps connect users with each other to realise automatic energy transactions, including auction, bidding, and payment. Each node in the blockchain negotiates a spot price, transmission path, and transaction priority allocation in a time sequence.

What drives the hype in energy trading?

Around the world, as well as in Australia, the electricity system is undergoing rapid changes with an increasing share of embedded renewable generation (wind and solar) and distributed energy resources (DER) such as electrical vehicles, solar panels, battery storage.

Energy systems are entering the digital era, as shown by the large deployment of smart meters. The Australian Energy Market Commission's (AEMC) *Integrating Distributed Energy Resources for the Grid of the Future* forecast that by 2039, Australia will have one of the most decentralised electricity systems in the world. AEMC has flagged that the high level of DER uptake will facilitate the emergence of different market participants. Australia is expected to see the growth and increasing sophistication of third-party businesses to provide energy management services (Box 2, bullet point 3).

Figure 5:

BOX 2: DIFFERENT WAYS OF INTERACTING WITH THE ELECTRICITY SYSTEM IN THE FUTURE

In the future, consumers with access to DER may interact with the electricity system in one or a combination of the following ways:

- Drawing electricity from the grid
- Generating electricity for their own consumption only (becoming less reliant on grid supply)
- Buying, trading or selling energy, either to a retailer or through other platforms such as peer-to-peer trading
- Participating in new services markets such as providing demand response, network support or ancillary services to the wholesale energy market
- Supplying energy (or other services) to community projects such as a community battery.

Source: *Integrating Distributed Energy Resources for the Grid of the Future*, September 2019

Challenges in adopting blockchain in energy trading

However before we see the mainstream adoption of blockchain technology in the energy system, there remains key challenges[ix]:

- Several proven small-scale projects around the world are still in an early development phase and blockchain technology is yet to be proven at a larger scale to determine whether it can offer scalability, speed and security. Advanced data exchanges between different parts of the electricity distribution and local distributed control are required to accommodate these decentralisation and digitalisation trends.
- Blockchain systems require new costly technology equipment; the cost factor needs to outweigh the benefits. In the energy sector, smart meters have been installed without significant computational capabilities, therefore integrating existing smart meters with a distributed blockchain system likely to incur a significant cost.
- The biggest challenge is the reliability of the technology – data privacy and cybersecurity. Malicious attacks or data security breaches are likely before the technology becomes mature, resulting in

delays and a possible low uptake by end-users. Building a resilience to these attacks remains highly important, especially in critical infrastructure like energy networks.

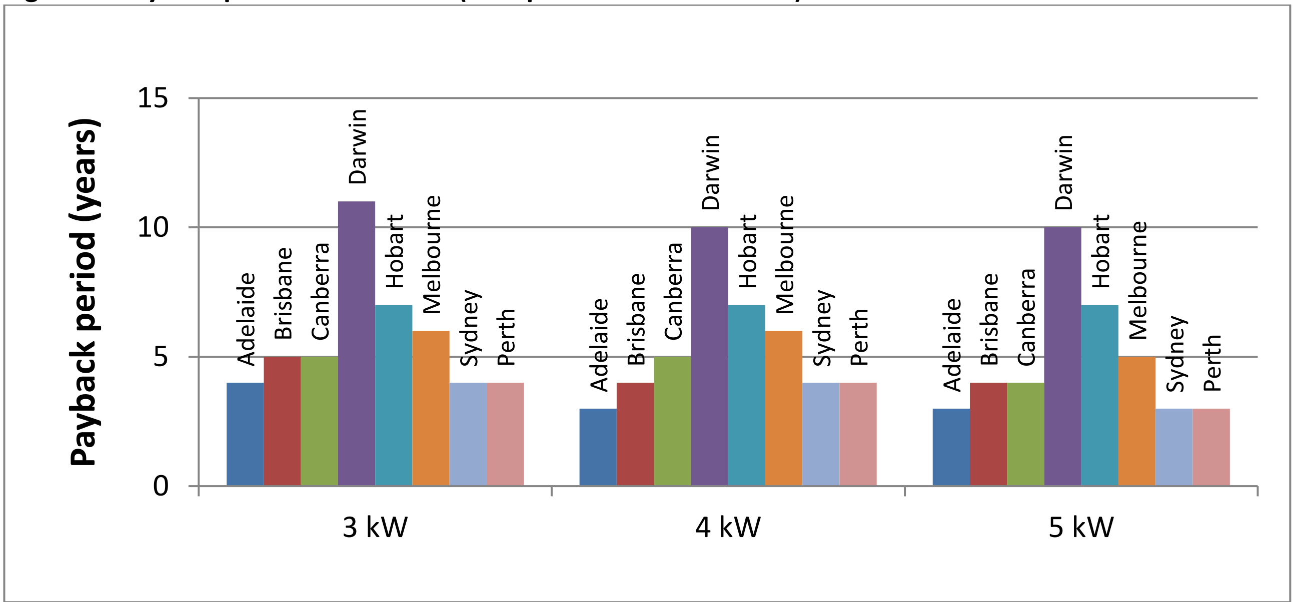
The explosion of data generated along with the proliferation of the Internet of Things (IoT) devices and the decreasing cost of renewable energy will unlock new technologies in the coming decades. Providing a decentralised trading platform to consumers will assist to manage energy consumption and blockchain technology is one potential solution to deploy in the trading system.

SECTION III: 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 6 highlights the payback period for different system sizes across Australia. Note that electricity prices are subject to change with CPI levels (currently 1.8 per cent, last updated April 2020) and thus 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 6: Payback period for solar PV (3.42 per cent discount rate)

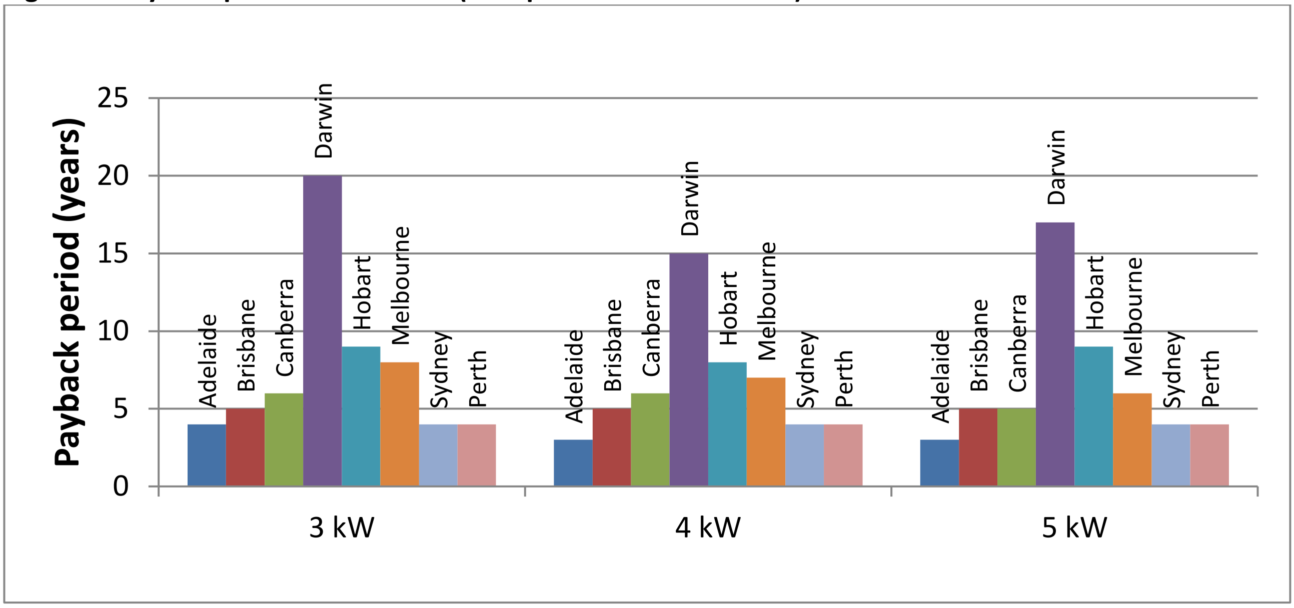


Source: Australian Energy Council analysis, April 2020

Earlier this month the Northern Territory announced a reduction of its FiT from 23.6 c/kWh to 8.3 c/KWh and Darwin is now the capital with the highest payback period at 10 years for 4 kW and 5 kW systems – double the payback period at the lower FiT rates. In the last solar report (January 2020) Hobart had the highest payback period for the units show above.

Figure 7 shows the expected payback period for systems with a 5.98 per cent discount rate (10-year average home loan rate). Darwin is the only city which is highly sensitive to a higher interest rate due to the high cost of rooftop solar PV units, Darwin has the payback period of 20 years for a 3 kW system or 15 years or more for a 4kW system or a 5kW system. Other jurisdictions and capitals see the payback period increased by only 1 or 2 years with a higher interest rate.

Figure 7: Payback period for solar PV (5.98 per cent discount rate)



Source: Australian Energy Council analysis, April 2020

SECTION IV: 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

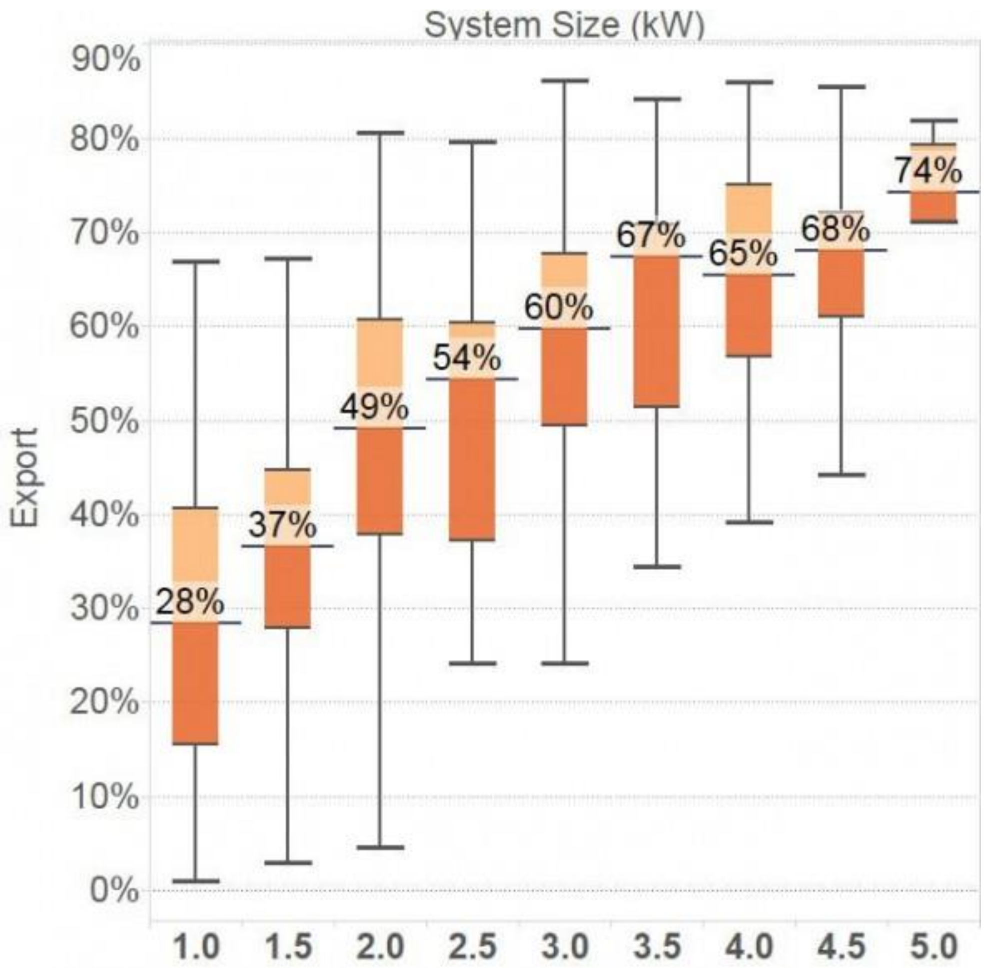
Avoided cost and FiT

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[x]. See Figure 10 below.

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



Source: Sunwiz analysis, 2015

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[i] Data as of 20 April 2020
[ii] Data as of April 2019
[iii] https://www.pv-magazine-australia.com/2020/04/13/nt-solar-installations-fall-as-fit-slashed-by-66/
[iv] https://energy.nsw.gov.au/renewables/clean-energy-initiatives/empowering-homes
[v] https://www.solar.vic.gov.au/solar-battery-rebate
[vi] https://www.sa.gov.au/topics/energy-and-environment/energy-efficient-home-design/solar-photovoltaic-systems
[vii] https://www.qld.gov.au/community/cost-of-living-support/concessions/energy-concessions/solar-battery-rebate/about-the-program
[viii] https://microgridknowledge.com/blockchain-electricity-market-successfully-trialed-switzerland/
[ix] Blockchain technology in the energy sector: A systematic review of challenges and opportunities
[x] Sunwiz, Solar Pays Its Way on Networks. Last accessed 17 June 2015.