



Green Energy
Markets

Updated STC Forecast 2019 - 2023

Report to the Clean Energy Regulator

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Updated STC Forecasts 2019-23

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Updated STC Forecasts 2019-23

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Executive Summary

The Clean Energy Regulator (CER) has engaged Green Energy Markets Pty Ltd (GEM) to provide updated forecasts of the Small-scale technology certificates (STCs) likely to be created during the 2019 calendar year, and for the years 2020 to 2023.

In developing our projections for small generating units (SGUs) and solar water heater (SWH) we have updated and expanded our models and databases used in developing our STC forecasts previously undertaken for the CER in January 2019. We have also made extensive use of the registry data provided by the CER and interviewed a range of solar industry participants.

We have segmented the solar market into the following sub-markets to more accurately forecast the level of installations:

- SGU PV – New Residential market
- SGU PV – Upgrade Residential market
- SGU PV – Non-residential (commercial market)
- SGU PV – Upgrade Non-residential market
- SWH – New building market
- SWH - Replacement or existing dwelling market

In making projections for installations of solar PV and SWH we have aimed to isolate the key factors that have influenced the historical uptake of systems. In the case of solar PV the predominant factor influencing uptake is financial attractiveness. We have developed a state-based payback model as a proxy for financial attractiveness, for the residential and commercial sectors and then incorporate the expected impact of market saturation in each state. To incorporate non-financial factors we also account for changes in customer awareness and solar industry competitiveness and marketing which are informed by industry interviews.

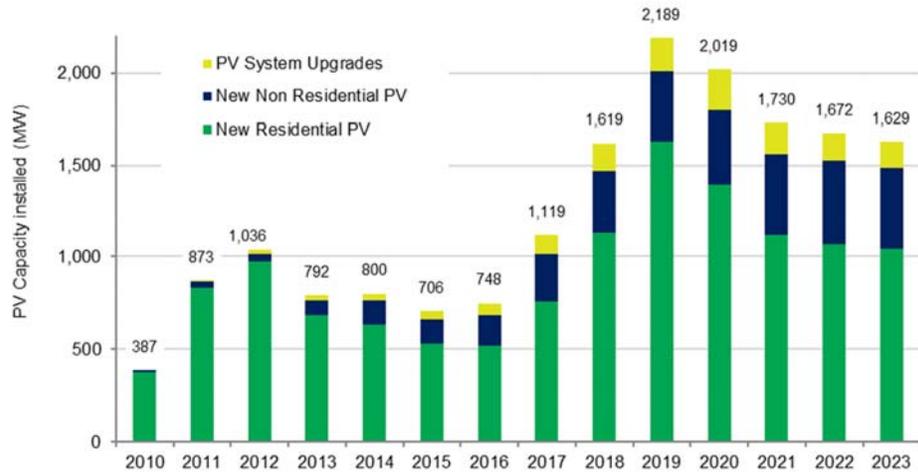
The following factors have been influential in the development of our estimates of the level of future solar installations:

- Wholesale power prices are expected to remain higher in 2019 and 2020 than previously assumed and are not expected to decline until after 2020. We have assumed that the level of daytime wholesale power prices progressively reduces to reach \$55 per MWh in real terms by 2023. This means that the attractiveness of solar PV starts to decline considerably after 2020 with resultant declines in the number of installations (other than in Victoria).
- The Victorian Solar Program is expected to underpin increasing levels of installations in the state over the forecast period with parameters of the program assumed to be adjusted to deliver on the policy commitment of 650,000 PV systems over 10 years;
- The average system size for new residential installations is expected to continue to increase, but at a more modest rate as we begin approaching the typical network inverter connection constraint of 5 kW (6.5 kW panel capacity);
- The number of non-residential (commercial) PV system installations is expected to continue to increase through to 2022 and then expected to fall after this reflecting worsening system paybacks as wholesale electricity prices fall; and
- The number of SWH systems installed in new homes is expected to decline over the forecast period in line with declines in the expected rate of new home commencements. We expect a progressive increase in the replacement market as increasing numbers of SWH systems installed in 2009 and 2010, where the market surged due to expanded government grants, start to be replaced.

Updated STC Forecasts 2019-23

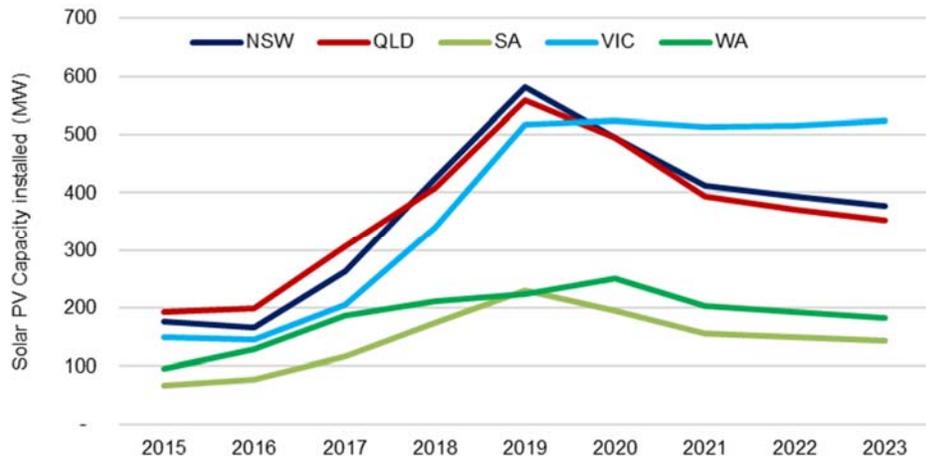
We estimate that 2189 MW of solar PV will be installed in 2019 which is a 14% increase on our previous forecast of 1927 MW. We expect that the level of installations in 2020 will fall by 8% to 2019 MW and then continue to decline to reach 1629 MW by 2023.

PV Capacity installed by sector



The Victorian market underpinned by the government's solar program will underwrite Australia's PV capacity installations over the next four years. Victoria's share of capacity in 2023 is expected to be 32%, significantly higher than its 21% share in 2018.

PV Capacity installed by state



We expect that 36.3 million STCs will be submitted for registration in 2019 which is 4.0 million more than our previous report. The main reason for the variation is a 14% increase in the number of residential PV systems now expected to be installed in 2019. The level of STCs expected to be created over the forecast period drops dramatically to 20.3 million in 2023 with the reduction in PV capacity installed combined with the reduction in the number of years of deemed creation.

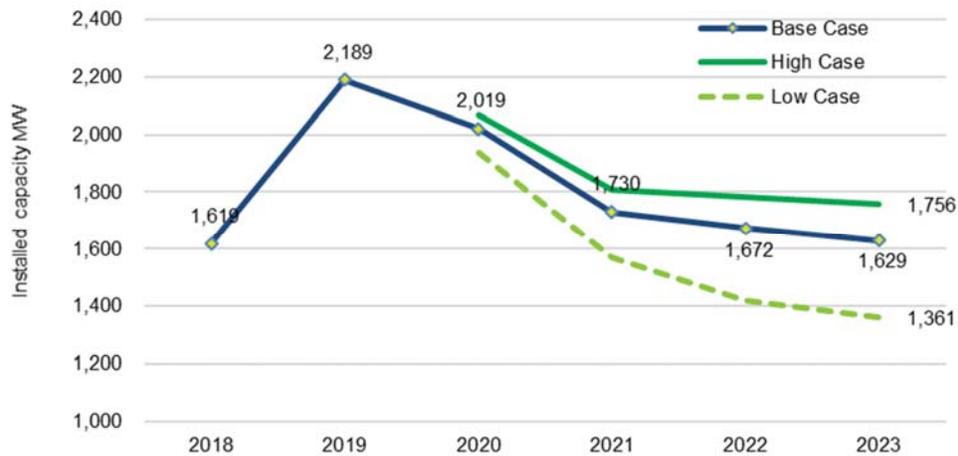
Updated STC Forecasts 2019-23

Summary of results are as follows:

'000 STCs	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
STCs for installations in year						
Solar PV	28,191	35,052	29,522	22,887	19,877	17,176
SWH	2,002	2,060	2,075	2,099	1,923	1,760
Total	30,193	37,112	31,597	24,986	21,800	18,937
Less						
STCs submitted following year (lag)	3,357	4,126	3,513	2,778	2,424	2,105
Add						
Previous year installs created this year	2,580	3,357	4,126	3,513	2,778	3,513
STCs submitted for creation	29,416	36,342	32,210	25,721	22,154	20,344

The major uncertainty in developing the estimates revolves around the future level of daytime wholesale prices which has a material impact on the attractiveness of both residential and commercial PV. We have undertaken a sensitivity analysis and considered a "High" scenario where the drop in daytime wholesale price to \$55/MWh (real) is delayed by two years to 2025. We have also considered a "Low" scenario whereby daytime wholesale prices reduce to \$28/MWh (real) by 2023. The impact of the above sensitivities on installed PV capacity is shown in the following chart.

PV Capacity installed under different electricity price scenarios



The forecast level of STCs to be created under the Base Case and the two other scenarios are summarised below.

'000 STCs	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Total Certificates - Base Case	29,416	36,342	32,210	25,721	22,154	20,344
Total Certificates - High Case	0	0	32,708	26,611	23,397	21,793
Total Certificates - Low Case	0	0	30,716	23,044	18,415	16,030

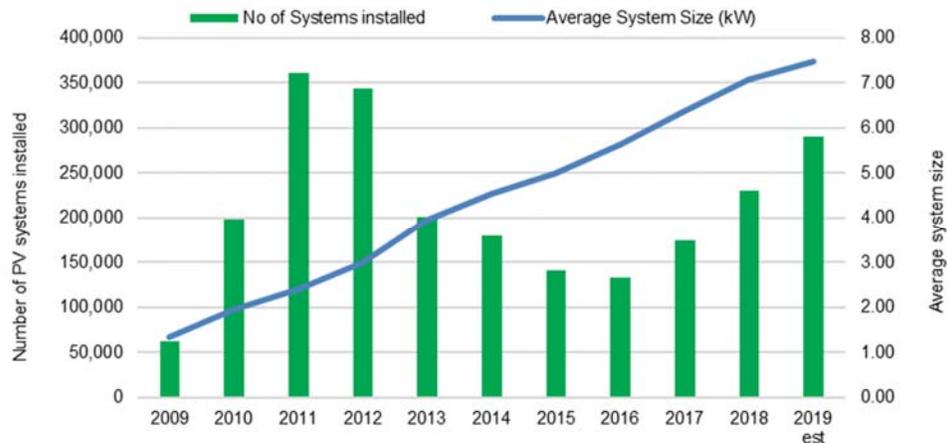
1. Introduction

The Clean Energy Regulator (CER) has engaged Green Energy Markets Pty Ltd (GEM) to provide an updated and revised Small-scale technology certificates (STCs) forecast to reflect recent data and trends.

The Small-scale Renewable Energy Scheme (SRES) creates financial incentives for investment in eligible small-scale renewable energy systems. Small-scale renewable energy systems are defined as solar PV systems with a capacity no more than 100kW and solar hot water installations. Solar PV dominates the creation of STCs accounting for 95% of STCs.

The growth in the number of solar PV installations has been primarily due to the surge in the demand from small and large businesses as power prices have increased and solar PV has become a more financially attractive proposition. The average system size has continued to increase which has resulted in a significant expansion in the capacity installed and subsequent STC creation.

Figure 1.1 Number of solar PV systems installed and average system size (kW)



As part of its report GEM is required to:

- model expected small-scale technology installations and provide updated STC forecasts for 2019-2023. This will include forecasts of the number of STCs and installed capacity for the five compliance years from 2019 to 2023;
- identify key factors affecting the type, number and size of small-scale systems installed and the trends in STC creation by various categories including residential and commercial uptake across state and territories in Australia; and
- update prior years' modelling and estimates. This will include reviewing the current STC dataset and remodelling prior estimates for STC creations in light of any identified changes to circumstances. Variance between the prior and revised estimates is to be analysed and clearly specified.

This report is set out in 4 sections

Section 2. Methodology and approach – summarises the approach that GEM has taken in developing its STCs estimates for each solar market sub-sector.

Section 3. Assumptions – summaries the key assumptions that have been made in the models used to develop the estimates

Section 4. Updated STC forecasts for Solar PV – summarises the number of PV systems expected to be installed together with the expected capacity and resultant STCs created.

Section 5. Updated STC forecasts for SWH – summarises the number of SWH systems expected to be installed together with the resultant STCs created.t

2. Methodology and Approach

We have segmented the solar market into the following sub-markets, which tend to have different characteristics and consumer drivers:

- SGU PV – New Residential market
- SGU PV – Upgrade Residential market
- SGU PV – Non-residential (commercial market)
- SGU PV – Upgrade Non-residential market
- SWH – New building market
- SWH - Replacement or existing dwelling market

Residential and commercial installations have been segmented based on the “property installation type” classification in the registry data provided by the CER. We have used the CER’s delineation from 2015 when a full years data was available. For systems installed prior to 2015 we have assumed that systems greater than 10 kW were commercial and those less than 10kW were residential.

1. Modelling new residential PV system installations

Our projections for new residential PV systems are based on isolating the factors that have influenced the historical uptake of PV. The predominant influencing uptake is financial attractiveness. We use a simple payback calculation as the proxy for financial attractiveness.

Forecasting PV payback periods

Payback period is modelled using Green Energy Markets payback model. The payback (in years) in the year of installation is determined by dividing the expected savings in the year of installation into the installed system cost (refer to Attachment 2).

- The expected savings in the year of installation is determined by the sum of (i) the value of avoided electricity purchases in the year of installation and (ii) the value of electricity exports in the year of installation.
- The installed system cost is derived by the total cost of the system less the value of STCs less and any other rebates available.

The assumptions used in the model are summarised in Section 3.

PV Demand

We forecast the level of demand for each state with reference to the following four factors:

- Relative financial attractiveness - as represented by simple payback index for each year with 2015 as the base;
- Relative level of saturation – represented by scaling factor that reduces as saturation increases, we have calibrated this as being 1.0 (no discount) at saturation levels of 20% or less and then reduces to 0.5 (50% discount) at saturation levels of 80%. This is then also converted into an index with 2015 as the base;
- Relative customer awareness – heightened media concerns over high power prices has been demonstrated (through market interviews) to be a major contributing factor to customer preparedness to consider solar. We have developed a scaling factor that considers the impact in each year and then convert this into an index with 2015 as the base; and

- Relative solar industry competitiveness and marketing – the level of new market entrants (and exit), general industry competitive environment together with the level of marketing and promotion will also have an impact on solar PV uptake. We have developed a scaling factor that considers the impact in each year and then convert this into an index with 2015 as the base.

The last two factors (customer awareness and industry competitiveness and marketing) are extremely subjective but have clearly impacted on the level of demand particularly over the last two years (refer to Figure 4.1).

The five years from 2015 to 2019 provide a reasonable timeframe and cover new residential installations rising from 124,000 systems in 2015 to 252,000 systems in 2019. This now represents 5 years of reasonable data that is not complicated by solar credits multipliers or extremely attractive feed-in tariffs. The residential market sector can be seen to be mature and enables us to have confidence in this approach, albeit with some subjective factors. Interviews with industry participants have been a key component in gauging factors and issues that are actually working on the ground influencing customer purchasing decisions, beyond just financial attractiveness.

We have used systems installed in 2015 as the base level of demand for 2015 which is our base year. We have used 2016 level installations as base data in the case of WA, SA and NT as this was seen to be more representative.

Our approach can be represented by the following formula:

$$\text{Demand (year)} = \text{Base year installations} \times \text{Relative Financial Attractiveness Index (year)} \times \text{Relative Level of Saturation (year)} \times \text{Relative Customer Awareness Index (year)} \times \text{Relative Solar Industry Competitive Index (year)}$$

2. Modelling new non-residential (commercial) PV systems

The commercial or non-residential sector continues to be seen as an attractive market by the solar industry, now representing over 20% of installed capacity.

This market sector is not as mature as the residential market and we use 2019 installations as our base level of demand. Forecast installations are based on relative financial attractiveness (relative to the 2019 base year) we have also incorporated a scaling factor to reflect improved industry attractiveness as more solar businesses target this sector.

We have also analysed capacity sub-segments as follows:

- Up to 30kW
- 30.1kW to 50kW
- 50.1kW to 100 kW

3. Modelling upgrades and expansions of residential and commercial systems

This market sector is increasing albeit from a very low base. Many small systems (less than 1.6 kW) were installed over the 2010 to 2013 period and a number of the customers are expanding their systems in response to higher power prices and lower panel prices. While this market sector is still very small we expect it to continue to grow and become a much more important feature of the industry in future years as saturation increases. The commercial upgrade market at an estimated 50 MW (820,000 STCs) is probably not that material, however we believe it is worth separating as it has scope to grow in future and it is also important to exclude these systems when considering saturation levels.

4. Modelling solar water heating certificates

Water heater systems are essential appliances and subject to state regulations increasingly limiting choice in some applications. As such, water heater system choices are based on different factors which include: the existing system type (if being replaced); the relevant state regulations; the type of premises; access to reticulated gas, and also net system up-front costs (after taking incentives into account). Operational costs, such as future electricity and gas prices (particularly in the case of LPG) are also factors that may be considered.

The solar water heater (SWH) market (including heat pump water heaters) has two key sub-markets which are each subject to different incentives and regulations – these are the new building market (residential) and the replacement market (for existing water heaters in residences). The commercial market which had been important previously is not significant and will not be separately analysed.

SWH systems in each state and each sub-market are separately modelled. Major inputs into this analysis will include building forecasts (new and total), system replacement rates and market shares for each water heater technology by year.

The model will consider relative market shares together with the following key factors largely impacting future installations:

- State regulations for new/replacement systems
- Relative financial and market attractiveness
- Other state and federal government incentives (if any)

SWH system installation forecasts will be combined with average system certificate creation (based on recent data) to estimate total certificate creation in each state and each submarket.

5. Modelling other small generation unit certificates

Certificate creation for small wind and hydro power systems are presently not material and are not included.

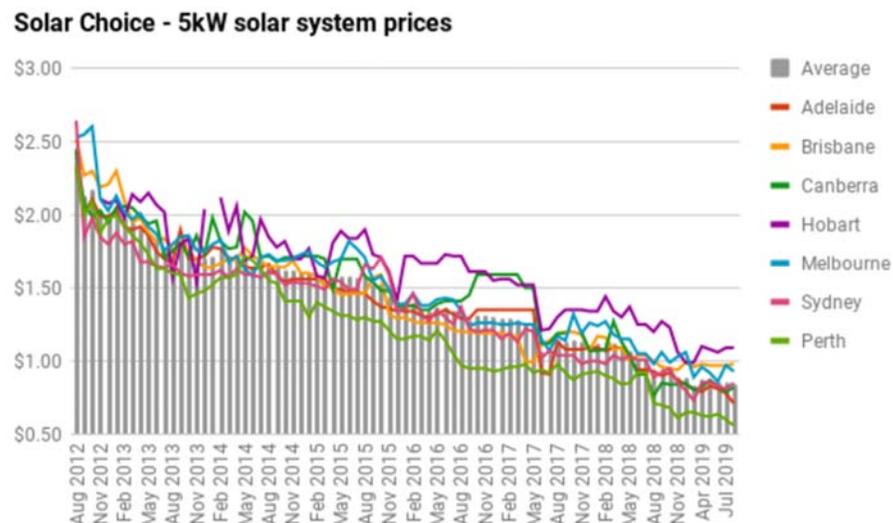
3. Assumptions

We have updated our assumptions and slightly refined our modelling approach in developing our STC forecasts for the 2019 to 2023 period. Key assumptions used are outlined in this section.

3.1 Forecasting Installed PV costs

Installed system costs have drifted lower during 2019. The most recent Solar Choice analysis shows that net system prices have levelled out over the last five months (Figure 3.1)

**Figure 3.1 Installed system Costs (after STCs) for 5kW system (\$/Watt)
(Solar Choice, Aug 2019)**



<https://www.solarchoice.net.au/blog/solar-power-system-prices>

We estimate that the average installed system cost (pre STCs) in 2019 will average \$1.60 per Watt which is slightly lower than the \$1.65 per Watt used in our previous analysis.

Cost reductions to date have been due to a combination of factors including; declines in module prices, lower labour and balance of system equipment costs per watt installed through gains in solar module conversion efficiency and increasing system size. In addition, the increasing number of systems installed has meant fixed administration and sales and marketing costs have been easier to cover.

Whilst we expect to see modest reductions in module prices and continued gains in conversion efficiency, we expect to see constraints on continued increases in system size and we expect that lead generation and sales and marketing costs will increase as saturation increases and financial attractiveness reduces.

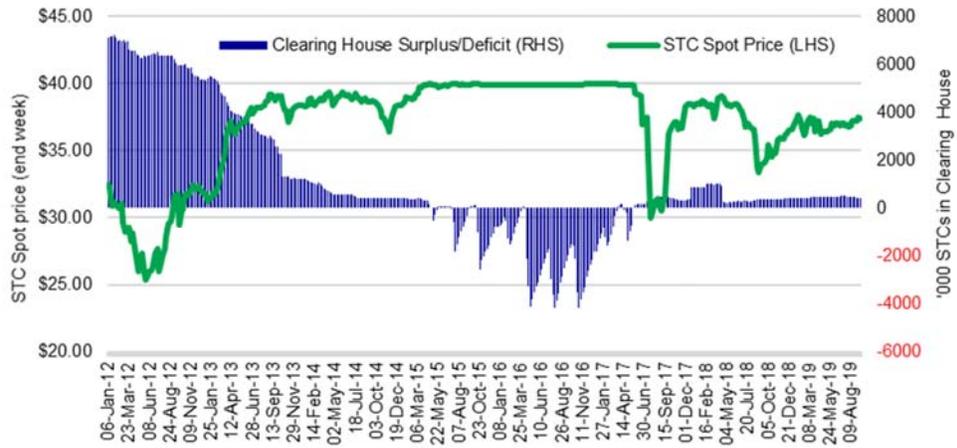
As a result, we expect to see only modest real cost reductions over the next four years and as result we assume that the current gross installed cost (prior to STCs) of \$1.60 per Watt will be maintained in nominal terms over the forecast period.

3.2 Forecasting STC prices

Spot STC prices in 2019 have averaged \$36.92 (to mid September). Spot prices averaged \$37.00 for 2018. Since mid-2017 the Clearing House has been in surplus with more STCs created than required by Liable Parties to meet their STC surrender

needs. The resulting surplus of STCs in the market has meant that STCs have traded at a considerable discount to the \$40 Clearing House Price (Figure 3.2).

Figure 3.2 Spot STC prices and Clearing House Surplus/ Deficit



We are assuming that over the forecast period the STC market comes in to better balance and that the Clearing House does not go into deficit. We are forecasting an underlying STC spot price of \$39 from 2020 to 2023 and after allowing for 47 cents registration cost we have used \$38.53 per STC to incorporate into our payback model.

STCs accounted for nearly 37% of the total cost of the system in 2019 and this is expected to drop considerably to 26% by 2023 as the number of years deeming reduces (Figure 3.3).

Figure 3.3 Forecast Installed system costs for 5 kW system (\$/Watt)



3.3 Forecasting Electricity prices

There are two components to electricity prices that we incorporate into our payback model:

- Import replacement price: this is the variable electricity price that can be avoided by that level of solar generation that is consumed by the household or business; and
- Export price: this is the variable electricity price that is received through the export of electricity to the grid.

Our payback model time series generally incorporates the Australian Energy Market Commission's (AEMC) latest projections (December 2018 Report) and are adjusted for standing charges utilising AEMC demand estimates. We have then progressively reduced the wholesale price component to reflect the expected significant decline during daylight hours.

A significant amount large-scale solar generation capacity (6000 MW) will be added over the 2017 to 2021 period. This is on top of a similar level of roof-top solar PV and a further 6,000 MW of wind generation. As a result, we expect that wholesale market prices (during sunlight hours) will drop considerably over the period to 2023.

We have assumed that the price in the NEM drops to \$55/MWh by 2023 in real terms and that this represents the average marginal cost of gas and NSW black coal generation each setting the price 50% of the time during daylight hours. For WA we have assumed that the equivalent price during daylight hours is \$50/MWh by 2023 in real terms.

Figure 3.4 Value of exported electricity for key states (cents per kWh nominal)

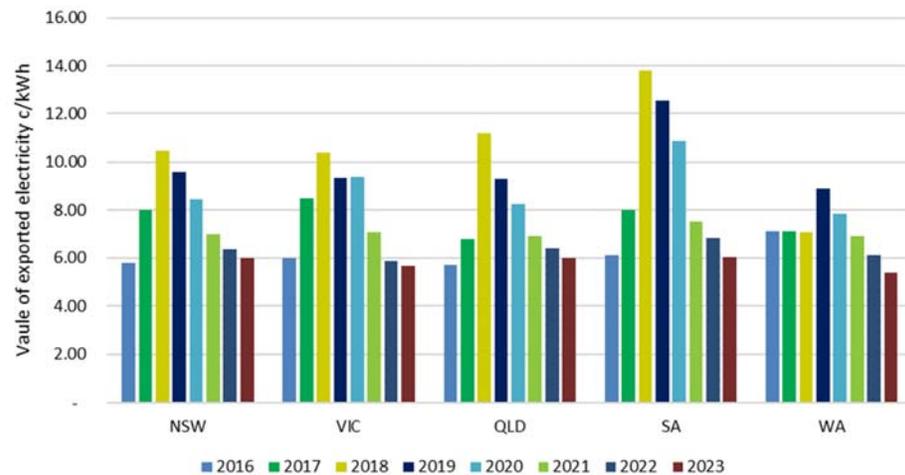
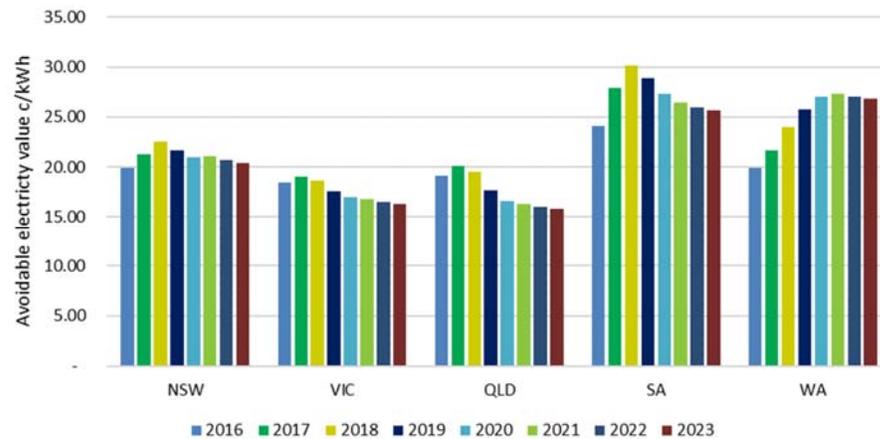


Figure 3.5 Avoidable electricity price (variable cents per kWh nominal)

3.4 Forecasting new residential and commercial PV payback periods

We adopt a simple payback approach to represent the relative financial attractiveness of PV to consumers in each state. The system payback is derived by dividing the installed cost of the system (less the value of STCs) by the value of electricity produced in the year of installation. In addition to the installed system cost, STC price and electricity price assumptions covered above we have also incorporated the following assumptions:

For residential systems:

- For payback modelling purposes we use a generic average system size for each state and is assumed to be generally 5.0 kW; and
- Electricity exports are determined by state and are linked to the average system size and the average consumption levels in each state. Export levels range from 60% in the NT to 70% in NSW and Victoria.

For commercial systems:

- Most business sites consume less than 160 MWh of electricity per annum and pay electricity tariffs that are broadly similar to residential customers. The average system size is assumed to be 20 kW which is consistent with the average system size installed over the last few years; and
- We assume that most of the power generated is consumed on site and that only 20% of the electricity generated by solar PV is exported at an assumed zero value (other than in Victoria where systems less than 100kW are eligible for a feed-in tariff).

Average system paybacks dropped dramatically in most NEM states during 2018 and 2019 due to high wholesale prices. With the expected reduction in the value of exported electricity and lower avoided import prices combined with reducing STC value, paybacks across all states are expected to increase considerably over the forward period.

Figure 3.6 Simple Payback for typical residential PV system

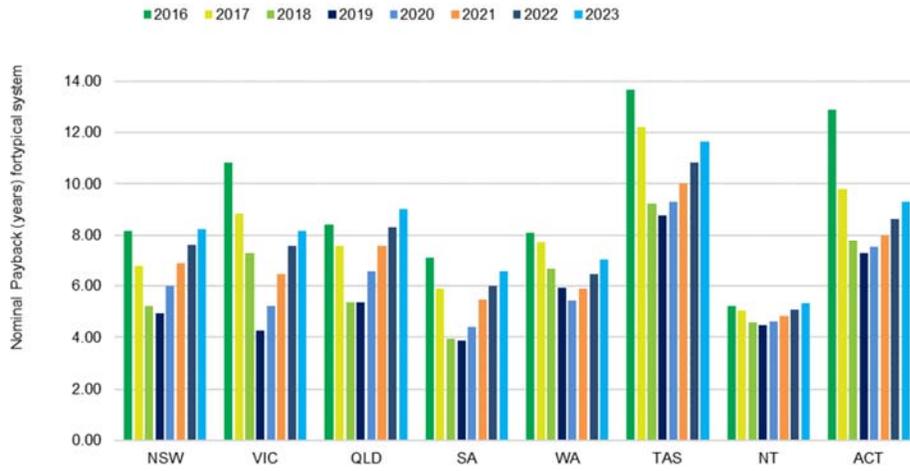
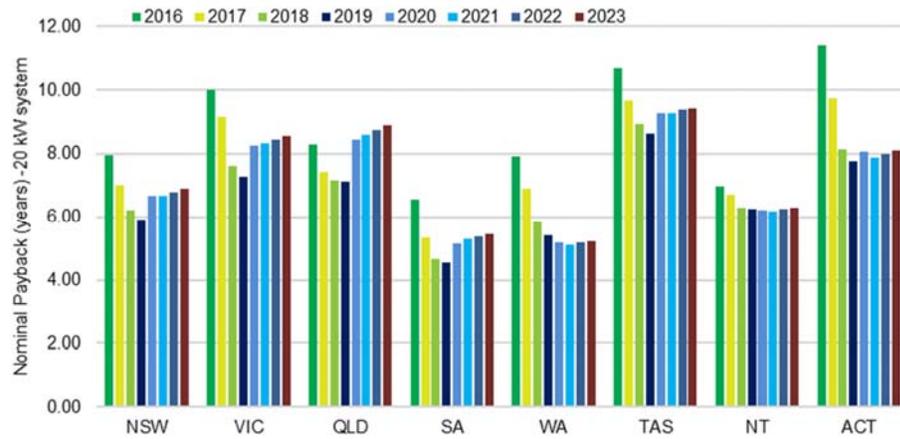


Figure 3.7 Simple Payback for typical Commercial PV system



4. Updated STC Forecasts for solar PV

We have updated our assumptions and slightly refined our modelling approach in developing our STC forecasts for the 2019 to 2023 period.

4.1 Solar industry participant interviews

We have undertaken a series of informal interviews with a cross section of solar market participants to obtain their views on the current market for solar installations and expected activity over the coming years. This has informed our judgements on the non-financial factors that impact on consumers purchasing decision.

Some key observations that have informed our assumptions used in the modelling are set out below:

- Lead generation is becoming more expensive;
- Financing PV systems still appears relatively modest (Victoria an exception with Government interest free loans for 4 year);
- Commercial sector still offering considerable potential, though uncertain economic outlook means sales take longer to close;
- While considerable customer interest in batteries, the level of uptake remains low;
- Not much room for Panel prices to fall further and expectation that installed system costs to remain stable; and
- System sizes continue to increase though seem to have levelled out.

4.2 Estimated STCs to be created for 2019 Installations

We have analysed the level of STCs that have been submitted for creation on a weekly basis by year of installation for the key market sectors. We have assumed that the average lag in 2019 creation will be an average of the lag experienced for the 2017 and 2018 years. The lag in creation for all market sectors is summarised in Attachment 9. We have scaled these rates back by 5% for solar PV to reflect a relative slowdown in the typical end of calendar year surge in installations given comments from market participants that it was becoming harder to obtain and close sales.

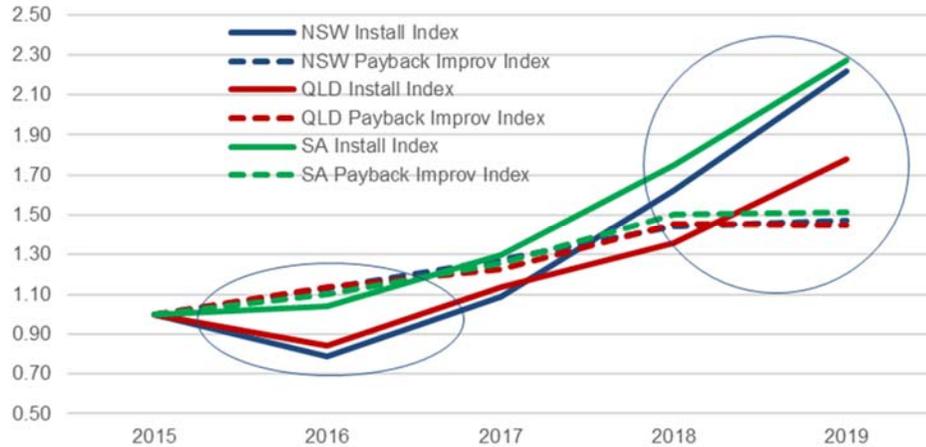
4.3 Forecasting new residential PV installations and STCs created

We have adopted the same approach as we have in our previous modelling exercise in develop demand for new residential solar PV systems (refer to Section 3).

The results from our system payback model are summarised in Attachment 2 and shown in graphical form in Figure 3.6. Paybacks have been converted to an index with 2015 as a base and compared to the level of installations as an index also with 2015 as base (Figure 4.1). This is showing system payback and level of installations as a linear relationship, with the exception of two time periods.

- In 2016 paybacks were increasing however the level of installations in NSW and QLD fell by more than 10%; and
- In 2019 paybacks for systems in NSW, QLD and SA were similar to 2018 levels, however the number of systems installed increased significantly.

Figure 4.1 Payback Index cf: Installation levels for NSW, QLD and SA



The above apparent anomalies can be explained by:

- Reduced solar industry competitiveness and marketing in 2016 and 2017 as the industry was consolidating with a number business exiting from the market. This situation has been reversed in 2018 and 2019 with many new entrants in the market with expanded marketing and promotion. Some new entrants have adopted different business models and market focus.
- Heightened customer awareness was apparent in 2018 and 2019 with increases in wholesale power prices and considerable media focus and attention on energy reliability and cost; and
- There will also be lags between the time parameters change, customers make purchasing decisions and when the system is finally installed.

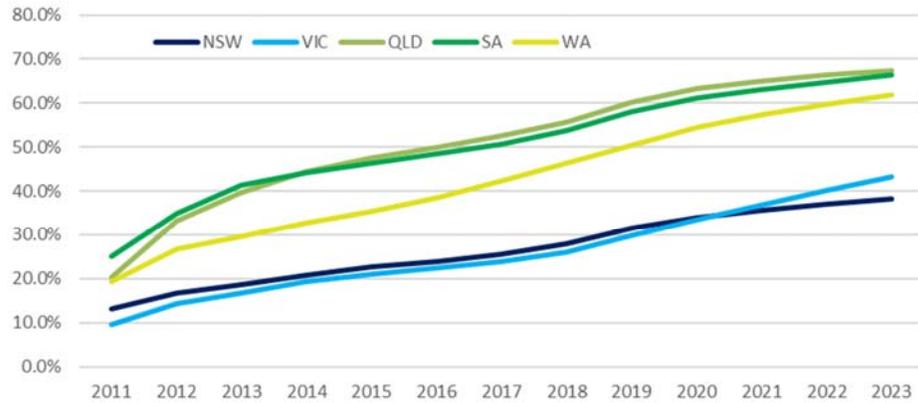
In our modelling with have assumed that the enhanced industry competitiveness and customer awareness remains in place for 2020 but at a lower levels compared to 2019 and then proceed to get back to more normal levels by 2021.

We have assumed that the level of new residential installations in Victoria will be governed by the Victorian Solar Program with the desire to support 650,000 residential PV systems over 10 years. The level of rebates each year is expected to be back-ended. Other than for the 2019/20 financial year few details are available as to the specific level of rebates to be supported in each year. We have incorporated the Victorian Government’s commitment to fund an additional 23,000 rebates for the 2019/20 financial year. We have assumed that the program parameters will be adjusted to ensure that the policy commitment of 650,000 solar PV systems will be achieved. We have assumed that new residential installations (including new residential systems that are not eligible for the rebate) in 2019 will be 65,256, 65,500 in 2020, 62,750 in 2021, 62,500 in 2022 and 63,313 in 2023.

We expect that the NSW government will announce details of their solar financing scheme later in 2019 and that this will support modest demand for systems from 2020 onwards.

The level of projected system installations by state is outlined in detail in Attachment 3 together with expected penetration levels. Penetration level by state is summarized in the following chart.

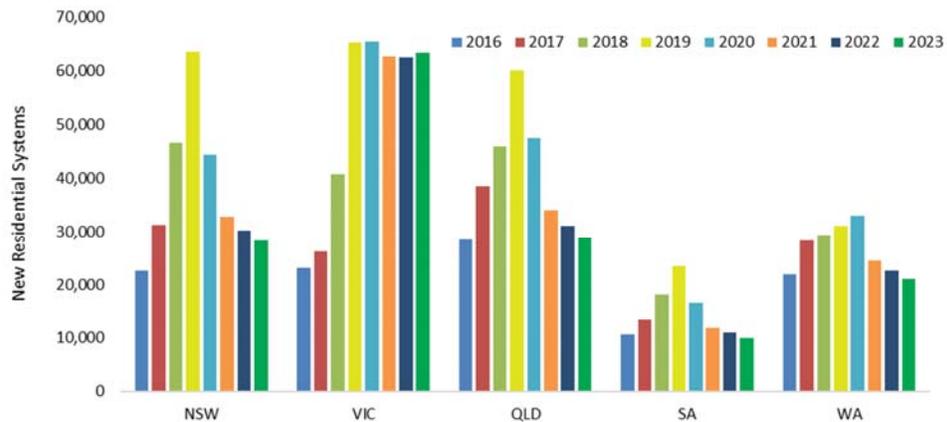
Figure 4.2 Penetration level by key state



Note: Penetration rate represents the cumulative proportion of residential systems installed as a proportion of owner occupied houses (separate and semi-detached)

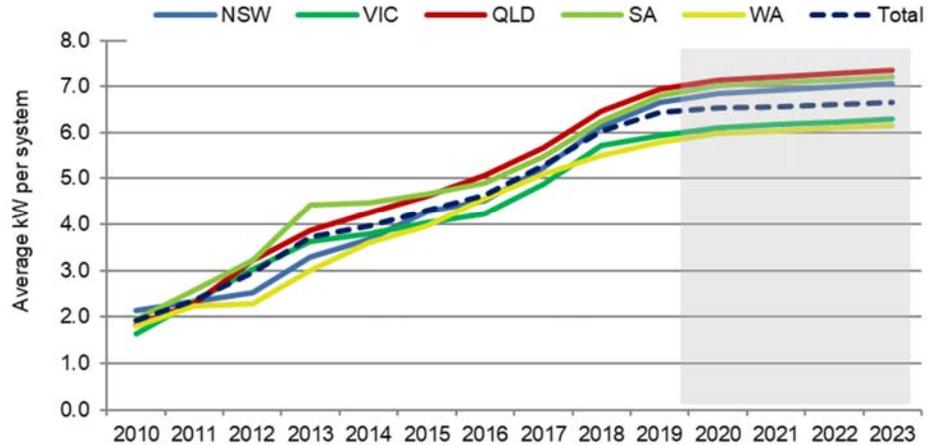
New residential system installations are expected to decline markedly over the next four years as financial attractiveness deteriorates. The only exception is Victoria where installations are supported under the solar program (Figure 4.2)

Figure 4.2 New residential installations by key state



We are expecting a slowdown in the increase in the average system size that has been experienced over the last few years. As the level of STC deeming reduces and the value of exported electricity falls, there will be less of an incentive to opt for larger systems. In addition there has to date been a soft electricity network constraint whereby it is a much easier process to connect systems where the inverter capacity is 5kW or less (with 30% oversizing is equivalent to between 6.5 and 7 kW of panels).

Figure 4.3 Average system size installed for NSW, Qld, SA, Vic and WA



The capacity installed and resultant STCs created by state are included in Attachment 4. A summary of results is outlined in Figure 4.3 below:

Figure 4.4 New residential solar installations and STC creation

Year of installation	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Number of Systems Installed	187,844	252,502	213,583	171,078	162,181	155,945
Avge kW/system	6.03	6.44	6.54	6.57	6.62	6.67
Avge Certificates/kW	17.4	16.0	14.5	13.1	11.8	10.4
MW Installed	1,132.5	1,626.2	1,397.6	1,123.2	1,073.2	1,040.0
Eligible Certificates ('000)	19,699	25,994	20,318	14,720	12,625	10,844

4.4 Forecasting new commercial PV installations and STCs created

We identified in Section 2 of this report, the CER has been collecting data on the type of premises that the system was installed since mid-2014. We have used the CER’s delineation from 2015 when a full years data was available. For systems installed prior to 2015 we have continued to use systems greater than 10 kW as a proxy for non-residential systems.

We have adopted the same approach as previous modelling exercises in developing our estimates for new commercial PV installations. As opposed to residential installations demand is not significantly constrained by high levels of saturation. The commercial sector therefore is expected to be an attractive market for the solar industry as the residential market declines.

Assumptions used and methodology are summarised in Sections 2 and 3. The expected reduction in wholesale prices combined with a reduction in the contribution of STCs will see a modest increase in payback periods from 2020 (Figure 3.7).

For the forecast period, we have assumed that the average system size in each state for 2019 period applies.

The total number of systems installed, and associated certificates created for the non-residential PV market is detailed in Attachment 5 and summarised in Figure 4.5.

Figure 4.4 New non-residential solar installations and STC creation

Year of installation	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Number of Systems Installed	14,645	18,703	19,095	20,860	21,540	21,263
Avgc kW/system	22.91	20.54	20.96	20.95	20.96	20.95
Avgc Certificates/kW	17.4	16.0	14.8	13.4	12.1	10.7
MW Installed	335.4	384.1	400.2	437.1	451.4	445.6
Eligible Certificates ('000)	5,834	6,148	5,904	5,862	5,449	4,781

3.7 Forecasting upgrade residential and commercial PV installations and STCs created

We have separately analysed the solar PV systems that have created certificates at an address that already had a system installed. These installations will either represent instances where a solar system has been upgraded (ie. the capacity has been increased) or where the previous system has been replaced. From 1 February 2018 replacement systems will no longer be eligible to create certificates. We have segmented these installations into residential and non-residential.

With rising penetration in the new residential market segment solar resellers and installers are increasingly targeting their existing customers to upgrade their systems. More than 600,000 solar PV systems were installed before 2012, the vast majority of which were less than 1.6 kW. With the average size of new residential system installed in recent years being above 5.5 kW there is enormous potential for the progressive upgrading of these systems. There is however a disincentive to upgrade systems where attractive feed-in tariffs are in place.

We have modelled upgrade systems using 2019 as a base and then applying recently observed growth rates moderated by changes in relative payback rates.

The total number of systems installed, and associated certificates created for the upgrade PV market is detailed in Attachment 6 and summarised in Figures 4.5 and 4.6.

Figure 4.5 Upgrade residential solar installations and STC creation

Year of installation	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Number of Systems Installed	20,443	25,062	33,741	23,861	21,548	19,871
Avgc kW/system	5.11	5.12	5.11	5.10	5.10	5.10
Avgc Certificates/kW	17.6	16.3	14.9	13.6	12.2	10.9
MW Installed	104.4	128.4	172.5	121.6	109.8	101.3
Eligible Certificates ('000)	1,842	2,089	2,574	1,651	1,343	1,101

Figure 4.6 Upgrade non-residential solar installations and STC creation

Year of installation	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Number of Systems Installed	2,085	2,414	2,322	2,303	1,799	1,984
Avgc kW/system	22.32	20.99	21.03	21.01	21.02	21.01
Avgc Certificates/kW	17.5	16.2	14.9	13.5	12.2	10.8
MW Installed	46.5	50.7	48.8	48.4	37.8	41.7
Eligible Certificates ('000)	816	820	726	654	460	451

5. Updated STC Forecasts for SWH

Overview

We estimate that nearly 68,800 SWH systems will be installed and create certificates in 2019 which is a 3% increase on 2018 levels. The most important drivers of uptake have been the level of new home building and policy support measures such as building regulations and energy efficiency schemes.

New building market

The number of systems installed by state in the new building market has been reasonably stable on a year to year basis (refer to Attachment 7). This is in sharp contrast to the replacement market.

The primary drivers behind purchase behaviour in the new home market segment is the number of new dwellings and building regulations.

SWH sales data, sourced from Industry, suggests that the number of SWH systems that create certificates is between 10 to 15% lower than the total number of systems sold. This is not a new trend, and we see no reason for this to change. The SWH systems that do not create certificates are generally thought to be the result of difficulties that home builders/renovators face when faced with the prospect of creating certificates. The difficulties arise from the confusion and uncertainty as to who has the right to create the certificates. Specifically, when the future owner of the home/building may not own the system at the time it was installed. This means that using SWH systems creating certificates will understate the real level of SWH installations in new homes by 20 to 25%.

Using the data provided by the CER we have isolated the SWH systems installed in new buildings and analysed historic trends. We use this analysis as the basis for forecasting SWH installations for the new-build submarket.

The level of new home starts is expected to fall in most states over the next few years (other than WA and NT) according to forecasts by the Master Builders Association (Figure 5.1)

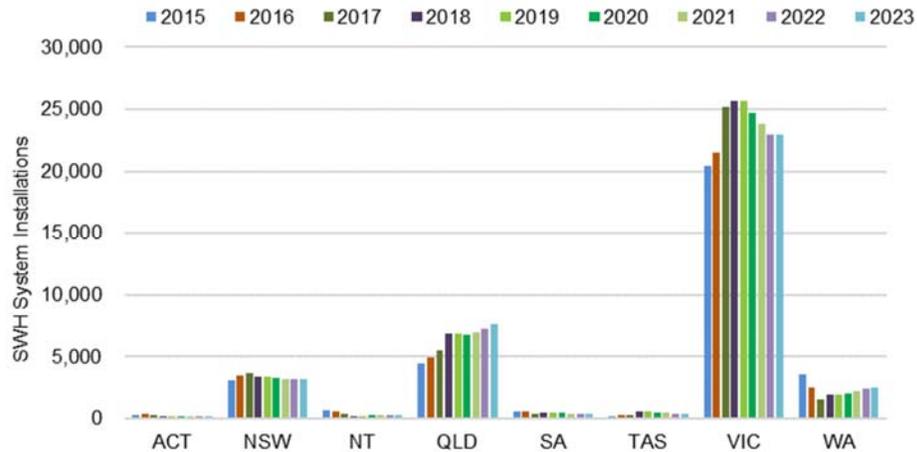
Figure 5.1 Master Builders Association (MBA) – New Home starts

	2019	2020	2021	2022	2023
ACT	2.00%	-2.85%	-2.31%	-4.69%	-2.22%
NSW	-7.76%	-5.64%	-4.95%	-3.90%	-1.73%
NT	6.36%	9.83%	8.47%	4.95%	2.00%
QLD	-4.57%	-2.96%	-0.63%	2.74%	2.15%
SA	-5.53%	-9.57%	-10.28%	-8.23%	-4.15%
TAS	-1.17%	-12.12%	-13.72%	-13.46%	-6.91%
VIC	-2.88%	-6.28%	-6.28%	-5.91%	-2.59%
WA	-4.50%	3.88%	7.37%	4.51%	1.31%
	-4.66%	-4.51%	-3.36%	-2.30%	-0.84%

We do not envisage any changes to new building regulations over the forecast period and have used the MBA forecast of new home starts as the basis for projections. We have also incorporated a market growth factor of 2.5% per annum which is the observed growth in the level of SWH installations over the last four years beyond what would have been suggested by the level of new home starts.

The level of SWH systems creating certificates is summarised in Figure 5.2. Victoria which has the most progressive new building regulations remains the leading state for this segment.

Figure 5.2 SWH Systems installed claiming certificates for New Homes by state



Replacement submarket

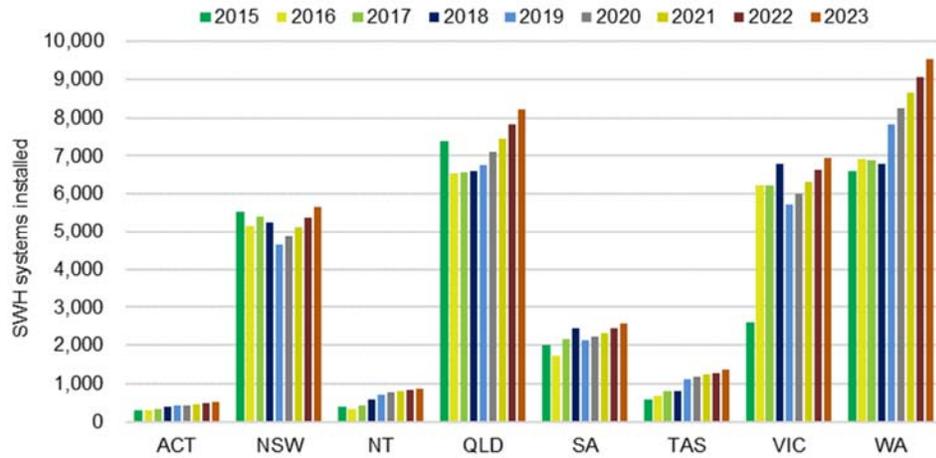
At the time of replacement, most hot water systems are replaced with the same or similar type of system. The dynamics of the replacement market, which are often dictated by a rush to replace a broken or failed water heater, mean there is little time and/or financial liquidity to make thoroughly researched decisions. Thus, historically, the majority of water heater replacements have been on a 'like-for-like' basis.

There have been a range of state-based schemes, incentives and/or regulations, particularly for the replacement of electric resistance water heaters (EWH).

The only material rebates that are currently available are in Victoria through the Victorian Energy Upgrade (VEU) which includes SWH as an eligible activity and the Governments new Solar Program. Under the VEU, a EWH system replaced by a SWH system can generate between 30 to 50 Victorian Energy Efficiency Certificates (VEECs). VEECs provide an added financial incentive of \$400 to \$1200 that helps drive extra SWH system installations in Victoria. Under the Solar Program a \$1000 rebate will be available on the installation of a SWH.

We forecast that the replacement market will grow over the coming four-year period as increasing numbers of SWH systems installed in 2009 and 2010, where the market surged due to expanded government grants, will start to be replaced. We have factored in average growth rates of 5% per annum to reflect this development.

Figure 5.3 Replacement SWH Systems installed claiming certificates by state



Certificates created from the installation of water heater systems

We have assumed that the average certificates per system (on a state basis) for the 2020 to 2023 forecast period will be similar to the average levels achieved over the 2018 to 2019 period.

Table 9.4 Certificate creation from SWH

Year of installation	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
New Buildings						
Number of Systems Installed	37,247	39,439	38,389	37,640	37,249	37,675
Avg Certificates/System	29.8	30.0	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	1,108	1,182	1,151	1,128	1,005	904
Replacement						
Number of Systems Installed	29,660	29,337	30,804	32,344	33,961	35,659
Avg Certificates/System	30.1	29.9	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	894	878	925	971	918	856
Total						
Number of Systems Installed	66,907	68,776	69,193	69,984	71,210	73,334
Avg Certificates/System	29.9	30.0	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	2,002	2,060	2,075	2,099	1,923	1,760

Summary of Results

base Case

Year of installation	Actual 2016	Actual 2017	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
1. SGUs (PV)								
1.1 New Residential								
Number of Systems Installed	111,461	143,060	187,844	252,502	213,583	171,078	162,181	155,945
Avg kW/system	4.64	5.29	6.03	6.44	6.54	6.57	6.62	6.67
Avg Certificates/kW	20.1	18.8	17.4	16.0	14.5	13.1	11.8	10.4
MW Installed	517.5	756.8	1,132.5	1,626.2	1,397.6	1,123.2	1,073.2	1,040.0
Eligible Certificates ('000)	10,401	14,246	19,699	25,994	20,318	14,720	12,625	10,844
1.2 Residential Upgrades								
Number of Systems Installed	11,984	18,965	20,443	25,062	33,741	23,861	21,548	19,871
Avg kW/system	3.69	4.24	5.11	5.12	5.11	5.10	5.10	5.10
Avg Certificates/kW	20.4	19.0	17.6	16.3	14.9	13.6	12.2	10.9
MW Installed	44.2	80.4	104.4	128.4	172.5	121.6	109.8	101.3
Eligible Certificates ('000)	901	1,530	1,842	2,089	2,574	1,651	1,343	1,101
1.3 New Non Residential								
Number of Systems Installed	8,338	11,583	14,645	18,703	19,095	20,860	21,540	21,263
Avg kW/system	20.13	22.03	22.91	20.54	20.96	20.95	20.96	20.95
Avg Certificates/kW	20.2	18.7	17.4	16.0	14.8	13.4	12.1	10.7
MW Installed	167.9	255.2	335.4	384.1	400.2	437.1	451.4	445.6
Eligible Certificates ('000)	3,388	4,784	5,834	6,148	5,904	5,862	5,449	4,781
1.4 Non Residential Upgrades								
Number of Systems Installed	948	1,375	2,085	2,414	2,322	2,303	1,799	1,984
Avg kW/system	19.44	19.66	22.32	20.99	21.03	21.01	21.02	21.01
Avg Certificates/kW	20.5	18.9	17.5	16.2	14.9	13.5	12.2	10.8
MW Installed	18.4	27.0	46.5	50.7	48.8	48.4	37.8	41.7
Eligible Certificates ('000)	377	511	816	820	726	654	460	451
Total PV Systems								
Number of Systems Installed	132,731	174,983	225,017	298,681	268,741	218,102	207,068	199,062
Avg kW/system	5.64	6.40	7.19	7.33	7.51	7.93	8.08	8.18
Avg Certificates/kW	20.1	18.8	17.4	16.0	14.6	13.2	11.9	10.5
MW Installed	748.1	1,119.5	1,618.9	2,189.4	2,019.2	1,730.2	1,672.3	1,628.6
Eligible Certificates ('000)	15,067	21,071	28,191	35,052	29,522	22,887	19,877	17,176
2. SWH Systems								
2.1 SWH System (New Homes)								
Number of Systems Installed	34,182	35,366	37,247	39,439	38,389	37,640	37,249	37,675
Avg Certificates/System	30.3	30.0	29.8	30.0	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	1,035	1,061	1,108	1,182	1,151	1,128	1,005	904
2.2 SWH System (Replacement)								
Number of Systems Installed	27,836	28,778	29,660	29,337	30,804	32,344	33,961	35,659
Avg Certificates/System	30.4	30.2	30.1	29.9	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	845	870	894	878	925	971	918	856

Summary of Results

base Case

Year of installation	Actual 2016	Actual 2017	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
Total SWH Systems								
Number of Systems Installed	62,018	64,144	66,907	68,776	69,193	69,984	71,210	73,334
Avg Certificate/System	30.3	30.1	29.9	30.0	30.0	30.0	27.0	24.0
Eligible Certificates ('000)	1,880	1,931	2,002	2,060	2,075	2,099	1,923	1,760
3. Small Wind/Hydro Systems								
Number of Systems	10	10	2	2	2	2	2	2
Avg Certificate/System	26.8	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Eligible Certificates ('000)	0	0	0	0	0	0	0	0
TOTAL Certificates ('000)	16,947	23,002	30,193	37,112	31,597	24,986	21,800	18,937

'000 STCs	Actual 2016	Actual 2017	Estimate 2018	Estimate 2019	Forecast 2020	Forecast 2021	Forecast 2022	Forecast 2023
STCs for installations in year								
Solar PV	15,067	21,071	28,191	35,052	29,522	22,887	19,877	17,176
SWH	1,880	1,931	2,002	2,060	2,075	2,099	1,923	1,760
Total	16,947	23,002	30,193	37,112	31,597	24,986	21,800	18,937
Less								
STCs submitted following year (lag)	1,897	2,580	3,357	4,126	3,513	2,778	2,424	2,105
Add								
Previous year installs created this year	1,321	1,897	2,580	3,357	4,126	3,513	2,778	3,513
STCs submitted for creation	16,371	22,319	29,416	36,342	32,210	25,721	22,154	20,344

Sensitivity Analysis

'000 STCs Submitted for Creation	2016	2017	2018	2019	2020	2021	2022	2023
Total Certificates - Base Case	16,371	22,319	29,416	36,342	32,210	25,721	22,154	20,344
Total Certificates - High Case					32,708	26,611	23,397	21,793
Total Certificates - Low Case					30,716	23,044	18,415	16,030

Attachment 2

New Residential PV Systems

PV Financial Attractiveness

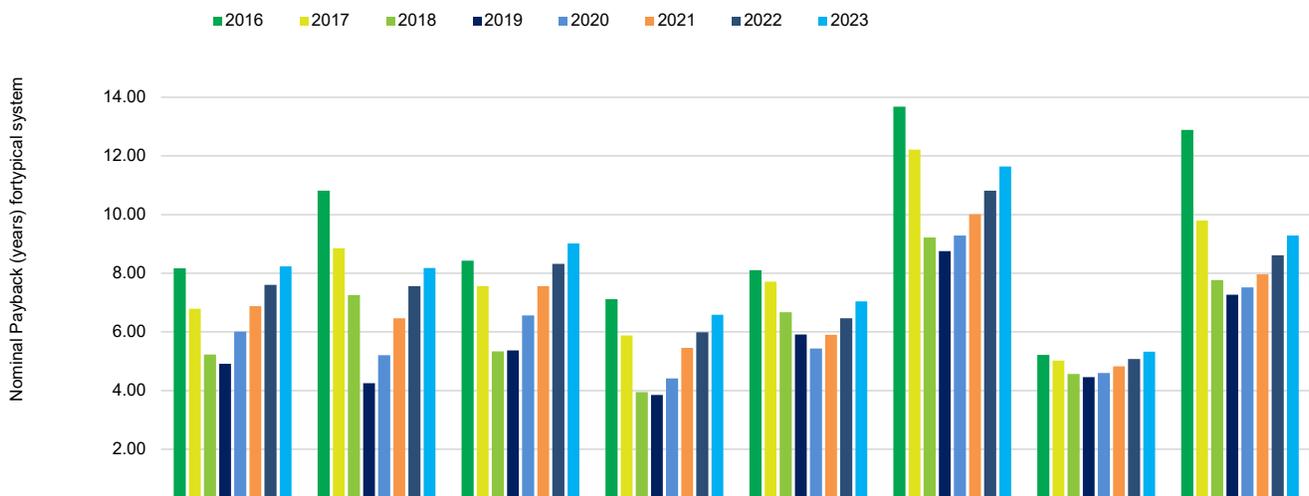
Typical projected Installed cost of solar PV in NSW (nominal terms)

	2016	2017	2018	2019	2020	2021	2022	2023
\$ per Watt								
System Cost (Pre STCs)	1.95	1.80	1.65	1.65	1.65	1.65	1.65	1.65
STCs	0.82	0.71	0.66	0.61	0.59	0.53	0.48	0.43
Net Cost	1.13	1.09	0.99	1.04	1.06	1.12	1.17	1.22
STC % of Total Cost	41.9%	39.6%	39.8%	36.7%	35.5%	32.3%	29.0%	25.8%
STC Price	\$39.44	\$36.81	\$36.53	\$36.53	\$38.53	\$38.53	\$38.53	\$38.53
STCs/kWatt	20.73	19.35	17.97	16.58	15.20	13.82	12.44	11.06
STC \$/Watt value	0.82	0.71	0.66	0.61	0.59	0.53	0.48	0.43

Average Nominal Payback (assuming 5 kW system)

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT
2016	8.17	10.82	8.43	7.12	8.11	13.68	5.22	12.89
2017	6.80	8.86	7.57	5.88	7.71	12.22	5.02	9.80
2018	5.23	7.27	5.35	3.95	6.68	9.22	4.57	7.77
2019	4.92	4.26	5.37	3.86	5.92	8.75	4.46	7.27
2020	6.01	5.21	6.57	4.41	5.44	9.29	4.60	7.52
2021	6.88	6.47	7.57	5.46	5.90	10.01	4.83	7.97
2022	7.61	7.56	8.32	5.99	6.47	10.82	5.08	8.62
2023	8.23	8.18	9.01	6.59	7.04	11.64	5.33	9.29

Average simple paybacks on an annual basis

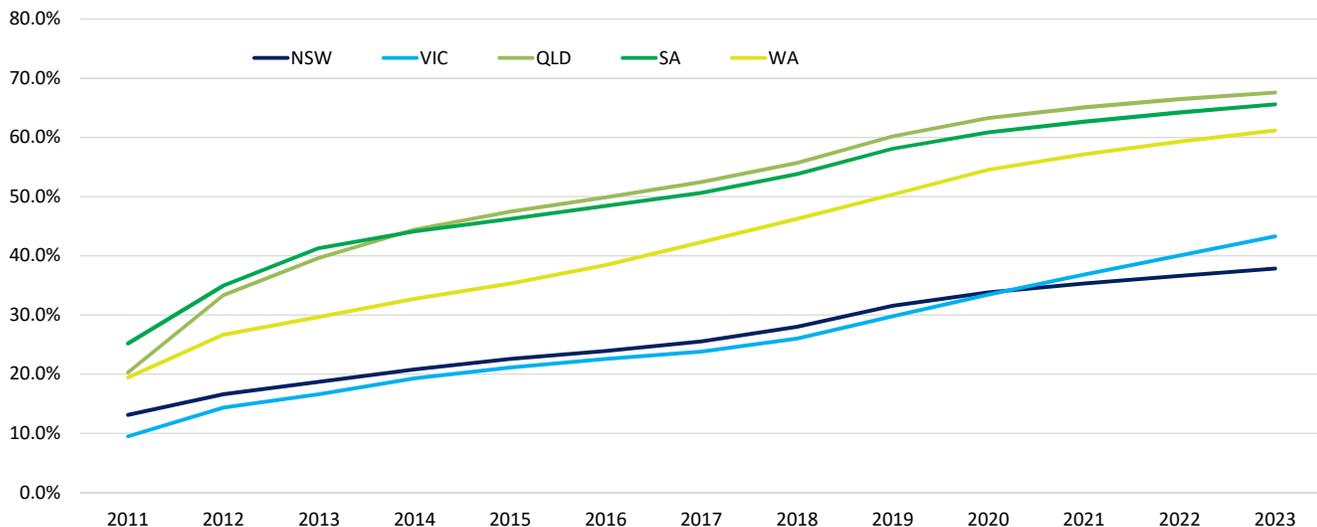


Solar PV Residential Systems by State

	2	3	4	5	6	7	8	9	
	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Systems installed									
2009	13,990	8,429	18,260	8,594	11,142	1,452	206	802	62,875
2010	69,667	35,658	48,548	16,666	22,209	1,883	620	2,311	197,562
2011	79,158	58,950	92,968	62,212	50,235	2,402	368	6,766	353,059
2012	52,937	64,769	123,257	41,022	40,734	6,000	475	1,472	330,666
2013	31,518	31,598	62,220	27,579	19,787	6,878	976	2,267	182,823
2014	33,022	37,545	49,146	13,194	21,158	3,804	954	1,177	160,000
2015	28,677	28,293	33,800	10,291	18,733	1,830	1,084	976	123,684
2016	22,616	23,140	28,520	10,715	21,818	2,272	1,530	850	111,461
2017	31,264	26,231	38,474	13,346	28,213	2,106	1,709	1,717	143,060
2018	46,625	40,798	45,932	18,011	29,371	2,179	2,053	2,875	187,844
2019	63,532	65,256	60,064	23,379	31,146	2,190	3,251	3,684	252,502
2020	44,453	65,500	47,528	16,617	32,917	3,115	1,796	1,657	213,583
2021	32,830	62,750	34,075	11,888	24,515	2,395	1,329	1,297	171,078
2022	30,225	62,500	31,081	10,991	22,617	2,288	1,236	1,243	162,181
2023	28,248	63,313	28,751	10,052	21,051	2,180	1,161	1,189	155,945
Cumulative Installations									
2011	191,919	121,168	187,680	103,431	100,664	7,112	2,217	12,043	726,234
2012	244,856	185,937	310,937	144,453	141,398	13,112	2,692	13,515	1,056,900
2013	276,374	217,535	373,157	172,032	161,185	19,990	3,668	15,782	1,239,723
2014	309,396	255,080	422,303	185,226	182,343	23,794	4,622	16,959	1,399,723
2015	338,073	283,373	456,103	195,517	201,076	25,624	5,706	17,935	1,523,407
2016	360,689	306,513	484,623	206,232	222,894	27,896	7,236	18,785	1,634,868
2017	391,953	332,744	523,097	219,578	251,107	30,002	8,945	20,502	1,777,928
2018	438,578	373,542	569,029	237,589	280,478	32,181	10,998	23,377	1,965,771
2019	502,110	438,798	629,093	260,968	311,624	34,371	14,249	27,061	2,218,273
2020	546,563	504,298	676,621	277,584	344,541	37,486	16,045	28,717	2,431,856
2021	579,393	567,048	710,696	289,472	369,056	39,881	17,374	30,014	2,602,934
2022	609,618	629,548	741,778	300,463	391,673	42,169	18,610	31,257	2,765,116
2023	637,866	692,861	770,529	310,515	412,724	44,349	19,771	32,446	2,921,060
Penetration rates									
2011	13.1%	9.5%	20.3%	25.2%	19.4%	5.4%	9.0%	14.5%	15.0%
2012	16.6%	14.4%	33.3%	34.9%	26.7%	9.9%	10.6%	15.7%	21.6%
2013	18.7%	16.6%	39.6%	41.3%	29.7%	15.0%	14.0%	17.6%	25.1%
2014	20.8%	19.3%	44.4%	44.2%	32.8%	17.8%	17.2%	18.4%	28.1%
2015	22.6%	21.1%	47.5%	46.3%	35.3%	19.1%	20.6%	19.0%	30.2%
2016	24.0%	22.6%	49.9%	48.5%	38.5%	20.7%	25.4%	19.5%	32.1%
2017	25.5%	23.8%	52.5%	50.7%	42.3%	21.9%	30.7%	21.0%	34.1%
2018	28.0%	26.1%	55.7%	53.8%	46.3%	23.1%	36.9%	23.6%	36.8%
2019	31.6%	29.8%	60.2%	58.1%	50.4%	24.2%	46.8%	27.0%	40.7%
2020	33.8%	33.5%	63.3%	60.9%	54.5%	26.1%	51.5%	28.3%	43.8%
2021	35.3%	36.8%	65.1%	62.6%	57.2%	27.4%	54.4%	29.3%	46.0%
2022	36.7%	40.1%	66.5%	64.2%	59.3%	28.6%	56.8%	30.1%	48.0%
2023	37.8%	43.3%	67.6%	65.6%	61.2%	29.8%	58.8%	31.0%	49.8%

Penetration Rate - Larger States

As proportion of Owner Occupied detached and semi-detached homes



Attachment 4

Certificate Creation - Solar PV Residential

	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	Total
Residential Systems installed (No.)									
2014	33,022	37,545	49,146	13,194	21,158	3,804	954	1,177	160,000
2015	28,677	28,293	33,800	10,291	18,733	1,830	1,084	976	123,684
2016	22,616	23,140	28,520	10,715	21,818	2,272	1,530	850	111,461
2017	31,264	26,231	38,474	13,346	28,213	2,106	1,709	1,717	143,060
2018	46,625	40,798	45,932	18,011	29,371	2,179	2,053	2,875	187,844
2019	63,532	65,256	60,064	23,379	31,146	2,190	3,251	3,684	252,502
2020	44,453	65,500	47,528	16,617	32,917	3,115	1,796	1,657	213,583
2021	32,830	62,750	34,075	11,888	24,515	2,395	1,329	1,297	171,078
2022	30,225	62,500	31,081	10,991	22,617	2,288	1,236	1,243	162,181
2023	28,248	63,313	28,751	10,052	21,051	2,180	1,161	1,189	155,945
Average system size (kW/system)									
2014	3.67	3.79	4.26	4.47	3.61	4.30	4.61	3.80	3.96
2015	4.27	4.03	4.61	4.66	3.96	4.02	4.73	4.46	4.30
2016	4.52	4.24	5.06	4.90	4.56	3.94	4.84	5.20	4.64
2017	5.24	4.87	5.68	5.48	5.11	4.83	5.81	5.45	5.29
2018	6.12	5.72	6.45	6.26	5.51	5.42	6.74	6.00	6.03
2019	6.66	5.93	6.94	6.80	5.80	5.57	6.98	6.80	6.44
2020	6.86	6.10	7.15	7.01	5.98	5.00	7.19	7.00	6.54
2021	6.93	6.17	7.22	7.08	6.04	5.00	7.27	7.07	6.57
2022	7.00	6.23	7.29	7.15	6.10	5.05	7.34	7.14	6.62
2023	7.07	6.29	7.36	7.22	6.16	5.10	7.41	7.22	6.67
Installed Capacity (MW)									
2014	121.3	142.2	209.5	59.0	76.4	16.3	4.4	4.5	633.5
2015	122.6	114.0	155.8	48.0	74.2	7.4	5.1	4.4	531.3
2016	102.3	98.1	144.4	52.5	99.5	9.0	7.4	4.4	517.5
2017	163.7	127.8	218.7	73.2	144.1	10.2	9.9	9.4	756.8
2018	285.5	233.2	296.4	112.7	161.7	11.8	13.8	17.2	1132.5
2019	423.0	386.7	416.7	159.1	180.8	12.2	22.7	25.1	1626.2
2020	304.8	399.8	339.7	116.5	196.8	15.6	12.9	11.6	1397.6
2021	227.4	386.9	245.9	84.1	148.0	12.0	9.7	9.2	1123.2
2022	211.4	389.2	226.6	78.6	137.9	11.6	9.1	8.9	1073.2
2023	199.6	398.2	211.7	72.6	129.7	11.1	8.6	8.6	1040.0
2019 Avge Zone Rating	1.377	1.188	1.377	1.371	1.377	1.177	1.533	1.376	1.332
Average Certificates/kW installed									
2014	20.6	17.8	20.7	20.5	20.6	17.6	23.3	20.6	19.9
2015	20.7	17.8	20.6	20.6	20.6	17.6	23.2	20.6	20.0
2016	20.7	17.9	20.7	20.6	20.6	17.6	23.1	20.6	20.1
2017	19.3	16.7	19.3	19.2	19.3	16.5	21.6	19.3	18.8
2018	17.9	15.5	17.9	17.8	17.9	15.3	20.0	17.9	17.4
2019	16.5	14.3	16.5	16.5	16.5	14.1	18.4	16.5	16.0
2020	15.1	13.1	15.1	15.1	15.1	12.9	16.9	15.1	14.7
2021	13.8	11.9	13.8	13.7	13.8	11.8	15.3	13.8	13.3
2022	12.4	10.7	12.4	12.3	12.4	10.6	13.8	12.4	12.0
2023	11.0	9.5	11.0	11.0	11.0	9.4	12.3	11.0	10.7
Calculated Certificates ('000) ##									
2014	2,503	2,532	4,326	1,212	1,573	288	102	92	12,628
2015	2,535	2,033	3,215	986	1,527	130	119	90	10,635
2016	2,117	1,753	2,982	1,079	2,049	158	171	91	10,401
2017	3,158	2,133	4,214	1,405	2,774	167	214	180	14,246
2018	5,114	3,612	5,304	2,009	2,894	181	277	308	19,699
2019	6,989	5,515	6,884	2,617	2,986	172	418	414	25,994
2020	4,617	5,227	5,143	1,756	2,980	202	218	176	20,318
2021	3,131	4,598	3,385	1,154	2,037	141	148	126	14,720
2022	2,620	4,162	2,807	970	1,709	122	125	110	12,625
2023	2,198	3,786	2,331	796	1,428	105	106	94	10,844

Notes

These are certificates that are eligible to be created on a generation year basis and do not allow for the a delay from system installation to certificate approval

New Non Residential PV installations

Attachment 5

		2015	2016	2017	2018	2019	2020	2021	2022	2023
Systems										
	ACT	41	71	79	127	169	187	211	218	215
	NSW	2,419	2,161	2,950	3,929	5,640	5,746	6,346	6,544	6,453
	NT	75	167	139	174	153	177	195	203	202
	QLD	1,192	1,785	2,680	3,393	4,779	4,645	5,024	5,171	5,094
	SA	702	816	1,235	1,633	1,969	1,999	2,130	2,201	2,173
	TAS	88	98	150	202	158	169	186	193	192
	VIC	1,540	2,063	2,793	3,503	4,530	4,601	5,021	5,194	5,134
	WA	846	1,177	1,557	1,683	1,304	1,570	1,747	1,815	1,801
		6,903	8,338	11,583	14,645	18,703	19,095	20,860	21,540	21,263
kw/System										
	ACT	34.91	29.01	31.48	30.24	30.24	30.24	30.24	30.24	30.24
	NSW	18.00	20.11	19.65	19.88	19.88	19.88	19.88	19.88	19.88
	NT	41.04	28.70	36.13	32.42	32.42	32.42	32.42	32.42	32.42
	QLD	18.52	19.15	21.06	20.10	20.10	20.10	20.10	20.10	20.10
	SA	18.31	22.57	25.75	24.16	24.16	24.16	24.16	24.16	24.16
	TAS	19.99	24.31	23.80	24.06	24.06	24.06	24.06	24.06	24.06
	VIC	18.80	18.81	22.85	20.83	20.83	20.83	20.83	20.83	20.83
	WA	22.05	20.20	21.90	21.05	21.05	21.05	21.05	21.05	21.05
		19.17	20.13	22.03	22.91	20.54	20.96	20.95	20.96	20.96
Installed capacity (kW)										
	ACT	1,431	2,060	2,487	3,693	3,740	5,668	6,382	6,594	6,508
	NSW	43,533	43,460	57,960	85,835	96,538	114,224	126,162	130,096	128,271
	NT	3,078	4,794	5,022	5,846	4,621	5,732	6,318	6,584	6,543
	QLD	22,072	34,176	56,433	69,897	91,584	93,370	100,986	103,949	102,397
	SA	12,854	18,419	31,798	42,729	46,856	48,304	51,455	53,181	52,497
	TAS	1,759	2,383	3,571	5,110	4,475	4,066	4,472	4,649	4,614
	VIC	28,952	38,796	63,811	85,133	106,392	95,820	104,577	108,180	106,915
	WA	18,653	23,770	34,095	37,193	29,916	33,049	36,766	38,198	37,900
		132,331	167,857	255,176	335,436	384,124	400,233	437,117	451,433	445,645
			26.8%	52.0%	31.5%	14.5%	4.2%	9.2%	3.3%	-1.3%
Certificates/kW										
	ACT	20.72	20.71	18.97	17.62	16.26	14.91	13.55	12.20	10.84
	NSW	20.77	20.80	19.39	18.01	16.62	15.24	13.85	12.47	11.08
	NT	23.23	23.22	21.64	20.09	18.55	17.00	15.46	13.91	12.36
	QLD	20.77	20.78	19.40	18.02	16.63	15.25	13.86	12.47	11.09
	SA	20.69	20.60	19.28	17.90	16.52	15.15	13.77	12.39	11.02
	TAS	17.74	17.75	16.57	15.39	14.20	13.02	11.83	10.65	9.47
	VIC	18.18	18.24	16.88	15.67	14.47	13.26	12.06	10.85	9.65
	WA	20.75	20.62	19.37	17.98	16.60	15.22	13.83	12.45	11.07
		20.21	20.18	18.75	17.39	16.01	14.75	13.39	12.07	10.73
Certificates created										
	ACT	29,646	42,656	47,188	65,063	60,830	84,499	86,491	80,426	70,557
	NSW	904,251	904,174	1,124,082	1,545,786	1,604,797	1,740,560	1,747,705	1,621,990	1,421,541
	NT	71,494	111,299	108,671	117,459	85,713	97,453	97,648	91,588	80,902
	QLD	458,368	710,262	1,095,006	1,259,385	1,523,185	1,423,488	1,399,630	1,296,633	1,135,354
	SA	265,927	379,468	612,984	764,871	774,244	731,642	708,524	659,068	578,294
	TAS	31,211	42,298	59,160	78,625	63,560	52,934	52,930	49,522	43,690
	VIC	526,343	707,746	1,077,047	1,334,295	1,539,229	1,270,755	1,260,808	1,173,823	1,031,194
	WA	387,026	490,083	660,282	668,836	496,588	502,883	508,574	475,551	419,415
		2,674,266	3,387,986	4,784,420	5,834,320	6,148,147	5,904,213	5,862,310	5,448,599	4,780,946
			26.7%	41.2%	21.9%	5.4%	-4.0%	-0.7%	-7.1%	-12.3%

New Non Residential PV installations

Breakdown by Capacity Bands

Attachment 5

		2019				2020			
		10 - 30kW	30 - 50kW	50 - 100kW	Total	10 - 30kW	30 - 50kW	50 - 100kW	Total
Systems									
	ACT	127	17	25	169	137	16	35	187
	NSW	4,713	434	492	5,640	4665	459	621	5,746
	NT	86	38	29	153	102	37	38	177
	QLD	3,763	677	339	4,779	3583	712	350	4,645
	SA	1,399	366	204	1,969	1446	312	241	1,999
	TAS	112	21	25	158	121	22	26	169
	VIC	3,436	509	585	4,530	3469	507	625	4,601
	WA	984	216	104	1,304	1182	271	118	1,570
		14,621	2,278	1,803	18,702	14,705	2,336	2,054	19,095
Installed capacity (kW)									
	ACT	945	582	2,214	3,740	1,456	648	3,564	5,668
	NSW	38,946	15,589	42,003	96,538	43,879	17,269	53,076	114,224
	NT	1,007	1,375	2,239	4,621	1,246	1,354	3,133	5,732
	QLD	36,177	24,684	30,723	91,584	36,306	26,031	31,032	93,370
	SA	15,975	12,775	18,106	46,856	16,906	10,764	20,634	48,304
	TAS	1,875	685	1,915	4,475	1,627	707	1,732	4,066
	VIC	38,056	18,201	50,135	106,392	33,245	15,922	46,653	95,820
	WA	11,480	8,253	10,182	29,916	13,034	9,585	10,430	33,049
		144,460	82,144	157,518	384,122	147,698	82,281	170,254	400,233
		2021				2022			
		10 - 30kW	30 - 50kW	50 - 100kW	Total	10 - 30kW	30 - 50kW	50 - 100kW	Total
Systems									
	ACT	154	18	40	211	159	18	41	218
	NSW	5,152	507	686	6,346	5,313	523	708	6,544
	NT	112	41	42	195	117	42	44	203
	QLD	3,875	770	378	5,024	3,989	793	390	5,171
	SA	1,541	332	257	2,130	1,592	344	265	2,201
	TAS	134	24	28	186	139	25	29	193
	VIC	3,786	554	682	5,021	3,916	573	705	5,194
	WA	1,315	301	131	1,747	1,366	313	136	1,815
		16,068	2,547	2,244	20,860	16,591	2,631	2,318	21,540
Installed capacity (kW)									
	ACT	1,639	729	4,013	6,382	1,694	754	4,146	6,594
	NSW	48,465	19,074	58,623	126,162	49,977	19,669	60,451	130,096
	NT	1,373	1,492	3,453	6,318	1,431	1,555	3,598	6,584
	QLD	39,268	28,155	33,563	100,986	40,420	28,981	34,548	103,949
	SA	18,009	11,466	21,980	51,455	18,613	11,851	22,717	53,181
	TAS	1,789	778	1,905	4,472	1,860	809	1,980	4,649
	VIC	36,283	17,377	50,917	104,577	37,533	17,976	52,671	108,180
	WA	14,499	10,663	11,603	36,766	15,064	11,079	12,055	38,198
		161,326	89,735	186,057	437,117	166,592	92,673	192,168	451,433
		2023							
		10 - 30kW	30 - 50kW	50 - 100kW	Total				
Systems									
	ACT	157	18	40	215				
	NSW	5,239	516	698	6,453				
	NT	116	42	43	202				
	QLD	3,929	781	384	5,094				
	SA	1,572	339	262	2,173				
	TAS	138	25	29	192				
	VIC	3,870	566	697	5,134				
	WA	1,355	310	135	1,801				
		16,376	2,597	2,289	21,263				
Installed capacity (kW)									
	ACT	1,671	744	4,092	6,508				
	NSW	49,275	19,393	59,603	128,271				
	NT	1,422	1,545	3,576	6,543				
	QLD	39,817	28,548	34,032	102,397				
	SA	18,373	11,698	22,425	52,497				
	TAS	1,846	803	1,965	4,614				
	VIC	37,094	17,766	52,055	106,915				
	WA	14,947	10,992	11,961	37,900				
		164,446	91,489	189,710	445,645				

Residential PV Upgrades

Attachment 6

		2015	2016	2017	2018	2019	2020	2021	2022	2023
Systems										
	ACT	41	71	146	179	212	324	258	238	221
	NSW	2,175	4,452	8,666	8,183	9,832	12,737	9,257	8,372	7,736
	NT	30	36	88	141	163	250	207	196	187
	QLD	4,334	3,864	4,915	5,293	6,635	8,574	5,937	5,402	4,986
	SA	994	948	1,462	1,956	2,718	3,760	2,187	1,994	1,814
	TAS	96	106	119	225	303	451	311	288	268
	VIC	1,399	1,389	2,045	2,526	3,039	3,925	2,626	2,248	2,078
	WA	1,152	1,118	1,524	1,940	2,161	3,720	3,077	2,809	2,581
		10,221	11,984	18,965	20,443	25,062	33,741	23,861	21,548	19,871
kw/System										
	ACT	3.11	5.29	4.39	5.33	5.33	5.33	5.33	5.33	5.33
	NSW	3.39	3.52	3.94	4.91	4.91	4.91	4.91	4.91	4.91
	NT	3.89	3.19	3.33	3.45	3.45	3.45	3.45	3.45	3.45
	QLD	2.95	3.99	4.88	5.72	5.72	5.72	5.72	5.72	5.72
	SA	4.40	4.23	4.77	5.46	5.46	5.46	5.46	5.46	5.46
	TAS	3.83	3.99	4.14	4.48	4.48	4.48	4.48	4.48	4.48
	VIC	3.42	3.48	3.99	4.61	4.61	4.61	4.61	4.61	4.61
	WA	2.20	3.04	3.77	4.77	4.77	4.77	4.77	4.77	4.77
		3.17	3.69	4.24	5.11	5.12	5.11	5.10	5.10	5.10
Installed capacity (kW)										
	ACT	127	376	642	953	1,130	1,728	1,375	1,271	1,180
	NSW	7,371	15,683	34,143	40,144	48,229	62,482	45,411	41,069	37,952
	NT	117	115	293	488	563	863	714	678	646
	QLD	12,766	15,420	23,990	30,277	37,956	49,045	33,964	30,904	28,521
	SA	4,371	4,009	6,973	10,674	14,830	20,515	11,933	10,881	9,896
	TAS	368	423	493	1,008	1,355	2,019	1,394	1,290	1,199
	VIC	4,786	4,827	8,150	11,644	14,010	18,095	12,107	10,362	9,582
	WA	2,531	3,396	5,742	9,251	10,302	17,741	14,674	13,393	12,306
		32,437	44,249	80,424	104,440	128,377	172,489	121,572	109,848	101,282
					29.9%	22.9%	34.4%	-29.5%	-9.6%	-7.8%
Certificates/kW										
	ACT	20.58	20.64	19.24	17.88	16.49	15.12	13.74	12.37	10.99
	NSW	20.81	20.83	19.32	17.97	16.56	15.18	13.80	12.42	11.04
	NT	23.60	23.35	21.67	20.05	18.57	17.03	15.48	13.93	12.38
	QLD	20.59	20.62	19.28	17.89	16.52	15.15	13.77	12.39	11.02
	SA	20.53	20.57	19.24	17.85	16.49	15.12	13.74	12.37	10.99
	TAS	17.64	17.63	16.44	15.29	14.09	12.92	11.75	10.57	9.40
	VIC	17.85	17.95	16.74	15.55	14.35	13.16	11.96	10.76	9.57
	WA	20.51	20.55	19.22	17.86	16.47	15.10	13.73	12.35	10.98
		20.20	20.37	19.02	17.64	16.27	14.92	13.58	12.23	10.87
Ceertificates created										
	ACT	2,623	7,751	12,346	17,044	18,641	26,127	18,900	15,726	12,977
	NSW	153,402	326,642	659,574	721,402	798,602	948,399	626,621	510,028	418,947
	NT	2,754	2,685	6,344	9,789	10,459	14,702	11,044	9,450	7,998
	QLD	262,812	318,014	462,459	541,635	627,164	742,859	467,662	382,974	314,178
	SA	89,712	82,482	134,156	190,556	244,567	310,124	163,991	134,584	108,799
	TAS	6,493	7,458	8,105	15,412	19,095	26,082	16,375	13,638	11,268
	VIC	85,453	86,642	136,457	181,034	201,072	238,050	144,798	111,533	91,676
	WA	51,911	69,786	110,356	165,240	169,714	267,892	201,436	165,466	135,145
		655,160	901,460	1,529,797	1,842,111	2,089,315	2,574,233	1,650,827	1,343,399	1,100,987
			37.6%	69.7%	20.4%	13.4%	23.2%	-35.9%	-18.6%	-18.0%

Non Residential Upgrade PV installations

Attachment 6

		2015	2016	2017	2018	2019	2020	2021	2022	2023
Systems										
ACT		8	9	5	15	15	18	19	15	17
NSW		207	285	400	627	721	699	702	547	602
NT		8	12	14	13	17	16	16	13	16
QLD		181	256	382	554	626	589	579	451	473
SA		96	126	150	307	347	341	330	258	283
TAS		6	11	18	35	34	41	41	32	37
VIC		137	163	295	423	532	471	467	366	402
WA		66	86	111	112	122	147	149	117	153
		709	948	1,375	2,085	2,414	2,322	2,303	1,799	1,984
kw/System										
ACT		23.20	13.83	28.29	12.62	20.46	20.46	20.46	20.46	20.46
NSW		13.69	18.60	17.87	21.88	19.87	19.87	19.87	19.87	19.87
NT		42.91	32.09	14.41	35.08	24.75	24.75	24.75	24.75	24.75
QLD		11.66	21.77	19.78	20.81	20.29	20.29	20.29	20.29	20.29
SA		15.20	21.73	22.60	28.14	25.37	25.37	25.37	25.37	25.37
TAS		6.32	8.03	20.07	24.54	22.31	22.31	22.31	22.31	22.31
VIC		15.26	17.12	19.00	21.28	20.14	20.14	20.14	20.14	20.14
WA		13.47	16.60	23.67	19.49	21.58	21.58	21.58	21.58	21.58
		14.04	19.44	19.66	22.32	20.99	21.03	21.01	21.02	21.04
Installed capacity (kW)										
ACT		186	124	141	190	305	373	382	299	358
NSW		2,835	5,301	7,147	13,708	14,323	13,885	13,942	10,877	11,959
NT		343	385	202	454	413	407	407	321	405
QLD		2,110	5,572	7,558	11,517	12,715	11,951	11,751	9,151	9,590
SA		1,459	2,738	3,390	8,632	8,803	8,648	8,375	6,549	7,184
TAS		38	88	361	861	767	915	915	720	835
VIC		2,091	2,791	5,605	9,009	10,713	9,480	9,406	7,361	8,088
WA		889	1,427	2,627	2,179	2,633	3,180	3,216	2,528	3,306
		9,952	18,427	27,032	46,549	50,673	48,839	48,394	37,806	41,724
Certificates/kW			85.2%	46.7%	72.2%	8.9%	-3.6%	-0.9%	-21.9%	10.4%
ACT		20.71	20.70	19.33	17.94	16.56	15.18	13.80	12.42	11.04
NSW		20.84	20.79	19.45	18.05	16.67	15.28	13.90	12.51	11.12
NT		23.45	23.82	21.98	20.70	18.84	17.27	15.70	14.13	12.56
QLD		20.73	20.77	19.40	17.99	16.63	15.25	13.86	12.47	11.09
SA		20.66	20.61	19.29	17.89	16.53	15.16	13.78	12.40	11.02
TAS		17.71	17.72	16.56	15.39	14.20	13.01	11.83	10.65	9.46
VIC		17.96	18.55	17.05	15.72	14.62	13.40	12.18	10.96	9.75
WA		20.83	20.69	19.40	17.97	16.63	15.24	13.86	12.47	11.09
		20.26	20.46	18.90	17.53	16.18	14.86	13.51	12.15	10.81
Certificates created										
ACT		3,844	2,576	2,734	3,403	5,056	5,666	5,272	3,709	3,948
NSW		59,064	110,215	139,044	247,367	238,833	212,234	193,732	136,029	132,938
NT		8,050	9,172	4,436	9,406	7,782	7,022	6,396	4,539	5,086
QLD		43,749	115,748	146,649	207,190	211,470	182,206	162,866	114,152	106,333
SA		30,159	56,418	65,395	154,383	145,549	131,069	115,389	81,206	79,179
TAS		671	1,565	5,985	13,246	10,892	11,911	10,827	7,664	7,906
VIC		37,558	51,759	95,583	141,650	156,607	127,026	114,574	80,703	78,818
WA		18,523	29,537	50,974	39,149	43,777	48,472	44,564	31,526	36,653
		201,618	376,990	510,800	815,795	819,967	725,606	653,621	459,528	450,861
			87.0%	35.5%	59.7%	0.5%	-11.5%			

SWH Systems New Buildings

Attachment 7

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SWH systems installed															
ACT	507	236	422	432	190	135	266	374	364	308	214	213	214	209	209
NSW	3,361	5,098	4,522	2,579	2,646	2,946	3,076	3,464	3,582	3,653	3,433	3,325	3,244	3,198	3,223
NT	346	436	522	653	578	525	655	581	547	375	230	258	287	308	322
QLD	10,652	10,497	9,359	9,042	6,529	5,219	4,419	4,900	5,461	5,477	6,856	6,825	6,953	7,317	7,657
SA	1,126	1,669	1,677	1,060	765	801	546	554	459	382	495	460	424	400	393
TAS	177	266	192	137	83	111	208	278	236	321	559	505	448	399	382
VIC	17,124	20,119	20,559	17,726	16,873	18,058	20,490	21,494	22,913	25,182	25,719	24,746	23,811	23,000	22,979
WA	4,123	5,728	5,077	4,710	4,652	4,000	3,603	2,537	1,804	1,549	1,933	2,057	2,260	2,418	2,510
Total	37,416	44,049	42,330	36,339	32,316	31,795	33,263	34,182	35,366	37,247	39,439	38,389	37,640	37,249	37,675
Certificates created															
ACT	18,125	7,501	13,138	12,503	6,071	4,684	9,304	12,528	12,509	9,548	6,765	6,742	6,754	5,946	5,300
NSW	131,981	172,125	145,841	83,654	87,769	97,782	98,380	110,068	108,922	113,385	105,917	102,586	100,073	88,800	79,542
NT	10,468	13,429	13,929	18,070	15,734	15,266	19,750	17,451	15,961	11,628	6,386	7,173	7,960	7,698	7,150
QLD	374,016	339,788	275,585	259,317	198,795	171,276	145,694	151,905	168,901	165,795	204,302	203,364	207,174	196,220	182,525
SA	38,281	54,845	51,074	29,642	22,678	25,088	17,466	17,122	14,229	12,368	13,998	13,008	11,996	10,178	8,897
TAS	11,377	8,115	4,994	3,889	2,401	3,429	6,115	8,356	7,047	9,568	16,293	14,725	13,073	10,477	8,902
VIC	457,839	533,397	531,095	434,730	461,636	511,680	589,200	626,379	672,769	736,083	767,136	738,114	710,235	617,442	548,331
WA	142,995	188,152	162,535	144,164	143,109	131,865	126,916	91,052	60,782	49,802	60,908	64,796	71,189	68,564	63,270
Total	1,185,082	1,317,352	1,198,191	985,969	938,193	961,070	1,012,825	1,034,861	1,061,120	1,108,176	1,181,705	1,150,509	1,128,454	1,005,325	903,918
Certificates per SWH System															
ACT	35.7	31.8	31.1	28.9	32.0	34.7	35.0	33.5	34.4	31.0	31.6	31.6	31.6	28.5	25.3
NSW	39.3	33.8	32.3	32.4	33.2	33.2	32.0	31.8	30.4	31.0	30.8	30.8	30.8	27.8	24.7
NT	30.3	30.8	26.7	27.7	27.2	29.1	30.2	30.0	29.2	31.0	27.8	27.8	27.8	25.0	22.2
QLD	35.1	32.4	29.4	28.7	30.4	32.8	33.0	31.0	30.9	30.3	29.8	29.8	29.8	26.8	23.8
SA	34.0	32.9	30.5	28.0	29.6	31.3	32.0	30.9	31.0	32.4	28.3	28.3	28.3	25.5	22.6
TAS	64.3	30.5	26.0	28.4	28.9	30.9	29.4	30.1	29.9	29.8	29.2	29.2	29.2	26.2	23.3
VIC	26.7	26.5	25.8	24.5	27.4	28.3	28.8	29.1	29.4	29.2	29.8	29.8	29.8	26.8	23.9
WA	34.7	32.8	32.0	30.6	30.8	33.0	35.2	35.9	33.7	32.2	31.5	31.5	31.5	28.4	25.2
Total	31.7	29.9	28.3	27.1	29.0	30.2	30.4	30.3	30.0	29.8	30.0	30.0	30.0	27.0	24.0

SWH Systems

Replacement Market

Attachment 8

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
SWH systems installed																	
ACT	414	888	1,467	724	616	302	263	316	306	303	341	384	421	442	465	488	512
NSW	5,489	16,528	82,095	33,427	20,809	8,231	6,499	6,695	5,536	5,147	5,389	5,249	4,645	4,877	5,121	5,377	5,645
NT	866	826	1,385	867	745	518	306	501	408	339	418	596	723	760	798	837	879
QLD	6,416	10,699	26,007	23,765	21,578	9,931	6,881	8,214	7,386	6,542	6,563	6,598	6,759	7,097	7,452	7,824	8,216
SA	1,966	4,080	7,668	5,143	3,767	2,413	2,218	1,129	2,011	1,727	2,158	2,455	2,116	2,222	2,333	2,450	2,572
TAS	237	734	2,092	1,167	1,533	762	744	851	595	669	798	804	1,118	1,174	1,232	1,294	1,359
VIC	1,677	8,759	24,996	7,614	5,887	3,868	2,735	2,555	2,597	6,208	6,213	6,799	5,724	6,010	6,311	6,626	6,957
WA	6,604	8,792	11,569	10,337	7,785	7,102	6,337	6,672	6,602	6,901	6,898	6,774	7,831	8,222	8,633	9,065	9,518
Total	23,669	51,306	157,279	83,044	62,720	33,127	25,983	26,933	25,441	27,836	28,778	29,660	29,337	30,804	32,344	33,961	35,659
Certificates created																	
ACT	12,141	28,397	50,169	22,897	19,099	9,354	8,345	10,163	10,135	9,535	11,177	12,121	13,451	14,042	14,744	13,933	13,004
NSW	170,768	713,696	3,021,137	1,167,325	662,471	262,431	210,361	212,620	173,598	158,119	165,374	159,899	140,585	148,091	155,496	146,943	137,147
NT	26,915	26,505	65,827	31,740	20,807	14,673	8,781	13,514	11,362	9,709	12,288	16,832	20,872	21,688	22,772	21,520	20,085
QLD	191,928	346,445	1,045,900	793,279	666,758	309,804	217,464	256,632	231,221	203,310	202,000	203,528	207,471	218,386	229,305	216,694	202,247
SA	60,666	133,496	321,816	170,271	109,047	68,624	64,718	34,607	59,195	51,229	62,987	71,780	62,416	65,251	68,513	64,745	60,429
TAS	6,653	58,209	143,895	61,940	40,289	22,502	23,303	25,070	18,256	20,408	24,859	25,028	33,227	35,704	37,489	35,427	33,065
VIC	47,899	578,923	1,652,280	398,889	184,229	118,345	85,835	79,966	83,416	188,755	186,059	205,385	173,135	181,668	190,752	180,260	168,243
WA	184,539	287,502	385,193	310,613	220,545	198,832	185,532	194,235	196,657	204,032	205,085	198,962	227,009	239,924	251,920	238,065	222,194
Total	701,509	2,173,173	6,686,217	2,956,954	1,923,245	1,004,565	804,339	826,807	783,840	845,097	869,829	893,536	878,166	924,754	970,992	917,587	856,415
Certificates per SWH System																	
ACT	29.3	32.0	34.2	31.6	31.0	31.0	31.7	32.2	33.1	31.5	32.8	31.6	31.9	31.7	31.7	28.6	25.4
NSW	31.1	43.2	36.8	34.9	31.8	31.9	32.4	31.8	31.4	30.7	30.7	30.5	30.3	30.4	30.4	27.3	24.3
NT	31.1	32.1	47.5	36.6	27.9	28.3	28.7	27.0	27.8	28.6	29.4	28.3	28.9	28.6	28.6	25.7	22.8
QLD	29.9	32.4	40.2	33.4	30.9	31.2	31.6	31.2	31.3	31.1	30.8	30.8	30.7	30.8	30.8	27.7	24.6
SA	30.9	32.7	42.0	33.1	28.9	28.4	29.2	30.7	29.4	29.7	29.2	29.2	29.5	29.4	29.4	26.4	23.5
TAS	28.1	79.3	68.8	53.1	26.3	29.5	31.3	29.5	30.7	30.5	31.2	31.1	29.7	30.4	30.4	27.4	24.3
VIC	28.6	66.1	66.1	52.4	31.3	30.6	31.4	31.3	32.1	30.4	29.9	30.2	30.2	30.2	30.2	27.2	24.2
WA	27.9	32.7	33.3	30.0	28.3	28.0	29.3	29.1	29.8	29.6	29.7	29.4	29.0	29.2	29.2	26.3	23.3
Total	29.6	42.4	42.5	35.6	30.7	30.3	31.0	30.7	30.8	30.4	30.2	30.1	29.9	30.0	30.0	27.0	24.0

Delay in Certificate creation

Attachment 9

Determining total number of STCs to be created for 2019 generation year

Data up to and Including 9 Aug 2019

	Total to 9 Aug (Week 32)	To be created in 2019	To be created in 2020	Total	% created after week 32	% created after week 52	% to be created as share of Week 32
1. Solar PV							
New Non-Residential							
ACT	24,916	22,227	16,757	63,901	39.0%	73.8%	156.46%
NSW	719,998	670,116	268,360	1,658,474	43.4%	83.8%	130.34%
NT	35,974	38,106	14,311	88,390	40.7%	83.8%	145.71%
QLD	661,051	680,517	226,365	1,567,933	42.2%	85.6%	137.19%
SA	330,332	326,309	141,243	797,883	41.4%	82.3%	141.54%
TAS	27,722	25,233	12,496	65,451	42.4%	80.9%	136.10%
VIC	668,351	598,943	317,798	1,585,092	42.2%	80.0%	137.16%
WA	248,430	197,686	63,786	509,902	48.7%	87.5%	105.25%
	2,716,774	2,544,215	1,044,384	6,305,372	43.1%	83.4%	132.09%
New Residential							
ACT	177,584	191,996	56,367	425,948	41.7%	86.8%	139.86%
NSW	3,379,977	3,184,042	614,416	7,178,435	47.1%	91.4%	112.38%
NT	187,111	208,925	33,907	429,943	43.5%	92.1%	129.78%
QLD	3,580,289	3,047,531	429,745	7,057,565	50.7%	93.9%	97.12%
SA	1,230,711	1,194,386	265,216	2,690,313	45.7%	90.1%	118.60%
TAS	86,581	75,368	14,942	176,891	48.9%	91.6%	104.31%
VIC	2,353,649	2,511,041	816,768	5,681,458	41.4%	85.6%	141.39%
WA	1,658,501	1,255,303	142,127	3,055,931	54.3%	95.3%	84.26%
	12,654,403	11,409,600	2,180,446	26,244,449	48.2%	91.7%	107.39%
2. SWH							
New Buildings	441,924	472,034	267,632	1,181,590	37.4%	77.3%	167.4%
Replacement Market	456,427	363,741	57,830	877,998	52.0%	93.4%	92.4%
	898,351	835,775	325,462	2,059,587	43.6%	84.2%	129.3%

Variance Analysis

Attachment 10

1. Comparison of expected STCs to be created for the calendar year

	2018	2019	2020	2021
Current Analysis (September 2019)				
STCs for systems installed in the year				
Solar PV	28,191	35,052	29,522	22,887
SWH	2,002	2,060	2,075	2,099
Total	30,193	37,112	31,597	24,986
Less STCs submitted the following year (lag)	3,357	4,126	3,513	2,778
Add Previous year installs created this year	2,580	3,357	4,126	3,513
STCs submitted for creation	29,416	36,342	32,210	25,721
Previous GEM Report (Jan 2019)				
STCs for systems installed in the year				
Solar PV	28,357	30,741	24,067	20,963
SWH	1,989	2,031	2,086	2,101
Total	30,346	32,772	26,153	23,064
Less STCs submitted the following year (lag)	3,357	3,625	2,893	2,551
Add Previous year installs created this year	2,580	3,357	3,625	2,893
STCs submitted for creation	29,569	32,504	26,885	23,405
Variance	-153	3,838	5,325	2,316
Explained by:				
Increase in system installations for year	-153	4,339	5,444	1,923
Impact of creation lags	0	-501	-119	393

Variance Analysis

Attachment 10

2. Comparison of Market segments on an Installation year basis

Current Analysis (September 2019)

'000 STCs by Installation Year	2018	2019	2020	2021
Solar PV				
New Residential	19,699	25,994	20,318	14,720
Residential System Upgrades	1,842	2,089	2,574	1,651
Non Residential	5,834	6,148	5,904	5,862
Non Residential System Upgrades	816	820	726	654
Total Solar PV	28,191	35,052	29,522	22,887
SWH				
New Homes	1,108	1,182	1,151	1,128
Replacement	894	878	925	971
Total SWH	2,002	2,060	2,075	2,099
Total STCs	30,193	37,112	31,597	24,986

Previous GEM Report (Jan 2019)

'000 STCs by Installation Year	2018	2019	2020	2021
Solar PV				
New Residential	20,022	21,732	16,801	14,474
Residential System Upgrades	1,932	2,127	1,604	1,345
Non Residential	5,601	6,087	5,017	4,536
Non Residential System Upgrades	802	795	645	608
Total Solar PV	28,357	30,741	24,067	20,963
SWH				
New Homes	1,095	1,083	1,115	1,107
Replacement	894	948	970	994
Total SWH	1,989	2,031	2,086	2,101
Total STCs	30,346	34,803	28,239	25,164

Variance

'000 STCs by Installation Year	2018	2019	2020	2021
Solar PV				
New Residential	-323	4,262	3,517	246
Residential System Upgrades	-90	-38	970	306
Non Residential	233	61	887	1,327
Non Residential System Upgrades	14	25	81	46
Total Solar PV	-165	4,310	5,455	1,924
SWH				
New Homes	13	99	35	21
Replacement	-1	-70	-46	-23
Total SWH	12	29	-11	-1
Total STCs	-153	4,339	5,444	1,923
Creation lag adjustments	0	-501	-119	393
Total Variance	-153	3,838	5,325	2,316

Variance Analysis**Attachment 10****3. Consideration of PV installations and capacity installed**

by Installation Year	2018	2019	2020	2021
Current Analysis (September 2019)				
Number of Systems Installed	225,017	298,681	268,741	218,102
Avge kW/system	7.2	7.3	7.5	7.9
Avge Certificates/kW	17.4	16.0	14.6	13.2
MW Installed	1,619	2,189	2,019	1,730
Eligible Certificates ('000)	28,191	35,052	29,522	22,887
Previous GEM Report (Jan 2019)				
Number of Systems Installed	230,178	268,127	224,864	209,480
Avge kW/system	7	7	7	8
Avge Certificates/kW	17	16	15	13
MW Installed	1,626	1,927	1,654	1,589
Eligible Certificates ('000)	28,357	30,741	24,067	20,963
Variance				
Number of Systems Installed	-5,161	30,554	43,877	8,622
Avge kW/system	0.13	0.14	0.16	0.35
Avge Certificates/kW	0.0	0.1	0.1	0.0
MW Installed	-7	262	365	141
Eligible Certificates ('000)	-165	4,310	5,455	1,924
STC Impact of:				
Increase in number of systems ('000 STCs)	-636	3,503	4,696	863
Increase in kW per system ('000 STCs)	471	807	759	1,061
	-165	4,310	5,455	1,924