Small-scale Technology Certificates Forecasts (2014 to 2016)

Prepared for
Clean Energy Regulator

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IES
Intelligent Energy Systems

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Executive Summary

IES Advisory has been engaged by the Clean Energy Regulator to provide forward estimates of Small-scale Technology Certificate (STC) creation from 2014-2016 to inform the decision making process for determining the binding Small-scale Technology Percentage for 2014 and the non-binding Small-scale Technology Percentage for 2015 and 2016.

Projections have been based on IES analysis and assumptions derived from underlying installation data as provided by the Clean Energy Regulator, understanding of market drivers and the current regulatory environment for Small Generation Units and Solar Water Heaters. Forecasts have been made on a state and technology type level per year.

The largest segment of STC creation by far has been residential solar rooftop PV and has historically been challenging to assess under changing circumstances in the form of government initiatives, panel prices and feed-in tariffs. 2013 was the first year that all of these subsidies (ignoring the underlying STCs) expired leading to a stabilisation of STC creation over recent months in this category.

Under the "One million solar roofs" program, it is assumed that a $500 rebate will be provided for installations but will be capped at 100,000 installations per year with priority given to solar water heaters and to low income earners. The incentive program is expected to start from January 2015. We expect low income earners to install smaller sized PV systems (1.5kW) in addition to the normal solar PV uptake without the rebate and expect this to be made available to other households should this not be taken up by low income households.

Technology Type	2014	2015	2016
SGU	14,542,237	16,471,884	17,204,252
SWH - New Housing	885,421	1,247,471	1,270,717
SWH - Replacement of electric water heaters	580,220	953,277	877,844
TOTAL	16,007,878	18,672,631	19,352,814

IES estimates that yearly solar PV installations will increase from approximately 184,231 installations in 2014 to 239,247 in 2016 across Australia, driven by QLD and NSW due to eligible housing growth. On aggregate this segment is expected to contribute 14.5m to 17.2m STCs from 2014 to 2016, comprising 88% of total STC creation as forecast. This compares to an estimated 15.2m certificates from solar PV in 2013 which included 6 months of the Solar Credit Multiplier at 2. On a capacity basis as at November 2013, there is 3,200MW of solar PV installed with the next 3 years forecast to add approximately another 800MW each year across Australia.

The additional growth forecast can be summarised by additional housing growth and impact of the "One million solar roofs" program in the context of forecast stable uptake rates. We expect the environment over the next 3 years to remain stable and relatively unchanged from today with technological advances in solar PV offset by a weakening AUD and recovery of operating conditions amongst global manufacturers. The net effect results in slight improvements to discounted payback periods in each state.

Solar Water Heaters account for 10%-12% of all certificate creation historically. Solar Water Heater installations for new housing is forecast to rise from 30,502in 2014 to 43,141 in 2016 driven by the "One million solar roofs" program and its priority towards Solar Water Heaters. Due to the start of the "One million solar roofs" program, replacement SWH installations are forecast to increase in 2015 and then drop off in 2016 (above 2014 levels) as the number of eligible households starts to decrease. The average life span of electric water heaters is more than seven years leaving a smaller number of eligible households for replacement.

Across the 3 years we expect STC creation to be stable with slight increases to STC creation over each year.

1 Introduction

This report presents analysis of recent trends in the creation of Small-scale Technology Certificates (STC) and forecast results of modelling undertaken by IES Advisory Services (IES) for the purpose of projecting STC creation for a projection period from 2014 to 2016. These figures are intended to be a guide for the Clean Energy Regulator in determining estimates of the Small-scale Technology Percentage over this period.

1.1 Notes

Unless otherwise stated, all prices are in real January 2013 dollars, except for analysis of historical pricing outcomes which are shown in nominal terms. Years are also quoted on a calendar basis.

1.2 Report Structure

This report is structured as follows:

- Chapter 2 provides background to the Small-scale Renewable Energy Scheme (SRES) via an analysis of trends in STC creation and market outcomes;
- Chapter 3 provides an overview of relevant federal and state level policy incentives, and key drivers impacting mid-term trend of small-scale renewable uptake;
- Chapter 4 analyses historical data and trend on the solar PV and solar water heaters uptake;
- Chapter 5 presents our methodology and assumptions for projections of STC creation;
- Chapter 6 and 7 presents projection results for STCs created from Small Generation Unit (SGU) installations, and Solar Water Heater (SWH) installations; and
- Chapter 8 concludes the report with a summary of our findings.

2 Background

As part of the split of the Renewable Energy Target into the Large-scale Renewable Energy Target and Small-scale Renewable Energy Scheme (SRES), the Clean Energy Regulator (CER) is required to administer the creation and surrender of STCs including the annual calculation of an annual Small-scale Technology Percentage (STP). The STP is derived from an estimate of the number of STCs as a proportion of total liable electricity demand prior to 15 March each year under section 40B of the Renewable Energy (Electricity) Act 2000. The forward estimates of STC creation (2014-2016) used to inform the CER in determining the STP is the focus of this project. An STC is equivalent to 1MWh of generation by eligible Small Generation Units (SGU) comprising of PV, wind and hydro systems, or electricity displaced by the installation of SWH.

The number of STCs created each year needs to be well estimated to avoid the over-supply or under-supply of STCs to incentivise small-scale renewable generations by maintaining a stable certificate price level.

IES have modelled STC creation taking into consideration the broader range of factors such as the State and Commonwealth-based incentives, technologies, electricity and system prices. These factors are discussed in the following sections.

2.1 Creation of STCs under the SRES

2.1.1 Non-binding STC targets

As part of its legislative requirements, the CER publishes forward estimates of the STC target out to 3 years. These estimates are, but are intended to provide guidance to stakeholders. The binding STP for the 2013 year was 19.7%, equivalent to 35.7 million STCs (based on an estimate of around 16 million STCs carried over from 2012).

The non-binding STP published on 15 March 2013 under section 40B of the *Renewable Energy (Electricity) Act 2000* for subsequent years are as follows:

- 2014 is 8.98 per cent (equivalent to 16.7 million STCs as a proportion of total estimated liable electricity for the 2014 year); and
- 2015 is 8.49 per cent (equivalent to 15.8 million STCs as a proportion of total estimated liable electricity for the 2015 year).

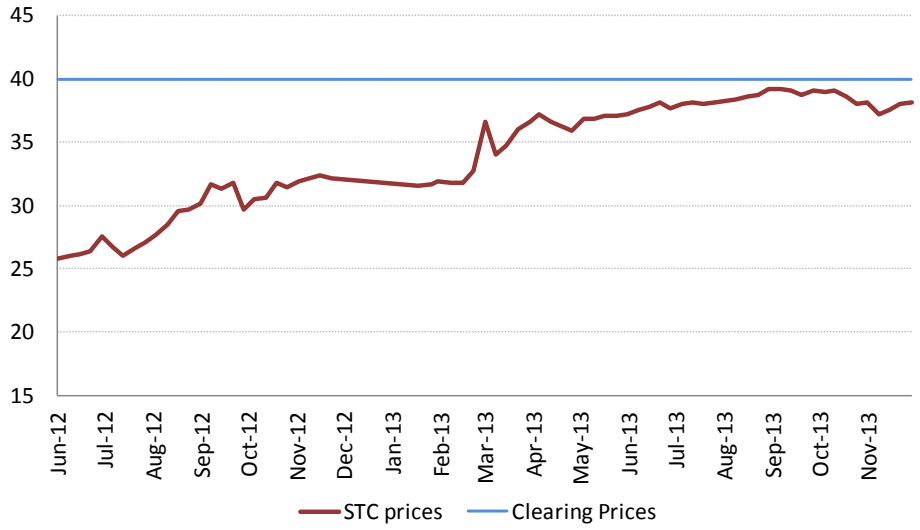
2.1.2 The market for STCs: mechanics and recent trends

When an STC eligible installation occurs, the holder of the STC can sell the certificate via the STC clearinghouse or on the open market. The clearinghouse operates on a first-in-first-out basis, with sellers placing their STCs in a queue. When the supply of STCs exceeds demand, the clearinghouse is said to be in surplus. Conversely, when the number of orders for STCs exceeds the number in the queue the market is said to be 'in deficit'. The price for all trades through the clearinghouse is fixed at $40 a certificate.

Alternatively, the holder of an STC can sell it onto the open market. Figure 2-1 presents the historical market prices of STCs from Jun 2012. The STC prices have been steadily

rising from June 2012 towards the clearinghouse price of $40 per certificate maintaining a slight discount.

Figure 2-1 STC market price history ($ per certificate)



Source: The Green Room, weekly newsletter from Nextgen.

Since July 2013, the STC prices have generally remained above $38 per certificate, reflecting the expectation on the slowing of solar PV and Solar Water Heater installations after the closure of many federal and state incentive programs, and subsequent slowing and stabilisation of STC creation in the market.

2.1.3 Sources of STC creation

STC creations fall into one of the following two categories:

- STCs from SGUs, which encompass photovoltaic systems (PVs), micro-wind and micro-hydro generation units; and
- STCs from SWHs, which are created by the installation of solar water heaters and Heat Pump Water Heaters (HPWHs) that draw heat from the ground.

Table 2-1 shows the breakdown of STC creation for 2013 (to November 2013) by technology type. IES expect the total number of STCs created for the full year to be approximately 21 million. PV systems accounted for the majority of STC creations of total STCs created (90%) and 76% of total installations.

Table 2-1 Profile of STC creation by technology (2013)

Installation type	STCs created	Number of installations
SGU - Hydro	80	2
SGU - Solar	17,894,940	202,173
SGU - Wind	128	1
SWH	1,364,573	51,167
HPWH	299,713	13,108
TOTAL	19,559,434	266,451

Source: CER data to November 2013.

For the purposes of this report we limit our examination of SGUs to solar PV systems, as the relative impact of small-scale wind and hydro is negligible. As a result, we have used the terms SGU and PV system interchangeably throughout the report. Furthermore, SWHs can be considered a reasonably close substitute for HPWHs and so we have treated both technologies as a single category.

3 Policy Review

The Small-scale Renewable Energy Scheme, state solar feed-in tariffs and solar credit multiplier put in place by both the federal government and the state governments in the last few years have prompted phenomenal growth in the uptake of solar rooftop PV, SWH, and other small-scale renewables in the residential and commercial sector in Australia.

The main national policies reviewed in this chapter are the national Renewable Energy Target (RET) scheme, the Direct Action Plan and One Million Roofs program, and various state small-scale solar incentives, such as the New South Wales Solar Bonus Scheme, Queensland Solar Bonus Scheme and Victorian Feed-in Tariff Scheme. Other relevant policies, such as energy efficiency schemes and building standards are also discussed in this chapter.

The policy impact on the STC creation is expected to be an approximation as it is largely intertwined with other factors, such as household decision patterns, market maturity, installation and STC creation/registration lifecycle, system costs and economics. This study focuses on existing policies and measures affecting the small-scale renewables eligible for STCs.

3.1 Small-scale Renewable Energy Scheme

Small-scale Renewable Energy Scheme was separated from the Large-scale Renewable Energy Target (LRET) from 1 Jan 2011. The eligible technologies to create STCs under SRES include small generation units (small-scale solar photovoltaic, small wind turbines and micro hydroelectric systems) and solar water heaters.

The current Coalition Government has announced that the RET will be reviewed in 2014[1]. Although this review may impact the SRES scheme, the key drivers for the up-take of solar PV or solar water heaters will however remain largely driven by the federal and state level subsidies, cost of systems, electricity prices and STC prices.

3.2 Direct Action Plan and One Million Solar Roofs

Under the current government's Direct Action Plan, funding will be provided and a range of measures will be introduced to further promote the use of renewable energy in homes and communities. Some proposed initiatives for solar energy include:

- One Million Roofs Solar program;
- Supporting Solar Towns and Schools; and.

[1] The potential impact of this review on STC creation has not been included

- Supporting Solar Energy in Homes by providing incentives for the installation of residential solar electric systems and replacement of energy-intensive electric hot water systems.

3.2.1 Carbon Prices

Australian greenhouse gas emissions are currently regulated by the *Clean Energy Act 2011*, which establishes a national Carbon Price Mechanism (CPM) beginning with a fixed carbon price period running from 1 July 2012 through to June 30 2015, followed by a floating price period – or an emissions trading scheme (ETS).

The carbon tax bill is expected to be successfully repealed by the current government and will directly impact wholesale electricity prices in the NEM and other jurisdictions, and will subsequently flow through to retail electricity tariffs. The extent of reduction in retail electricity prices is however likely to vary among retailers and regions.

3.2.2 One Million Solar Roofs

The government has set the goal of one million additional solar energy roofs by 2020. We have assumed a $500 rebate for either solar panels or solar hot water systems for up to 100,000 low income households capped at a total cost of $50 million per year. Heat pumps will also be eligible under the program.

Although further details of this initiative have not yet been released by the Federal Government, it is expected to provide extra incentive for households to install solar water heaters or rooftop PV aimed at low-income households.

3.3 Subsidies for PV systems

Some solar PV subsidies in Australia have been phased out by the federal and state governments in the last couple of years, including the end of the Solar Credits Multiplier (SCM) and the reduction in state-based feed-in tariffs, in line with the falling cost of PV systems.

3.3.1 Solar Credits Multiplier

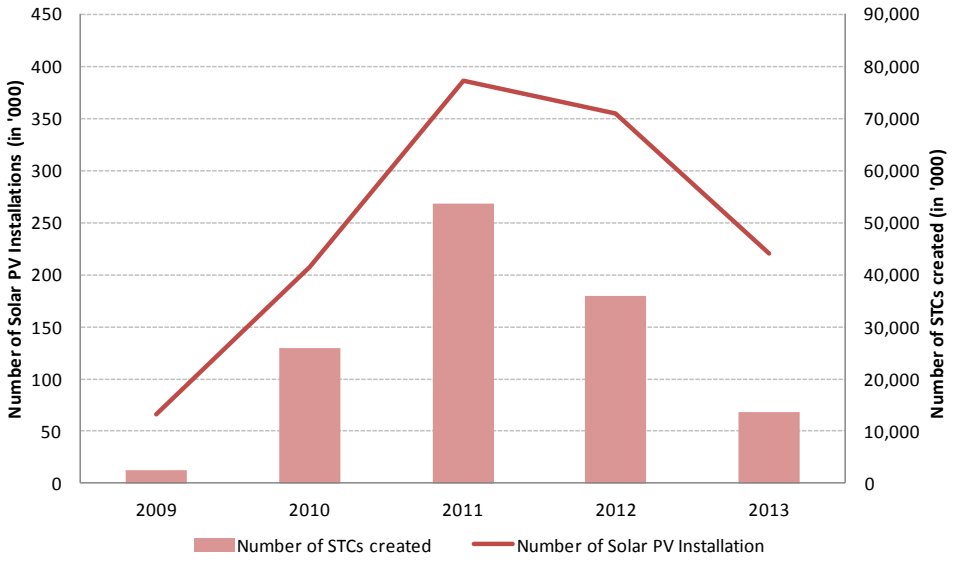
The SCM was a federal government initiative which allowed PV systems to create multiple certificates of actual generated energy over the deeming period. This provided additional upfront cost relief as systems were initially allowed to register up to 5 times the number of certificates produced by the first 1.5 kW capacity of eligible PV systems installed before July 2011. Table 3-1 shows the history of the SCM which ended in July 2013 i.e. STCs are now awarded on a 1-for-1 basis against generation.

Table 3-1 Schedule of the SCM

	Up to 30 June 2011	July 11 – Jun 12	July 12 – June 13	From July 13
Multiplier	5	3	2	1 (scheme ends)

As the Solar Credits Scheme greatly reduced the upfront cost of purchasing a PV system the multiplier had a significant impact on installations of PV systems and more evidently on the number of certificates created, shown in Figure 3-1 below. The number of certificates and installations (386,212 installations and 56.2 million STCs for PV in 2011) peaked in 2011, in anticipation of the proposed drop in SCM the following year.

Figure 3-1 Impact of Solar Multiplier



3.3.2 Feed-in tariffs

Most of the states have announced the closure of state-based feed-in tariffs. Solar incentives however continue to be supported by many electricity retailers through the Retailer Contribution Scheme or Solar Buy-back Scheme at between 6-8c/kWh. The retailer payments are determined by relevant retailers each year.

- New South Wales: the NSW Solar Bonus Scheme offered 60 cents per kWh gross feed-in tariff to solar PV applicants till 27 October 2010 then a tariff of 20 cents per kWh till midnight 28 April 2011; after the closure of the scheme in April 2011, IPART set benchmark rates paid by retailers for new solar power participants of between 5.2c and 10.3c/kWh for 2011-2012, between 7.7c and 12.9c/kWh for the financial year 2012-2013, and between 6.6c and 11.2c/kWh for the financial year 2013-2014[2].
- Australian Capital Territory: ACT's gross feed-in tariff incentive program paid a premium rate of 45.7¢ per kWh for solar PV participants between 1 July 2010

[2] http://www.ipart.nsw.gov.au/Home/For_Consumers/Solar_energy

and 30 June 2013; at present ActewAGL is offering 7.5c/kWh net tariff for new applicants[3].

- Queensland: applications for the 44c/kWh net tariff for the QLD Solar Bonus Scheme closed at midnight 9 July 2012; From 10 July 2012 onwards, a new tariff of 8 cents per kWh was applied and set to end on 30 June 2014. The government is currently reviewing the future for solar feed-in tariffs in Queensland[4].
- South Australia: Up till 30 September 2011, solar PV applicants could receive the premium net solar feed-in tariff of 44 cents per kWh; a lower tariff of 16 cents per kWh was offered between 1 October 2011 and 30 September 2013; after the closure of the South Australian solar feed-in scheme from 1 October 2013, new applicants are only eligible for the Minimum retailer payment of 7.6 cents per kWh[5].
- Victoria: the Victoria Premium Net Feed-in Tariff of 60 cents per kWh concluded at the end of September 2011; from 1 January 2012 a transitional net feed-in tariff of 25 cents per kWh was offered to applications below 5 kW and a standard feed-in tariff offered to applications above 5 kW (up to 100 kW) at the same rate as their retail electricity tariff[6].
- Tasmania: before August 30 2013, solar PV applicants could receive the gross feed-in tariff of 27.785 cents per kWh; a transitional feed-in tariff rate of 8 cents per KWh applied for new customers from August 31 till December 2013; The Tasmanian Economic Regulator will determine the new feed-in tariff from 2014[7].
- Western Australia: a 40 cents per kWh net tariff was offered under the WA residential net feed-in tariff scheme (to 30 June 2011); 20 cents per kWh was offered between 1 July 2011 to 1 August 2011; new applicants after 1 August 2011 had to apply under the Renewable Energy Buyback Scheme to be paid by Synergy or Horizon Power[8].
- Northern Territory: Power and Water Corporation offers a gross buy-back rate at 25.91 cents per kWh for residential customers[9].

[3] http://www.actewagl.com.au/Product-and-services/Offers-and-prices/Prices/Residential/ACT/Feed-in-schemes/ActewAGL-Solar-buyback-scheme.aspx
[4] http://www.dews.qld.gov.au/energy-water-home/electricity/solar-bonus-scheme/frequently-asked-questions
[5] http://www.sa.gov.au/subject/Water,%20energy%20and%20environment/Energy
[6] http://www.solarchoice.net.au/blog/victoria-solar-feed-in-tariffs-standard-transitional/
[7] http://www.electricity.tas.gov.au/
[8] https://www.finance.wa.gov.au/cms/content.aspx?id=14713
[9] http://www.powerwater.com.au/customers/save/renewable_products_and_rebates/photovoltaic_pv_solar_systems/going_solar_faqs

Table 3-2 summarises the state-based incentives noting:

- Horizon Energy is currently offering up to 50 c/kWh buyback rate for household solar PV in the remote areas of Western Australia.
- Victoria is still offering solar net Feed-in Tariff, however at a much lower rate, reduced from 60 cents per kWh to 8 cents per kWh from 1 Jan 2013.
- Queensland is offering solar net Feed-in Tariff till 30 June 2014 at 8 cents per kWh.

Solar feed-in tariffs were a major driving factor behind the significant take-up of solar rooftop PV in the last few years, coupled with the rapid reduction in solar PV panel costs.

Table 3-2 Current Solar Incentives by State

State	Current solar incentives	Rates Paid	Feed-in Tariff Scheme	Feed-in Tariff in 2010
VIC	Victoria Transitional and Standard Feed-in Tariff scheme (net)	8 c/kWh for 2014	Open	60 c/kWh
NSW	Retailer contribution scheme (net)	6.6 c/kWh for FY2014	Closed	60 c/kWh
SA	Minimum retailer payment (net)	7.6 c/kWh for 2014 (reviewed annually)	Closed	44 c/kWh
QLD	Solar Bonus scheme (net Feed-in Tariff)	8 c/kWh till 30 June 2014	Open	44 c/kWh
ACT	Solar Buyback Scheme (gross)	7.5 c/kWh	Closed	50.05 c/kWh
TAS	Retailer contribution scheme (net)	8 c/kWh till the end of 2013	Closed	27 c/kWh
WA	Renewable Energy Buyback Scheme (rates, terms and conditions determined by relevant retailers) (net)	8.8529 c/kWh (synergy) 10 – 50 c/kWh (Horizon Power)	Closed	40 c/kWh
NT	Solar Buyback Scheme (gross)	25.91 c/kWh		25.91 c/kWh

3.4 Subsidies for SWHs

3.4.1 Phase-out of Electric Hot Water Systems

As part of its national strategy for energy efficiency the Australian Government announced the phasing out of greenhouse-intensive electric hot water systems from new buildings from 2011.

The restrictions have been placed on the installation of greenhouse-intensive water heaters in new detached, terrace, row and town houses (Class 1 buildings under the Building Code of Australia 2010). These regulations apply in Australian Capital Territory, South Australia and Western Australia currently.

The New South Wales Government has announced that it will not implement the mandatory phase out of electric hot water systems in existing homes[10] while standards for hot water installations in new detached, terrace or town house will continue to comply with the New South Wales BASIX – Building Sustainability Index.

In Queensland, the mandatory requirements to install energy efficient (gas, solar or heat pump) hot water systems in new houses and existing houses located in a gas reticulated area were also repealed on 1 February 2013[11].

3.4.2 Solar Hot Water Rebate

The Federal Solar Hot Water Rebate was concluded as a part of the Renewable Energy Bonus Scheme (REBS) on 30 June 2012. Most of state rebates on solar water heater systems were also closed, including Western Australia, Northern Territory, Australian Capital Territory, New South Wales, Queensland and Tasmania.

South Australia currently has a solar hot water rebate program targeting low income households offering a $500 rebate. Victoria offers a rebate of up to $1600 under its Metropolitan Melbourne and Regional Victorian Solar Hot Water programs, and extra credits may be provided under the Victorian Energy Efficiency Target.

Solar water heater systems remain supported through the SRES. Under this scheme, solar and heat-pump water heater systems are assigned Small-scale Technology Certificates (STCs).

The Table 3-3 below exhibits past and existing Solar Hot Water Heater rebate incentives.

[10] http://www.environment.nsw.gov.au/energy/hotwater.htm
[11] http://www.hpw.qld.gov.au/construction/Sustainability/SustainableHousingLaws

Table 3-3 Current Solar Hot Water Heater Incentives by State

State	Solar Hot Water Heater Rebate	Closing date	Other State Incentives	Rebate in 2010
Victoria	Victorian Solar Hot Water Rebate	31 May 2013	Victorian Energy Efficiency Target (VEET)	$800 - $1,400
New South Wales	New South Wales Government Solar Hot Water Rebate	30 June 2011		$300
South Australia	South Australian Solar Hot Water Rebate	30 June 2013	Targeting low income households of $500 rebate	
Queensland	Queensland Government Solar Hot Water Rebate	28 September 2012		$600
Australian Capital Territory	Australian Capital Territory Solar Hot Water Rebate	20 April 2013	Energy Efficiency Improvement Scheme (EEIS)	
Tasmania	Not available			
Western Australia	Solar Hot Water Heater Subsidy Scheme	1 June 2013		
Northern Territory	Solar Hot Water Retrofit Rebate program offering a rebate of up to $1000	Open	Alice Solar city for Alice Spring resident only	$1,000

Remaining subsidies are targeting low income households and households in regional areas, such as regional Victoria and the Northern Territory. This may reflect the fact that households in more remote locations do not have access to mains gas, and must therefore use a SWH.

3.5 Federal and State Energy Efficiency Policies

Aside from the Renewable Energy initiatives, various Energy Efficiency policies were also put in place to reduce greenhouse gas emissions. The National Partnership Agreement on energy efficiencies were agreed by the Council of Australian Government in 2009.

Each state and territory has since introduced its own policy to improve residential energy efficiency in lighting, white goods, shower head, heating & cooling, and water heating, including:

- The New South Wales Energy Savings Scheme;
- The Queensland Renewable Energy Plan 2012;
- The South Australia Residential Energy Efficiency Scheme; and
- The Victorian Energy Efficiency Target Scheme.

These energy efficiency initiatives have ongoing impacts in reducing household energy consumption, and therefore may offset the amount of renewable energy required.

Some state schemes offer additional rebates (on top of STC subsidies) towards the replacement of electric water heaters with SWH.

3.6 Energy Efficiency Building Standards

The Energy Efficiency Provisions for Building Code of Australia (BCA) 2010 require all new houses to be built in Australia to a six-star energy efficiency rating equivalence[12]. Apartments also need to have an average rating of six stars or equivalent.

Although the details of building standards vary slightly among states, many of the standards include provisions on energy-efficient water heaters for new homes.

Following the establishment of the BCA, each NEM region has introduced its own energy efficiency building standards. Table 3-4 lists the time of the introduction, and summarises the building standard.

[12] http://www.abcb.gov.au/education-events-resources/publications/~/media/Files/Download%20Documents/Education%20and%20Training/Handbooks/2010_EE-Handbook-BCA-2010-Vol1-web.ashx

Table 3-4 Current Building Standards by State

State	Introduction on	Description of impact on electricity demand
Victoria	1 May 2011	The 6 star standard applies to the thermal performance of a new home, roof, walls, floor and windows, lighting, but not plug in appliances such as hot water heaters[13]
New South Wales (NSW BAXIS program)	October 2005	The program encourages a reduction in energy use and greenhouse gas emissions through energy efficient hot water systems, heating & cooling, lighting, alternative renewable sources, ventilation & exhaust, pools and spas[14].
Australian Capital Territory	1 July 2006	All class 1, 2 and class 4 parts of buildings must meet the energy efficiency provisions in the 2010 version of the BCA[15]
Queensland	1 May 2010	New houses and townhouses, and major renovations to existing buildings, must achieve a minimum 6-star energy equivalence rating. New unit buildings and major renovations to units must achieve a 5-star energy equivalence rating[16].
South Australia	September 2010	All new homes and extensions built in South Australia need to achieve a 6-star level of energy efficiency for thermal comfort, new houses must also meet lighting requirements and have energy-efficient water heaters. The SA water heater requirements are currently under review by the SA government[17].
Tasmania	1 May 2013	All building designs for new houses or additions (or a conditioned Class 10a building) submitted to building surveyors for a Certificate of Likely Compliance should include 6 star energy efficiency measures in the design[18].
Western Australia	1 May 2012	New Class 1 and 10 residential buildings are required to comply with the Acceptable Construction Practices detailed in the BCA 2012 Volume 2[19].
Northern Territory	1 May 2010	New residential houses and alterations to existing houses are required to achieve a 5 star energy efficiency rating, and new flats and caretaker accommodation (Class 2 and 4 buildings) to achieve a 3.5 Star Rating[20]

3.7 Other Key Drivers for STCs

3.7.1 Global Solar Industry and Solar Panel Prices

Significant changes in the solar subsidies in Europe in the last couple of years have triggered price wars among solar PV manufacturers as a result of the global over-supply in solar PV capacity.

According to data compiled by Bloomberg, the global solar PV manufacturing capacity stands at around 69.8 GW as in September 2013, significantly outstripping the global demand. The average global PV panel price has decreased significantly to USD $0.84 per

[13] http://www.buildingcommission.com.au/sustainability/introduction-of-6-star
[14] https://www.basix.nsw.gov.au/basixcms/
[15] http://www.actpla.act.gov.au/topics/design_build/siting/energy_ratings
[16] http://www.hpw.qld.gov.au/SiteCollectionDocuments/6-star-housing-fs.pdf
[17] http://www.sa.gov.au/subject/Housing,+property+and+land/Building+and+development
[18] http://workplacestandards.tas.gov.au/resources/building_guides/energy_efficiency
[19] http://www.buildingcommission.wa.gov.au/industry/codes-standards/energy-efficiency
[20] http://www.lands.nt.gov.au/building/energy

watt, compared with USD $2 per watt at the end of 2010[21]. The solar PV manufacturing industry will continue to consolidate and the solar PV module prices are likely to be determined by the balance of global supply and demand as well as technological improvements in the next few years.

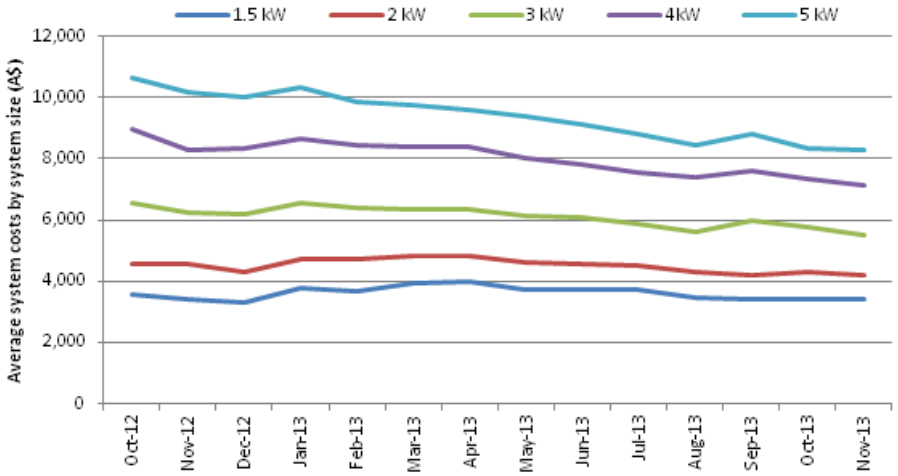
In this study, we have not taken into solar battery storage into consideration as this technology will not have a significant impact over the next three years. The cost of a solar battery storage system is around USD $9 per watt at present, almost 5 times higher than a normal solar PV system. The installation of a 3 kW solar system with battery storage is estimated to cost $25,000 compared to the cost of approximately $6,000 without battery storage.

3.7.2 Australian Dollar

The declining trend of the Australian dollar in the last year may continue with the Reserve Bank of Australia commenting on a relatively high Australian dollar currently around $0.90 USD compared to the historical average. Potential further weakening of the Australian dollar will have an offsetting effect to the reduction in solar panel prices over the coming years.

3.7.3 Average System Costs

Figure 3-2 Average system costs by system size in Australian dollar



System costs among states can vary considerably but the trend has been consistent across all states. Average system costs (simple average across all states) have continued to decrease in the last year with the prices for 5kW and 4-4.99 kW systems declining most rapidly at an average of 1.7% per month over the last 12 months. Figure 3-2 shows the trend of average system costs by system size in AUD.

[21] http://www.bloomberg.com/news/2013-09-17/china-to-strictly-limit-building-of-more-photovoltaic-capacity.html

The declining cost on a $ per kW basis, especially for the larger size systems over 4 kW, has been the principal driving factor for the increase in average system size and the increase in the uptake of larger systems.

3.7.4 Other Market Benefits and Delivered Energy Costs

Aside from the direct financial benefits to households and businesses there are market benefits delivered from the large number of solar installations in recent years. The effect of solar PV and solar water heater includes:

- Reduction in peak demand and shift of peak demand period from late afternoon to early evening in many states;
- Significant reduction in electricity demand and greenhouse gas emissions; and
- An increase in the short-term elasticity of electricity prices, which inhibit individual companies to exercise market power leading to a reduction in wholesale market prices.

We have not factored in avoided transmission and distribution costs or potential avoided generation costs in this study as the wider market benefits from solar PV need to be separately modelled and quantified and is out of scope of this study.

4 Historical Analysis

This section of the report is based on data provided by the CER and includes:

- Solar PV by individual installation – includes state, postcode, RECs created, system size, date of installation and RECs successfully registered; and
- SWH by individual installation – state, postcode, deeming period, type, date of installation and RECs successfully registered.

As data for the 2013 calendar year was incomplete at the time of the report, IES have estimated the number of installations and STCs created for November and December for solar PV and solar water heaters.

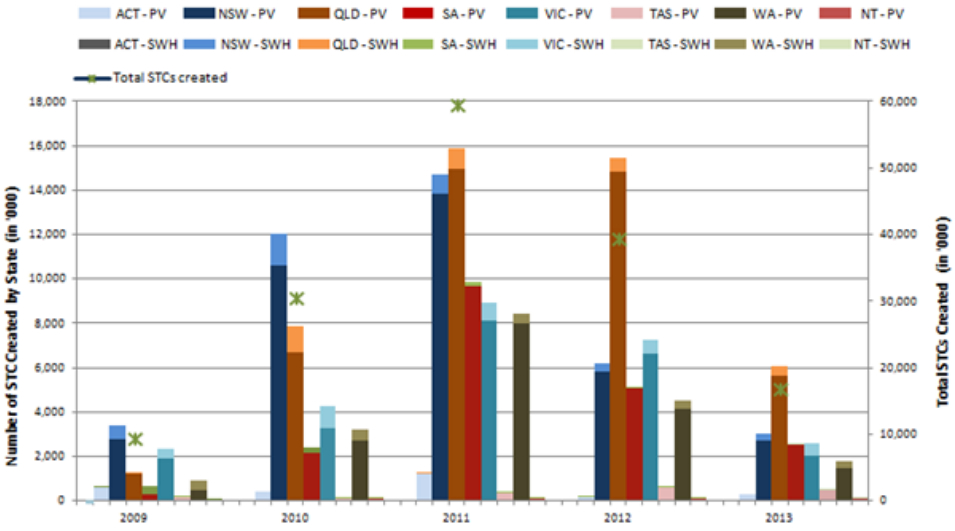
4.1 STC Creation by State and Technology

The closure of Solar Credit Scheme and solar feed-in tariffs in many states has greatly affected the number of STCs created for solar PV. The effect of their impact can be noted in the following:

- STC creation peaked in 2011 with around 60 million STCs created when households rushed in for solar PV installations to take advantage of the high solar credit multiplier of 5 and high solar feed-in tariffs before the closure of the various solar rebate programs in several states;
- Since 2012, the number of STCs created has dropped sharply by over 50% year on year. The STCs created in 2013 are less than a quarter of that of 2011; and
- The percentage of STCs created by Solar Water Heaters was lowest in 2011 and 2012.

Figure 4-1 shows STCs created by state and technology; STCs are stacked by Solar PV and SWH by state with total STC creation represented by the crosses. The percentage of STCs created for SWHs on average accounted for less than 15% of the total. Since 2010, consumer preference has shifted from SWH to solar PV due to the initial Solar Credit Multiplier, the rapid reduction in PV panel costs as well as increases in electricity prices.

Figure 4-1 STC Created by State and Technology



4.2 Historical Analysis of Solar PV Data

4.2.1 Solar PV capacity and Penetration Level by State

There have been a total of 1.2 million households with solar rooftop PVs installed in Australia with a total installation capacity of 3,186 MW (Nov 2013). Queensland has the most solar PV installed at over 1,024 MW, followed by New South Wales at 661 MW. South Australia and Queensland have the highest penetration level[22] of 31% and 28% respectively.

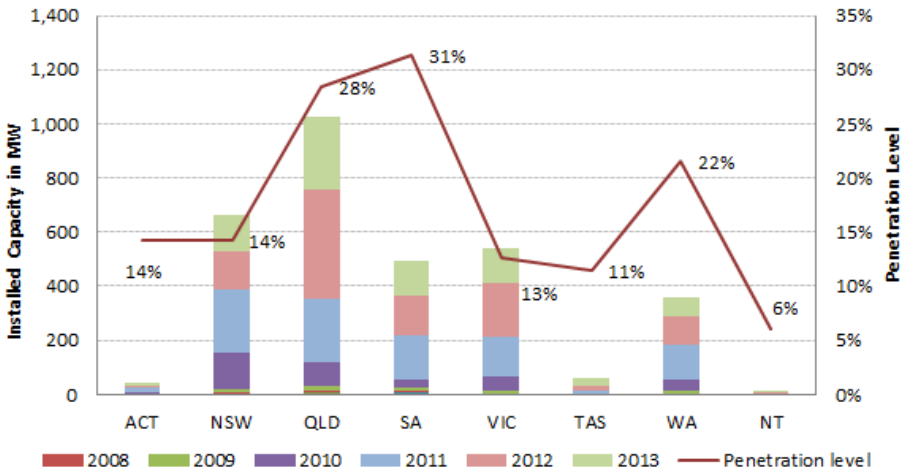
As installed solar PV capacity continues to rise we expect to see:

- the growth of solar PV in states with higher penetration level to slow;
- the share of solar PV in states with lower penetration level and good sunshine exposure such as Northern Territory, Victoria, New South Wales and Western Australia to continue increasing;
- Northern Territory and remote areas of Western Australia are likely to have higher growth than other regions due to favourable feed-in tariffs, high sunshine exposure and difficulty of grid access; and
- The One Million Solar Roofs initiative is expected to provide extra incentives to low income house household to take up solar PV and solar water heaters over the duration of the initiative.

[22] Penetration level is defined as the total number of Solar PV installations divided by the total number of owner-occupied separated houses in each state (excluding rental properties).

Figure 4-2 below shows the installed PV capacity and the penetration level by state.

Figure 4-2 Solar PV installation capacity and penetration level by state

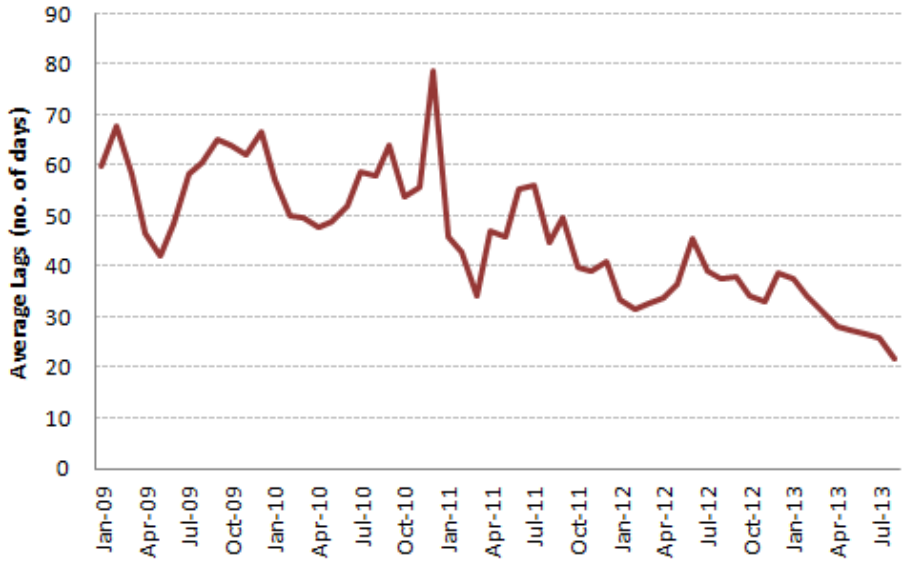


4.2.2 Lag times between SGU installation and STC creation

Projecting levels of STC creation needs to be adjusted for the delay between installation of a system and registration of the associated STCs. This delay may be due to processing times or installers failing to apply for STCs immediately. As a result, registration of STC creation to date for the 2013 year would still be incomplete by early 2014 due to the delay in registering eligible systems.

The lags between installation and STC creation have been trending downwards from an average of 57 days during 2009 and 2010 to an average of around 31 days during 2012 and 2013. This reduction in lag times reflects a more streamlined solar installation service and a maturing and stabilising solar industry. Figure 4-3 shows the number of days of lag for PV installations (recent months are artificially low given a large portion of systems installed have not yet registered). We have accounted for these lag times in calibrating the forecasts for each jurisdiction.

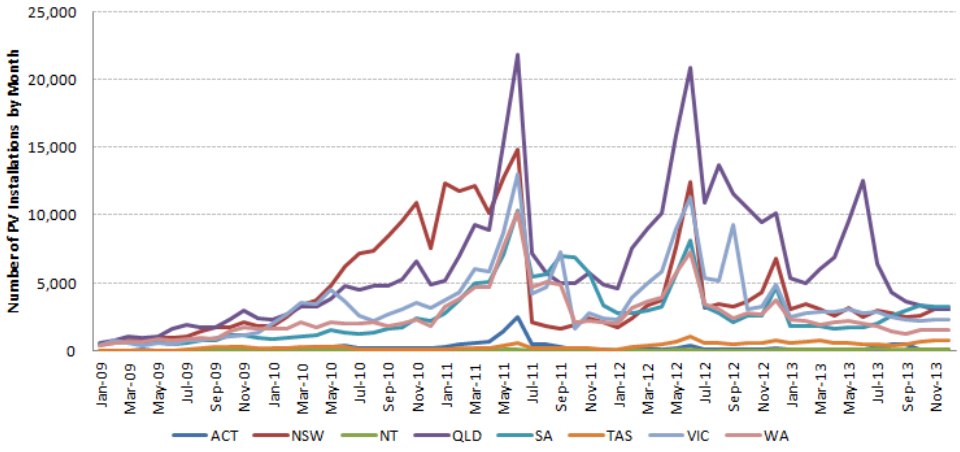
Figure 4-3 Lag between installation and STC registration



4.2.3 Historical levels of PV installations

Figure 4-4 shows the historical numbers of PV installations by month across the entire SRES scheme. There have been two peaks in the second quarter of 2011 and 2012, mainly due to the phase out of the solar multiplier from 5 to 3 times in 2011 and a 3 to 2 times multiplier in 2012. The number of installations has dropped off significantly after solar feed-in tariffs were closed in most of the NEM states.

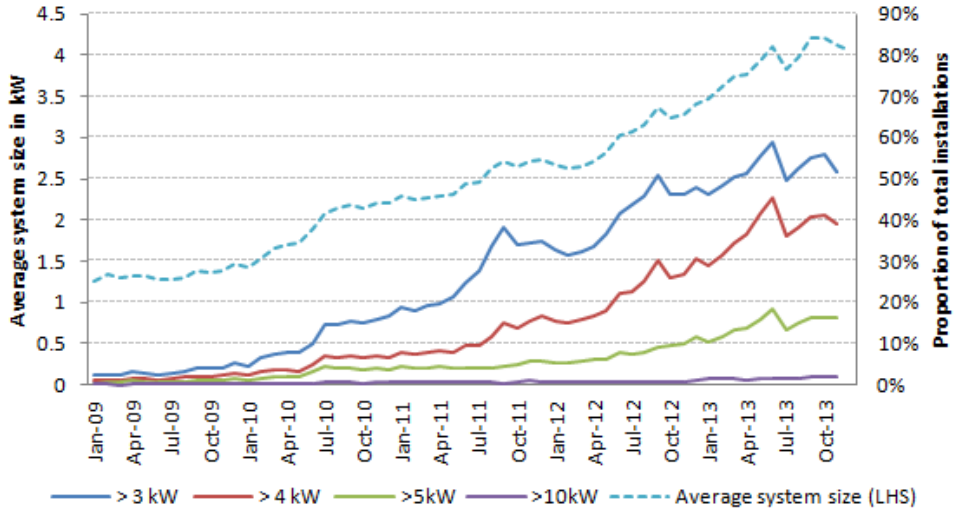
Figure 4-4 Historical monthly PV installations



4.2.4 Average system size

The number of STCs created by an installation depends on the system size that a household installs. Figure 4-5 shows the average system size of installations and the proportion of installations exceeding 3 kW, 4 kW, 5 kW and 10 kW from 2009 to 2013.

Figure 4-5 Average system size and proportion of installations by month



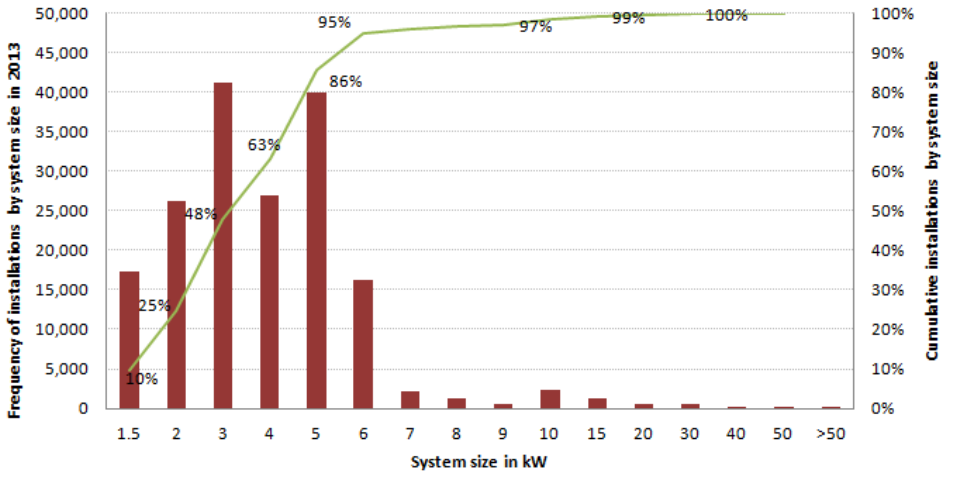
The past few years has seen a marked rise in the proportion of 3 kW and greater installations, from around 3% at the start of 2009 to almost 56% in November 2013. Similarly, the proportion of systems that are 4 kW and greater has risen from around 1% to 43%; the proportion of systems that are 5 kW and greater has risen from 0.3% to 19%. From this graph the average system size seems to have stabilised around the 4 kW level (blue line).

It is clear that system sizes have been increasing even though the solar subsidies have been cut considerably during the 2011 to 2012 period. Possible explanations include:

- Consumers are installing larger panels and converters due to the lower $/watt for larger installations; and
- Consumer expectations that larger systems can hedge against potential further future electricity prices rises. As a result, system sizes have become progressively larger over the last few years.

Figure 4-6 shows the distribution of installations by system size in 2013. Installed systems were generally in the range of 2-3 kW and 4-5 kW, with 95% of the total PV installations accounted for by installations less than 6 kW in size. The proportion of installations greater than 10kW, including some commercial solar installations is still very small, making up 1.6% of the total installations in 2013.

Figure 4-6 Distribution of number of installations by system size in 2013



The average system size is 4.06 kW in 2013 (year to date). Despite the rising trend of system sizes in the last few years, we expect that the largest number of installations will remain below 5 kW as economics for solar PV installations will not significantly improve and barriers for commercial solar PV installation (defined here as above 10kW) are unlikely to be removed in the next three years – competing capital requirements in the context of an uncertain energy outlook, mismatch between property ownership, and inflexible leasing options remain critical barriers for small or medium size businesses to take up commercial size of solar PV.

Figure 4-7 Installations greater than 10kW by State

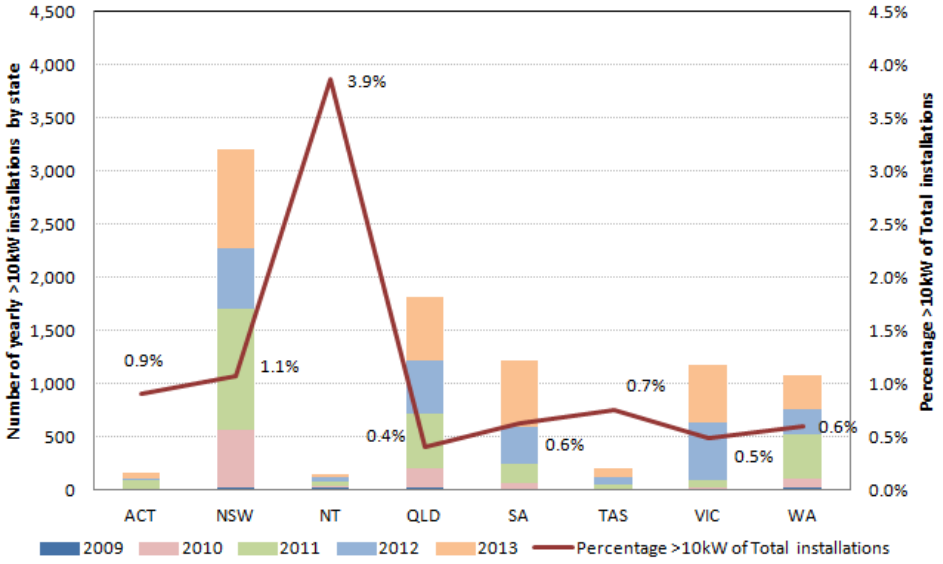


Figure 4-7 shows the number of installations and the proportion of installations that are greater than 10kW by state. New South Wales has more than twice the number of installations greater than 10kW than other states, possibly due to the fact that the New

South Wales Energy Savings Scheme (ESS) has a larger component targeting the commercial & industrial sector than energy efficiency policies in other states. Northern Territory has the highest proportion of +10kW installations among all states at 3.9 % of all solar PV installations which can be partly attributed to difficulty in grid access in remote areas and more hours of sunshine exposure in Northern Territory.

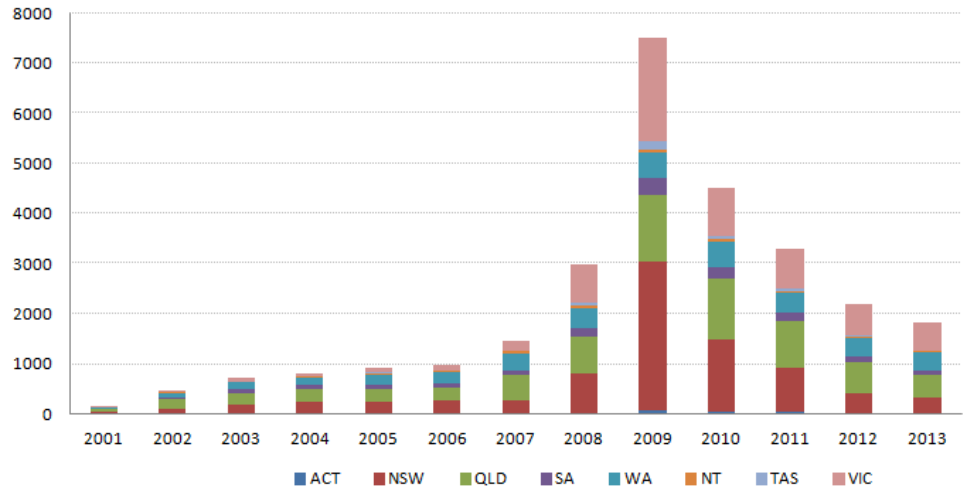
4.3 Historical Analysis of Solar Water Heater Data

4.3.1 Historical levels of Solar Water Heater installations by state

Supported by the federal and various state solar hot water rebate programs, around 864,000 homes have installed a solar hot water system as of November 2013. However, there has been a decreasing trend on the installation of solar water heaters in the last five years as shown in the Figure 4-8, which can be explained by:

- Better economics for installing solar rooftop PV due to the Solar Credit Multiplier and generous federal and state level solar PV feed-in tariffs;
- Costs of Solar Water Heaters have not been falling as fast as solar PV; and
- Household preference for solar rooftop PV due to the potential of exporting excess electricity to the grid.

Figure 4-8 Historical STCs Created by SWH by State (thousands)



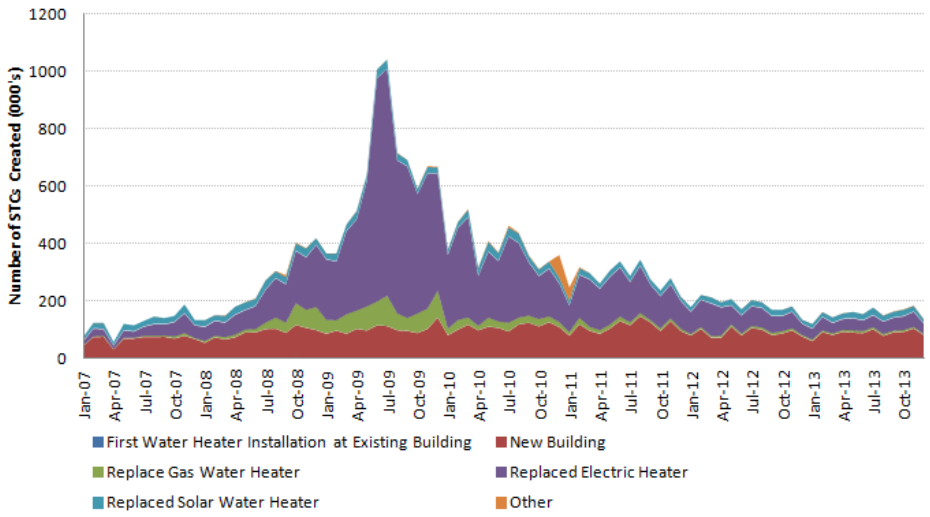
4.3.2 Historical levels of Solar Water Heater installations by Type

Federal and state policies have been the driving factor in the uptake of solar water heaters. As a result, installations to replace existing electric heaters and installations of solar water heaters in new buildings account for the largest proportion of the total installations (over 80%) as shown in Figure 4-9.

- The Australian government's Renewable Energy Bonus Scheme, operating from February 2009 to 30 June 2012, induced a large number of solar water heater installations to replace Electric Water Heaters.

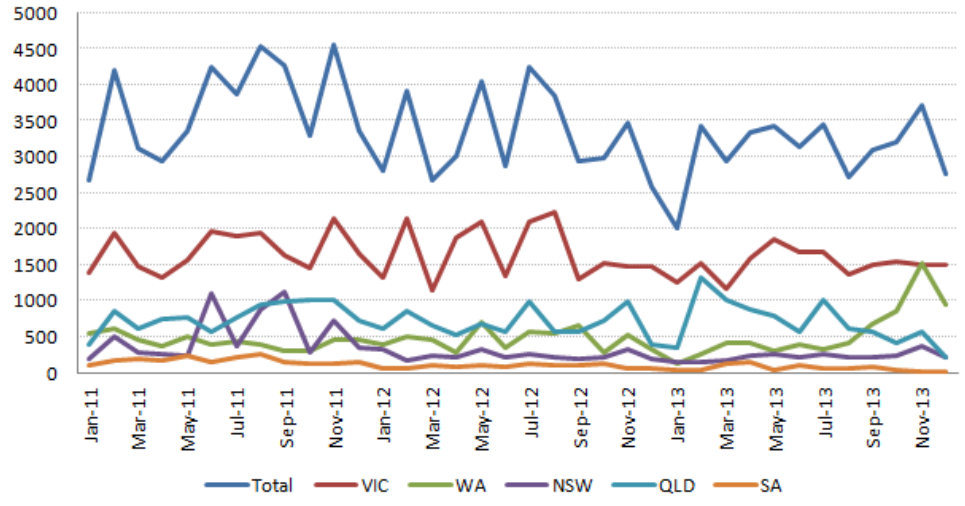
- The phase-out of the Electric Hot Water Initiative and state energy efficiency building standards has supported a more consistent rate of Solar Water Heater installations in new buildings.

Figure 4-9 Historical STCs Created by Solar Water Heater by Type



4.3.3 Installations in new houses

Figure 4-10 SWHs in new houses by month of installation



Source: CER data

Figure 4-10 shows the historical rates of SWH installations in new houses by month of STC creation for New South Wales, Queensland, Victoria, Western Australia, South Australia and the total of all jurisdictions.

Dividing the number of installations by housing completions data for 2013, we can calculate the proportion of new houses where SWHs are installed. Table 4-1 shows the proportion for each jurisdiction.

Table 4-1 Proportion of new houses installing SWHs – 2013

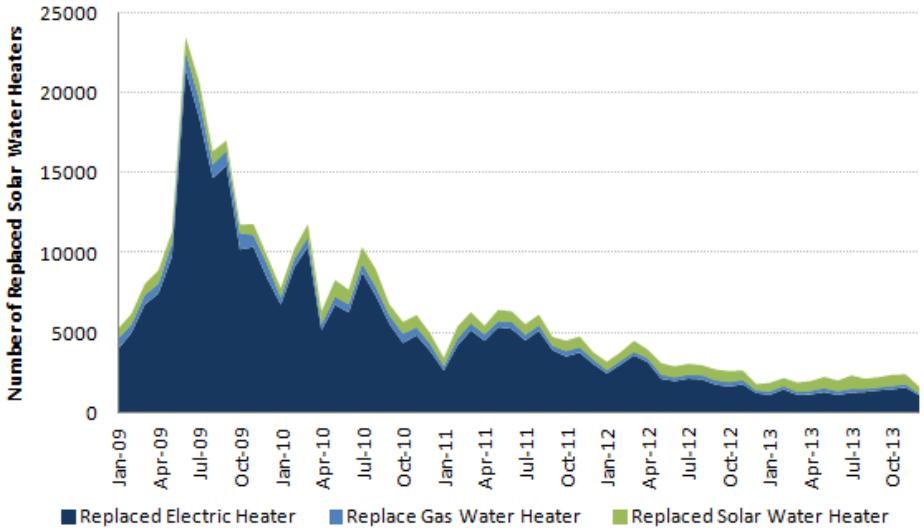
Jurisdiction	SWH installations in new houses – 2013 (IES Projection)	Completed detached houses – 2013	Proportion of new houses installing SWHs
ACT	213	1,502	14%
New South Wales	2,595	19,643	13%
Northern Territory	572	633	90%
Queensland	8,582	18,321	47%
South Australia	909	7,250	13%
Tasmania	98	1,480	7%
Victoria	17,715	26,770	66%
Western Australia	4,807	22,694	21%
Total	35,491	98,293	36%

We note that uptake rates show some signs of being related to sunshine exposure and gas reticulation, with higher rates observed in the Northern Territory and Queensland, and lower rates in Tasmania. The level of SWH uptake for Victoria is high in light of the high level of gas penetration in that state.

4.3.4 Replacements of existing solar water heaters

Figure 4-11 shows the historical rates of SWHs installed to replace existing water heaters, by the type of system being replaced. The graph shows that the vast majority of replacement SWH installations are for displacing electric hot water systems and the number of replacement installations is trending downwards.

Figure 4-11 SWH installations in detached houses by installation month



Source: CER data

Our research indicates that on average around 8% of electric hot water systems are replaced per annum[23]. Table 4-2 calculates the implied percentage of households that replace electric water heaters with SWHs.

We note the following:

- Uptake rates range from 2.2% in Northern Territory to 7.6% in South Australia;
- Variations among the states and territories are relatively small. One exception to this is the Northern Territory, but can be accounted for by very high levels of existing SWH penetration; and
- The uptake rates for replacement purposes are significantly lower than those for new houses due to more stringent energy efficiency standards in new buildings.

[23] Estimated based on failure rates listed in *ABS Household Water, Energy Use and Conservation Victoria, Oct 2009.*

Table 4-2 Uptake rate of replacement SWHs in 2013

Jurisdiction	Households with electric water heaters (IES projection)	Total replacement installations	SWH installations replacing electric (CER)	Implied SWH uptake rate
ACT	71,322	5,706	176	3.1%
New South Wales	1,720,750	137,660	5,309	3.9%
Northern Territory	43,813	3,505	78	2.2%
Queensland	1,258,259	100,661	5,074	5.0%
South Australia	291,824	23,346	1,762	7.6%
Tasmania	190,190	15,215	586	3.9%
Victoria	595,262	47,621	2,041	4.3%
Western Australia	231,912	18,553	961	5.2%
Total	4,403,332	352,267	15,987	4.5%

Source: Environmental Issues: Energy Use and Conservation, ABS Mar 2011.

5 Modelling methodology

The number of STCs that are created in any given year is determined by a range of factors which impact decision making by tens of thousands of individual households and small businesses. This chapter examines the overarching methodologies and assumptions that we have applied to forecast SGU and SWH installations and STC creation. To inform our modelling assumptions IES has examined recent trends for SGU and SWH installations. Different models have been used for these two technology types due to the fact that unlike SWH, SGUs are a discretionary purchase.

5.1 Solar PV

The number of PV installations and STC creation has been modelled based on a function of the uptake rate, eligible households and average system size. Our approach has been to represent PV installations for a given year as:

- PV Installations = Uptake rate × eligible households, and
- STC creation = PV installations x average system size

- **Uptake rate** – is the proportion of eligible houses projected to install PVs in a given year. At some level, a consumer who purchases a PV system expects to obtain a return on their investment. The uptake rate is modelled as a function of the discounted pay-back period (see below) as we assume the decision driver is entirely based on whether PV provides a net economic benefit and the horizon for the investment to break-even. As the discounted pay-back period increases, the uptake rate is expected to decline.
- **Eligible households** – not all households are suitable such as rental properties where the avoided electricity cost accrues to the tenant rather than homeowner. It is assumed that eligible households are owner-occupied and for detached housing. There are already over 1 million installations across Australia, so the eligible number of households has been adjusted for market penetration i.e. the number of eligible houses is reduced to reflect this. New housing stock is also factored in the eligible households forecast.
- **System size** – has been increasing over past few years as a result of the continued drop in system costs. Transition to unfavourable solar buy-back tariffs will have an impact on the increasing trend of average system sizes.

5.1.1 Modelling the uptake rate as a function of the pay-back period

PV systems represent a significant investment for a household. In the absence of government subsidies, a 2kW PV system costs approximately $4,000 including installation and STC subsidies. Assuming a discount rate of 10 per cent, a 4kW PV system must recover $525 a year to compensate its upfront cost and interest over a 15 year period.

We define discounted pay-back period to be the amount of time taken for the benefits accruing from the installation to return the cost of the upfront investment. All future benefits are discounted to a present value to reflect the opportunity cost of the

investment. It is assumed that the uptake rate decreases as the pay-back period increases; households are less inclined to purchase a PV system as the pay-back period lengthens.

In addition we have assumed the following:

- Base discounted pay-back periods are calculated for historical uptake rates for the previous 12 months. Forecast changes to the base discounted pay-back period (on a percentage basis) are then applied to the historical uptake rates to derive forecast uptake rates. IES has assumed the rate of change in the uptake rate is slightly slower than the change in the discounted pay-back periods i.e. A 5% drop in discounted pay-back period only results in a 3.8% increase in the base uptake rate.
- There is an underlying level of demand for PV systems that is independent of the discounted pay-back period. This 'baseline demand' represents demand drivers outside discounted payback economics such as a preference for green technology or the desire to be self-sufficient. At the point where the discounted pay-back period is equal to the expected life of the asset, the uptake rate is equal to the baseline demand. We have assumed the minimum baseline demand is 1%.
- Although most PV systems come with guarantees that are substantially longer than warranty periods of 15 years and up, we believe that households cannot realistically be expected to invest in generation systems that will not make a net return within the next 15 years. As a result, our projections assume that once the pay-back period exceeds 15 years, there is only baseline demand for PV systems.

Major factors that have been included in the calculation of discounted payback periods are:

- Installation and capital costs driven by technological improvement;
- Exchange rates and interest rates reflecting the opportunity cost of money;
- Average system size installed and net exports back into the grid;
- Solar buy-back tariffs or feed-in tariffs and delivered energy costs;
- STC prices offsetting out-of-pocket expenses; and
- 'One Million Roofs Initiative' and other government initiatives.

5.2 Solar water heaters

SWH are different to solar PV systems as water heaters are a household necessity. SWHs are installed as a result of a newly constructed dwelling or as a replacement for an existing water heater that has failed. We propose a methodology here that models these two cases separately based on historical installation rates.

- **New housing** – will be based on a proportion of new housing (and trends that may be forming) that will elect SWH versus gas and other options.
- **Replacements** – we can analyse the historical SWH installations that replace existing gas, electrical or solar hot waters systems. Combined with projections around the annual level of hot water system replacement allows us to derive an estimated rate of SWH installation that replace existing hot water systems.

Factors that drive the number of SWH installations include:

- New housing stock and trends, building regulations; and
- Replacement rates of electric hot water heaters.

5.3 Wind and hydro systems

Wind and hydro systems have a much lower impact on STC creation over the past few years (less than 2MW and 50kW installed capacity respectively). IES do not expect the role of wind and hydro SGU to materially impact total STC creation forecasts.

5.4 Projection assumptions - SGU

5.4.1 One million solar roofs initiative

We have assumed that under the "One Million Solar Roofs" program, a rebate of $500 will be provided for installations but will be capped at 100,000 installations per year with priority given to solar water heaters and to low income earners. No additional information has been made public and IES have assumed a start date of January 2015 and that PV systems will be allocated 40% of the total 100,000 installations per year.

As this program is on top of existing incentives such as SRES, it will impact on the number of STCs being created throughout the life of the initiative. We have assumed in this study that the allocation of the rebate is 40,000 to solar PV and 60,000 to SWH. Table 5-1 below shows the assumed allocation for each technology type.

As the rebate is focused on low income earners we expect low income earners to install smaller sized PV systems (1.5kW) in addition to the uptakes without the rebate. We expect this initiative be made available to other households should the entire allocation not be taken up by low income households. We have assumed the allocation left over will be passed on to non-low income households which will install slightly larger systems of 3kW. For modelling purposes we have assumed 80% of the rebate allocation is taken up by low income households.

We have assumed an allocation of 60,000 SWH installations to qualify for the $500 rebate. Available rebates will be further subdivided between installations in new households and replacement electricity water heaters.

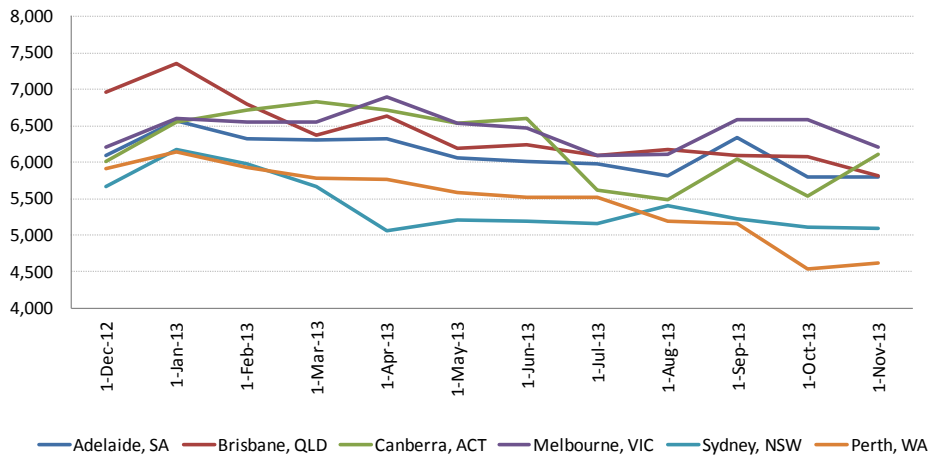
Table 5-1 One million solar roofs allocation (yearly)

Technology type	Allocation (yearly)
Solar PV (SGU)	40,000
SWH - New Buildings	45,000
SWH- Electric replacement	15,000
TOTAL	100,000

5.4.2 Solar PV system costs

The cost of an installed PV system minus the value of the STCs it creates represents the upfront investment required[24]. Our methodology assumes that the discounted pay-back period for this investment determines the probability that an eligible household will choose to install a PV system. Figure 5-1 below shows the total cost after STC subsidies of a 3kW installation over the previous 12 months. Although relativities between states can be volatile at times the general downward trend has been exacerbated by a high AUD and surplus global PV panel supply entering the Australian market.

Figure 5-1 Cost of a 3kW PV system by state ($'s)



Source: Solar Choice, accessed 9 Dec 2013

[24] There have been several installers that also offer financing arrangements allowing the customer to avoid having to make an upfront payment as a means to provide a solution for households with cash flow concerns.

Global demand of PV systems is on the rise leading to higher production rates. Going forward we have assumed PV system prices to decline at an annual rate of 5% reflecting economies of scale. However this is expected to be largely offset by an assumed weakening AUD dropping to 0.8 USD/AUD over the course of the forecast period i.e. the net effect is a slight decline in PV system prices.

In calculating the discounted pay-back period we have used a discount rate of 9.5%. This reflects the opportunity cost for investing in a PV system, and is in line with the long term borrowing rate for households plus a margin for risk.

5.4.3 Electricity prices

Delivered electricity costs are an important component to the discounted pay-back period calculation as electricity generated from the PV systems offsets grid electricity consumption and is effectively paid at the rate of consumption. Table 5-2 shows the historical and projected residential electricity tariffs from the AEMC. The figures reported in the AEMC 2013 Residential Electricity Price trends report[25] include a component of carbon however this has been stripped out assuming the carbon tax will be repealed by July 2014. Across the major cities the tariff is relatively stable (compared to recent price rises) sitting within the 25c-30c/kWh range – this is compared to roughly 15c/kWh for the cost of solar PV.

Excess energy that is exported into the grid is generally paid a solar buy-back tariff that is often much lower than the 15c/kWh cost of solar PV and residential consumption tariffs. As a result any additional energy that gets exported increases the discounted pay-back period and places a limit on the size of the system installed in residential dwellings. We have assumed that current net feed-in tariffs remain constant through to the end of FY 2016 noting there may be the possibility for revisions down as a result of the carbon tax repeal.

Furthermore, the percentage of electricity being exported by a PV system was estimated for each region on the basis of average household load profiles and average generation profiles[26].

[25] http://www.aemc.gov.au/news/announcements/publication-of-2013-residential-electricity-price-trends-report.html
[26] Rooftop PV Information Paper, AEMO 2012

Table 5-2 Historical and projected residential electricity prices (c/kWh)

State	FY2013	FY2014	FY2015	FY2016
Australian Capital Territory	20.78	21.48	22.10	20.27
New South Wales	27.86	27.94	28.66	27.23
Northern Territory	23.19	25.93	27.23	28.24
Queensland	23.71	26.59	28.48	30.37
South Australia	31.27	31.03	31.71	30.41
Tasmania	28.98	28.72	28.66	28.98
Victoria	27.66	28.84	30.10	28.64
Western Australia	25.00	26.02	26.13	25.50

Source: 2013 Residential Electricity Price Trends, AEMC Dec 2013

5.4.4 Average system size

As discussed previously the average system size increase has mainly been driven by much larger systems that would be associated with commercial sites (non-residential). Installations smaller than 10kW seem to have stopped increasing in size over the past few months across most states. Although there are only a few data points to suggest a firm trend, we believe that the growing average system size over the past few years coupled with higher out-of-pocket expenses and much lower solar buy-back tariffs will slow as observed recently – based on our assumption that a shorter discounted pay-back period is more favourable.

To capture this trend we have assumed that average system sizes is to remain constant at a state level. Table 5-3 shows our projections of average system size under these assumptions.

Table 5-3 Projected average system size by state (kW)

State	System Size
ACT	4.0
NSW	3.8
NT	4.6
QLD	3.9
SA	5.0
TAS	4.2
VIC	3.8
WA	3.5
Overall Average	4.1

5.4.5 Eligible households

Not all residences are suitable for PV installations. Although it is possible for residents in apartment buildings to install solar panels it is highly impractical. Furthermore, landlords are unlikely to install PV systems in rental properties as the benefit of avoided electricity costs accrues to the tenant. As a result, we have assumed that eligible households are owner-occupied detached houses.

We have also adjusted for market penetration by factoring in the increasing stock of houses that have a PV installation. In any given year, the number of eligible houses is

reduced to reflect this. Table 5-4 shows eligible households that can install PV on their roofs.

Table 5-4 Eligible households for uptake of solar PV

State	2014	2015	2016
Australian Capital Territory	69,683	71,665	73,571
New South Wales	1,170,736	1,186,781	1,201,398
Northern Territory	29,572	30,329	31,068
Queensland	672,701	683,498	690,614
South Australia	287,497	290,908	292,804
Tasmania	120,647	121,450	121,826
Victoria	1,148,170	1,177,515	1,205,755
Western Australia	428,047	439,206	449,326
Total	3,927,053	4,001,352	4,066,363

Figure 5-2 shows penetration rate as at 2013 in the various states. Approximately 64% of households are owner occupied and detached or semi-detached. Of the eligible houses, Queensland and South Australia have already reached a penetration level 28% and 31% respectively which is expected to increase every year, decreasing the number of existing households eligible for PV installation.

Figure 5-2 Solar PV penetration level by state

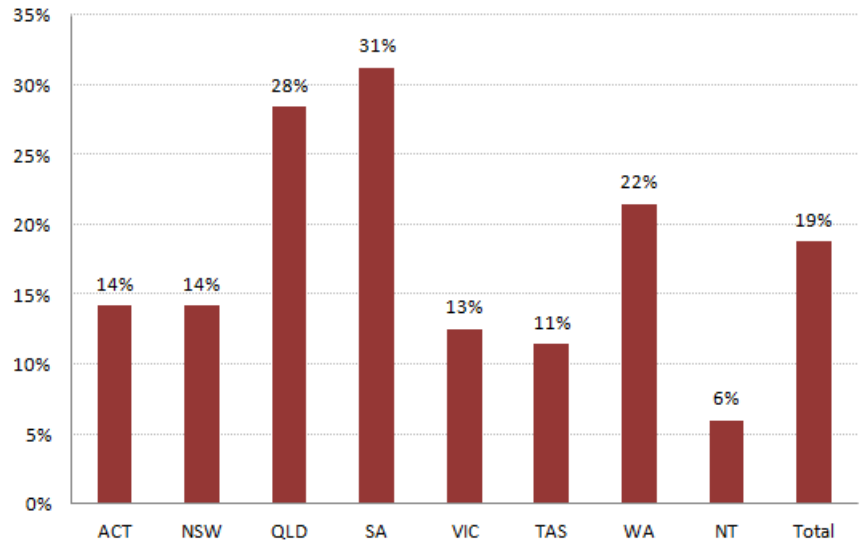


Table 5-5 shows our assumed uptake rates per state (for a 4kW system) across the forecast horizon. Uptake rates increase steadily across all states due to slightly decreasing system costs and increasing electricity consumption tariffs, resulting in a drop in discounted pay-back period year on year.

Table 5-5 Uptake rates based on eligible households in different states

State	2014	2015	2016
ACT	2.98%	3.12%	3.26%
NSW	3.04%	3.14%	3.25%
NT	2.92%	2.93%	2.96%
QLD	9.33%	9.68%	10.04%
SA	7.07%	7.32%	7.57%
TAS	5.31%	5.31%	5.33%
VIC	2.66%	2.76%	2.86%
WA	5.09%	5.25%	5.44%

5.4.6 Creation of new housing stock

To account for the additional eligible houses that are built each year, the number of eligible houses has been adjusted to reflect growth in owner occupied and detached dwellings. This has been estimated using 2012 data relating to housing approvals. Table 5-6 shows the annual housing approvals as a proportion of the existing housing stock.

Table 5-6 Approvals as a proportion of existing housing stock for 2012

Jurisdiction	Dwellings	2012 Approvals	% of existing stock
Australian Capital Territory	140,000	3,738	2.7%
New South Wales	2,791,000	36,297	1.3%
Northern Territory	74,000	1,872	2.5%
Queensland	1,762,000	27,740	1.6%
South Australia	681,000	8,268	1.2%
Tasmania	210,000	1,964	0.9%
Victoria	2,149,000	51,385	2.4%
Western Australia	903,000	20,807	2.3%
Total	8,710,000	152,071	1.7%

Source: 8731.0 Building Approvals Australia, Australian Bureau of Statistics.

We have assumed that these growth rates remain constant for the duration of the projection period.

5.4.7 STC Prices

Buyers and sellers can trade STCs at a fixed price of $40 via the clearinghouse but is generally traded on the open market around $38 a certificate, lower than the legislated $40 a certificate over past few months. This gives installers access to capital immediately at a slight discount.

Nevertheless, it is our view that extended periods of depressed STC prices are unlikely from here on in due to the stabilisation of the market with the removal of state-based schemes in recent years. Recent spot trades and our price chart support this view, see Figure 2-1. As such we have not forecast STC prices to materially move from current levels, therefore having neglible impact on existing solar PV uptake rates.

5.5 Projection assumptions - SWHs

Under the "One Million Solar Roofs" program, IES have assumed that a maximum of 60,000 installations will be directed towards installation of solar water heaters and a further subdivision of 45,000 and 15,000 installations between new houses and replacement of electric water heaters respectively.

5.5.1 Eligible households and creation of new housing

Our assumptions regarding creation of new houses match those in the previous section, except that for SWHs we have not restricted eligible households to those that are owner occupied. It is our view that the decision to install a SWH is independent of whether that house is owner-occupied. As a result, all detached houses have been included in the stock of eligible households.

5.5.2 Installation rates – new housing

We have assumed that the proportions of new houses that install SWHs match our estimates for 2012, as listed in Table 4-1. Moreover, we assume that these proportions remain the same over the course of the projection period.

5.5.3 Installation rates – replacement of existing water heaters

We have restricted our analysis to replacements of electric water heaters. We do not account for replacements of existing SWHs because most SWHs are relatively new and are likely to have very low failure rates over the projection period. Similarly, we assume that SWHs do not replace gas water heaters as households with existing gas systems are unlikely to switch to solar, as is demonstrated by historical installation rates.

Our research indicates that around 8% of electric hot water heaters fail in any given year, and we have made this assumption to determine the number of replacements that occur for each year of the projection period. SWHs are assumed to replace a proportion of these failed water heaters, based on the uptake rates listed in Table 4-2. Although these rates remain constant, the number of installations will decline in line with the stock of electric hot water systems.

5.5.4 Number of STCs per installation

Table 5-7 shows our assumed levels of STC creation per SWH installation. These are based on the average number of STCs created for installations occurring between 1 January 2009 and 31 December 2012.

Table 5-7 Average number of STCs per installation

Jurisdiction	Average STCs per SWH installation
Australian Capital Territory	31
New South Wales	32
Northern Territory	27
Queensland	31
South Australia	30
Tasmania	27
Victoria	27
Western Australia	31

Source: CER data

6 Projection results – SGUs

This section presents our projection results for the period from 2014 to 2016. This is broken down into STC creation by state, installation numbers by year of STC creation; and total installed capacity.

6.1 STC Creation

Table 6-1 and Figure 6-2 shows our projections of STC creation by state.

Table 6-1 Projected STC creation from PV installations

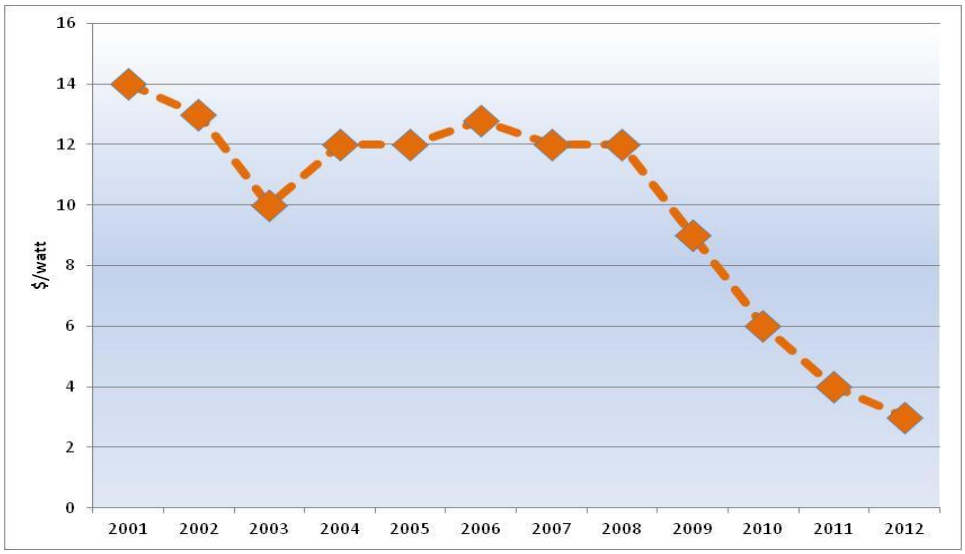
State	2014	2015	2016
ACT	175,444	201,208	214,530
NSW	2,818,029	3,162,960	3,301,839
Northern Territory	92,948	99,728	101,990
Queensland	5,130,830	5,850,611	6,104,613
South Australia	2,129,893	2,390,025	2,479,720
Tasmania	478,764	529,102	530,580
Victoria	2,101,868	2,409,841	2,542,847
Western Australia	1,614,460	1,828,410	1,928,133
Total	14,542,237	16,471,884	17,204,252

STC creation from PV installations increases steadily from 14.5 million in 2014 to 17.2 million in 2016. The trend is relatively stable compared to historical STC creation due to the drop-off of the SCM, and state based feed-in tariffs in a maturing environment. Constant growth in creation of certificates from PV installations can be attributed to the following factors:

- Increasing retail electricity tariffs even without the carbon tax;
- Figure 6-1 shows the drop in system costs [27] over the years. System costs have dropped by 75% to around $3 per watt over last 10 years;
- Consumers are installing larger systems to offset a larger portion of their electricity bills; and
- Certificates trading very close to the clearinghouse price of $40 relative to the past; and
- Increasing stock of eligible housing.

[27] System cost includes panel cost, cost of installing a full solar system, Inverter, Wiring and other components.

Figure 6-1 Average solar PV system cost



Source: The critical decade: Australia's future – solar energy, Climate Commission report

QLD is still expected to contribute the highest amount of certificate creation of 5.1 million certificates or 35% of total STC creation. This is due to minor changes in forecast discounted pay-back period and the high uptake rates in the 2013 base year. In 2012, Queensland reported highest number of installations (38% of the total) but the rate of increase is expected to taper down as the state has reached a penetration level of 28%. Similarly, South Australia is expected to show a slower growth as penetration levels in the state has already reached 31%.

The "One Million Solar Roofs" program is directed towards low income earners who are not expected to install solar panels of size bigger than 1.5KW. As mentioned earlier, modelling was based on a maximum of 40,000 PV installations eligible for the $500 rebate per household.

6.2 Solar PV installations

Figure 6-2 Projected STCs created by PV installations

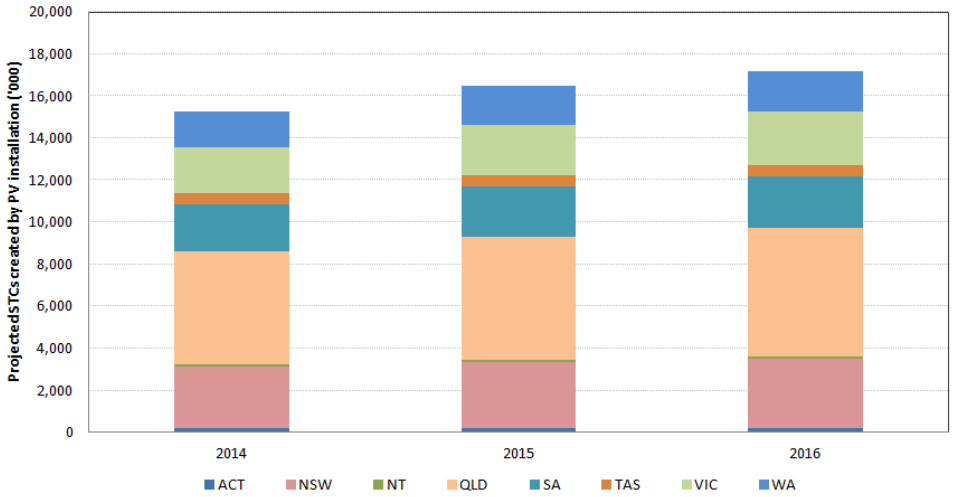


Figure 6-2 shows forecast results of PV installations. The growing numbers across all states is driven by the increase in dwellings eligible for solar PV. We also note the following:

- "One Million Solar Roofs" program is expected to start from January 2015. A jump is seen from 2014 to 2015 as this incentive program is expected to be available for the whole of 2015;
- Although both Queensland and South Australia are showing a rise in number of PV installations, PV installations in both states grow at a slower rate due to high penetration levels;
- Queensland is forecasted to still have the most number of installations per year. 35% of total installations is expected to occur in Queensland followed by New South Wales (19%), Victoria (17%), Western Australia (12%) and other states;
- Absence of federal and state feed-in tariffs has reduced the uptake rates of solar panels in 2013, the lowest since 2010; and
- Solar buy-back tariffs in different states are in the range of 6c to 8c/kWh which has minimal or no effect on bringing down the payback period of solar panels (for small sized systems).

Table 6-2 Projected PV installations

Jurisdiction	2014	2015	2016
ACT	2,140	2,716	2,879
NSW	36,129	44,155	45,935
Northern Territory	885	1,070	1,091
Queensland	64,135	81,152	84,327
South Australia	20,679	26,582	27,453
Tasmania	6,470	7,846	7,866
Victoria	31,371	38,746	40,731
Western Australia	22,423	27,580	28,965
Total	184,232	229,846	239,247

An average solar PV system price has dropped 75% over last 10 years and the trend is seen in all system sizes and across all states. Consumers are realising more savings (on a $/watt basis) when moving from a smaller system size to a larger system. A household can realise a saving in the range of 43c to 76c per watt when moving from a 1.5KW to 5KW system (Table 6-3). In the absence of feed-in tariffs, large system sizes have considerably longer payback periods than smaller panels but $/watt savings from larger panels are making more households to move towards larger panels (3KW – 5KW) allowing them to offset their electricity bill and generate more STCs.

Table 6-3 Solar system price, $/Watt

Jurisdiction	1.5KW	2KW	3KW	4KW	5KW
ACT	$2.46	$2.22	$2.04	$2.00	$1.86
NSW	$2.02	$1.90	$1.68	$1.66	$1.59
Queensland	$2.35	$2.23	$1.94	$1.84	$1.69
South Australia	$2.34	$2.17	$1.96	$1.87	$1.70
Tasmania	$1.70	$1.99	$1.66	$1.70	$1.54
Victoria	$2.62	$2.32	$2.07	$1.88	$1.76
Western Australia	$1.75	$1.75	$1.55	$1.53	$1.46

Source: Solar PV price index, Solar Choice November 2013

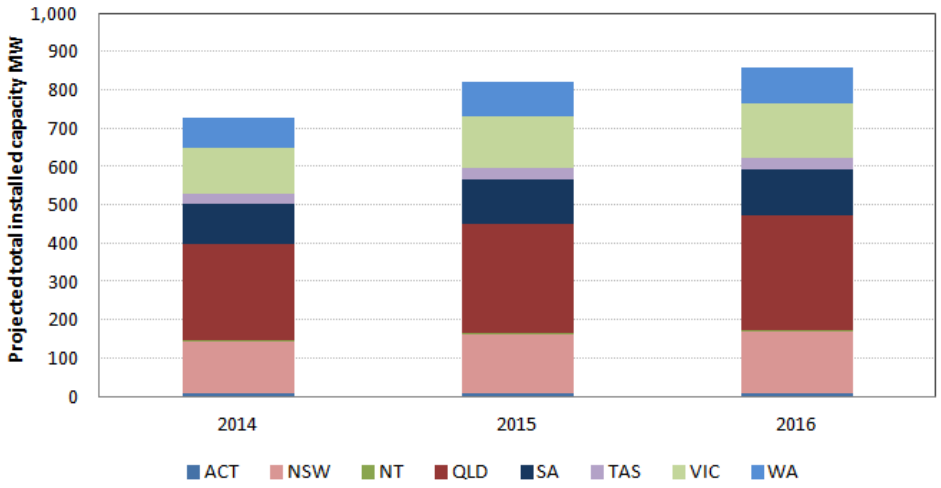
6.3 Total installed capacity

Table 6-4 and Figure 6-3 shows our projections of the total installed capacity of PV systems for each forecast year. Between 2014 and 2016, projected installed capacity is expected to grow the most in Queensland (47MW, from 250MW to 297MW in 2014 to 2016 respectively) followed by NSW (24MW) and Victoria (23MW). South Australia and Western Australia forecasted to see a rise of 17MW and 16MW respectively while other regions to have a very small growth.

Table 6-4 Projected MW of total installed capacity

Jurisdiction	2014	2015	2016
ACT	9	10	10
NSW	137	154	161
Northern Territory	4	4	4
Queensland	250	285	297
South Australia	103	116	120
Tasmania	27	30	30
Victoria	119	135	142
Western Australia	78	89	94
Total	727	822	859

Figure 6-3 Projected total installed capacity of PV systems



7 Projection Results – SWHs

Modelling suggests Solar Water Heaters (SWHs) account for approximately 10% of all STC creations. This section presents our projection results for the period from 2014 to 2016. This is broken down into installations and STC creation by state and type.

7.1 SWH Installations

Figure 7-1 shows our projections of the number of SWH installations, based on whether the installation occurred in new housing or as a replacement.

- SWH installations for new housing are forecast to rise from 30,502 in 2014 to 43,141 in 2016 driven by rebate to be made available under the "One million solar roofs" program.
- Due to the start of the "One million solar roofs" program, replacement SWH installations are forecast to increase in 2015 and then moderate in 2016 (above 2014 levels) as the number of eligible households starts to decrease. The average life span of electric water heaters is more than seven years leaving a lower number of eligible households for replacement.

Installations in new housing represent an increasingly large proportion of SWH installations. This is due to both larger numbers of new houses, and a reduction in the stock of electric water heaters.

States like New South Wales and Queensland have chosen not to phase out old energy intensive water heater which in our modelling impacts the total uptake of solar water heaters in these two states.

Figure 7-1 SWH installations by type

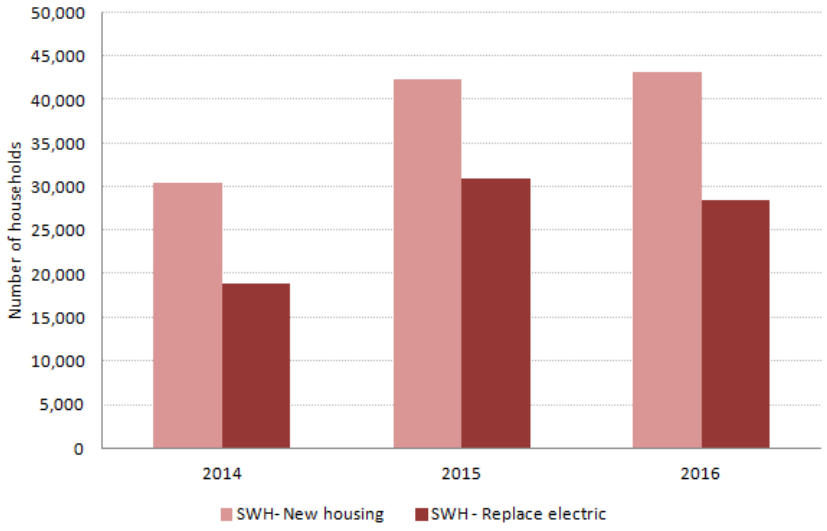


Table 7-1 and Table 7-2 provide breakdowns by states of projected SWH installations in new housing and as replacements of electric water heaters, respectively.

Table 7-1 Projected SWH installations in new housing

State	2014	2015	2016
ACT	177	186	191
NSW	2,255	5,651	5,681
Northern Territory	491	620	636
Queensland	6,441	9,942	10,098
South Australia	707	1,228	1,243
Tasmania	75	171	173
Victoria	16,157	18,605	19,050
Western Australia	4,200	5,934	6,070
Total	30,502	42,336	43,141

Table 7-2 Projected replacement SWH installations

Jurisdiction	2014	2015	2016
ACT	192	330	305
NSW	5,813	9,942	9,186
Northern Territory	98	157	144
Queensland	6,945	10,685	9,782
South Australia	1,702	3,058	2,836
Tasmania	654	1,084	999
Victoria	2,335	3,858	3,554
Western Australia	1,087	1,821	1,680
Total	18,825	30,934	28,486

7.2 STC creation

Figure 7-2 Total STC creation for SWHs

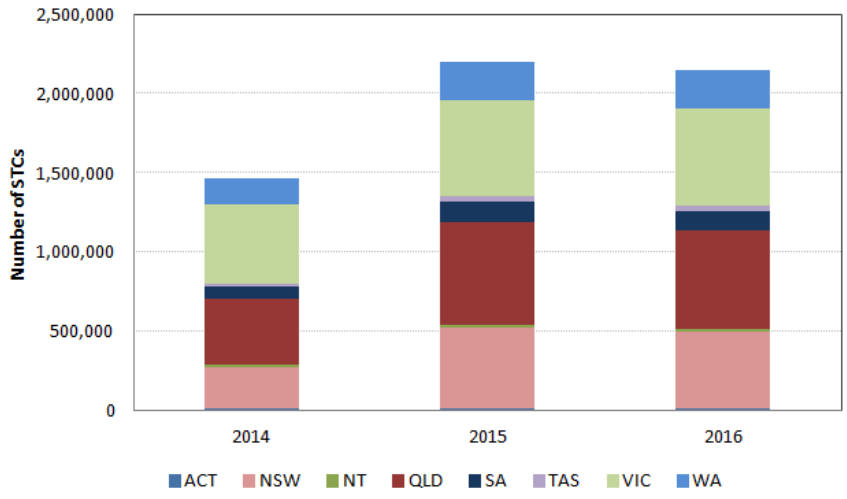


Figure 7-2 shows our projections of STC creations arising from SWH installations. Evidently overall creation increases slightly in 2015 then slightly decreases in 2016.

A detailed breakdown of STC creation by region is provided in Table 7-3.

Table 7-3 Projected STC creation from SWH installations

Jurisdiction		2014	2015	2016
	New housing	5,582	5,856	6,012
	Replacement (electric water heaters)	6,052	10,389	9,602
ACT	Sub Total	11,634	16,245	15,614
	New housing	73,027	183,013	183,975
	Replacement (electric water heaters)	188,253	321,984	297,510
NSW	Sub Total	261,281	16,245	15,614
	New housing	13,315	16,820	17,246
	Replacement (electric water heaters)	2,652	4,246	3,901
NT	Sub Total	15,967	16,245	15,614
	New housing	202,229	312,164	317,079
	Replacement (electric water heaters)	218,065	335,508	307,158
QLD	Sub Total	420,295	16,245	15,614
	New housing	21,090	36,634	37,078
	Replacement (electric water heaters)	50,779	91,238	84,636
SA	Sub Total	71,868	16,245	15,614
	New housing	2,005	4,544	4,586
	Replacement (electric water heaters)	17,373	28,785	26,526
TAS	Sub Total	19,378	16,245	15,614
	New housing	437,428	503,708	515,753
	Replacement (electric water heaters)	63,218	104,441	96,222
VIC	Sub Total	500,646	16,245	15,614
	New housing	130,745	184,732	188,989
	Replacement (electric water heaters)	33,828	56,687	52,289
WA	Sub Total	164,573	16,245	15,614
	New housing	885,421	1,247,471	1,270,717
	Replacement (electric water heaters)	580,220	953,277	877,844
TOTAL	TOTAL projected STC creation	1,465,641	2,200,748	2,148,561

8 Conclusion

A summary of our projection results is presented in Table 8-1 and Figure 8-1. IES forecast STC creation to be 16.0m, 18.7m and 19.4m over 2014, 2015 and 2016 respectively. The main contributor is still expected to come from solar PV installations comprising 88% of the total projection.

Table 8-1 Projections of STC creation by technology type

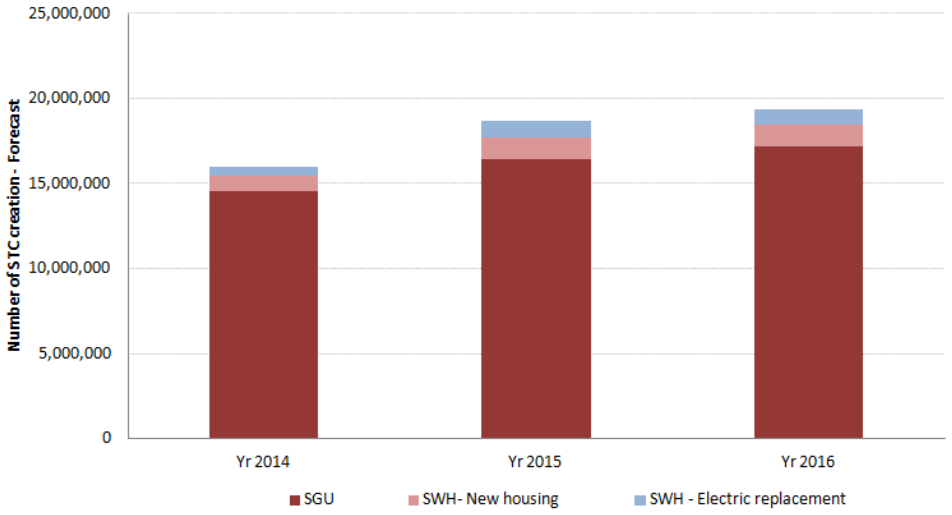
Technology Type	2014	2015	2016
SGU	14,542,237	16,471,884	17,204,252
SWH – New Housing	885,421	1,247,471	1,270,717
SWH – Replacement	580,220	953,277	877,844
Total	16,007,878	18,672,631	19,352,814

Uptake of solar PV by households has been a lot higher than for solar water heaters and this is driven by factors such as:

- For households, electricity bills are higher than hot water bills hence tend to prioritise offsetting electricity cost over water heaters;
- Solar PV can be connected back to the grid allowing households to sell extra energy produced.

Closure of various federal and state-based feed-in tariffs by the end of 2012 resulted in a drop in overall uptake rates in 2013 when compared to 2012. However the continued drop in system costs combined with rising electricity prices are still sufficient drivers for households to install solar PV.

Figure 8-1 Projected STC creation by technology type



Our projections show that PV systems remain the major driver of STC creation throughout the projection period. It is clear that the continued growth in solar PV installations throughout the 2013 year indicate the relative attractiveness of such an investment against relatively higher electricity tariffs without the need for government support (outside of the SRES). System costs have decreased to a level that represents a continued opportunity for remaining eligible households.

Main drivers that influenced growth in the number of PV installations are:

- **Electricity retail prices:** Electricity prices are forecast to remain relatively high compared to system costs even with the carbon tax repealed;
- **System cost**: System/panel costs are expected to slightly decline taking into account technological advances and a weakening AUD and consolidation amongst panel manufacturers;
- **System size**: Average system size to remain relatively stable around the 4kW level. The residential sector system size is expected to be curbed by much lower solar buy-back tariffs;
- **Uptake rates:** These are to stay around 2013 levels with forecast discounted pay-back periods to remain stable but slightly decreasing during the forecast period;
- **Dwelling construction:** Lower interest rates and rising population are driving construction of new dwellings. The number of dwelling approvals are expected to continue to rise in the near term;
- **One million solar roofs program:** The program is designed to provide rebate to low income earners and increase the uptake of solar technology (PV and water heaters). It is expected that the targeted group will utilise the rebate but will be installing smaller systems (in case of solar PV) as bigger panels are more costly with higher discounted payback periods. This will lead to additional installations while the certificates created from these additional households will be below the state average due to installations of smaller systems.