Modelling creation of Small-scale Technology Certificates

Projection for calendar years 2012, 2013 and 2014

Prepared for the Office of the Renewable Energy Regulator

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ACIL Tasman

Economics Policy Strategy

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ACIL Tasman Pty Ltd

ABN 68 102 652 148
Internet www.aciltasman.com.au

Melbourne (Head Office)
Level 4, 114 William Street
Melbourne VIC 3000

Telephone (+61 3) 9604 4400
Facsimile (+61 3) 9604 4455
Email melbourne@aciltasman.com.au

Brisbane
Level 15, 127 Creek Street
Brisbane QLD 4000
GPO Box 32
Brisbane QLD 4001

Telephone (+61 7) 3009 8700
Facsimile (+61 7) 3009 8799
Email brisbane@aciltasman.com.au

Canberra
Level 1, 33 Ainslie Place
Canberra City ACT 2600
GPO Box 1322
Canberra ACT 2601

Telephone (+61 2) 6103 8200
Facsimile (+61 2) 6103 8233
Email canberra@aciltasman.com.au

Darwin
GPO Box 908
Darwin NT 0801

Email darwin@aciltasman.com.au

Perth
Centa Building C2, 118 Railway Street
West Perth WA 6005

Telephone (+61 8) 9449 9600
Facsimile (+61 8) 9322 3955
Email perth@aciltasman.com.au

Sydney
PO Box 1554
Double Bay NSW 1360

Telephone (+61 2) 9389 7842
Facsimile (+61 2) 8080 8142
Email sydney@aciltasman.com.au

For information on this report

Please contact:

Guy Dundas
Telephone (02) 6103 8213
Mobile 0405 169 116
Email g.dundas@aciltasman.com.au

Contributing team members:

Jim Diamantopolous
Owen Kelp

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The Office of the Renewable Energy Regulator (ORER) commissioned ACIL Tasman to analyse the likely rate of creation of 'Small-scale Technology Certificates' (STCs) in the years 2012, 2013 and 2014 ('the projection period') under the Commonwealth Government's Small-scale Renewable Energy Scheme (SRES).

The SRES supports take-up of two renewable energy sources by households and businesses: 'Small generation units' (SGUs), particularly solar photovoltaic (PV) systems, and solar water heaters (SWHs). It does so by requiring wholesale purchasers of electricity to purchase and surrender STCs created by installing SGUs and SWHs.

To determine the number of STCs that each wholesale purchaser of electricity must surrender under the SRES, the responsible Minister is required to set a value in regulations known as the 'small-scale technology percentage' (STP).

ACIL Tasman's modelling for ORER is intended to support ORER's advice to the responsible Minister on setting the STP for the 2012 calendar year. This modelling is also intended to support ORER's publication of non-binding estimates of the 2013 and 2014 STPs.

This analysis occurs against the background of changes to an element of the SRES policy known as 'Solar Credits'. The Solar Credits policy applies a 'multiplier' to the rate at which SGUs create STCs, and thereby increases the number of STCs that any given SGU installation can create. The Solar Credits policy has a significant effect on both the level of solar PV installations that occurred in Australia (by increasing the subsidy available from STCs to SGUs) and the number of STCs created by those installations (by increasing the number of STCs per installation).

In turn, historical and imminent changes to the Solar Credits multiplier have a material impact on our projection of STC creation. Assumptions regarding the level of the Solar Credits multiplier are shown in Table ES 1.

Table ES 1 **Solar Credits multiplier assumptions**

	9 June 2009 to 30 June 2011	1 July 2011 to 30 June 2012	1 July 2012 to 30 June 2013	1 July 2013 onwards
Solar Credits Multiplier	5	3	2	1

Methodology

ACIL Tasman adopted separate methodologies for projecting STC creation by SGUs and SWHs, due to the different policy and economic drivers of uptake of these technologies.

Small generation units

STC creation by SGUs was modelled using an econometric regression examining the relationship between historic installation rates for solar PV systems and the discounted financial return available to owners of such systems. By then projecting financial returns for PV installations occurring during the projection period we can estimate SGU installation rates and STC creation rates.

Our analysis of financial returns to SGUs examined three key variables:

- PV system costs
- the value of government incentives for PV systems such as Solar Credits and feed-in tariffs
- the value to the installer of electricity generated by the PV system (with retail electricity prices calculated for this purpose being inclusive of a carbon price as implemented by the Commonwealth Government's *Clean Energy Future* policy).

ACIL Tasman's econometric regression found a robust relationship between new capacity installed in each quarter when modelled as an exponential function of the payback (i.e. net discounted financial return) from installation. The fit of the models against historical data as measured by the R^2 statistic exceeded 90% for five of the eight jurisdictions. This means that for these jurisdictions over 90% of the variation in the natural log of installed capacity could be explained by the model's explanatory variables. These five jurisdictions are amongst the six largest in terms of installed PV capacity, supporting the overall robustness of the econometric model in projecting nation-wide PV installation rates.

Solar water heaters

STC creation by SWH exhibits different dynamics to that by SGUs. Essentially, all households in Australia have one working water heater. Accordingly, our approach examines firstly SWH installation rates in new dwellings in part by examining changes to the stock of new dwellings. Separately, we look at typical rates of SWH installations as a replacement for existing water heaters as being reflective of likely rates of turnover of the existing water heater stock. Critically, this approach captures the key non-economic variables affecting SWH installation rates in a manner that a pure financial analysis could not.

Given the potential for these trends to vary over the projection period, a sensitivity analysis approach was adopted involving a mid-range 'reference' estimate and 'high' and 'low' bounds.

ACIL Tasman analysed SWH installations in new dwellings separately from installations that replace an existing water heater. The new dwellings projection drew on estimates of the historical implied market share of SWHs for new dwelling water heaters and a projection of separate dwelling (house) completions over the period to 2014.

By contrast, for replacement SWH installations, the analysis drew on analysis of historical rates of this type of installation, overlaid with an analysis of key policy and economic drivers that might lead to material changes in future installation rates.

Results

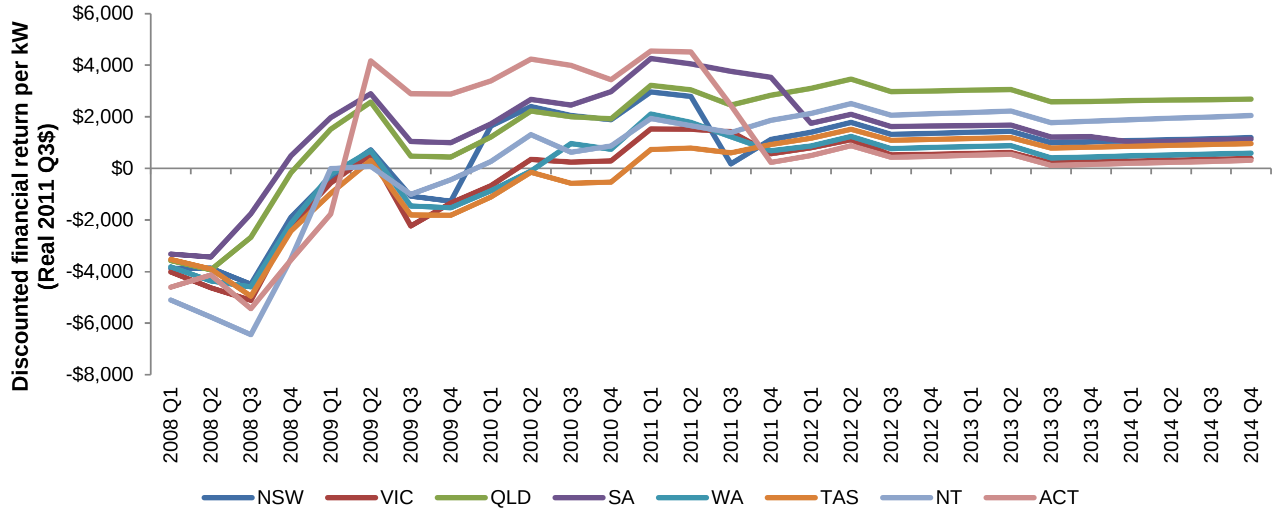
Small generation units

ACIL Tasman's analysis indicates that reducing PV system costs will support ongoing strong installations of these systems through the projection period, albeit at a slightly lower level than observed in the first half of 2011.

This trend occurs despite the closure of most state and territory feed-in tariffs to new PV installations and the phasing out of the Solar Credits policy.

Despite this reduction in government assistance, reductions in PV system costs sustain historically high financial returns to PV installations over the projection period, as shown in Figure ES 1.

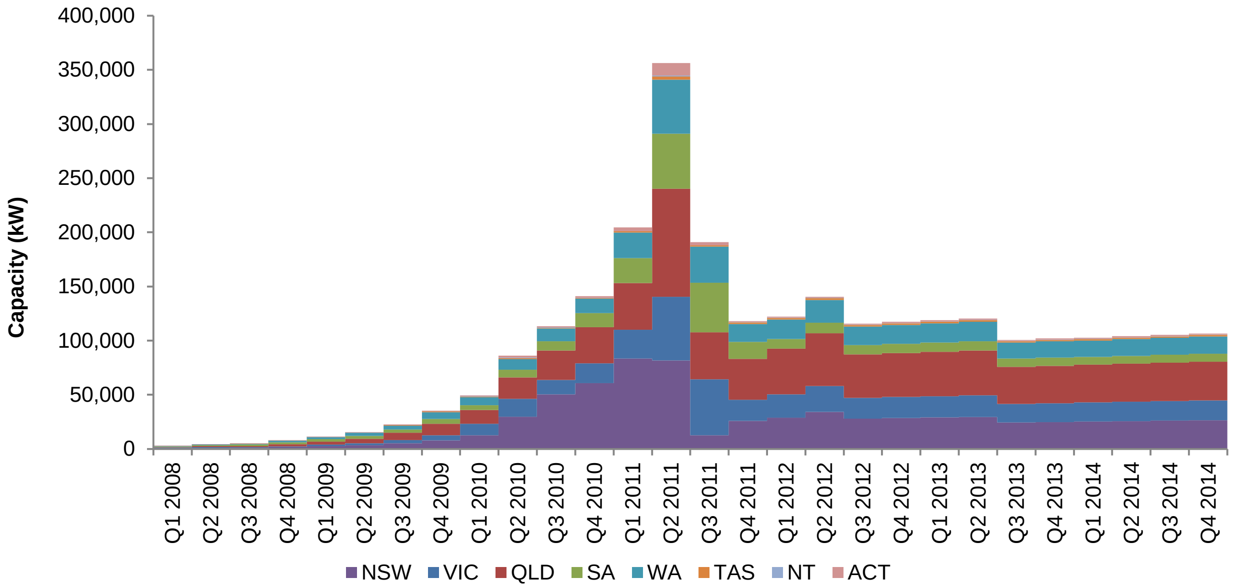
Figure ES 1 **Financial paybacks to PV installations – 2008 to 2014**



Source: ACIL Tasman analysis

In turn, ACIL Tasman's regression analysis indicated a projected rate of installation of solar PV systems as shown in Figure ES 2. For comparison, ACIL Tasman's projected installed capacity from Q4 2011 onwards is shown with observed installation rates derived from ORER data for the period Q1 2008 to Q3 2011.

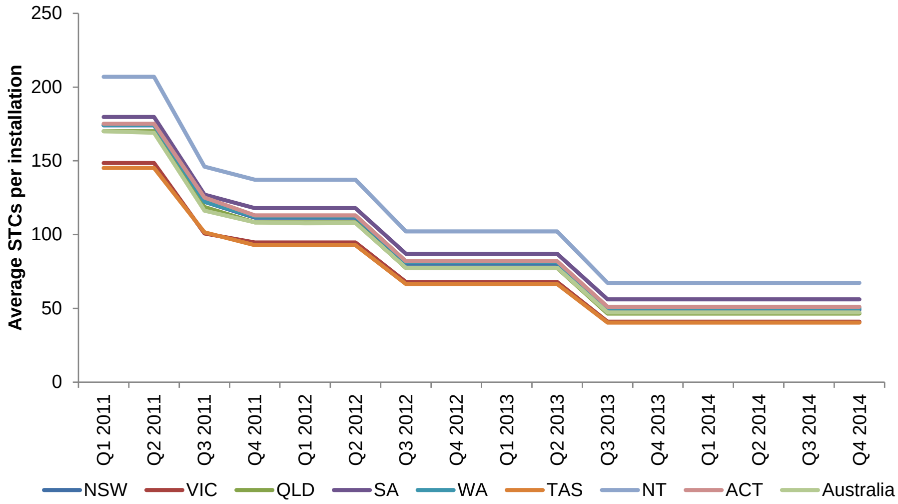
Figure ES 2 **Historical and projected installed capacity – 2008 to 2014**



Source: ORER to Q3 2011; ACIL Tasman analysis

Critically, ACIL Tasman's analysis indicates that changes to the Solar Credits multiplier on 1 July of the years 2011, 2012 and 2013 progressively reduce the number of STCs created per SGU installation, as shown in Figure ES 3.

Figure ES 3 **Average STCs per installation – 2011 to 2014**



Source: ACIL Tasman analysis

In turn, this results in a steady reduction in the number of STCs created by SGUs over the projection period. ACIL Tasman estimates that STC creation by SGUs will reduce from around 22.5 million STCs in 2012 to around 13 million in 2013 and around 8.5 million in 2014, as shown in Table ES 2.

Table ES 2 **Projected STC creation by SGUs (000s)**

Jurisdiction	2012	2013	2014
New South Wales	5,342	3,312	2,183
Victoria	3,548	1,973	1,305
Queensland	7,795	4,694	2,974
South Australia	1,948	940	607
Western Australia	3,364	1,996	1,311
Tasmania	221	144	98
Northern Territory	55	37	28
Australian Capital Territory	235	120	85
Australia	**22,508**	**13,216**	**8,591**

Data source: ACIL Tasman analysis

Solar water heaters

ACIL Tasman derived high, reference and low estimates of STC creation by SWH, reflecting the inherent potential for variation in the numerous financial and non-financial (e.g. regulatory) factors that affect SWH uptake.

The key driver of SWH installations in new dwellings are regulations in most states, particularly New South Wales, Queensland and Victoria, that essentially prevent the use of electric water heaters in new detached or semi-detached dwellings.

ACIL Tasman assumed that SWH penetration in new detached dwellings would largely reflect the implied market share in each jurisdiction over the twelve months to September 2011, which captures this, largely regulatory driven, increase in SWH penetration. Historical market share levels for SWHs in new dwellings are shown in Table ES 3

Table ES 3 **Implied market shares – SWH installations in new dwellings**

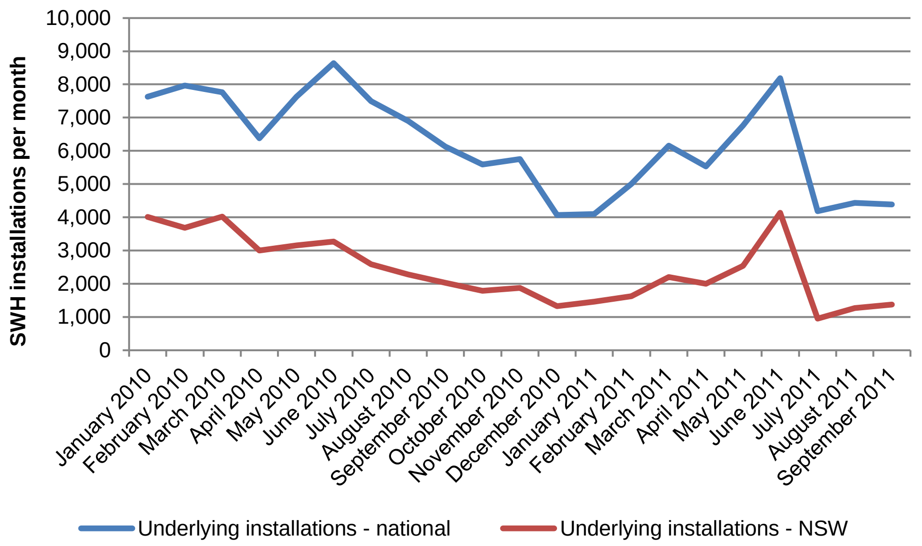
Jurisdiction	2008	2009	2010	October 2010 to September 2011
New South Wales	26.3%	25.3%	32.5%	65.4%
Victoria	44.1%	53.8%	53.7%	56.4%
Queensland	46.2%	49.6%	48.0%	57.4%
South Australia	11.9%	12.5%	17.7%	25.0%
Western Australia	21.3%	25.1%	31.0%	25.5%
Tasmania	7.0%	7.4%	11.0%	11.4%
Northern Territory	68.1%	57.7%	59.0%	57.7%
Australian Capital Territory	9.9%	28.2%	12.7%	33.8%

Data source: ACIL Tasman analysis

The rate of SWH installations as a replacement for existing water heaters is also affected by regulatory measures limiting the use of electric water heaters in existing dwellings, in place in Queensland and South Australia. Installation rates have also declined markedly since 1 July 2011 due to the removal of a rebate for SWHs that replace electric water heaters in New South Wales from that date.

ACIL Tasman's estimate of underlying SWH installations nationally and in the key state of New South Wales over the period from January 2010 to September 2011 are shown in Figure ES 4. ACIL Tasman's estimates for future installation rates vary either side of the broad trend through late 2010 and 2011, ignoring the transient spike in installations in mid 2011, which was largely driven by events in New South Wales.

Figure ES 4 **SWH replacement installation trends – Australia and New South Wales**



Source: ACIL Tasman manipulation of ORER data

Considering both new dwellings and replacement installations together, STC creation by SWHs is projected to be largely stable. ACIL Tasman's projection suggests that this rate will vary between 2.7 and 4 million STCs per year over the projection period, which is substantially lower than the rate of STC creation by SGUs.

Detailed STC creation results by jurisdiction are shown in Table ES 4.

Table ES 4 **STC creation by SWHs (000s)**

	2012			2013			2014		
Jurisdiction	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	1,026	864	701	1,088	878	668	1,096	877	658
Victoria	705	658	611	717	661	605	721	664	607
Queensland	1,126	992	919	1,285	1,079	935	1,314	1,096	940
South Australia	220	176	132	254	201	147	261	205	149
Western Australia	435	358	281	472	375	278	504	372	239
Tasmania	60	49	38	61	49	37	61	49	37
Northern Territory	41	34	27	42	35	28	42	34	27
Australian Capital Territory	42	35	28	41	33	25	41	33	25
Australia	**3,655**	**3,166**	**2,737**	**3,960**	**3,310**	**2,722**	**4,040**	**3,331**	**2,684**

Data source: ACIL Tasman analysis

Combined results

Combining STC creation rates by SGUs and SWHs, ACIL Tasman's analysis indicates that the total level of STC creation over the projection period will reduce from around 25.7 million in 2012 to around 16.5 million in 2013 and just under 12 million in 2014.

Table ES 5 **Projected STC creation – SGUs and SWHs (000s)**

	2012	2013	2014
SGU estimate	**22,508**	**13,216**	**8,591**
SWH – reference estimate	**3,166**	**3,310**	**3,331**
SWH – high estimate	3,655	3,960	4,040
SWH – low estimate	2,737	2,722	2,684
Total – reference estimate	**25,674**	**16,526**	**11,922**
Total – high estimate	26,163	17,176	12,631
Total – lower estimate	25,245	15,938	11,275

Data source: ACIL Tasman analysis

1 Introduction

The Office of the Renewable Energy Regulator (ORER) commissioned ACIL Tasman to analyse the likely rate of creation of 'Small-scale Technology Certificates' (STCs) in the years 2012, 2013 and 2014 ('the projection period') under the Commonwealth Government's Small-scale Renewable Energy Scheme (SRES).

The SRES supports take-up of two renewable energy sources by households and businesses: 'Small generation units' (SGUs), particularly solar photovoltaic (PV) systems, and solar water heaters (SWHs). It supports these technologies by requiring wholesale purchasers of electricity to purchase and surrender STCs, which can only be created by owners of SGUs and SWHs (or agents assigned STC creation rights by the owner).

The SRES does not have a pre-specified target for the level of renewable energy from SGUs and SWHs that it will support. Rather, the number of STCs that wholesale purchasers of electricity must surrender is estimated in advance based on expected levels of STC creation in the coming calendar year. Individual liabilities are then calculated as a percentage of total liable energy acquisitions, known as the 'small-scale technology percentage' (STP).

ACIL Tasman's modelling for ORER is intended to support ORER's advice to the responsible Minister on the setting the STP for the 2012 calendar year in regulations. This modelling is also intended to support ORER's publication of non-binding estimates of the 2013 and 2014 STPs.

Further background on the operation of the SRES relevant to this analysis is provided in section 2.

ACIL Tasman adopted separate methodologies for projecting STC creation by SGUs and SWHs, due to the different policy and economic drivers of uptake of these technologies.

STC creation by SGUs was modelled using an econometric regression examining the relationship between historic installation rates for solar PV systems and the discounted financial return available to owners of such systems. By then projecting financial returns for PV installations occurring during the projection period, we can estimate SGU installation rates and STC creation rates.

Section 3 outlines ACIL Tasman's analysis of financial returns to solar PV systems, and analysis of historical PV installation rates. This section discusses our assumptions on critical factors affecting financial returns to PV systems, namely PV system costs, government policies that support PV systems such as feed-in tariffs and STC subsidies, and retail electricity prices.

Section 4 describes how these inputs were combined in ACIL Tasman's econometric model with projected financial returns to project the rate of installation of PV generation capacity during the projection period. This section also outlines other assumptions critical to translating the projected rate of installed capacity into a projected rate of STC creation, and summarises the SGU projection results.

STC creation by SWH exhibits different dynamics to that by SGUs. Essentially, all households in Australia have one working water heater. Accordingly, our approach examines firstly SWH installation rates in new dwellings in part by examining changes to the stock of new dwellings. Separately, we look at typical rates of SWH installations as a replacement for existing water heaters as being reflective of likely rates of turnover of the existing water heater stock. Given the potential for these trends to vary, we adopted a sensitivity approach to the SWH projection involving high, reference and low estimates.

Section 5 outlines the key assumptions and results of ACIL Tasman's projection of STC creation by SWHs.

Section 6 summarises the overall projected level of STC creation in 2012, 2013 and 2014 by both SGUs and SWHs.

2 Policy background

The SRES commenced operation on 1 January 2011. As noted in section 1, it supports take-up of two renewable energy sources by households and businesses: 'Small Generation Units' (SGUs), particularly solar photovoltaic (PV) systems; and solar water heaters (SWHs). It supports these technologies by requiring wholesale purchasers of electricity to purchase and surrender STCs. As STCs can only be created by owners of SGUs and SWHs (or agents assigned STC creation rights by the owner) this requirement gives STCs a financial value and therefore supports take-up SGUs and SWHs.

2.1 The small-scale technology percentage

The SRES is an 'uncapped' scheme, which means that it does not target a particular number of STCs that should be created by SGUs and SWHs in a given year. Rather, the Government has provided that any appropriately registered liable entity can purchase STCs from a Government-run clearing house at the price of $40, effectively capping the price of STCs at this level (although STCs regularly trade bilaterally at prices below this level). The quantity of STCs created is uncertain and will depend on the market's response to the incentive created by the STC price, as well as other factors that affect supply and demand for STC-eligible technologies such as system costs, electricity prices and feed-in tariff policies.

To ensure that liable entities purchase and surrender an appropriate amount of STCs each quarter, the responsible Minister must publish a 'small-scale technology percentage' (STP) at the start of each SRES compliance year that represents the estimated rate of STC creation as a proportion of all sales of electricity that are treated as 'relevant acquisitions' under the SRES.

ORER will provide advice to the Minister in support of his determination of the 2012 STP, and ACIL Tasman's modelling will, in turn, support ORER's development of this advice. ACIL Tasman's modelling will also support ORER's publication of non-binding estimates of the STP for calendar years 2013 and 2014.

In December 2010, the Commonwealth Government set the 2011 STP at 14.8 per cent, reflecting expected STC creation of 28 million in 2011. This decision was supported by analysis undertaken for ORER by ACIL Tasman and other organisations.

Importantly, section 40A(3)(d) of the Renewable Energy Act requires that, if the year in question is 2012 or later, the making of a regulation to set the STP must take into account "the amount by which the previous year's estimate under paragraph (a) [the STP for the previous year] exceeded, or was exceeded by, the value, in MWh, of small-scale technology certificates that were created in that year…".

At the time of writing, the number of STCs registered and surrendered (i.e. used for compliance obligations) was approaching 50 million, i.e. 22 million in excess of ex ante estimates of 2011 STC creation underpinning the 2011 STP. This implies than an 'overhang' of at least 22 million STCs will be 'carried over' to the 2012 STP as intended by section 40A(3)(d) of the Renewable Energy Act.

ACIL Tasman's understanding is that ORER will set the 2012 STP taking into account both this modelling and that of other independent analysts, but also taking into account the most up-to-date information of 2011 STC creation rates available at the time the STP is set.

Accordingly, this report specifically focuses on 2012 STC creation estimates and cannot, without additional analysis of 2011 STC creation rates, be used to estimate 2012 SRES compliance obligations. Further, the 2012 STP cannot be implied from this analysis without estimating the level of 'reduced acquisitions' for 2012, this being the number of MWh of electricity acquisitions that are liable under the SRES and not exempted from liability.

2.2 Solar Credits

Under the SRES, the number of STCs created by an SGU is ordinarily determined by the system's expected renewable electricity output over its life. However, the 'Solar Credits' policy increases the number of STCs that could be created by SGUs so as to increase the value of assistance that these installations received.

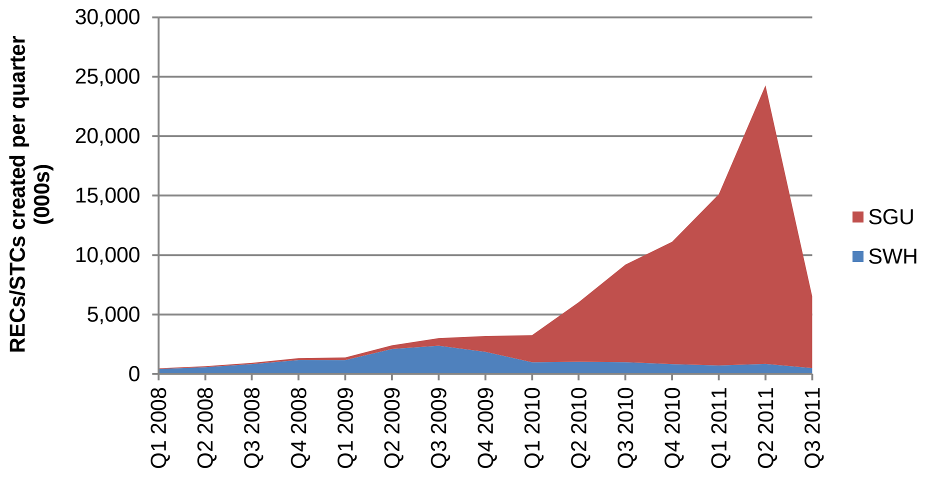
For solar PV systems, an initial 'Solar Credits multiplier' of five was set in June 2009, which meant that the number of STCs created by the first 1.5 kilowatts of capacity of any single installation was increased five-fold. The Solar Credits multiplier reduced to three on 1 July 2011 (subject to various transitional arrangements) and is set to reduce to two on 1 July 2012 and one on 1 July 2013. In effect, the Solar Credits policy will cease to operate from 1 July 2013, as STC creation by SGUs will occur at the 'normal' rate.

The Solar Credits policy has had a significant effect on both the level of solar PV installations that occurred in Australia (by increasing the subsidy available for SGUs from STCs) and the number of STCs created by those installations (by increasing the number of STCs per installation).

2.3 SGU and SWH trends

Recent increases in the uptake of SGUs in response to declining PV system costs and generous government subsidies have dramatically increased the portion of STCs (historically Renewable Energy Certificates or RECs) from small-scale sources created by SGUs rather than SWHs (see Figure 1).

Figure 1 **Portion of STCs created by technology**



Note: STC creation attributed to quarters by the date of installation, not the date of certificate creation. Accordingly, data for Q4 2010 through Q3 2011 is incomplete. SWHs and SGUs installed before 31/12/2010 created RECs rather than STCs.

Data source: ORER.

Accordingly, analysis of STC creation rates by SGUs increasing explains the key trends in overall STC creation rates, as is reflected by the emphasis on SGU STC creation trends in this analysis.

Further, STC creation by SGUs is dominated by solar PV systems, in preference to the other SGU technologies, micro-hydro and micro-wind, as shown in Table 1.

Table 1 **Micro-wind, micro-hydro and solar PV comparison, 2001-present**

Technology	Installations	Capacity installed (kW)	STCs created
Micro-hydro	20	33	406
Micro-wind	451	1,703	19,650
Solar PV	610,732	1,281,678	73,119,269

Data source: ORER (current to 6 November 2011).

Accordingly, one can focus entirely on trends in the solar PV sector to discern likely future trends in STC creation by SGUs. Reflecting this, the discussion below generally uses the terms SGU and solar PV interchangeably, and trends analysed are exclusively through reference to solar PV policy settings.

3 Analysis of financial returns from SGUs

ACIL Tasman's projection of installation rates of, and STC creation by, SGUs is fundamentally underpinned by an analysis of the financial returns to installers of SGUs, both historically and in the future.

Our estimates of historical financial returns to solar PV systems over the period from the start of 2008 to the end of September 2011 are compared with historical PV installation rates in the econometric analysis described in section 4.2.

Once the econometric analysis has established a historical relationship between financial returns and installation rates, this relationship can be used to project solar PV installations rates over the projection period, and thereby STC creation rates.

ACIL Tasman has estimated discounted financial return to installers of PV systems over the full system life for systems of various sizes in each jurisdiction, using a nominal discount rate of 10%.

This analysis must capture historic and potential changes in a range of variables that will affect the attractiveness of SGUs to households and businesses, and therefore likely SGU installation and STC creation rates. The key variables are:

- PV system costs
- the value of government incentives for PV systems such as Solar Credits and feed-in tariffs
- the value to the installer of electricity generated by the PV system.

Assumptions made in relation to these variables are set out in the following sections.

It should be noted that a range of factors other than those listed above may affect household and business decisions to install solar PV systems. Many of these factors are not easily quantifiable, such as environmental attitudes, marketing and anecdotal responses to the experiences of friends and family.

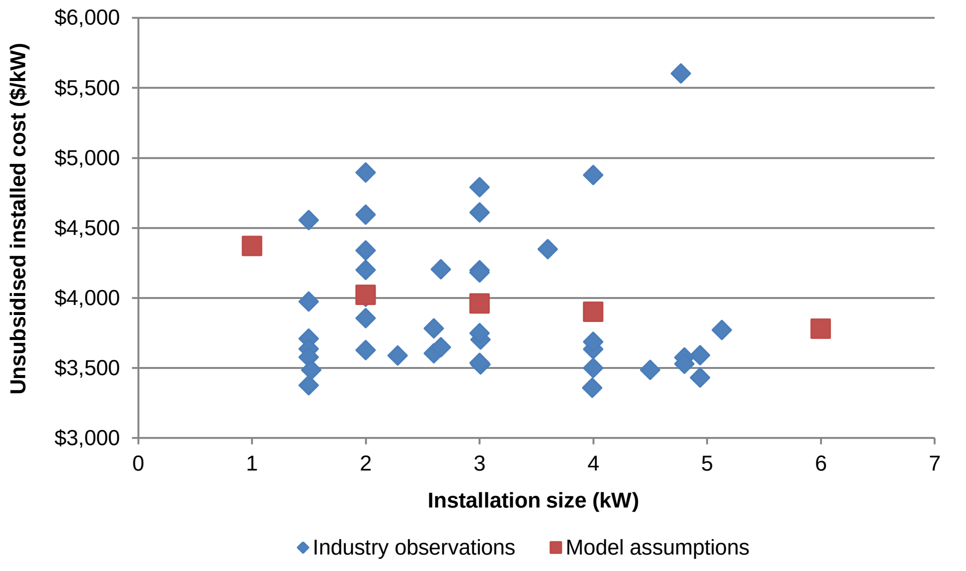
Nevertheless, it is still reasonable to project future installation rates for this technology as being related to the financial attractiveness of the systems, even if the decision-making process of the households and businesses making the decision is not directly or exclusively financial.

3.1 System costs

ACIL Tasman's analysis of system costs drew on a literature review of system cost components and a web-based review of public system cost quotes. The series of system cost quotes obtained indicated a large variation within common system size bands, potentially indicating a combination of variation in system quality, different treatment of non-standard installation costs and some special offers reflecting unusual market circumstances.

ACIL Tasman has modelled PV system installation costs for the period October 2011 to December 2011 as varying either side of $4,000 per kilowatt installed (unsubsidised and exclusive of GST), as shown in Figure 2.

Figure 2 **October to December 2011 variation in unsubsidised installed system cost by size (exclusive of GST)**



Note: Installed costs are GST exclusive. Estimating unsubsidised costs required, in some cases, estimates of supplier assumed STC prices, and estimates about additional (non-standard) installation charges. Accordingly, the pattern on installation costs is indicative only and may not accurately reflect any single installation.

Source: NUenergy; EcoKinetics; Australian Sun Power; Solar Gain; Sunterra.

Looking forward, unsubsidised system costs were projected to decline in real terms. In particular, real module costs were assumed to decline at a rate of 5.5 per cent per year based on an assumed annual growth rate of module production of 22 per cent per year and a learning rate of 18 per cent (i.e. costs reduce 18 per cent for every doubling of installed capacity).[1] Conversely, other cost components were projected to reduce at a lower rate:

[1] As estimated by Hearps and McConnell, University of Melbourne Energy Research Institute, *Renewable Energy Technology Cost Review*, for the 2011 Garnaut Review, drawing on estimates by the International Energy Agency and the European Photovoltaic Industry Association.

- inverter costs by 3 per cent real per annum
- balance of system costs declining at 0.8 per cent per year (reflecting that these components are largely mature)
- labour efficiency improving at 2 per cent per annum, partially offset by skilled labour costs increasing at 1.4 per cent per annum (drawing on ACIL Tasman estimates of demand for and value of skilled labour).

Slight adjustments were also made to labour cost assumptions based on labour market conditions: labour costs were assumed to be 130 per cent of the base assumption in northern Western Australia, 110 per cent in south-west Western Australia and the Northern Territory, 90 per cent in lower cost jurisdictions South Australian and Tasmania, and 100 per cent elsewhere.

Once installed, the output of a system is assumed to degrade by 0.5 per cent per year. System life was assumed as 25 years, with inverters replaced every 10 years.

3.2 Government assistance to SGUs

Government assistance to SGUs is an important driver of the financial attractiveness of these systems to households and businesses, and so must be adequately captured in our analysis of financial returns. This is particularly true of the historical period analysed, where PV system costs were substantially higher than at present and the attractiveness of these systems was heavily dependent on upfront subsidies (e.g. through STC creation) or ongoing assistance in the form of feed-in tariffs.

3.2.1 STCs/Solar Credits

SGUs typically create STCs by 'deeming' the likely electricity output of the system over its first fifteen years of operation. In this way, STC creation represents an upfront subsidy to installers of SGUs.[2]

As discussed above in section 2.2, the Solar Credits policy has operated to enhance the level of subsidy provided by the SRES to SGUs by multiplying the amount of STCs that can be created in respect of the first 1.5 kilowatts of installed capacity for each individual installation.

The Solar Credits policy affects STC creation rates in two important ways. Firstly, the Solar Credits policy affects the rate of STC creation for any given level of SGU installation, as it increases the number of STCs any single installation can create. Secondly, the Solar Credits policy affects the financial

[2] Whilst installers of SGUs can elect to create STCs on an annual of five-yearly basis rather than upfront, this is extremely rare.

attractiveness of SGUs, and therefore SGU installation rates. Given these two interrelated effects, the level of the Solar Credits multiplier is critical to the projection.

ACIL Tasman has assumed the Solar Credits multiplier policy settings set out in Table 2 in determining historical and future financial returns to PV systems.

Table 2 **Assumed Solar Credits multiplier**

	9 June 2009 to 30 June 2011	1 July 2011 to 30 June 2012	1 July 2012 to 30 June 2013	1 July 2013 onwards
Solar Credits Multiplier	5	3	2	1

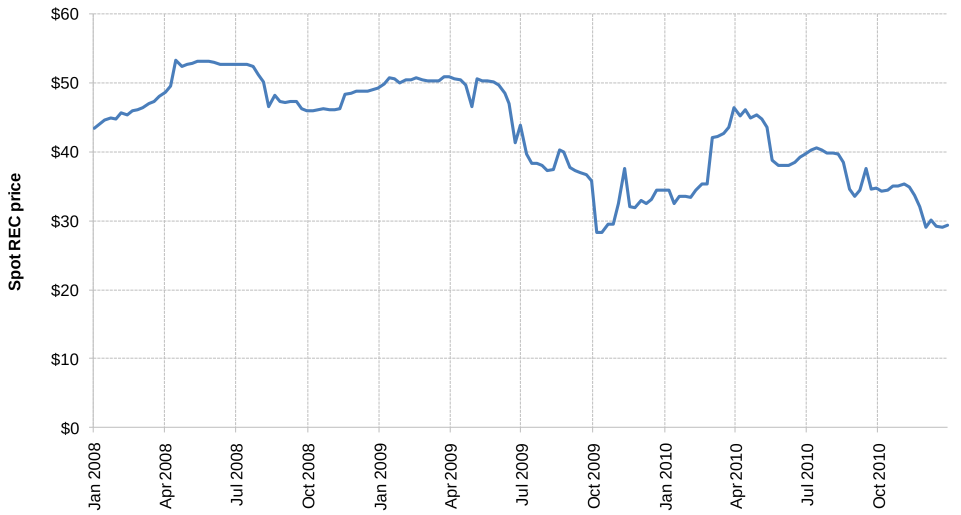
The Commonwealth Government put in place transitional arrangements in relation to the reduction of the Solar Credits multiplier from five to three on 1 July 2011, such that some systems that were committed to be installed before 5 May 2011, but installed after 1 July 2011, would receive a multiplier of four rather than three.

However, ACIL Tasman's analysis for ORER in June 2011, which included a survey of PV system suppliers to assess their views of the operation of the transitional arrangements, indicated that very few if any installations that are eligible to receive a Solar Credits multiplier of four would occur after 1 January 2012. Accordingly, these arrangements will have a negligible effect on STC creation rates in 2012, although some installations occurring between July 2011 and December 2011 will create STCs under this transitional multiplier during 2012. For completeness, ACIL Tasman assumed that half of the installations occurring in July and August 2011 would receive the transitional Solar Credits multiplier of 4.

Also of importance to analysing the financial value of the Solar Credits policy to SGUs are changes in historic REC prices (prior to 1 January 2011) and historic and future changes in STC prices (following 1 January 2011).

REC prices for the period 2008 to 2010 are shown below in Figure 3. This captures the steady decline in the REC price towards the end of 2010 as high levels of solar PV installation tended to exacerbate the existing bank of certificates and depress price expectations.

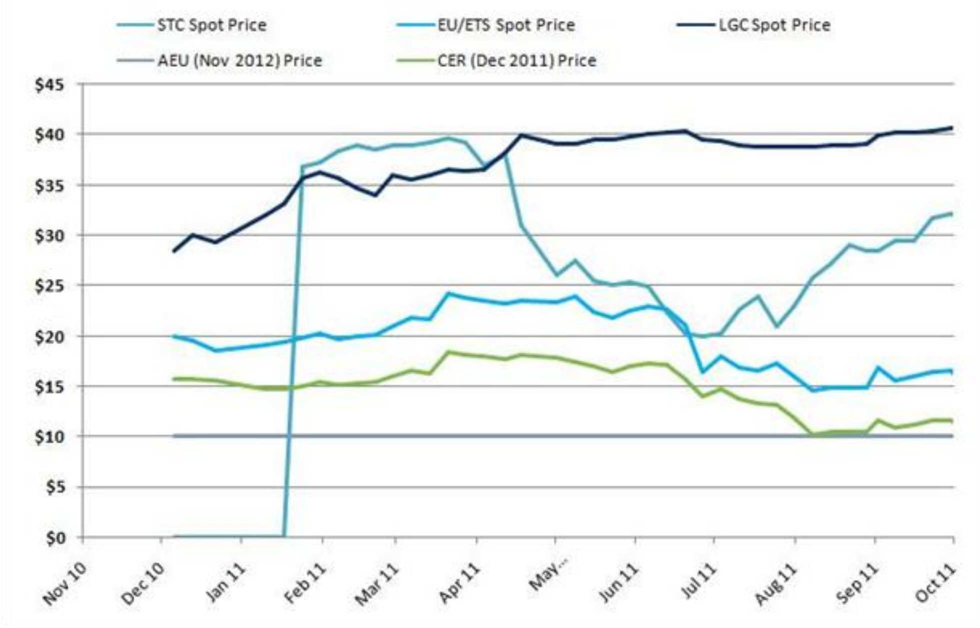
Figure 3 **Historic REC prices 2006-2010**



Data source: AFMA Environmental Products Curve (mean of mids, excluding outliers).

Given recent significant reductions in STC prices, ACIL Tasman has specifically analysed potential future trends in this variable. In the early months of 2011 STCs traded close to their legislated price of $40/certificate. However, around mid April 2011 the balance of supply and demand in the STC market led to material reductions in this price, with prices dropping as low as $20. However, as shown in Figure 4, STC prices have since recovered to around $30/certificate.

Figure 4 **STC and LGC prices**



Source: Green Energy Markets (accessed 18 November 2011)

The recent trend of a firming STC price should be supported by the establishment of the 2012 STP by the responsible Minister, which this analysis is intended to support. At that time, the market will have firm guidance that the excess STCs created during 2011 will be required to satisfy the 2012 STP (as foreshadowed by section 40A(3)(d) of the Renewable Energy Act), returning the price towards the clearing house price.

Further, it is relevant to note that, whilst the relevant Minister can make a determination varying the clearing house price, such a determination cannot take effect until the first 1 April following the determination at the earliest. This means that if no such determination is made prior to 1 April 2012 it could not take effect until 1 April 2013, and therefore the clearing-house price of $40 would effectively be fixed for the 2012 compliance year. The absence of such a determination would also greatly support the firming of STC prices towards this level during 2012.

Accordingly, the STC price assumptions used in this modelling are shown in Table 3.

Table 3 **STC price assumptions**

	1 January 2011 to 31 March 2011	1 April 2011 to 30 June 2011	1 July 2011 to 30 September 2011	1 October 2011 to 31 December 2011	1 January 2012 to 31 March 2012	1 April 2012 onwards
STC price	$40	$25	$25	$30	$35	$40

Data source: ACIL Tasman assumptions for modelling purposes (not to be taken as a price forecast)

3.2.2 Feed-in tariffs

Many state and territory governments in Australia have implemented 'feed-in tariffs' to support the take-up of small scale solar PV systems. A feed-in tariff entitles a household or business that installs a small-scale PV unit to earn a premium rate for the electricity they export to the grid (i.e. 'feed in' to the grid). This premium rate subsidises the installation of PV units by offsetting the owner's up-front cost of purchasing a system more rapidly than if they were simply being paid the standard retail rate for electricity for their exported electricity.

Some feed-in tariffs work on a 'gross' basis, where all electricity generated by the unit receives the premium rate, not just that which is fed in to the grid. This is a more generous arrangement for the owner and results in the unit's up-front capital cost being paid back faster. More typically, feed-in tariffs operate on a 'net' basis where the unit owner only receives the feed-in tariff on the amount of electricity exported to the grid (i.e. system output less the household's own consumption of that output).

A range of changes to feed-in tariff policies have occurred during 2011, with the effect that, at the time of writing, only Queensland has a 'premium' feed-in tariff available for solar PV systems that are committed today or in the future. Nevertheless, it is important to faithfully represent the availability of feed-in tariffs during the historical period to understand how historical installation rates have varied in response to the available financial returns.

NSW Solar Bonus Scheme

The original NSW Solar Bonus Scheme, consisting of a 60 cents/kilowatt-hours (kWh) gross feed-in tariff, was closed as of 27 October 2010 and replaced with a 20 cents/kWh gross feed-in tariff.

However, transitional arrangements provided that customers who had already entered a binding agreement to purchase a system were given until 18 November 2010 to apply to receive the original 60 cents/kWh tariff. A substantial number of applications to enter the Solar Bonus Scheme were received between 27 October and 18 November 2010, such that around 323 MW of applications to enter this feed-in tariff were eventually received and either installed or remain active as of 30 June 2011. Of these 323 MW, the NSW Auditor General estimated that around 272 MW were connected as of 30 June 2011 (i.e. 51 MW were still to be connected).[3]

[3] *Solar Bonus Scheme Special Report*, Audit Office of New South Wales, November 2011.

On 28 April 2011, the NSW Government suspended applications to the 20 cents/kWh feed-in tariff scheme as of the following day. This suspension remains in place at the time of writing.

As of 30 June 2011, around 29 MW of installations had already occurred under the 20 cents/kWh feed-in tariff, with around 20 MW yet to be installed.

On 13 May 2011, the NSW Government announced retrospective changes to the 60 cents/kWh feed-in tariff such that the rate for all eligible installations (whether installed or pending) would be reduced to 40 cents/kWh. However, this policy position was withdrawn on 7 June 2011 and so has not been factored in to this analysis.

ACIL Tasman's analysis of ORER data indicates that installation rates prevalent through Q3 2011 will be sufficient to complete the remaining installations eligible to receive both the 60 cents/kWh and 20 cents/kWh feed-in tariffs. Accordingly, ACIL Tasman has modelled paybacks for Q4 2011 onwards as receiving no feed-in tariff.

It is also possible that some installations during Q1 to Q3 2011 will not receive any feed-in tariff, but financial returns have been modelled on the basis that the elevated installation rates observed during Q1 and Q2 2011 are reflective of the 'back log' of installations committed prior to 18 November 2010 under the 60 cents/kWh feed-in tariff. In turn, installation rates observed during Q3 2011 appear to be reflective of those installations primarily receiving the 20 cents/kWh feed-in tariff.

Victorian feed-in tariff

On 1 September 2011 the Victorian Government announced that it would close its 'premium' 60 cents/kWh net feed-in tariff as of 30 September 2011. Systems were required to have been physically installed by this date to receive this feed-in tariff. However, systems installed after that date would receive a new transitional feed-in tariff of 25 cents/kWh (with the feed-in tariff being paid from 1 January 2012 to 31 December 2016).

As this policy transition applied according to the physical date of installation, ACIL Tasman has modelled Q3 2011 financial returns as being inclusive of the 60 cents/kWh feed-in tariff, whilst Q4 2011 installations are modelled as receiving the 25 cents/kWh feed-in tariff.

The Victorian Government also announced a 75 MW capacity cap for the transitional feed-in tariff. ACIL Tasman's modelling of future financial returns assumes that this capacity cap will be applied at the time it is reached.

South Australian Solar Feed-in Scheme

On 31 August 2010 the South Australian Government announced that it would increase its feed-in tariff from 44 cents/kWh to 54 cents/kWh.

On 6 April 2011, the South Australian Government introduced legislation implementing this change, and also providing that the Solar Feed-in Scheme would close as of 1 October 2011.

However, on 23 June 2011 this legislation was passed by the South Australian Parliament with amendments that prevented the increase in the feed-in tariff rate to 54 cents/kWh, but extended the scheme for two years through a transitional feed-in tariff of 16 cents/kWh.

Unlike under the Victorian scheme, systems that were committed to be installed as of 30 September 2011, but not physically installed until after this date, would still be eligible to receive the higher feed-in tariff rate.

To represent these variations in South Australian feed-in tariff policy, ACIL Tasman has assumed the following:

- Most installations physically occurring between Q4 2010 and Q3 2011 (inclusive) would have been committed on the expectation of receiving the 54 cents/kWh feed-in tariff, and so expected financial returns were modelled on this basis, with a lag between the termination of this policy in late June 2011 and the roll-out of installations committed on this basis (assumed to occur through until September 2011)
- Most installations occurring in Q4 2011 would have been committed after June 23 2011 but before 30 September 2011 (reflecting the lag between commitment and installation), and therefore would both expect to receive, and actually receive, the 44 cents/kWh feed-in tariff
- Installations occurring from 2012 onwards would receive the transitional 16 cents/kWh feed-in tariff.

Western Australian Feed-in Tariff Scheme

On 20 May 2011 the Western Australian Government announced that its scheme will move from a 40 cents/kWh net feed-in tariff to a 20 cents/kWh net feed-in tariff from 1 July 2011, with an overall scheme cap of 150 MW.

Subsequently the Western Australian Government announced that the 150 MW cap had been reached and that therefore the 20 cents/kWh feed-in tariff would be closed from 1 August 2011.

Based on its analysis of implied PV installation rates in Western Australia during Q2 and Q3 2011, ACIL Tasman has modelled paybacks on the assumption that all installations physically occurring Q2 2011 received the 40 cents/kWh tariff, whilst those occurring during Q3 2011 received either the 40 cents/kWh or 20 cents/kWh feed-in tariff in equal proportion.

ACT Feed-in tariff Scheme

The ACT Government announced on 1 June 2011 that its small-scale feed-in tariff scheme (providing a gross feed-in tariff of 45.7 cents/kWh) had reached its pre-announced capacity cap of 15 MW and therefore that the scheme was closed as of midnight the previous day.

Subsequently the ACT Government decided to open its medium-scale gross feed-in tariff of 30.3 cents/kWh to small-scale installations. A rush of applications meant that this feed-in tariff was closed two days later, on 14 July 2011, once the medium-scale scheme's capacity cap of 15 MW had been reached.

Based on its analysis of implied PV installation rates in the ACT during Q2 and Q3 2011, ACIL Tasman has modelled paybacks on the assumption that all installations physically occurring Q2 2011 received the 45.7 cents/kWh tariff, whilst those occurring during Q3 2011 received either the 45.7 cents/kWh or 30.3 cents/kWh feed-in tariff in equal proportion.

Summary

A summary of model assumptions made in relation to major state and territory feed-in tariffs for the financial analysis is provided in Table 4.

Table 4 **Major Australian solar PV feed-in tariffs**

Jurisdiction	Basis	Rate (cents/ kWh)	Scheme start	Scheme closed	Tariff paid until	Availability in the model
NSW	Gross	60	1 January 2010	18 November 2010	31 December 2016	For installations occurring to end Q2 2011
	Gross	20	28 October 2010	29 April 2011	31 December 2016	For installations occurring in Q3 2011
Victoria	Net	60	1 November 2009	30 September 2011	31 October 2024	For installations occurring to end Q3 2011
	Net	25	1 January 2012	-	31 December 2016	For installations occurring from Q4 2011 onwards, until the capacity cap of 75 MW is reached
Queensland	Net	44	1 July 2008	-	30 June 2028	Available throughout projection
South Australia	Net	54*	1 July 2008	Never implemented	30 June 2028	For installations occurring from Q4 2010 to Q3 2011 inclusive
	Net	44	1 July 2008	30 September 2011	30 June 2028	For installations occurring in Q4 2011
	Net	16	1 October 2011	-	30 September 2016	For installations occurring from Q1 2012 onwards
Western Australia	Net	47 or 58.94**	1 August 2010	30 June 2011	10 years from installation	All installations occurring until Q2 2011, half of installations occurring in Q3 2011
	Net	27 or 38.94**	1 July 2011	1 August 2011	10 years from installation	Half of installations occurring in Q3 2011
ACT	Gross	45.7	1 March 2009	31 May 2011	20 years from installation	All installations occurring until Q2 2011, half of installations occurring in Q3 2011
	Gross	30.3	12 July 2011	14 July 2011	20 years from installation	Half of installations occurring in Q3 2011

** Announced but never implemented*

*** 27/47 cents/kWh applies for customers in the Synergy supply area; 38.94/58.94 cents/kWh applies in the Horizon supply area, consisting of the combined Solar Feed-in Scheme and Renewable Energy Buyback Scheme rates. These rates are subject to change.*

Note: all feed-in tariff rates are expressed in nominal terms.

3.3 Retail electricity prices

To estimate the value of retail electricity charges avoided by owners of PV systems, this financial analysis has required detailed examination of network cost trends, the level and incidence of costs associated with purchasing Large-scale Generation Certificates (LGCs) to comply with the Large-scale Renewable Energy Target (LRET) and STCs under the SRES, wholesale energy costs, retail portfolio hedging costs, retail operating costs, unique charges (e.g. the Victorian smart meters charge) and retail margins.

ACIL Tasman has used its wholesale electricity market model – *PowerMark* – to project wholesale electricity prices for this retail electricity price projection. The *PowerMark* modelling scenario utilised assumed the introduction of $23 per tonne of carbon dioxide equivalent emissions fixed carbon price from 1 July 2012, escalating at 5% per annum in nominal terms for three years. From 1 July 2015, ACIL Tasman assumed a market-linked carbon price consistent with Treasury modelling supporting the *Clean Energy Future* policy package.

PowerMark time-weighted wholesale market prices were adjusted to reflect the extent to which load-weighted prices to serve residential users are higher than average market prices (reflecting that retail users' consumption is typically correlated with times of higher overall market demand and higher pool prices). This analysis drew on ACIL Tasman analysis of the correlation of small customer load profiles (based on analysis of historic 'net system load profiles' published by the Australian Energy Market Operator) with price in each market region. Further, retail portfolio hedging costs were estimated from analysis of volatility in price trends in each energy market region.

Network costs materially affect future retail price trends. The allocation of costs between customer classes in each state or network region was estimated through analysis of published network tariffs for different user types in each location. Cost increases were estimated from revenue allowances and load growth trends set out in network determinations approved by the Australian Energy Regulator or the Economic Regulatory Authority of Western Australia.

A portion of the bills of energy consumers takes the form of a fixed supply charge, and so cannot be avoided by producing electricity on-site using solar PV. For modelling purposes we have estimated the financial return to PV owners as amounting to 90 per cent of their retail cost in any given period, based on analysis of the typical ratio of fixed to variable bill components for small customers (this ratio would be significantly different for larger energy users). We note that whilst the true economically variable portion of the cost of supplying small electricity consumers is likely to be far smaller than this, and therefore the economic benefit of substituting grid supplied electricity for distributed PV generation is likely to be over-estimated by this approach, it is a reasonable approximation of the financial benefit to customers based on present bill structures.

However, where the PV system exports electricity *in the absence of a feed-in tariff*, further judgements are required as to what financial return the consumer will receive (where a feed-in tariff is in place, the consumer will be paid for their electricity at the rate of the feed-in tariff).

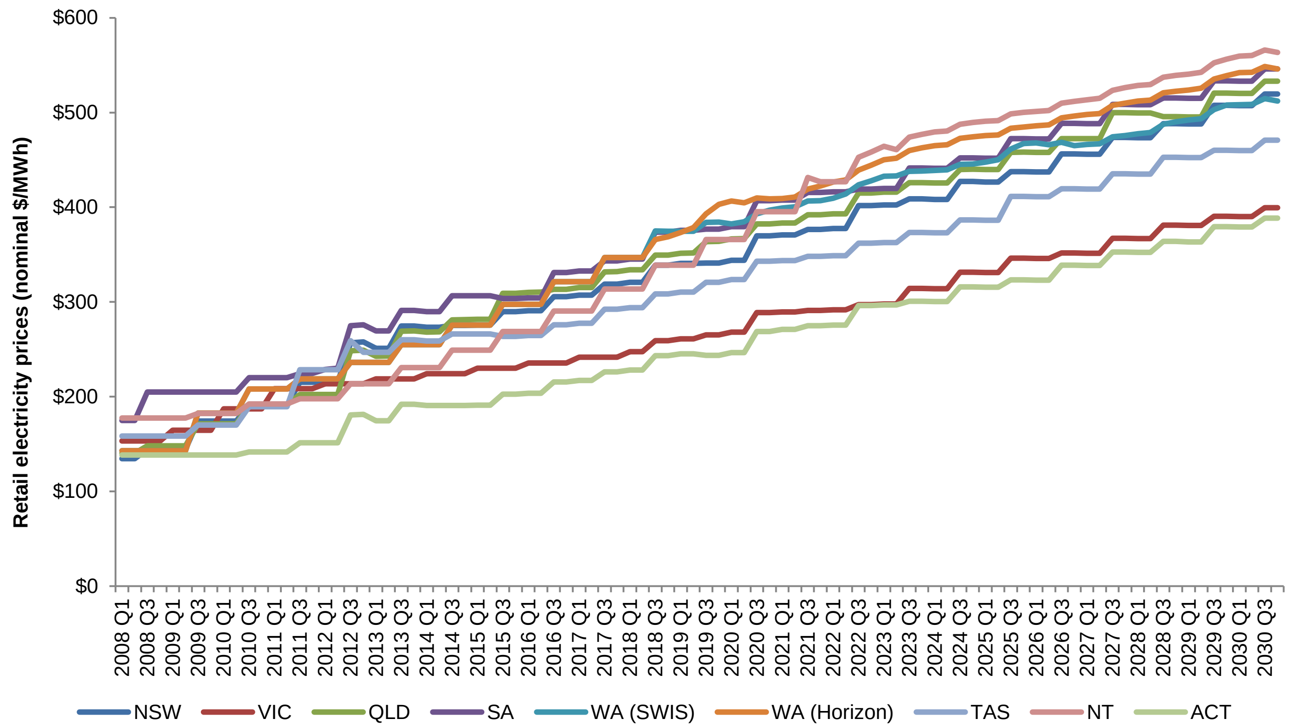
Given the existence of 'standard' feed-in tariffs in Victoria and Tasmania (which effectively guarantee that "the amount you pay to consume electricity from the grid is the same amount you receive when your solar PV system generates power and that is fed back into the grid"[4]), for these jurisdictions, ACIL Tasman adopted the approach of assuming that exported electricity receives the variable component of the prevailing electricity tariff when no feed-in tariff is in place.

For other jurisdictions, ACIL Tasman has assumed that exported electricity receives the 'economically avoidable' component of retail charges in the absence of a feed-in tariff. We estimated this component as consisting of wholesale energy (including carbon) and hedging costs, and variable 'green scheme' costs. Retail operating costs, retail margins and network costs can be broadly categorised as not being economically avoidable. We consider this approach to be broadly consistent with the approaches adopted by IPART (NSW) and ESCOSA (South Australia) in regulating the payment that retailers should make to PV system owners in the absence of, or in addition to, a feed-in tariff.

The projected overall trend in (carbon inclusive) retail electricity prices is illustrated in Figure 5 below. The projection period shown extends to 2030, reflecting that the financial returns to PV installations occurring in the period to 2014 are dependent on electricity prices well beyond 2014.

4 http://new.dpi.vic.gov.au/energy/policy/greenhouse-challenge/feed-in-tariffs/feed-in-tariffs-faq/standard-feed-in-tarrifs-faq; accessed 15 March 2011.

Figure 5 **Retail electricity price trends (nominal $/MWh)**



Note: Variable component of electricity prices presented only. Prices are expressed exclusive of GST.

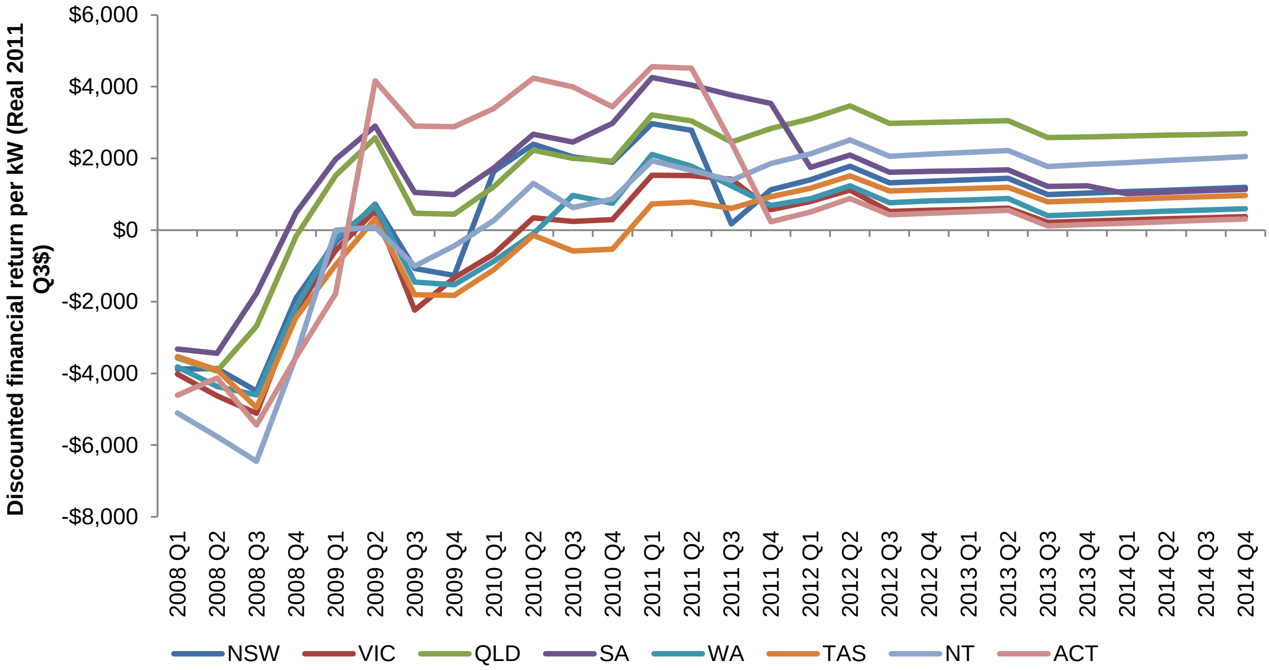
Source: ACIL Tasman analysis

3.4 Payback summary

Combining these policy elements, ACIL Tasman estimated discounted financial returns per kilowatt installed to PV systems in each jurisdiction. Discounted financial returns are calculated as the total financial benefits of a system to the installer – such as credits for exported electricity and the value of avoided electricity costs – less the total financial costs, consisting of the 'out of pocket' cost of the system (i.e. taking into account the benefit to the installer of creating STCs) plus ongoing costs such as inverter replacement. These benefits and costs are further adjusted through discounting. Discounting is the process of valuing costs and benefits in the future less than those received today to reflect people's preference to receive benefits earlier rather than later.

Figure 6 illustrates the discounted financial return that an installer of a PV system would earn over the life of that system, based on the date and location of installation. Where the figures shows negative discounted returns, this indicates that the system does not pay for itself on a discounted basis. However, if undiscounted cash flows are considered, such a system may recover the initial cash outlay over its life.

Figure 6 **Financial returns to PV installations – 2008 to 2014**



Source: ACIL Tasman analysis

4 SGU projection

Having developed a financial return series over both the historical and projection periods as outlined in section 3, our methodology requires:

- Analysing historical ORER data to estimate actual PV installation rates
- Using an econometric regression model to determine a relationship between historical financial returns and historical PV installation rates
- Projecting future installation rates in accordance with this relationship
- Converting future installation rates into future STC creation rates to derive the required output for this analysis.

4.1 Observed installation rates

To support this analysis, ORER provided ACIL Tasman with a comprehensive database of STC creation data at the installation level. This data contains information on certificate creation by creation date, installation date, installation location and system size to support this analysis. The data provided was current to 6 November 2011, although many SGUs that had created STCs were still subject to a compliance audit.

One difficulty in using ORER's STC creation database is that it relies on the STC creation process to provide information about installation date, location, size and other factors. SGUs and SWHs can create STCs up until twelve months after the physical installation occurs, and then are subject to audit processes. The lag between installation and STC creation inherent in this date set means that it is not complete until around one year after a given period has ended.

In turn, this means that estimating SGU installation rates for periods less than 12 months before the finalisation of the data set (i.e. November 2010 onwards) requires that allowance be made for this lag. However, the uncertainty surrounding this estimation declines significantly for periods approaching 12 months ago.

One further methodological point is relevant. The Solar Credits multiplier applying to a particular installation is related to the date of physical installation, not the date of STC creation. Accordingly, accurate assessment of STC creation rates requires analysis based primarily on the number of physical SGU installations occurring in a given period, rather than the number of STCs created in any given period. This methodology allows us to 'see through' the STC creation data to look at the underlying installation rate (which more directly reflects market conditions at a given time). Then, once the underlying installation rates are discerned and projected, further assumptions about the likely lag in STC creation rates are then laid over the installation estimate to derive the output of this analysis, namely STC creation levels for particular periods.

4.1.1 Estimations of lag in STC creation

ACIL Tasman's approach to estimating lag rates between physical installation and STC creation were derived by firstly examining the observed lags between installation and STC creation rate for installations occurring in the most recent month for which complete STC creation data is available, i.e. the installation month ending one year before the data set was finalised. As the data set was current as of early November 2011, we took October 2010 as being this 'complete' data set.

For installations that occurred in October 2010, the rate of STC creation for each of the 12 months after installation can be directly observed. However, for installations occurring in more recent months this rate needs to be inferred or assumed from earlier data. For installations that occurred in November 2010, we took the data set for STCs created within 11 months of installation as complete and inferred the likely rate of STC creation in the 12th month from data for the preceding three months (i.e. August to October 2010). Similarly, to infer December 2010 installation rates we drew on the observed or implied STC creation rates in 11th and 12th months after installation for September to November 2010 installations. This process was continued for more recent months to estimate an implied 'underlying' installation rate for months up to and including September 2011 (for which, 11 months of STC creation rates were implied from earlier periods, whilst only 1 full month of STC creation data was available).

For the purpose of estimating future lag rates, observed and inferred lag rates for the period September 2010 to August 2011 were averaged and assumed to remain constant through the projection period. This analysis suggests lag rates as set out in Table 5 below.

Table 5 **Assumed lag in STC creation by SGUs over projection period**

	SGU installations creating STCs within x days after installation		
Days (x)	September 2010	Observed/ inferred average over past 12 months	Incremental lag
30	57.7%	57.3%	57.3%
60	72.5%	75.0%	17.8%
90	80.1%	83.0%	8.0%
120	85.5%	87.4%	4.3%
150	86.9%	89.9%	2.6%
180	88.1%	92.4%	2.4%
210	89.1%	94.1%	1.7%
240	91.1%	95.4%	1.3%
270	94.9%	96.6%	1.2%
300	96.1%	97.2%	0.6%
330	96.9%	97.8%	0.6%
365	100.0%	100.0%	2.2%

Note: Totals may not add due to rounding.

Data source: ORER; ACIL Tasman assumptions.

4.1.2 Underlying installation rates

Applying the methodology described above suggested specific lag rates for each month of the period October 2010 to September 2011 (based on the three preceding months). These lag rates in turn imply 'underlying' installation rates for each of these months, with this being the estimated actual rate of installation that occurred in these months, but which will not be revealed fully in the STC creation data until all installations have created STCs and been audited.

This approach to estimating underlying installation rates allows meaningful analysis of the most recent data available whist allowing for the lag effect noted above, and therefore is necessary to include recent months in the econometric analysis.

Table 6 sets out national installation rates (installed capacity) for each month since October 2010 directly observed from the ORER STC creation data. It also sets out level of installed capacity in the data set where STCs were created within 60 days (to allow comparison with more recent months). Finally, the table set out our estimate of 'underlying' installed capacity for recent months based on the lag analysis described in section 4.1.1 above.

The reader may note that the percentage of installations creating STCs within 60 days tends to increase in recent periods: this is because more recent installations that will ultimately create STCs more than, say, 150 days after installation have, by definition, not yet done so. Put another way, when looking at a period of time that started less than 60 days ago, 100 per cent of observed STC creation will occur within 60 days. As further STC creation occurs, this percentage will fall to the true level. Accordingly, the reader should note that the numbers in bold in the table below can be misleading: these percentages must decrease as further STCs are created by installations undertaken in those months.

Table 6 **Observed and underlying SGU installed capacity – September 2010 to August 2011**

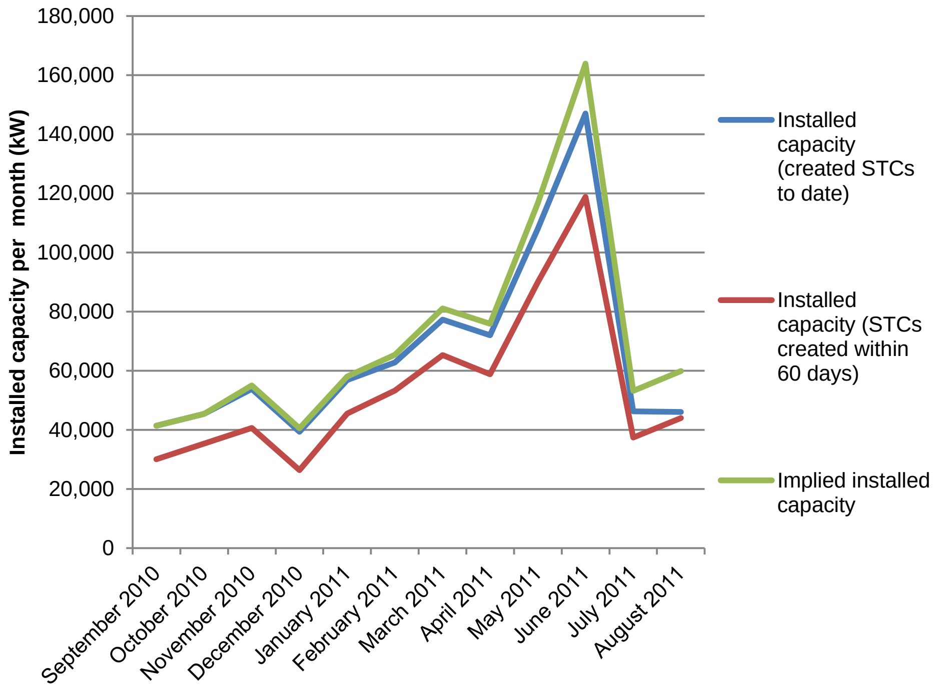
Month	Observed installed capacity (kW)	Installed capacity (STCs created within 60 days) (kW)	% of installed capacity with STCs created within 60 days	Assumed % of installed capacity creating STCs within 60 days	Underlying installed capacity (kW)
September 2010	41,398	30,029	72.5%	72.5%	41,398
October 2010	45,414	35,360	77.9%	77.9%	45,414
November 2010	53,822	40,614	**75.5%**	73.7%	55,073
December 2010	39,382	26,379	**67.0%**	65.1%	40,504
January 2011	56,809	45,538	**80.2%**	78.4%	58,079
February 2011	62,762	53,238	**84.8%**	81.4%	65,405
March 2011	77,269	65,256	**84.5%**	80.5%	81,034
April 2011	72,049	58,760	**81.6%**	77.5%	75,854
May 2011	107,991	89,914	**83.3%**	77.1%	116,606
June 2011	147,048	118,802	**80.8%**	72.5%	163,847
July 2011	46,214	37,347	**80.8%**	70.3%	53,152
August 2011	46,094	44,021	**95.5%**	73.6%	59,841

Note: The bold figures for 'Installed capacity (STCs created within 60 days)' are potentially misleading, as the full year of STC creation data is not available.

Data source: ORER; ACIL Tasman analysis.

The data is illustrated in Figure 7.

Figure 7 **SGU observed and underlying installation rates – September 2010 to August 2011**



Data source: ACIL Tasman manipulation of ORER data.

The underlying September 2011 rate of installed capacity was estimated using the rate of STC creation within 30 days, and so is not presented in this table. However, our underlying estimate for this month was included in our econometric analysis to provide a full Q3 2011 installed capacity variable.

The trend above is presented on a national basis, but underlying installed capacity estimates were derived for each state and territory as inputs to the econometric model.

4.2 Econometric model specification

4.2.1 Modelling approach

The method adopted to forecast the level of take-up of solar photovoltaic systems is an econometrically-based regression approach. The regression methodology works by fitting a line through the existing historical data such that the sum of squared errors are minimised between the predicted and actual values.

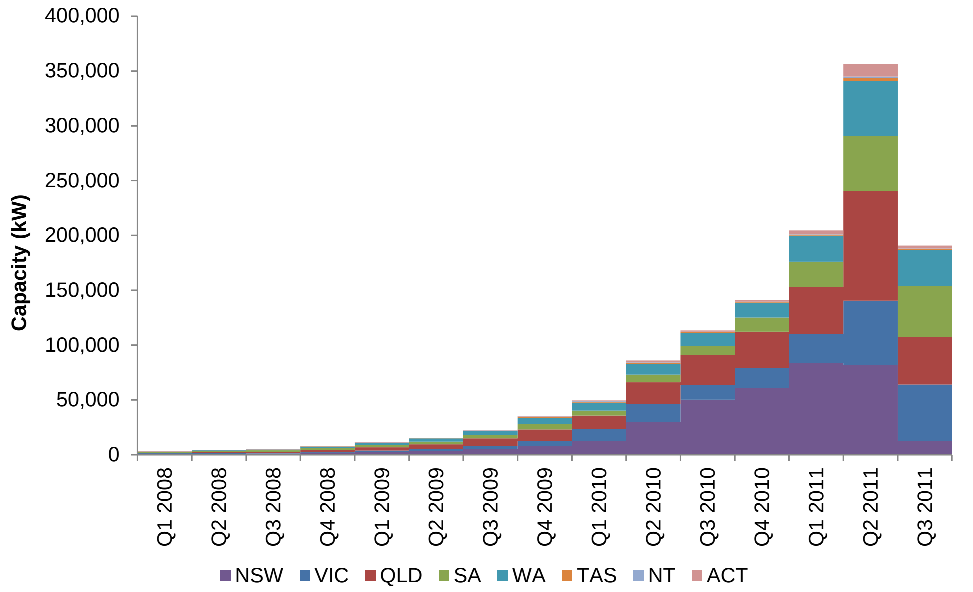
4.2.2 Data

The data used in this modelling exercise are the quarterly take-up of new solar systems (measured as installed capacity, by date of installation) and the present value of the net discounted financial return accruing to the owner of the system.

Figure 8 shows the increase in newly installed capacity (measured in kW) from the first quarter of calendar year 2008 (Q1 2008) up to the third quarter of 2011.

The chart shows that the growth in installed capacity has increased exponentially from early 2009, before peaking in Q2 2011 and declining in Q3 2011. This growth has seen the cumulative installed PV capacity in Australia increase from around 60 MW in the middle of 2009 to over 1,000 MW by the middle of 2011.

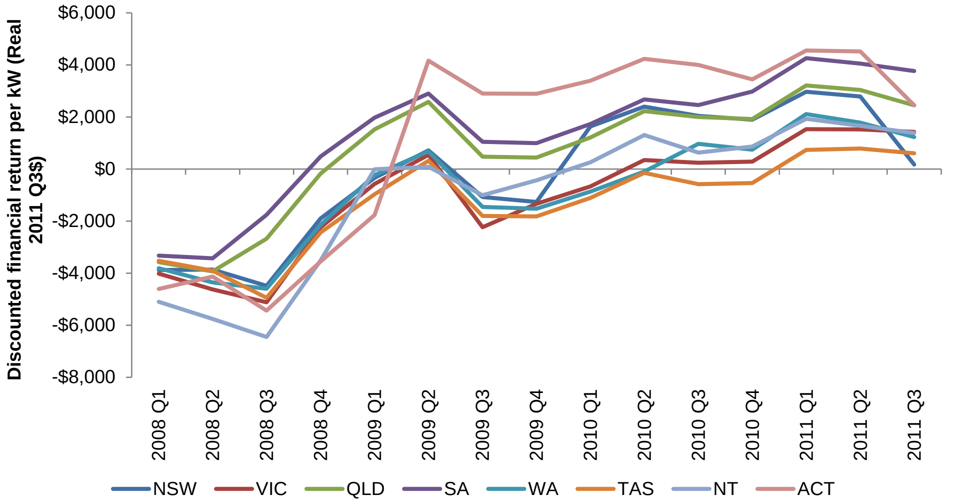
Figure 8 **Quarterly installed capacity of new solar PV systems by state, Q1 2008 to Q3 2011, capacity (MW)**



Data source: ORER

Figure 9 shows the average payback to the household from the installation of a solar system over the same period. It shows that the rapid take-up of new solar systems is associated with a significant improvement in the economic payback from installation between 2008 and 2011.

Figure 9 **Quarterly payback from installation by state, Q1 2008 to Q3 2011**



Data source: ORER

4.2.3 Model specification

The main driver of new installations is the economic payback from installation. Other potential explanatory factors include rising disposable incomes or an increase in environmental awareness of households. The marketing of solar systems in recent years is also likely to have a positive impact on sales of solar systems independently of the economic benefits of installation. However, none of these factors were explicitly incorporated in the regression model.

The model specification follows a non-linear functional form reflecting the exponential growth in installed capacity over time. The estimated equation is shown below.

$$\text{Capacity installed} = \exp(\text{c}+\beta\times\text{Payback}+ \text{SC dummy}) + \varepsilon$$

The new capacity installed in each quarter is modelled as an exponential function of the payback (i.e. net discounted financial return) from installation, with the coefficient β corresponding to the degree of responsiveness in new capacity from a unit change in the economic payback. The Solar Credits (SC) dummy captures an upward shift in the constant term which occurs after the introduction of the Solar Credits policy in the third quarter of 2009. This variable reflects the non-economic factors that are also driving the increased up-take of new solar systems, such as increased capacity of the PV suppliers to meet demand, increased marketing of solar PV systems and, potentially, increasing environmental awareness.

A separate regression was estimated for each of the states and territories in Australia. Prior to estimation, the model was transformed to linearity by taking the natural logarithm of both sides of the above equation.

4.2.4 Econometric model results

The results from the estimated models are shown in Table 7 below. The fit of the models against historical data as measured by the R^2 statistic exceeded 90% for five of the eight jurisdictions. This means that for these jurisdictions over 90% of the variation in the natural log of installed capacity could be explained by the model's explanatory variables. These five jurisdictions are amongst the six largest in terms of installed PV capacity, supporting the overall robustness of the econometric model in projecting nation-wide PV installation rates.

The poorest model fit was obtained for the Northern Territory where only 53% of the total variation in the log of newly installed capacity could be explained by the explanatory variables.

Table 7 **Model results, coefficients and R^2**

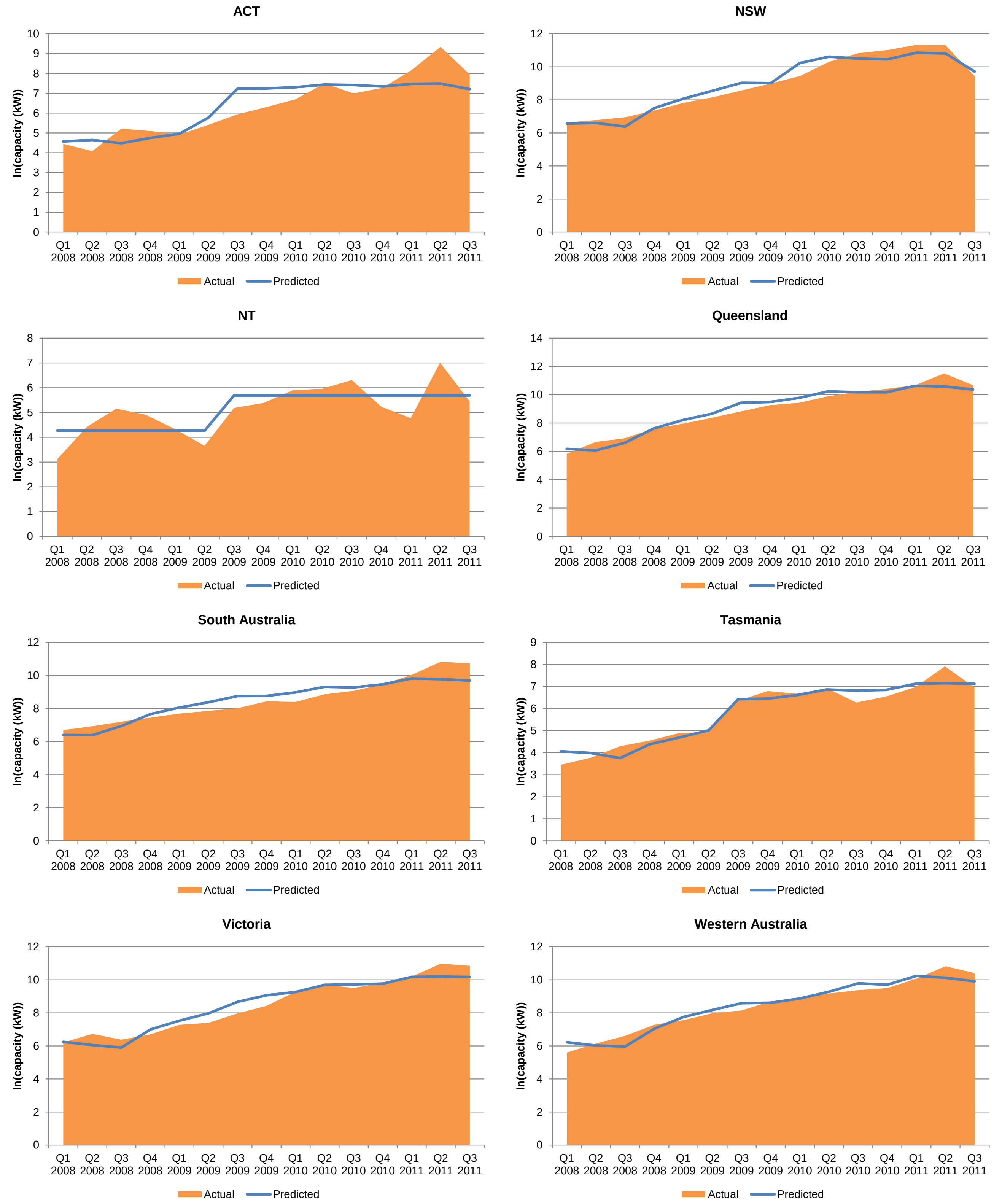
Jurisdiction	Constant	t-Stat	β	t-Stat	SC dummy	t-Stat	R-sq
ACT	5.214	29.793	0.000135	2.305	1.676	3.555	0.73
NSW	8.270	33.597	0.000422	6.214	1.415	4.220	0.94
NT	4.264	14.650	0.000000	NSS	1.424	3.791	0.53
QLD	7.659	39.144	0.000396	6.139	1.763	5.935	0.94
SA	7.491	29.779	0.000313	3.716	1.052	2.566	0.82
TAS	4.952	19.526	0.000242	3.296	2.046	8.044	0.93
VIC	7.795	25.948	0.000370	4.732	1.879	5.501	0.92
WA	7.916	33.557	0.000425	6.572	1.509	5.431	0.94

Data source: ACIL Tasman analysis

All estimated coefficients except one were found to be statistically significant at the 5% significance level. The one exception was the Northern Territory where the β coefficient was found to be statistically insignificant. In this case the insignificant variable was removed from regression and the model re-estimated.

Figure 10 below shows the predicted values from the estimated models graphically.

Figure 10 **Predicted versus actual values, natural logarithm of capacity installed (kW)**

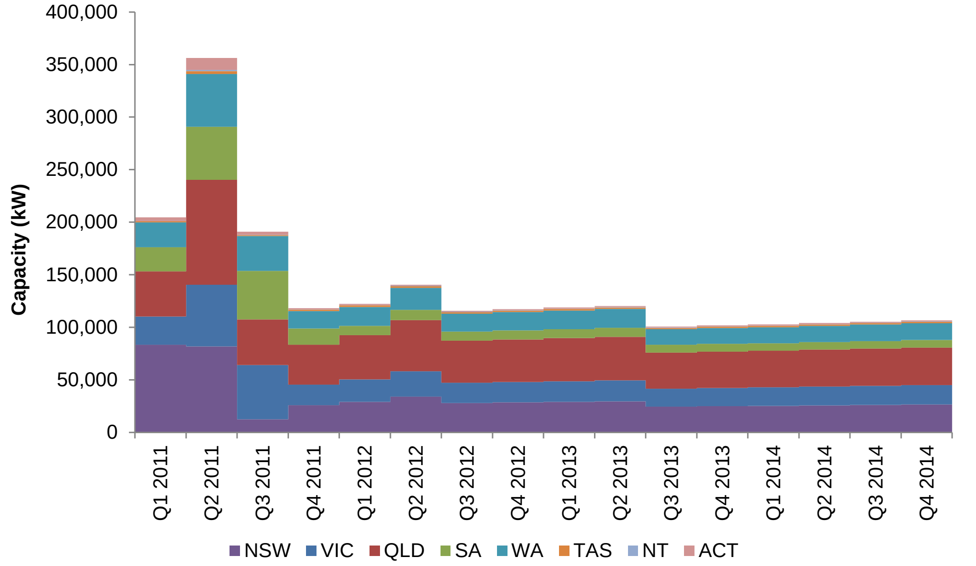


Data source: ACIL Tasman analysis

4.2.5 Projected installation rates

The calibration of the econometric model outlined above, when combined with the projected financial returns over the period from Q4 2011 to Q4 2014, suggest future installations rates by jurisdiction as shown in Figure 11 (with Q1 2011 to Q3 2011 illustrated for completeness).

Figure 11 **Projected installations rates, 2011 to 2014**



Source: ACIL Tasman analysis

This projection indicates a material reduction from the peak levels of installations that occurred in Q2 2011. This reduction reflects, in part, the reduction in financial returns to PV installations, particularly in Q3 2011, but also the 'outlier' nature of Q2 2011 in terms of installations. In essence, the econometric model, when calibrated to examine trends in uptake of PV systems over the period 2008 to 2011 cannot fully explain the outcomes of that quarter. This is to be expected, given the exceptional circumstances that prevailed in this period, including the imminent reduction of the Solar Credits multiplier and the phasing out of a range of state and territory feed-in tariffs.

Overall, the projected level of installed capacity reflects a return to 'normalised' conditions over the projection period, with the level of response to financial returns reflecting that demonstrated over the entire historical period analysed.

4.3 Other projection assumptions

4.3.1 System size

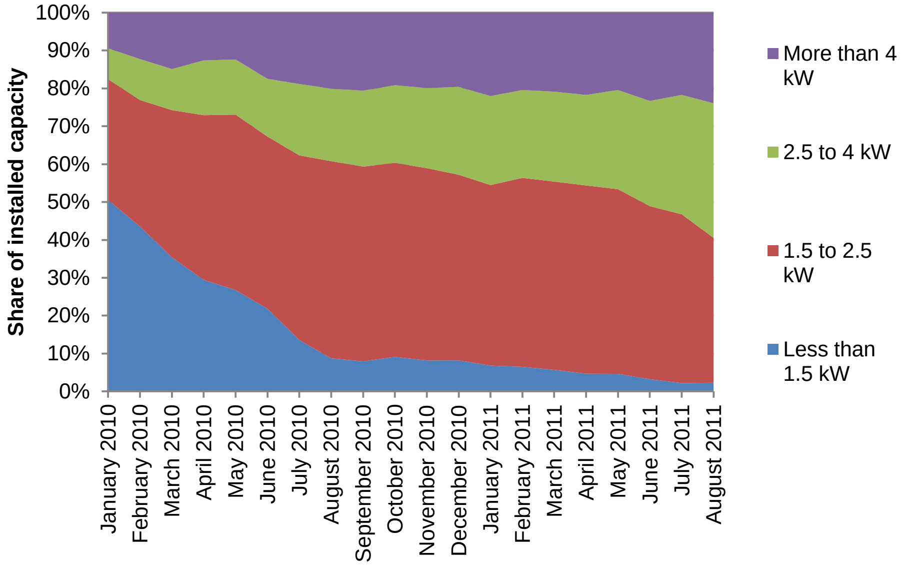
Under the Solar Credits policy, a given volume of installed PV capacity can create a varying quantity of STCs depending on the distribution of sizes of installations that produce this volume of capacity.

For example, if all installations were 1.5 kilowatts or less in capacity, the number of STCs per kilowatt of installed capacity would be maximised (holding all other variables that affect STC creation rates constant). This is because the Solar Credits multiplier only applies to the first 1.5 kilowatts of installed capacity for a given installation, and so, in this example, all kilowatts would be eligible to create Solar Credits. By contrast, the 'last' 1.5 kilowatts of a 3 kilowatt installation creates fewer STCS than the 'first' 1.5 kilowatts (where the Solar Credits multiplier is greater than one), and so a greater preponderance of large PV installations would tend to reduce STC creation rates for a given level of installed capacity, all things being equal.

For this reason, assumptions about system size are necessary to turn assumptions about installed capacity levels into assumptions about STC creation rates.

Figure 12 shows that, whilst the distribution of typical PV system sizes has changed materially since January 2010, these trends have largely stabilised.

Figure 12 **PV system size trends – January 2010 to August 2011**



Data source: ORER

Significantly for this analysis, Figure 12 also shows that the proportion of systems below 1.5 kilowatts is now negligible. This means that rates of STC creation per installation can be largely inferred from average system sizes, without much impact from the proportion of systems that are above or below 1.5 kilowatts.

For the purpose of estimating STC creation rates, ACIL Tasman assumed that the share of all installations that are below 1.5 kilowatts in capacity, and the average size of these installations, would reflect those levels observed in the period April to September 2011. ACIL Tasman also assumed that the average installation would reflect the observed average in each jurisdiction in the period October 2010 to September 2011. A longer average was adopted for this purpose as averages towards the middle of 2011 may excessively reflect the incentives to increase installation size to increase exports and thereby increase feed-in tariff payments in some jurisdictions. These assumptions are set out in Table 8.

Table 8 **Assumed system sizes**

Location	Average installation size (kW)	% of units below 1.5 kW	Average size of installations below 1.5 kW (kW)
New South Wales	2.35	7.4%	1.41
Victoria	2.28	4.8%	1.33
Queensland	2.24	8.3%	1.34
South Australia	2.71	4.5%	1.32
Western Australia	2.41	5.0%	1.24
Tasmania	2.27	9.3%	1.22
Northern Territory	2.87	8.6%	1.39
Australian Capital Territory	2.46	3.2%	1.39

Data source: ACIL Tasman assumptions.

4.3.2 Eligibility for Solar Credits

Our analysis of historic STC creation data supplied by ORER suggests that close to 100 per cent of SGU installations presently receive Solar Credits. Whilst a portion of systems may be ruled to be ineligible (e.g. due to participation in the National Solar Schools Program or the Renewable Remote Power Generation Program), recent data suggests close to 100 per cent access to Solar Credits. For simplicity we have assumed 100 per cent eligibility for Solar Credits in this projection.

4.3.3 Deeming periods

Solar Credits are only able to be created once, whether for a deemed period of one year, five years or 15 years, strongly discouraging the use of one year and five year deeming periods. This is reflected in the historical data: since the start of 2010, the portion of all SGUs opting for 15 year deeming periods has averaged 99 per cent in each month.

For simplicity we have assumed 100 per cent use of the 15-year deeming period throughout the projection period.

4.3.4 Location of installations

Solar PV locations in areas with different levels of solar irradiation can create STCs at different rates. The *Renewable Energy (Electricity) Regulations 2001* provides for four zones, with Zones 1 and 2 having higher solar irradiation, and therefore STC creation per kW installed, than Zones 3 and 4.

For the purpose of this analysis ACIL Tasman has assumed that the zonal location of installations in each State remain constant at the observed average over the period October 2010 to September 2011 over the projection period. These assumptions are set out in Table 9 below.

Table 9 **Location of solar PV installations – October 2010 to September 2011**

Jurisdiction	Zone 1 installations	Zone 2 installations	Zone 3 installations	Zone 4 installations
New South Wales	-	9%	89%	1%
Victoria	-	-	8%	92%
Queensland	-	1%	99%	-
South Australia	-	1%	98%	1%
Western Australia	2%	5%	91%	2%
Tasmania	-	-	-	100%
Northern Territory	32%	68%	-	-
Australian Capital Territory	-	-	100%	-

Data source: ORER.

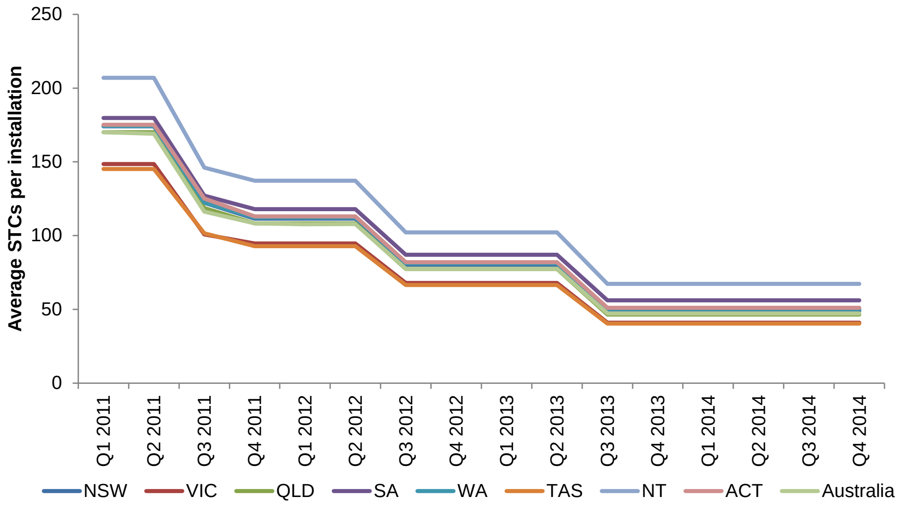
4.3.5 STCs per installation

In summary, the cumulative effect of assumptions surrounding the Solar Credits multiplier (section 3.2.1), system sizes (section 4.3.1), eligibility for Solar Credits (section 4.3.2), deeming periods (section 4.3.3) and zone locations (section 4.3.4) affect this projection by affecting the average number of STCs created per installation.

In turn, changes in the average number of STCs created per installation is a critical driver of overall STC creation rates, particularly in light of historic and anticipated reductions in the Solar Credits multiplier.

For completeness, our modelled estimates of the average number of STCs per installation in each jurisdiction are illustrated in Figure 13. This shows clearly the step-change reductions in STC creation per installation that occur at each change of the Solar Credits multiplier.

Figure 13 **Average STCs per installation – 2011 to 2014**



Source: ACIL Tasman analysis

4.3.6 Lag between installation and STC creation

Whilst section 4.1.1 describes the methodology adopted to estimate the underlying rate of installation occurring in a given month, a subtly different approach is necessary to project the timing of STC creation for installations occurring in that period.

This is because, whilst a certain portion of installations occurring in, say, September 2011, may create STCs within 30 days of installation (as shown in Table 5), not all installations occurring in September occur on the first day of that month. Accordingly, one cannot assume that this same proportion of installations will create STCs in September, whilst the proportion creating STCs within 60 days with create STCs in October, and so on.

Accordingly, ACIL Tasman has derived additional lag factors to estimate the proportion of any installations occurring in a given month that will create in that month, the following month, or in the 'nth' month after (up to the 12th month after).

These results are presented below for completeness in Table 10.

Table 10 **Conversion from time of installation to time of STC creation**

Time of STC creation	% of installations creating STCs
Month of installation	31.4%
1st month following installation	34.4%
2nd month following installation	13.3%
3rd month following installation	6.1%
4th month following installation	3.5%
5th month following installation	2.5%
6th month following installation	2.1%
7th month following installation	1.5%
8th month following installation	1.2%
9th month following installation	0.9%
10th month following installation	0.6%
11th month following installation	1.5%
12th month following installation	1.0%

Data source: ACIL Tasman analysis

4.4 Results

This modelling provides the estimate of the number of STCs that is likely to be created from SGU installations that will physically occur in 2012, 2013 and 2014 is set out in Table 11 (rounded to the nearest 10,000 STCs).

Table 11 **Projected STC creation by SGUs – by year of installation (000s)**

Jurisdiction	2012	2013	2014
New South Wales	4,927	3,032	2,167
Victoria	3,043	1,805	1,293
Queensland	7,177	4,272	2,935
South Australia	1,364	867	595
Western Australia	2,984	1,825	1,300
Tasmania	208	133	97
Northern Territory	49	35	28
Australian Capital Territory	169	112	84
Australia	**19,920**	**12,079**	**8,500**

Data source: ACIL Tasman analysis

However, some of the STCs from 2012 installations will not be created until 2013 and, similarly, some 2011 installations will create STCs in 2012. This lag between installation and STC creation means that the rate of STC creation in each year of the projection period (the object of this analysis) is somewhat different from the data presented in Table 11.

Allowing for lag has the effect that the rate of STC creation is higher in 2012 than would be implied by the rate of installation in that year, reflecting a hangover from the higher rate of installation in 2011. Similarly, the rates of STC creation in 2013 and 2014 are higher than implied by the installation rate in those respective years, due to the declining rate of STC creation over the projection period.

The lag rates applied for this adjustment are as shown in Table 10, with the results of the overall projection expressed in terms of STC creation by creation date presented in Table 12.

Table 12 **Projected STC creation by SGUs – by year of certificate creation (000s)**

Jurisdiction	2012	2013	2014
New South Wales	5,342	3,312	2,183
Victoria	3,548	1,973	1,305
Queensland	7,795	4,694	2,974
South Australia	1,948	940	607
Western Australia	3,364	1,996	1,311
Tasmania	221	144	98
Northern Territory	55	37	28
Australian Capital Territory	235	120	85
Australia	**22,508**	**13,216**	**8,591**

Data source: ACIL Tasman analysis.

5 SWH projection

5.1 Methodology

STC creation by SWH exhibits different dynamics to that by SGUs. As outlined in section 3 and section 4, the changing financial attractiveness of SGUs over time can be modelled with reasonable accuracy and shows a strong statistical relationship with installation of this technology. Accordingly, future installation and STC creation rates can also be estimated on this basis.

By contrast, a purely financial model of SWH uptake faces several key difficulties, including:

- The installation of a SWH in place of another water heating technology is often in response to the physical failure of an existing water heater. Whilst the financial attractiveness of different water heating technologies can be estimated, a key variable in the model is the rate at which these installations are required due to failure of the existing stock, rather than the absolute financial attractiveness of the SWH in isolation.
- As outlined below in section 5.2.1, a range of non-cost based regulatory measures affect water heater technology choice, not least the effective banning of electric water heaters in most Australian jurisdictions for certain classes of dwelling (broadly, detached and semi-detached dwellings) in certain locations (generally in locations where reticulated natural gas is available).
- A cost-based analysis is complicated by the range of technology types available in the water heater market, which include:
  - Electric storage (which in turn could use regularly metered electricity or cheaper 'off-peak' metered electricity)
  - Mains gas storage
  - Mains gas instantaneous
  - Liquefied petroleum gas (LPG) storage or instantaneous
  - Solar (including heat pump and flat plate technologies, and electric or gas boosting)
  - Miscellaneous other technologies, including wood heaters.
- The economic value of a water heater type will vary radically from household to household depending on consumption patterns. A larger household (in terms of occupants) with greater hot water usage will enjoy greater economic benefits from the higher capital cost, lower running cost SWHs than a smaller household. Unlike the situation for solar PV, where excess solar energy can be fed into the grid and earn an economic return, excess solar heated water (considered on a 24 hour cycle) does not have a ready use and will not deliver any economic benefit to the household.

Accordingly, an approach that examines SWH installation rates in new dwellings in part by examining changes to the stock of new dwellings, and which looks at typical rates of SWH installations as a replacement for existing water heaters as being reflective of likely rates of turnover of the existing water heater stock, is appropriate. Critically, this approach captures the key non-economic variables affecting SWH installation rates in a manner that a pure financial analysis could not.

Given the potential for these trends to vary over the projection period, a sensitivity analysis approach was adopted involving a mid-range 'reference' estimate and 'high' and 'low' bounds.

Accordingly, the methodology adopted for this SWH projection involved:

- For SWH installations in new dwellings:
  - An analysis of historical rates of this type of installation in each state and territory
  - A comparison with historic dwelling completion rates to determine an implied market share of SWHs for new dwelling water heaters
  - A projection of dwelling completion rates over the projection period
  - A sensitivity analysis approach to assess high and low bounds of potential STC creation rates, based on potential variation in the SWH share of new dwelling water heater installations
- For replacement SWH installations:
  - An analysis of historical rates of this type of installation in each state and territory
  - An analysis of key policy and economic drivers that might lead to material changes in future installation rates
  - A sensitivity analysis approach to assess high and low bounds of potential STC creation rates by replacement water heaters, based on potential variation from recently observed rates.

5.2 Policy settings

A range of government policy settings affect uptake of SWHs in Australia. These essentially fall into two categories: regulatory measures affecting water heater technology choice, and rebates that directly support uptake of particular water heater technologies.

5.2.1 Regulatory measures

In July 2009 the Council of Australian Governments agreed to phase-out the use of electric resistance water heaters as part of the National Partnership Agreement on Energy Efficiency. Implementation of this measure has been progressed by the Ministerial Council on Energy under the broader National Framework for Energy Efficiency (NFEE).

Implementation of this agreement varies between jurisdictions but broadly involves the banning of the use of electric resistance water heaters in new-build detached or semi-detached dwellings where natural gas is available from 1 January 2010.

The state of play at the time of writing is broadly as follows:

- Queensland has not implemented any new regulatory changes in response to the NFEE measures as these are substantially the same as measures for new homes introduced in that state from 1 March 2006
- Western Australia has not implemented any new regulatory changes in response to the NFEE measures as it had already imposed equivalent standards on water heaters for new buildings from 1 September 2008
- New South Wales and Victoria have incorporated changes within their respective building codes effectively banning electric water heaters in new buildings from 1 January 2010
- However, in Victoria, this regulatory change substantially overlapped with pre-existing requirements in its Building Code from 1 July 2004, which required either a solar water heater or a rainwater tank plumbed to the toilet to be installed in all new buildings
- Queensland and South Australia have made additional changes to their respective building codes, such that the effective ban applies to electric water heaters in new buildings and to replacement water heaters in 'class 1' dwellings (i.e. detached or semi-detached dwellings) where reticulated natural gas is available
- Tasmania is not implementing any changes due to the low greenhouse-intensity of its local electricity supply.

As is outlined further in sections 5.3 and 5.4, the response of SWH installations to these regulatory measures is broadly as follows:

- New South Wales has seen a significant increase in SWH installations in new buildings since around the middle of 2010, reflecting a (lagged) response in this market to the NFEE regulations
- Victorian and Queensland SWH installations levels in new dwellings have remained at sustained high levels, reflecting the pre-2010 regulations in favour of this technology
- Western Australian SWH installation levels in new dwellings have remained broadly constant, at lower levels than in Victoria and Queensland, reflecting the higher availability of reticulated natural gas in this state than Queensland, and the stronger regulatory measures in favour of SWHs in Victoria

- South Australian SWH installation levels in new dwellings have shown a noticeable but modest increase from mid-2010, again reflecting a lagged response to the NFEE regulations, with the lower level of response than in New South Wales reflecting the greater availability of reticulated natural gas in that state
- There has not been a noticeable increase in SWH installations for replacement water heaters in either Queensland or South Australia in response to those states' NFEE regulations.

5.2.2 Rebates and up-front subsidies

STCs

As for SGUs, the SRES provides up-front assistance to purchasers of SWHs by allowing them to create STCs which can be on-sold to recoup some of the cost of purchasing the system.

The value of assistance values with the value of STCs, and so the level of up-front subsidy available to SWHs from the SRES has reduced through the middle of 2011 due to the decline of STC prices.

As we project a firming of STC prices towards the legislated clearing-house price of $40/certificate through 2012, our SWH projection anticipates a modest upward trend in SWH installation rates compared to late 2011 levels.

Solar Hot Water Rebate

The Commonwealth Government also provides direct assistance to SWHs both through the value its Solar Hot Water Rebate (SHWR). The SHWR has undergone several changes, particularly:

- In September 2009, the rebate for HPWHs was reduced from $1600 to $1000
- In February 2010 the rebate for HPWHs was further reduced to $600
- In February 2010 the rebate for non-HPWHs was reduced from $1600 to $1000.

The SHWR is only available where the unit is replacing an electric water heater and so is only relevant to analysing replacement SWH installation rates.

The effect of these reductions is fully captured in data on replacement installations from recent quarters, and supports our assessment in the projection that installation rates will remain broadly similar to or below 2010 levels throughout the projection period.

State and territory government rebates

A range of state and territory government rebates are available for SWH installations. The state and territory schemes are briefly summarised in the table below.

Table 13 **State/territory SWH incentives and rebates**

Jurisdiction	Rebate	Date available	Status	Conditions
NSW	$300	15 January 2010 to 30 June 2011	Closed	Replace electric hot water system
	$1500	Prior to 15 January 2010	Closed	As part of NSW Home Saver Rebate package
Queensland	$600	Since 13 April 2010	Available	Replace electric hot water system
	$1000	Since 13 April 2010	Available	For pensioners and low-income earners
Victoria	$300-$1600	-	Available	Rebate depends on system size and varies between Melbourne and regional Victoria.
	Variable	Since 1 January 2009	Available	Assistance through Victorian Energy Efficiency Certificates
Western Australia	$500-700	Until 30 June 2013	Available	Applies only to gas or LPG boosted solar systems
South Australia	$500	Since 1 July 2008	Available	System must replace electric hot water system or be gas-boosted; available to concession card holders only
Tasmania	N/A	-	N/A	-
Northern Territory	Up to $1000	-	Available	Timber-trussed roofs that require reinforcement
	Up to $400	-	Available	Where additional plumbing is required
Australian Capital Territory	Up to $500	-	Available	Must replace an electric hot water system and be used in conjunction with other energy saving investments.

Data source: www.energymatters.com.au; www.environment.nsw.gov.au; www.cleanenergy.qld.gov.au; www.resourcesmart.vic.gov.au; www1.home.energy.wa.gov.au; www.dtei.sa.gov.au; www.powerwater.com.au.

As is outlined further in section 5.4, the closure of the New South Wales rebate scheme in mid 2011 has already resulted in a noticeable reduction in SWH installation rates in that state in recent months. We also anticipate a slight reduction in WA installation rates from mid 2013 due to the phase out of its rebate scheme at that time.

Otherwise, changes to rebate schemes are anticipated to have only minor effects on our SWH projection.

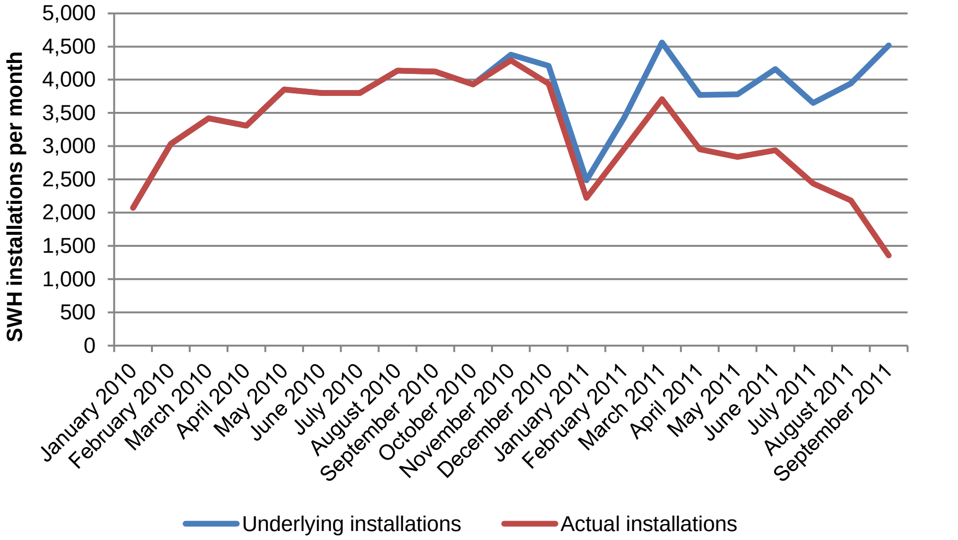
5.3 New building installations projection

The first step in the projection of SWH installations in new dwellings is to determine implied installation rates from the historic data on STC creation by these installations.

As discussed above in section 4.1.1, STC creation occurs in a lagged manner following the physical installation of a SWH or SGU, and so the actual rate of installations that physically occurred in a given month cannot be accurately determined until all STCs have been created (within 12 months of installation).

ACIL Tasman's analysis indicates a particularly strong lag between the physical installation of SWHs in new dwellings and STC creation. This is demonstrated by the large gap between actual and 'implied' new dwelling SWH installations shown in Figure 14.

Figure 14 **Actual and implied SWH installations in new dwellings – Australia**



Source: ORER; ACIL Tasman analysis.

These implied installation rates can be compared with new dwelling completions over the comparable periods to assess the market share of SWHs in new dwellings in each state and territory.

This analysis was based purely on new house (i.e. freestanding dwelling) completions, as published by the Australian Bureau of Statistics to June 2011. Although SWH installations could occur in other types of dwellings, particularly 'semi-detached' dwellings, the predominance of freestanding houses in the Australian housing stock, and the limited number of SWH installations that occur in multi-storey dwellings, means that robust projections can be made based on determining a market share of SWH installations in freestanding houses, and then projection SWH installations based on future movements in house completions. This relationship may hold irrespective of the fact that some SWH installations do, in fact, occur in semi-detached or other types of dwellings, and would only be misleading in the event that the share of house completions and other dwelling completions dramatically changed over the projection period.

Data for the period July to September 2011 was estimated based on Housing Industry Association (HIA) estimates of dwelling completions.

This analysis indicated penetration or 'market share' levels for SWHs in new dwellings in each jurisdiction as shown in Table 14.

Table 14 **Implied SWH penetration in new separate houses**

Jurisdiction	2008	2009	2010	October 2010 to September 2011
New South Wales	26.3%	25.3%	32.5%	65.4%
Victoria	44.1%	53.8%	53.7%	56.4%
Queensland	46.2%	49.6%	48.0%	57.4%
South Australia	11.9%	12.5%	17.7%	25.0%
Western Australia	21.3%	25.1%	31.0%	25.5%
Tasmania	7.0%	7.4%	11.0%	11.4%
Northern Territory	68.1%	57.7%	59.0%	57.7%
Australian Capital Territory	9.9%	28.2%	12.7%	33.8%

Data source: ABS Building Activity publication (catalogue number 8752.0) June 2011; Housing Industry Association; ORER.

This analysis demonstrates the dramatic increase in penetration of SWHs in new dwelling built in New South Wales in the past 12 months, increasing from around 25% through 2008 and 2009 to around 65% since October 2010. We estimate that this trend will be largely sustained, but have applied generous bounds of variation in our high and low estimates over the projection period. Due to the novelty of this trend, we have allowed for a slight reduction in the SWH penetration rate in new buildings as reticulated natural gas becomes more widely available in this state.

By contrast, Victoria and Queensland have sustained high penetration rates for SWHs in new dwellings since at least 2008, and so the bounds of uncertainty around these penetration rates are narrower in our projection. In Queensland, we have allowed for a potential slight reduction in SWH penetration rates in new buildings as reticulated natural gas becomes more widely available in this state.

South Australia has demonstrated a moderate strengthening of SWH installation in new dwellings in the past 12 months, from an earlier average closer to 15% to around 25%. This is likely a (lagged) response to the introduction of the NFEE regulatory requirements on SWHs. However, due to the high availability of reticulated natural gas in South Australia, we anticipate only slight further increases in penetration levels beyond those of the past 12 months, with allowances for variation in either direction in our high and low estimates.

ACIL Tasman's estimates of SWH penetration in new buildings in each jurisdiction are shown in Table 15 below.

Table 15 **SWH penetration assumptions – new separate houses**

Jurisdiction	Scenario	2011	2012	2013	2014
New South Wales	High	70%	70%	70%	70%
	Reference	65%	60%	55%	55%
	Low	60%	50%	40%	40%
Victoria	High	60%	60%	60%	60%
	Reference	57.5%	57.5%	57.5%	57.5%
	Low	55%	55%	55%	55%
Queensland	High	60%	60%	60%	60%
	Reference	57.5%	57.5%	55%	55%
	Low	55%	55%	50%	50%
South Australia	High	30%	30%	35%	35%
	Reference	25%	25%	27.5%	27.5%
	Low	20%	20%	20%	20%
Western Australia	High	30%	30%	35%	35%
	Reference	25%	25%	27.5%	27.5%
	Low	20%	20%	20%	20%
Tasmania	High	15%	15%	15%	15%
	Reference	12.5%	12.5%	12.5%	12.5%
	Low	10%	10%	10%	10%
Northern Territory	High	65%	65%	65%	65%
	Reference	57.5%	57.5%	57.5%	57.5%
	Low	50%	50%	50%	50%
Australian Capital Territory	High	40%	40%	40%	40%
	Reference	30%	30%	30%	30%
	Low	20%	20%	20%	20%

Note: 2011 estimates were made due to the lag between the physical installation of SWHs and the date of STC creation. This means that some 2011 installations create STCs in 2012.

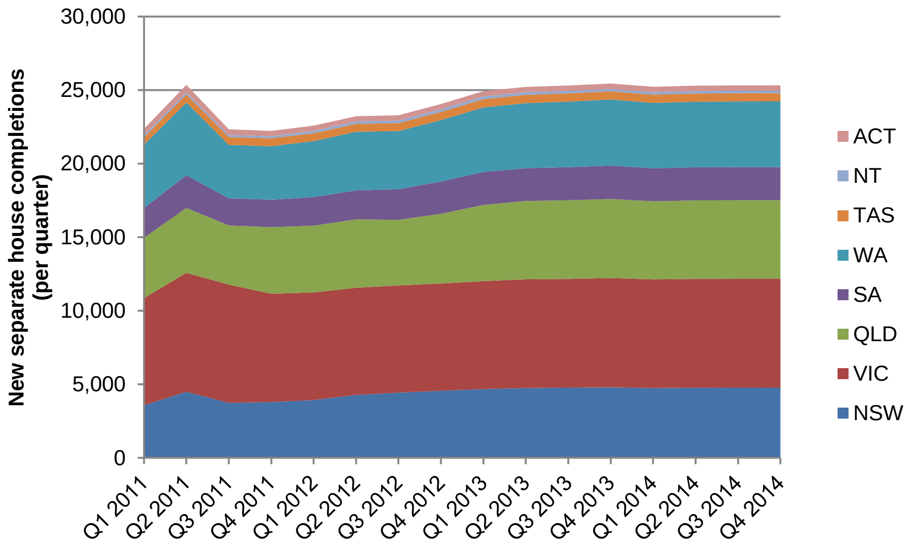
Data source: ACIL Tasman assumptions

These penetration rates were then combined with house completion estimates for each jurisdiction to estimate overall SWH installation rates in each jurisdiction.

ACIL Tasman adjusted the HIA's quarterly dwelling completion forecast to the end of 2013 using the HIA's annual estimates of the share of new dwellings by dwelling type to derive a quarterly completion forecast for separate houses.

The 2014 projection was a simple extrapolation of the HIA's relevant 2013 trends.

Figure 15 **Separate house completion assumptions**



Source: ABS (to Q2 2011); Housing Industry Association (Q3 2011 through Q4 2013); ACIL Tasman extrapolation.

To determine the number of STCs created, ACIL Tasman assumed that the observed average number of STCs per SWH installation in new buildings over October 2010 to September 2011 would be sustained over the projection period. These assumptions are set out in Table 16.

Table 16 **STCs/SWH new building installation**

Jurisdiction	STCs/install (October 2010 to September 2011 average)
New South Wales	32.1
Victoria	26.6
Queensland	30.1
South Australia	30.9
Western Australia	33.8
Tasmania	28.1
Northern Territory	28.8
Australian Capital Territory	32.8

Data source: ORER

In combination, these assumptions yielded the STC creation estimates by SWHs in new dwellings in Table 17, measured by the year of installation rather than the year of STC creation.

Table 17 **STC creation by SWHs in new dwellings – by year of installation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	386	331	276	426	335	244	428	336	244
Victoria	466	447	427	472	453	433	473	453	434
Queensland	332	318	304	383	351	319	385	353	321
South Australia	76	63	51	97	76	56	97	77	56
Western Australia	161	134	107	210	165	120	211	166	120
Tasmania	9	8	6	9	8	6	9	8	6
Northern Territory	13	11	10	13	11	10	13	11	10
Australian Capital Territory	19	14	9	19	14	10	19	14	10
Australia	**1,462**	**1,327**	**1,191**	**1,631**	**1,414**	**1,197**	**1,635**	**1,418**	**1,201**

Data source: ACIL Tasman analysis

Allowing for lag between the date of installation and the date of STC creation implied the STC creation estimates by the year of certificate creation set out in Table 18.

Table 18 **STC creation by SWHs in new dwellings – by year of certificate creation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	368	324	280	420	337	255	428	336	245
Victoria	473	455	438	470	450	431	473	453	434
Queensland	330	318	305	370	343	316	385	353	321
South Australia	72	61	50	92	74	55	97	77	56
Western Australia	155	132	108	198	158	117	211	166	121
Tasmania	9	7	6	9	8	6	9	8	6
Northern Territory	12	11	10	13	12	10	13	11	10
Australian Capital Territory	20	16	12	19	14	10	19	14	10
Australia	**1,440**	**1,324**	**1,209**	**1,592**	**1,396**	**1,200**	**1,636**	**1,419**	**1,201**

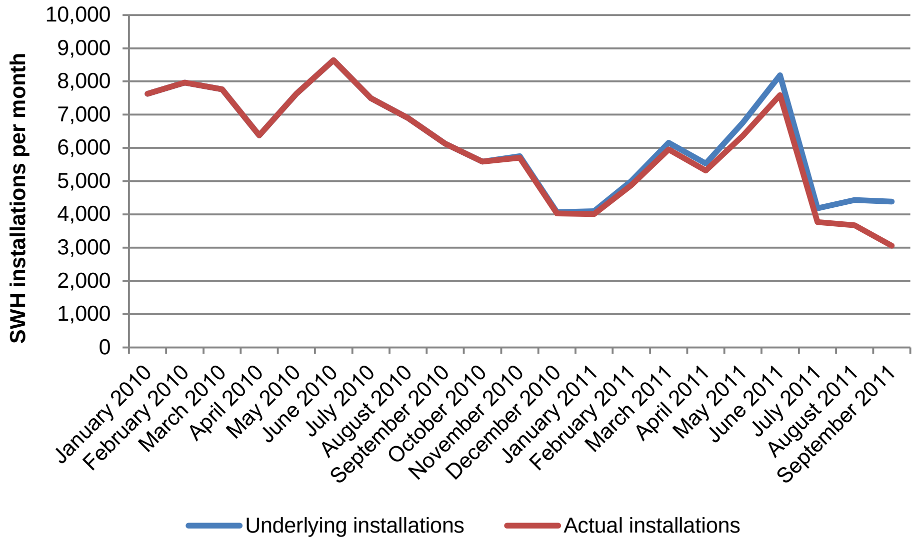
Data source: ACIL Tasman analysis

5.4 Replacement installations projection

As for SWH installations in new buildings, it was necessary to analyse ORER STC creation data to estimate implied or underlying rates of SWH replacement installations for the past 12 months of data, so as to allow for the lag between physical installation and STC creation.

The lag between physical installation and STC creation for replacement SWH installations is typically quite short, allowing reliable estimates to be made of physical installation rates for months as recent as September 2011. These estimates are shown in Figure 16.

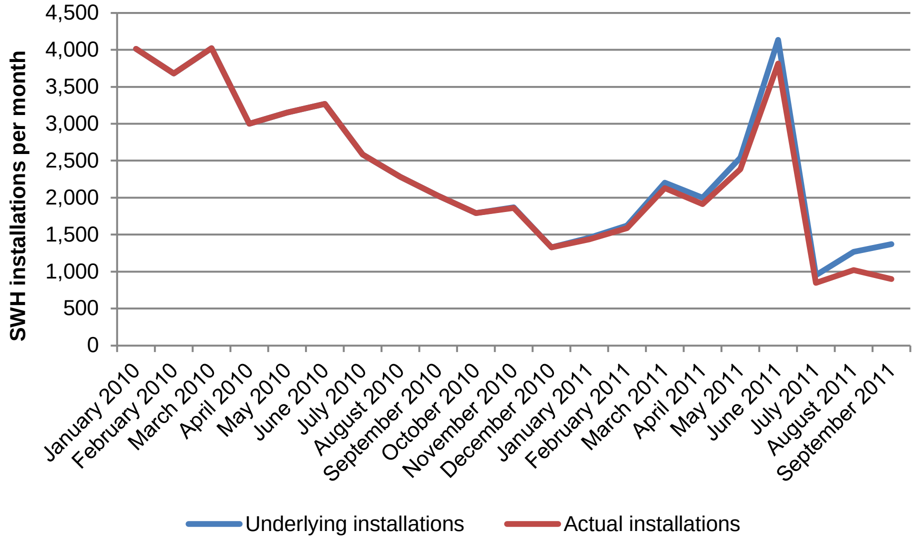
Figure 16 **Actual and implied replacement SWH installations – Australia**



Source: ORER; ACIL Tasman analysis

The drop in SWH installations from July 2011 onwards is primarily driven by a reduction in New South Wales, which is largely reflective of the closing of that state's rebate from 1 July. The trend in New South Wales is illustrated in Figure 17.

Figure 17 **Actual and implied replacement SWH installations – New South Wales**



Source: ORER; ACIL Tasman analysis

Together, these trends indicate a general increase in installation rates through the second quarter of 2011, driven primarily by trends in New South Wales, and then a reversion to rates prevalent through late 2010 and early 2011. Accordingly, we have largely looked through installation rates in the second quarter of 2011 and based our projections primarily on outcomes either side of this period. The assumptions adopted through our projection are shown in Table 19.

Table 19 **Replacement SWH installation rates (installations per quarter)**

Jurisdiction	Scenario	2011	2012	2013	2014
New South Wales	High	4,500	5,250	5,250	5,250
	Reference	4,000	4,250	4,250	4,250
	Low	3,500	3,250	3,250	3,250
Victoria	High	1,700	1,900	2,000	2,000
	Reference	1,550	1,650	1,700	1,700
	Low	1,400	1,400	1,400	1,400
Queensland	High	6,000	6,500	7,500	7,500
	Reference	5,000	5,500	6,000	6,000
	Low	4,500	5,000	5,000	5,000
South Australia	High	1,000	1,300	1,400	1,400
	Reference	850	1,000	1,100	1,100
	Low	700	700	800	800
Western Australia	High	2,200	2,500	2,400	2,600
	Reference	1,900	2,000	1,900	1,800
	Low	1,600	1,500	1,400	1,000
Tasmania	High	450	500	500	500
	Reference	400	400	400	400
	Low	350	300	300	300
Northern Territory	High	250	250	250	250
	Reference	200	200	200	200
	Low	150	150	150	150
Australian Capital Territory	High	175	175	175	175
	Reference	150	150	150	150
	Low	125	125	125	125

Note: 2011 estimates were made due to the lag between the physical installation of SWHs and the date of STC creation. This means that some 2011 installations create STCs in 2012.

Data source: ACIL Tasman assumptions

To determine the number of STCs created, ACIL Tasman assumed that the observed average number of STCs per replacement SWH over October 2010 to September 2011 would be sustained over the projection period. These assumptions are set out in Table 16.

Table 20 **STCs/replacement SWH installation**

Jurisdiction	STCs/install (October 2010 to September 2011 average)
New South Wales	31.8
Victoria	31.0
Queensland	31.0
South Australia	29.2
Western Australia	28.4
Tasmania	25.9
Northern Territory	29.0
Australian Capital Territory	30.9

Data source: ORER

In combination, these assumptions yielded the STC creation estimates by SWHs in new dwellings in Table 21.

Table 21 **STC creation by replacement SWHs – by year of installation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	668	541	413	668	541	413	668	541	413
Victoria	236	205	174	248	211	174	248	211	174
Queensland	805	681	619	929	743	619	929	743	619
South Australia	152	117	82	163	128	93	163	128	93
Western Australia	284	227	170	273	216	159	295	205	114
Tasmania	52	41	31	52	41	31	52	41	31
Northern Territory	29	23	17	29	23	17	29	23	17
Australian Capital Territory	22	19	15	22	19	15	22	19	15
Australia	**2,247**	**1,854**	**1,523**	**2,384**	**1,922**	**1,523**	**2,406**	**1,911**	**1,477**

Data source: ACIL Tasman analysis

Allowing for lag between the date of installation and the date of STC creation implied the STC creation estimates by the year of certificate creation set out in Table 22.

Table 22 **STC creation by SWHs in new dwellings – by year of certificate creation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	658	540	421	668	541	413	668	541	413
Victoria	232	203	173	247	210	174	248	211	174
Queensland	796	674	614	915	736	619	929	743	619
South Australia	147	115	82	162	127	92	163	128	93
Western Australia	280	227	173	274	217	160	293	206	119
Tasmania	51	41	32	52	41	31	52	41	31
Northern Territory	29	23	18	29	23	17	29	23	17
Australian Capital Territory	22	19	16	22	19	15	22	19	15
Australia	**2,215**	**1,841**	**1,528**	**2,368**	**1,915**	**1,523**	**2,404**	**1,912**	**1,483**

Data source: ACIL Tasman analysis

5.5 Combined results

ACIL Tasman's high, reference and low projections of STC creation by SWHs (from both new dwellings and replacement installations) according to the date of installation (rather than the date of STC creation) are shown in Table 23, whilst the projections by date of certificate creation are shown in Table 24.

Table 23 **STC creation by all SWHs – by year of installation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	1,054	872	689	1,094	876	657	1,096	877	658
Victoria	702	652	601	720	664	607	721	664	607
Queensland	1,137	999	924	1,312	1,094	939	1,314	1,096	940
South Australia	228	180	132	261	205	149	261	205	149
Western Australia	445	362	278	483	381	279	506	370	234
Tasmania	61	49	37	61	49	37	61	49	37
Northern Territory	42	35	27	42	35	27	42	34	27
Australian Capital Territory	40	33	25	41	33	25	41	33	25
Australia	**3,710**	**3,181**	**2,714**	**4,014**	**3,336**	**2,720**	**4,042**	**3,329**	**2,678**

Data source: ACIL Tasman analysis

Table 24 **STC creation by all SWHs – by year of certificate creation (000s)**

Jurisdiction	2012			2013			2014		
	High	Reference	Low	High	Reference	Low	High	Reference	Low
New South Wales	1,026	864	701	1,088	878	668	1,096	877	658
Victoria	705	658	611	717	661	605	721	664	607
Queensland	1,126	992	919	1,285	1,079	935	1,314	1,096	940
South Australia	220	176	132	254	201	147	261	205	149
Western Australia	435	358	281	472	375	278	504	372	239
Tasmania	60	49	38	61	49	37	61	49	37
Northern Territory	41	34	27	42	35	28	42	34	27
Australian Capital Territory	42	35	28	41	33	25	41	33	25
Australia	**3,655**	**3,166**	**2,737**	**3,960**	**3,310**	**2,722**	**4,040**	**3,331**	**2,684**

Data source: ACIL Tasman analysis

6 Conclusion

ACIL Tasman's modelling of installation and STC creation rates by SGUs in the projection period 2012 to 2014 indicates that, notwithstanding the anticipated reduction in the Solar Credits multiplier and the closure of most feed-in tariff policies, reductions in PV system costs will support ongoing strong levels of PV installation in most states of Australia.

Nevertheless, the reduction in the Solar Credits multiplier (from 3 to 2 on 1 July 2012 and 2 to 1 on 1 July 2013) is projected to substantially reduce the number of STCs any individual SGU installation can create, and therefore the aggregate level of STC creation by SGUs.

This level of reduction is, in broad terms, from around 22.5 million STCs in 2012 to around 13 million in 2013 and around 8.5 million in 2014.

STC creation by SWHs is lower in absolute terms but projected to be largely stable, being estimated to vary between 2.7 and 4 million STCs per year over the projection period.

As Table 25 shows, ACIL Tasman's analysis indicates that the total level of STC creation over the projection period will reduce from around 25.7 million in 2012 to around 16.5 million in 2013 and just under 12 million in 2014 (using our reference estimate of STC creation by SWHs).

Table 25 **Projected STC creation – by year of certificate creation (000s)**

	2012	2013	2014
SGU estimate	**22,508**	**13,216**	**8,591**
SWH – reference estimate	**3,166**	**3,310**	**3,331**
SWH – high estimate	3,655	3,960	4,040
SWH – low estimate	2,737	2,722	2,684
Total – reference estimate	**25,674**	**16,526**	**11,922**
Total – high estimate	26,163	17,176	12,631
Total – lower estimate	25,245	15,938	11,275

Data source: ACIL Tasman analysis

A Acronyms used

Acronym	Term
ESCOSA	Essential Services Commission of South Australia
HIA	Housing Industry Association (Australia)
kW	Kilowatt
kWh	Kilowatt-hour
IPART	Independent Pricing and Regulatory Tribunal (NSW)
LGC	Large-scale Generation Certificate
LRET	Large-scale Renewable Energy Target
MW	Megawatt
MWh	Megawatt-hour
NFEE	National Framework on Energy Efficiency
ORER	Office of the Renewable Energy Regulator
PV	Photovoltaic
REC	Renewable Energy Certificate
SGU	Small Generation Unit
SRES	Small-scale Renewable Energy Scheme
STC	Small-scale Technology Certificate
STP	Small-scale Technology Percentage
SWH	Solar water heater

Melbourne (Head Office)

Level 4, 114 William Street
Melbourne VIC 3000

Telephone (+61 3) 9604 4400
Facsimile (+61 3) 9604 4455

Email melbourne@aciltasman.com.au

Brisbane

Level 15, 127 Creek Street
Brisbane QLD 4000
GPO Box 32
Brisbane QLD 4001

Telephone (+61 7) 3009 8700
Facsimile (+61 7) 3009 8799

Email brisbane@aciltasman.com.au

Canberra

Level 1, 33 Ainslie Place
Canberra City ACT 2600

GPO Box 1322
Canberra ACT 2601

Telephone (+61 2) 6103 8200
Facsimile (+61 2) 6103 8233

Email canberra@aciltasman.com.au

Darwin

GPO Box 908
Darwin NT 0801

Email darwin@aciltasman.com.au

Perth

Centa Building C2, 118 Railway Street
West Perth WA 6005

Telephone (+61 8) 9449 9600
Facsimile (+61 8) 9322 3955

Email perth@aciltasman.com.au

Sydney

PO Box 1554
Double Bay NSW 1360

Telephone (+61 2) 9389 7842
Facsimile (+61 2) 8080 8142

Email sydney@aciltasman.com.au

ACIL Tasman
Economics Policy Strategy

ACIL Tasman Pty Ltd

www.aciltasman.com.au