ACIL Tasman

Economics Policy Strategy

ACIL Tasman Briefing Note

Date: 27 March 2013

Subject: The value of exported solar PV output

In January 2012, ACIL Tasman provided the Essential Services Commission of South Australia (the Commission) with an estimate of the value of electricity generated by a domestic solar photovoltaic (PV) system and exported to the electricity grid (exported PV output).[1]

The Commission went on to determine, on 27 January 2012, that electricity retailers would pay for exported solar PV output pursuant to the Electricity Act 1996 (SA).

ACIL Tasman's estimate of the value of exported PV output was based on:

1. the wholesale spot price of electricity
2. *weighted by* the net system load profile
3. *adjusted for* avoided network losses
4. *adjusted for* market and ancillary services fees.

A more detailed description of our methodology is provided in our accompanying report, which is available from the Commission's website.

The purpose of this briefing note is to provide an updated projection of the value of exported PV output using the above methodology with updated inputs. A summary of each input is provided below.

Wholesale spot price of electricity in South Australia

Table 1 shows the average (load weighted) wholesale spot price of electricity for 2013/14 as projected in December 2012. Our earlier (December 2011) projection is repeated for comparison.

Table 1 **Wholesale price projections load weighted average wholesale price of electricity in 2013/14 (nominal)**

	$/MWh
Actual (12 months to 25 March 2013)	$55.49
December 2012 projection (financial 2013/14)	$64.29
December 2011 projection (carbon scenario, financial 2013/14)	$87.05

Data source: *PowerMark* modelling

It is clear from Table 1 that our current projection of the wholesale spot price of electricity is lower than the projection that underpinned the Commission's determination of the retailer payment 12

[1] Report available from http://www.escosa.sa.gov.au/projects/167/2012-determination-of-solar-feed-in-tariff-premium.aspx

months ago. The main reason that projected prices are lower now than they were 12 months ago is that electricity demand is now projected to grow more slowly than was anticipated when the original projections were prepared, which is the result of slower than expected economic growth and a range of policy interventions that are likely to have further reduced electricity demand. There have also been a number of adjustments to the availability of generation plant. In South Australia:

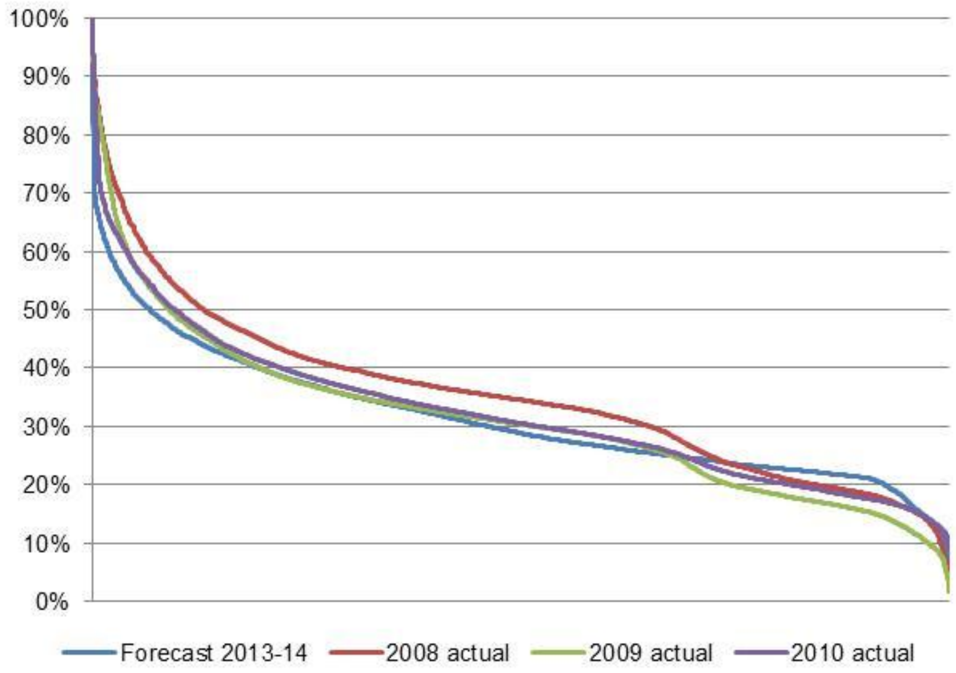
- Playford B is mothballed from 1 July 2012, in line with Alinta's public announcement in April 2012. It is assumed not to return to service
- From 1 July 2012, Northern Power Station is assumed only to operate in the summer months (October – March). It is assumed to return to full operation in the summer of 2014/15, based on Alinta's public announcement in April 2012.
- We understand that with the assumed exhaustion of the Leigh Creek coal resource in December 2017, Alinta will access a deeper seam of coal from 2018 onwards. Northern will continue to operate on this new seam, which has 25% higher mining costs and a lower heat content. This is reflected in the delivered coal price to Northern from 2018 onwards.
- Snowtown 2 wind farm is now committed with 270MW of capacity assumed to be in full operation by the end of 2014.

The Net System Load Profile

Our projection of the NSLP is developed using a regression based approach as described in the accompanying report. We apply the regression parameters obtained there to our load projection for the SA NEM region used in developing the *PowerMark* price projection for 2013-14 (plus information about peak periods and calendar quarters).

As is shown in Figure 1, the shape of this forecast NSLP is consistent with the shape of historic NSLPs for calendar years 2008 to 2010.

Figure 1 **Comparison of projected NSLP shape and historic NSLP shapes**



Note: All NSLPs sorted into descending order and expressed as a percentage of maximum load in the relevant year

Source: Actual NSLP data from AEMO; fitted values derived by ACIL Tasman

This process yields a projection of the half hourly demand of small customers in South Australia (all of whom are charged using the NSLP). However, this is not the demand profile that determines the wholesale cost of electricity to retailers. Rather, that cost is determined by the NSLP *less* the total amount of electricity generated by PV systems.

To calculate this we take two steps. First, in the regression described above we adjust both the NSLP (dependent variable) and SA regional load (one of several independent variables) to 'add back' our estimate of the output of solar PV systems. Therefore we use the estimated regression parameters outlined above to project the underlying electricity demand of customers that make up the NSLP, rather than the NSLP itself.

We then remove the projected output of PV systems from this projection leaving a projection of the NSLP that would be used to allocate the wholesale cost of electricity to retailers.

In both cases our estimate of the output of solar panels is developed based on two inputs:

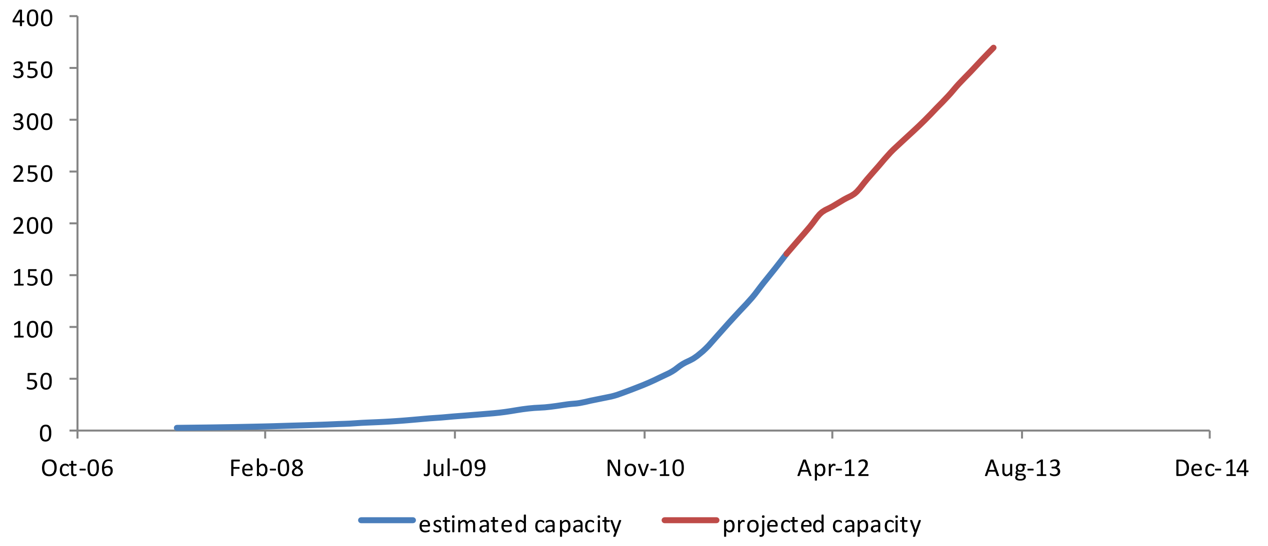
1) solar insolation data for North West Bend developed by 3TIER for Renewables SA.[2]
2) solar PV uptake data provided by SA Power Networks.

We projected the solar PV uptake on a straight line basis into the future by assuming that the quarterly rate of uptake of PV systems in future will be the same (on average) as it was in the first half of the 2012/13 financial year. We also assume that uptake is spread evenly among the three months in each

2 See Renewables SA, Renewable Energy Resource Maps available at http://www.renewablessa.sa.gov.au/investor-information/resources#Solar

quarter. The projection is shown in Figure 2. It shows rapid uptake throughout 2012 and to June 2013, which may seem unintuitive given the reduction in feed in payments in recent years. However, the projection is based on growth observed in the second half of 2012, by which time feed-in payments and other support for PV systems had already been reduced significantly.

Figure 2 **Domestic solar PV in South Australia, installed capacity**



Source: History – SA Power Networks, Projection, ACIL Tasman

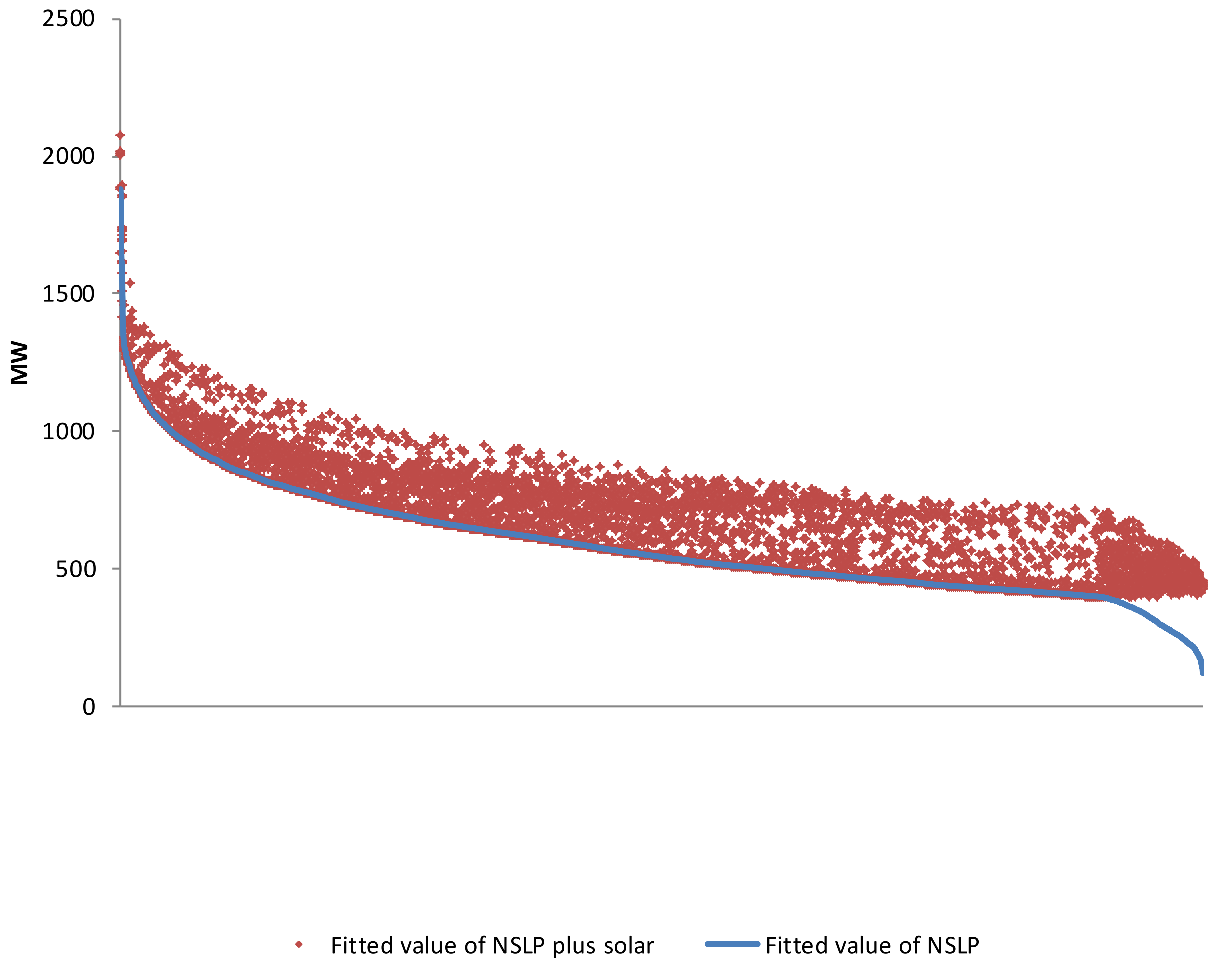
The impact of adjusting the NSLP to account for the output of PV systems in the projection period is illustrated in Figure 3. In the figure, the 'NSLP plus solar' is shown as a scatter plot because the output of PV systems varies independently of the NSLP demand.[3]

On average, the NSLP is 71 MW lower without the impact of PV systems than it is with their impact. The impact varies from zero to approximately 300 MW.[4] The median impact is approximately 4 MW, reflecting that the impact is often zero. The median impact excluding times of zero output is approximately 130 MW.

3 In other words, the chart shows the NSLP (blue line) in descending order. The red dots are calculated by adding our estimate of solar output to each dot that makes up the blue line.

4 Note that this does not imply that the installed capacity of PV systems is 300 MW. This level is tied to the assumed 1400kWh per kW, which is itself consistent with the experience of the Clean Energy Regulator and SA Power Networks. This indicates that, on average, the 'fleet' of installed PV systems does not operate at its total rated capacity. Factors such as cloud cover, shading from trees and nearby buildings, over optimal temperature and other factors are all likely to contribute to this.

Figure 3 **NSLP projection with and without solar output**



The value of avoided network losses

We have analysed historic distribution loss factors for South Australia as published by the Australian Energy Market Operator (AEMO). As Table 2 shows, historically these have been approximately eight per cent. While there is some annual variation, it is small and there is no discernible pattern. Therefore we have assumed that eight per cent is a central level that will not change over time and our estimates of the value of exported PV output are based on the assumption that distribution losses are 8.00 per cent.[5]

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5 Assuming that losses remain close to the historic range, any errors introduced by this assumption will be minimal and within the error margin of the wholesale electricity price projection.

Table 2 **Historic loss factors in South Australia**

	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Low voltage customer DLF	1.0799	1.079	1.074	1.0814	1.0765	1.0800
SA VTN MLF	1.0001	1.0009	1.0057	1.0003	1.003	0.9981
Combined loss factor (= DLF × MLF)	1.0800	1.0800	1.0801	1.0817	1.0797	1.0779
Implied losses	**8.00%**	**8.00%**	**8.01%**	**8.17%**	**7.97%**	**7.78%**

Note: DLF means distribution loss factor. MLF means marginal loss factor and applies to the transmission network. VTN means virtual transmission node and is an aggregated representation of most consumption MLFs in the SA NEM region.

Data source: AEMO

Market and ancillary services fees

AEMO levies two sets of fees on market customers in the National Electricity Market. The first covers its general operational costs (market fees). The second covers the cost of various ancillary services that are provided to ensure the reliable operation of the system (ancillary service fees).[6]

Market fees are published annually in advance and are generally levied on market customers (including retailers) on a per megawatt-hour basis.[7] AEMO's published 2012-13 fees are shown in Table 3. They indicate costs for market customers with a retail licence of around $0.4 per MWh.

Table 3 **AEMO 2012-13 market fees**

Fee class	Rate ($ per MWh)	Paying participants
General fees	$0.12333	Market customers
Allocated fees - market customers	$0.14830	Market customers
Full Retail Contestability – establishment	$0.01273	Market customers with a retail licence
Full Retail Contestability - operations	$0.04675	Market customers with a retail licence
National Transmission Planner	$0.03636	Market customers
National Smart Metering	$0.01531	Market customers
Electricity Consumer Advocacy Panel	$0.01264	Market customers
Total	$0.39542	

Data source: AEMO, Electricity Revenue Requirement and Fee Schedule 2012/13, http://www.aemo.com.au/About-AEMO/Corporate-Publications/Current-Energy-Market-Budget-and-Fees

Unlike market fees, AEMO seeks bids from market participants to provide ancillary services. Ancillary service fees are then set on a cost-recovery basis.

Ancillary service fees in South Australia are generally in the range of $0.1 per MWh to $0.2 per MWh. However, they can spike to much higher levels. Given this variability, we have assumed that the three year average level of ancillary service fees, which is $0.49 per MWh, reflects the likely future level of these costs.

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6 These deal with issues such as frequency control.

7 Other fees, such as for the registration of market participants, are levied on a user-pays basis, rather than on market customers specifically.

Therefore, we make the adjustment shown in Table 4 for the impact of market and ancillary services fees.

Table 4 **Market fees and ancillary service fees**

	2013/14	
	$ per MWh	c per kWh
Market fees	$0.40	0.0
Ancillary service fees	$0.49	0.1
Market fees and ancillary service fees (at RRN)	$0.92	0.1
Market fees and ancillary service fees (after adjustment for losses)	$1.00	0.1

Note: All prices are presented in nominal terms

Data source: ACIL Tasman analysis

Value of exported PV output

Table 5 summarises our current projection of the value of exported PV output in 2013-14 based on the above inputs and compares them with the estimates produced in December 2011.

Table 5 **Updated estimate of the value of exported PV output (nominal cents per kWh, GST exclusive, financial 2013/14)**

	c/kWh (2013 estimate)	c/kWh (2011 estimate - carbon scenario)
Net system load profile weighted wholesale spot price	8.53	10.2
Avoided losses	0.68	0.9
Market fees	0.10	0.1
Value of exported PV output	**9.31**	**11.2**

Data source: ACIL Tasman modelling