Oakley Greenwood

Profiling Uptake of Solar PV

prepared for:
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1. Background

Oakley Greenwood (OGW) was engaged by the Centre for International Economics (CIE) to undertake a metadata analysis of the potential impact of the following five decentralised technologies on the forecast peak demands of the terminal stations serving the Citipower and Powercor ('the Businesses') networks:

- Rooftop solar PV;
- Electric vehicles;
- Battery storage;
- Other forms of distributed generation (excluding PV); and
- Energy efficiency.

That report was provided as an input to the CIE's terminal station demand forecasts that it had been commissioned by the Businesses to produce.

During the period that that report was being prepared, the Victorian State Government announced a number of policy initiatives that were focused on incentivising the take-up of solar PV (particularly by residential customers).

In combination, the two programs announced (which are discussed in later sections of this report) provide extensive rebates for the installation, if fully filled, of 724,000 panels (24,000 to 30 June 2019; 650,000 from 1 July 2019 through 30 June 2029; 50,000 for renters).

As we stated in our original report, due to the timing of these announcements, any election commitment would not have been explicitly included in the CSIRO's forecasts that were relied upon by AEMO to inform their 2018 Electricity Statement of Opportunities (ESOO). As a result, the AEMO forecast (in particular as they pertain to residential installations) could not have accounted for the impact of these programs and had to be considered out of date.

To overcome this, we added into our original forecasts an estimate of the expected impact of a number of these announcements. However, we did not include any allowance for the Solar for Renters program in our original report, due to the timing of its formal announcement.

Consistent with the scope of that project, we did not do any detailed assessment of the profile of take-up under these programs, nor did we assess the affect that the programs may have on the underlying economics of taking up solar PV. Rather, we simply aligned the take-up with the broader AEMO take-up profile (from its 2018 ESOO), and assumed PV sizes that aligned with the basis for the rebate itself (4kW).

2. Objective

The Businesses have now engaged us to undertake a bespoke forecast of the **profile** of take-up of solar PV in Victoria for the forthcoming regulatory control period. In developing this profile, we are to have explicit regard for the impact that the Victorian State Government's solar PV related policies are likely to have on that profile.

We have also taken the opportunity to refine a number of our original assumptions.[1]

3. Caveat

The Businesses have not engaged OGW to develop a new bottom-up forecast of solar PV installations for the forthcoming regulatory control period, for example via the development of payback/economic models.

Rather, it has been assumed that given the magnitude of the incentive customers receive for installing a solar PV system under the Government's policy announcements, the underlying economics of installing solar systems under the Government's current policies is not in question.

In a practical sense, this means that the we have implicitly assumed that:

- The Victorian Government's solar packages[2] will be fully utilised by Victorian residential customers over their 10-year durations, and that these packages will represent the total amount of solar PV that is taken up by *residential* customers in Victoria[3]; and
- The take-up of solar PV systems by commercial customers will align with AEMO's 2018 ESOO forecasts.

4. Summary of remaining sections of report

The remaining sections of this report are structured as follows:

- Section 5 provides a description of the key solar related policy packages that have recently been implemented in Victoria;
- Section 6 discusses the key supply and demand factors that are likely to impact upon the take-up of systems under the Victorian Government's solar programs;
- Section 7 provides our conclusions regarding the factors affecting the supply and demand for solar panels over the life of the programs; and
- Section 8 provides our final profile, and in turn, forecast of solar panels at a state-wide level.

1 Our original report is still relevant for the purposes of explaining the process and assumptions that we used to allocate the state-wide forecasts contained in this report to LGAs and in turn, terminal stations. The only adjustment we made to that original allocation process was to adjust (down) the number of existing and forecast dwellings in the Melbourne and Port Phillip City Council regions so as to only reflect the number of standalone dwellings, noting that we originally used total dwelling numbers as the allocator. For solar installations, the number of standalone dwellings is a more appropriate allocator (this is not as relevant for other technologies, such as energy efficiency and EVs).

2 There are multiple packages related to the installation of solar PV systems in Victoria. These are discussed in more detail in latter sections of this report.

3 For completeness, we note that if anything, this may lead to an under estimate of solar PV take-up, given the eligibility criteria pertaining to the policies means that some high income, high wealth (based on house value as a proxy) are ineligible for a rebate.

5. A description of the relevant packages

5.1. Solar Homes

Under the Solar Homes program, eligible households can claim a rebate of up to $2,225 on the cost of a solar PV system or a $1,000 rebate for the replacement of hot water systems with solar hot water. Rebates are available for systems installed from 19 August 2018. There is no limit on the size of the installation, just on the rebate amount.

The Victorian Government allocated $74 million to Sustainability Victoria to deliver this package up until 30th June, 2019, with the package consisting of 24,000 solar PV system rebates and 6,000 solar hot water system rebates for eligible Victorians[4].

Further to the above, as part of the Solar Homes program, a loan scheme will commence for solar PV systems for owner-occupiers from July 2019. Households will be required to pay back the amount of the loan over four years[5]. Households who choose to access the solar PV rebate before the loans scheme opens in July 2019 **will not be able to apply for the interest-free loan**.

To qualify for the programs, customers must [6]:

- Be an owner occupier;
- Have a household income of up to $180,000 who live in their own home valued at up to $3 million;
- Install approved equipment using approved tradespeople; and
- Not have already applied for the solar hot water rebate.

It is expected that 650,000 rebates will be provided under the loan scheme over 10 years. The scheme also includes $9m of funding **to support accreditation of 4,500 electricians to install solar panels**. Solar systems can only be installed by accredited solar installers[7].

5.2. Solar for Renters

The government is investing $82 million over 10 years to provide 50,000 rebates on solar panels for Victorian renters[8]. To be eligible for the rebate and interest-free loans, landlords will need to strike an agreement with their tenants to share the costs of installation.

Under the program, renters will make a 25 per cent contribution toward the cost of installation through a small levy on rent spread over four years, with the government and the landlord to cover the rest. For example, for a $4,000 solar panel system, the government will cover half ($2000), the landlord will invest $1,000 over time, and the renters will pay a small monthly levy over four years of around $20 that will total the remaining $1000.

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4 Sustainability Victoria, *Business Plan 2018-19*, page 14

5 https://www.solar.vic.gov.au/Solar-rebates/Interest-free-loans

6 https://www.dtf.vic.gov.au/sites/default/files/document/Labor%20Party%20Costing%20Request%20042%20-%20Solar%20Homes%20-%2012%20November%202018.pdf

7 https://www.dtf.vic.gov.au/sites/default/files/document/Labor%20Party%20Costing%20Request%20042%20-%20Solar%20Homes%20-%2012%20November%202018.pdf

8 Information in this section has been derived from the Solar Victoria website (accessed on 28th February) https://www.solar.vic.gov.au/Solar-rebates/Solar-for-Renters

In order to receive the 50 per cent rebate and no-interest loan, the landlord will need to demonstrate that the benefits of installing solar panels will be passed on to tenants.

6. Factors impacting upon the take-up of systems under the Government's programs

6.1. Demand-side factors

The key factor that we believe will underpin most customers' decisions to invest in a solar PV system is the underlying economics of the investment (i.e., do the electricity bill savings exceed the cost of investing in and maintaining the PV system).

It is our view that given the magnitude of the incentive customers will receive for installing a solar PV system under the Government's policy announcements (50% rebate, and a 4-year interest-free loan for the remainder), the underlying economics of installing solar systems under the Government's current policies is not in question. Therefore, our underlying assumption is that if there are no supply-side constraints, the program will be completely filled.

Moreover, we note that the structure of the program is such that it would appear to always be more beneficial for a customer to install a system earlier in the program as opposed to later. In saying this, we note that the incremental benefits and costs of delaying a decision to have solar installed in a year primarily relates to the lost electricity bill savings as compared to the reduced (net) cost of the panel to the customer. Using the same assumptions that the Department of Treasury and Finance (DTF) used when it costed up the Labour Party's policy, the expected value of the 50% rebate is $2225[9] on a 4kW system, hence the net cost to the customer is the same (noting that from 1 July 2019, they are eligible for a 4-year interest free loan to cover this net amount).

In comparison, the expected bill savings arising from the installation of a 4KW solar panel in Victoria are in the order of around **$800 to $900 per annum[10].**

Quite clearly, the bill savings will almost certainly swamp the benefit they would receive (via a lower panel cost, and opportunity cost of capital) from choosing to defer their investment in solar PV under the Victorian Government's policy, given:

- They are only exposed to 50% of the net costs (for a 4kW system), which therefore halves the benefits that they receive from any decline in the cost of any system (up to 4kW) from one year to the next; and
- The net amount that they pay is actually paid via an interest-free loan from the Government (payable over 4 years).

9 https://www.dtf.vic.gov.au/sites/default/files/document/Labor%20Party%20Costing%20Request%20042%20-%20Solar%20Homes%20-%2012%20November%202018.pdf

10 Based on using Sustainability Victoria (https://www.sustainability.vic.gov.au/You-and-your-home/Save-energy/Solar-power) estimates, a 4kW panel would generate around 5300 kWh, with between 30% to 50% being used on-site (with the remainder exported). Assuming 30% is used on-site, and an average retail rate of $0.25/kWh, with the remaining 70% eligible to receive the ESC's most recent 'single rate' minimum feed-in tariff for 2019/20 ($0.12/kWh), the bill savings are around $840. We note that the Solar Victoria website quotes "typical household savings of $890 per year" (https://www.solar.vic.gov.au/Solar-rebates/Solar-Panel-Rebate).

Finally, we note that the above analysis is based on a 4kW system. Recent history suggests that customers have tended to install even larger systems. For example, our analysis of data from the Clean Energy Regulator's (CER) website indicates that the average size of each installation installed in 2018 in Victoria was around 6.9KW[11]. Whilst the difference in the cost of a 4KW system and say a 7KW system would not be eligible for a rebate (based on current cost estimates), it still does not mean that it is not economic for a customer to incur the incremental capital costs at the time of installation to upsize the system (assuming they have the space to do so). For example, if the incremental cost of installing a 7KW system as opposed to a 4KW system were to cost say $3300 (based on extrapolating DTF's capital costs for a 4KW system to a 7kW system), this could produce in the order of 4000kWh[12], which, even if fully exported, would generate $480 in revenue under the ESC's 'single rate' minimum feed-in tariff for 2019/20. This well exceeds the carrying costs of the incremental investment.

6.2. Supply-side factors

There are two key factors that could, in theory, impinge on the ability for the solar industry to keep up with demand for its products. These are:

- Constraints affecting the production of panels, and / or their importation into Australia; and
- Constraints affecting the installation of panels in Victoria over the 10-year program period.

In relation to the former, the relative size of the Victorian Government's solar program, in the context of the global production of solar panels (noting that it is our understanding that Australia does not have any significant local solar panel manufacturing, therefore most panels are imported), means that it is unlikely, in and of itself, to lead to capacity constraints stemming from a lack of panel production.

Regarding the installation of panels, the Clean Energy Council (CEC) website indicates that there are currently around 1421 registered solar installers in Victoria at present, and around 6080 Australia-wide.

11 Note that this data includes all small-scale systems, including those installed at commercial premises, which may mean that it exceeds the average residential sized system.

12 https://www.sustainability.vic.gov.au/You-and-your-home/Save-energy/Solar-power

Figure 1: Number of registered installers as per CEC website

Source: Clean Energy Council website, Map of Accredited Installers [accessed 1March, 2019]

We also have been able to ascertain the number of solar installations over CY 2018 from the Clean Energy Regulator (CER) website. These, along with the installer numbers, are contained in the table below.

Table 1: Number of solar installations and estimated number of installers in CY2018

Jurisdiction	Number of solar installations[1]	Est. number of installers[2]	Estimated installations per installer (pa)
Victoria	43, 605	1421	30.68
Australia-wide	214,035	6080	35.20

1. As per CER website (http://www.cleanenergyregulator.gov.au/RET/Forms-and-resources/Postcode-data-for-small-scale-installations#Postcode-data-files). 2. As per the CEC website, accessed 1 March, 2019.

On face value, the above figures indicate that there may be some small scope for the existing installers that operate in Victoria to increase their overall output in response to increases in demand. That said, we would caution reading too much into these figures, given that the circumstances affecting per-installer installation rates may vary significantly across different regions (e.g., travel time), as well as uncertainty regarding what the exact number of installers were throughout the year and whether they were "full time".

However, the figures do suggest that around 214,035 installations were installed across Australia (adding around 1.5MW of capacity, or around 7kW per installation) using around 6000 installers. This is of particular note, given that the Victorian Government's suite of policy measures includes a commitment to fund the training of an additional 4500 qualified installers[13], which, when added to the existing number of installers in Victoria, would bring the number of installers to levels slightly lower than the current Australia-wide figure (6080).

On face value, this is likely to represent a reasonable approximation of the supply capacity that would be created if one believes that an additional 4500 installers were to enter the market. That is, if around 6000 installers were operating in Victoria, one could expect that around 180,000 to 210,000 panels could theoretically be installed per annum.

Following on from this, there are two other constraints that may limit the number of currently qualified electricians actually undertaking the subsidised training:

- There are not enough qualified electricians currently available to undertake the course (hence the 4500 subsidised spots could not be filled); or
- There are not enough service providers to provide the subsidised courses.

In the case of the former, we have reviewed the "Registered Electrical Contractor (REC) listing" on the Energy Safe Victoria website, and we estimate that there are around 15,000 registered electrical contractors in Victoria. In our opinion, this would suggest that this would not appear to be a material constraint to the take-up of the 4500 subsidised training places over time.

In the case of the latter, our high-level review indicates that there are numerous providers of existing (accredited) training courses, including institutions such as Swinburne, Holmesglen, Victoria University and Melbourne Polytechnic[14]. The cost of these courses appear to be similar to the per-installer subsidy underpinning the DTF's costing of the Labour party's policy (around $2,000 per installer).

Whilst we cannot be absolutely sure as to whether or not they have the capability to increase the supply of accredited training courses, on face value, it would appear that this is unlikely to represent a material constraint **in the long-term** (however, it may be in the short-term), given the number of existing providers and the relatively small marginal cost of increasing the frequency of an existing course.

The other potential constraint is that PV installations in Victoria, or in certain particular parts of Victoria, might reach a saturation point (i.e., a point where technical limits are breached meaning that no more solar PV is able to be installed on the network).

On face value, there would appear to be no significant issue with the Victorian Government's policy. In saying this, we note that at a State-wide level, adding the number of panels expected under the Victorian Government's solar programs would not appear to lead to a penetration rate that is overly excessive, based on the recent experience of other states[15].

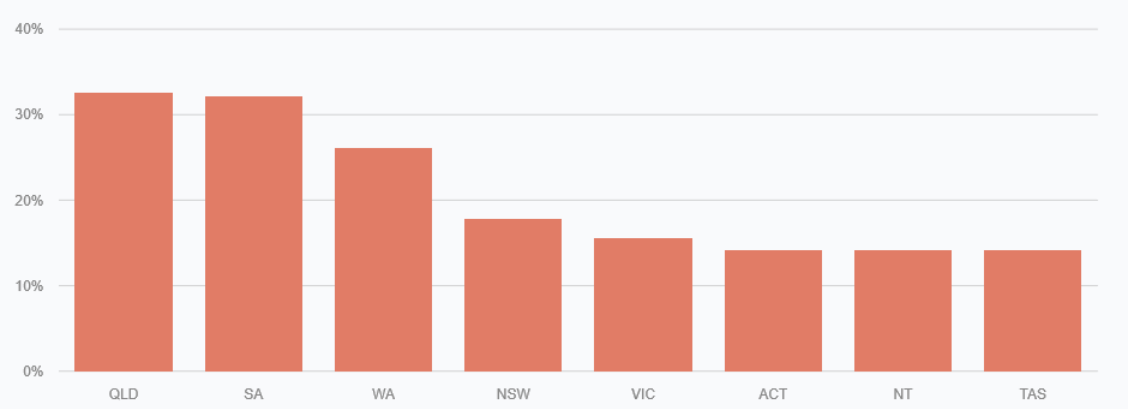
13 https://www.dtf.vic.gov.au/sites/default/files/document/Labor%20Party%20Costing%20Request%20042%20-%20Solar%20Homes%20-%2012%20November%202018.pdf

14 https://www.solaraccreditation.com.au/installers/becoming-accredited.html ['Registered training organisations' pdf]

15 This is not to suggest that there have not been some technical difficulties faced by distribution businesses in these states at a localised level (which presumably is also likely to be the case for Victorian distribution business in certain regions), but rather, they do not appear to have been insurmountable, or to a degree that has dampened the overall demand for solar PV systems in those states.

In particular, both Queensland and South Australia have penetration rates of around 33%.

Figure 2: Percentage of dwellings with a PV system by State/Territory



Source: http://pv-map.apvi.org.au/historical#7/-36.191/144.701

To this end, after making allowances for the expected growth in customer numbers over the 10-year period covered by the Victorian Government's solar programs, the penetration rate at a State level is estimated to be around 37%.

This is based on the following assumptions:

Table 2: Expected future penetration rate of PV

Parameter	Current Levels	Forecast in 2029
Number of installations	381,470[1]	1,105,470
Number of residential customers	2,544,179[2]	3,005,405[3]
Penetration	**15%**	**36.78%**

1. Based on CER data. 2. Based on the 2017 residential customer numbers reported by distribution business to the AER in their Regulatory Information Notices (RIN Data) 3. Growth rate imputed from the expected underlying growth in dwellings between 2021 and 2031 contained in the "VIC in Future (2016)" document (page 12), and then applied to the 2017 RIN customer number data.

The forecast does not appear to lead to any major systemic issues at an LGA level either. This results from the fact that we have allocated the state-wide forecast based on:

- new residential customers (41%), and then
- existing residential customers (35%),
- with the remaining 24% split between new and existing commercial customers,

rather than based on existing solar installations. Please see our original report for the rationale for adopting this approach.

7. Conclusions regarding supply / demand constraints

Based on our analysis, we are of the view that:

- Given the magnitude of the incentive customers receive for installing a solar PV system under the Victorian Government's solar policies (50% rebate, and a 4-year interest-free loan for the remainder), the economics of a customer installing a solar PV system under the Government's current policies is unquestionably positive. Therefore, our underlying assumption is that if there are no supply-side constraints, the program should be completely filled.
- There appears to be an underlying economic incentive for customers to install a PV system earlier in the program as opposed to deferring their decision and installing it later in the program.
- There is still an incentive for customers (and for installers to encourage customers) to upsize their PV system, beyond the 4KW sizing that underpins the rebate.
- The number of installations that are assumed to be installed under the Victorian Government's various solar packages[16] would not appear to lead to any systemic, technical constraints at a state-level, based on some other States' experiences.
- Assuming the Government adheres to its commitment to train an additional 4500 installers, the sector should have the capacity to cater for significant increases in the number of installations expected over **the longer-term**, relative to historical installation rates. On face value, based on the historical number of installations across Australia, utilising in the order of 6000 installers, it is reasonable to expect that around 180,000 to 210,000 panels per annum could theoretically be installed at best.
- Qualifying the above statement is that **short-term installation rates** are unlikely to reach that level, given the inevitable lag between the commencement of the Victorian Government's policy and when all 4500 installers could be trained by.
- Whilst the lag is difficult to quantify, we estimate that it would take around 3 to a maximum of 4 years for the full 4500 places to be taken up. We would expect that this would happen progressively over that period.

16 To be clear, this is not to say that there may not be isolated cases where this could occur, but rather, at a general level, the level of penetration does not appear to be so large as to promote wide-spread technical issues.

8. Final profile

Having regard to the above information, we are assuming the following installer numbers in Victoria and in turn, the maximum number of installations that could be made in a year.

Table 3: Estimated number of installers and maximum number of installations

Parameter	Current Est (2018)	End 2019	End 2020	End 2021	End 2022 onwards
Assumed number of installers in VIC	1421	2700	4000	5300	6000
Estimated maximum number of installations[1]	43,605	83,250	123,333	163,417	185,000
Number of installations @80% of maximum[2]	43,605	66,600	98,667	130,733	148,000

1. For years prior to "end 2022", this is based on proportioning down the estimated maximum number of installations that we assume could feasibly occur if 6000 installers were operating in Victoria (which we assume is 185,000 and is reached at the end of 2022). 2. We have modelled what would happen if installations were at 80% of the estimated maximum number of installers, to reflect the fact that if there may be some downside risk to future installer numbers as compared to the maximum (e.g., people train, but don't end up participating in the market full-time).

Our revised forecast of installations is based simply on:

- Assuming that the Victorian Government's solar program is fully utilised, and all panels that are installed under the:
  - **Solar Renters program**: Given the nature of the program, we believe that landlords and tenants are likely to limit their installations to 4kW, which in theory, is where the rebate ceases. We have assumed that this is taken up at a fairly constant rate over its assumed 10 year duration; and

- **Solar Homes program** (both pre and post July 2019): Are 6kW[17], with this based on discounting the current installation sizes derived from the CER installation data (as this includes commercial customers)[18]. We assume that for the pre-July 2019 part of the program, it is fully subscribed (with this allocated to 2019 in our tables below), and for the post 2019 part of the program (i.e., where customers are also eligible to receive loans), take-up increases significantly until 2023, in line with the increase in the number of installers available[19] over that period and consistent with the assumption that customers have an incentive to install panels earlier rather than later under the program, with annual installation rates then reducing to much lower levels over the backend of the program.

- Adding back AEMO's business-related PV system forecast.

Table 4: State-wide forecast of installed solar PV capacity (MW)

Installed capacity	2019	2020	2021	2022	2023	2024	2025	Source
AEMO forecast (ex 100kW-30MW)	2305.13	2670.09	2722.86	2777.11	2832.9	2890.33	2949.4	AEMO - ESOO (ex 100KW-30MW)
Less AEMO's Original Residential Forecast	1872.2	2108.42	2147.81	2188.22	2229.67	2272.21	2315.86	AEMO - ESOO (Residential)
Equals AEMO's Business (ex Large)	432.93	561.67	575.05	588.89	603.23	618.12	633.54	By deduction
Plus Solar Homes Package (Aug 18 - June 19)[1]	144	144	144	144	144	144	144	24,000 Installations @ 6kW per installation (Btw august 18-19)
Solar Homes with Loans (July 19 - June 29)[2]	171	621	1264	2070	2928	3198	3408	650,000 @ 6kW per installation (July 19-29)
Solar for Renters[2]	10	40	70	90	110	130	150	50,000 Installations @ 4kW per installation (Btw august 19-29)

17 This assumption differs to our original report, which assumed a 4kW system was installed, which aligned with the basis for the rebates under the Solar Homes program.

18 It also aligns with the assumptions underpinning the CSIRO's "moderate" PV installation case.

19 After allowing for the number of installations that occur under the other solar programs.

AEMO's 2018 residential figure	1432.09						
TOTAL	**2190.02**	**2798.76**	**3485.14**	**4324.98**	**5217.32**	**5522.21**	**5767.63**

1. This is based on this package being fully filled in the 18/19 period, noting that we have allocated it to 2019 for reporting purposes. 2. This is based on the installation rates outlined in the table below.

It should be noted that the 2019 figure (2190MW) is below AEMO's original forecast, despite the adoption of the Solar Home program. For clarity, AEMO's 2019 forecast appears to assume that an additional 440MW of capacity would be added in the residential customer segment in 2019. Assuming 6kW per installation, this equates to around 73,000 installations. We doubt that this is feasible given current installer levels, hence why our forecast is lower in this year.

The following table highlights assumed installation numbers under each program over the 10-year duration.

Table 5: Estimated number of installations under each program

Parameter	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Solar Homes Package (Aug 18 - June 19)	24000									
Solar Homes with Loans (July 19 - June 29)[1]	28602	75133	107200	134366	143000	45000	35000	35000	25000	21700
Solar for Renters	2500	7500	7500	5000	5000	5000	5000	5000	5000	2500
***Total*[2]**	**55102**	**82633**	**114700**	**139366**	**148000**	**50000**	**40000**	**40000**	**30000**	**24200**

1. In the early years, this is calculated as a residual, that is, this fills the gap between the overall installation capacity assumed, less the assumed number of installations that have been allocated to the other two programs. 2. This reflects our estimate of the overall installation capacity in the year, based on the **average** (up until 2022) number of installers assumed to be available at 80% capacity (See Table 3).

This leads to the following among of PV capacity at each LGA.

Figure 3: PV capacity by LGA

	PV capacity (MW)										
LGA	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
ARARAT RURAL CITY COUNCIL	5.9	6.5	7.1	8.0	8.8	9.1	9.4	9.6	9.8	10.0	10.0
BALLARAT CITY COUNCIL	42.2	53.6	66.5	82.3	99.0	104.8	109.4	114.0	117.5	120.4	120.8
BENALLA RURAL CITY COUNCIL	13.0	13.8	14.8	16.0	17.2	17.6	18.0	18.3	18.6	18.8	18.8
BOROONDARA CITY COUNCIL	33.4	51.8	72.6	98.0	125.0	134.3	141.7	149.1	154.8	159.5	160.1
QUEENSCLIFFE BOROUGH COUNCIL	0.0	0.3	0.6	1.0	1.4	1.5	1.6	1.7	1.8	1.9	1.9
BRIMBANK CITY COUNCIL	99.4	115.5	133.7	155.9	179.5	187.6	194.1	200.6	205.6	209.7	210.2
BULOKE SHIRE COUNCIL	7.2	7.5	7.7	8.1	8.4	8.5	8.6	8.7	8.8	8.9	8.9
CAMPASPE SHIRE COUNCIL	34.5	37.7	41.3	45.7	50.4	52.0	53.3	54.6	55.6	56.4	56.5
CENTRAL GOLDFIELDS SHIRE COUNCIL	11.2	12.1	13.2	14.5	15.8	16.3	16.6	17.0	17.3	17.5	17.6
COLAC OTWAY SHIRE COUNCIL	11.2	12.5	14.0	15.8	17.8	18.5	19.0	19.5	19.9	20.3	20.3
CORANGAMITE SHIRE COUNCIL	10.9	11.8	12.9	14.3	15.7	16.2	16.6	17.0	17.3	17.5	17.5
DAREBIN CITY COUNCIL	38.5	53.8	71.1	92.3	114.8	122.5	128.7	134.9	139.6	143.5	144.0
GANNAWARRA SHIRE COUNCIL	12.5	13.0	13.6	14.3	15.0	15.3	15.5	15.7	15.8	16.0	16.0
GLEN EIRA CITY COUNCIL	25.2	39.1	54.7	73.9	94.3	101.2	106.8	112.5	116.7	120.3	120.7
GLENELG SHIRE COUNCIL	7.8	9.0	10.5	12.2	14.1	14.7	15.2	15.7	16.1	16.4	16.5
GOLDEN PLAINS SHIRE COUNCIL	16.9	19.0	21.3	24.2	27.3	28.3	29.1	30.0	30.6	31.2	31.2
GREATER BENDIGO CITY COUNCIL	39.4	50.9	63.8	79.6	96.4	102.2	106.8	111.4	114.9	117.9	118.2
GREATER GEELONG CITY COUNCIL	98.5	121.8	148.2	180.4	214.6	226.3	235.7	245.2	252.3	258.3	259.0
GREATER SHEPPARTON CITY COUNCIL	42.4	48.2	54.7	62.7	71.1	74.0	76.4	78.7	80.5	82.0	82.1
HEPBURN SHIRE COUNCIL	8.6	9.9	11.4	13.3	15.3	16.0	16.5	17.1	17.5	17.8	17.9
HINDMARSH SHIRE COUNCIL	5.3	5.5	5.7	6.0	6.2	6.3	6.4	6.5	6.5	6.6	6.6
HOBSONS BAY CITY COUNCIL	24.3	33.0	42.9	54.9	67.7	72.1	75.6	79.2	81.8	84.1	84.3
HORSHAM RURAL CITY COUNCIL	13.6	15.3	17.3	19.6	22.2	23.0	23.7	24.4	24.9	25.4	25.4
HUME CITY COUNCIL	81.2	104.0	129.7	161.2	194.6	206.0	215.2	224.4	231.4	237.3	238.0
LODDON SHIRE COUNCIL	28.5	28.9	29.5	30.1	30.8	31.0	31.2	31.4	31.5	31.6	31.7
MACEDON RANGES SHIRE COUNCIL	28.9	33.9	39.5	46.4	53.7	56.2	58.2	60.2	61.7	63.0	63.1
MARIBYRNONG CITY COUNCIL	9.6	22.0	36.0	53.2	71.4	77.7	82.7	87.7	91.5	94.7	95.1
MELBOURNE CITY COUNCIL	14.0	14.9	16.0	17.4	18.8	19.3	19.7	20.1	20.4	20.6	20.7
MELTON CITY COUNCIL	58.4	81.1	106.6	137.8	171.0	182.3	191.5	200.6	207.5	213.4	214.1
MILDURA RURAL CITY COUNCIL	35.9	40.6	46.0	52.5	59.5	61.8	63.7	65.7	67.1	68.3	68.5
MITCHELL SHIRE COUNCIL	15.1	21.9	29.5	38.9	48.8	52.2	55.0	57.7	59.8	61.5	61.7
MOIRA SHIRE COUNCIL	34.4	37.2	40.3	44.2	48.3	49.8	50.9	52.0	52.9	53.6	53.7
MOONEE VALLEY CITY COUNCIL	23.7	35.3	48.4	64.4	81.4	87.2	91.8	96.5	100.1	103.0	103.4
MOORABOOL SHIRE COUNCIL	16.7	20.9	25.7	31.6	37.8	40.0	41.7	43.4	44.7	45.8	45.9
MORELAND CITY COUNCIL	18.8	36.5	56.4	80.7	106.6	115.4	122.5	129.7	135.1	139.6	140.1
MOUNT ALEXANDER SHIRE COUNCIL	22.0	23.6	25.4	27.6	30.0	30.8	31.5	32.1	32.6	33.0	33.1
MOYNE SHIRE COUNCIL	20.5	22.0	23.7	25.8	28.0	28.8	29.4	30.0	30.5	30.8	30.9
NORTHERN GRAMPIANS SHIRE COUNCIL	6.0	6.6	7.4	8.3	9.3	9.6	9.9	10.2	10.4	10.6	10.6
PORT PHILLIP CITY COUNCIL	7.1	13.2	20.0	28.4	37.2	40.3	42.7	45.2	47.0	48.6	48.8
PYRENEES SHIRE COUNCIL	3.3	4.0	4.7	5.7	6.6	7.0	7.3	7.5	7.7	7.9	7.9
SOUTHERN GRAMPIANS SHIRE COUNCIL	6.1	7.1	8.3	9.7	11.2	11.7	12.1	12.5	12.8	13.1	13.1
STONNINGTON CITY COUNCIL	5.8	20.8	37.6	58.2	80.0	87.5	93.5	99.6	104.1	108.0	108.4
STRATHBOGIE SHIRE COUNCIL	9.2	10.1	11.0	12.2	13.4	13.8	14.2	14.5	14.8	15.0	15.0
SURF COAST SHIRE COUNCIL	19.4	23.1	27.2	32.3	37.7	39.5	41.0	42.4	43.6	44.5	44.6
SWAN HILL RURAL CITY COUNCIL	18.1	19.5	21.2	23.2	25.3	26.0	26.6	27.2	27.6	28.0	28.0
WARRNAMBOOL CITY COUNCIL	0.0	3.0	6.4	10.6	15.0	16.6	17.8	19.0	19.9	20.7	20.8
WELLINGTON SHIRE COUNCIL	41.4	44.6	48.2	52.6	57.3	58.9	60.2	61.5	62.5	63.3	63.4
WEST WIMMERA SHIRE COUNCIL	1.5	1.7	1.8	2.1	2.3	2.4	2.5	2.5	2.6	2.6	2.6
WHITEHORSE CITY COUNCIL	23.3	38.2	54.9	75.5	97.3	104.8	110.8	116.8	121.3	125.2	125.6
WYNDHAM CITY COUNCIL	45.8	75.9	109.9	151.4	195.6	210.6	222.8	234.9	244.2	251.9	252.8
YARRA CITY COUNCIL	9.8	23.6	39.1	58.1	78.3	85.1	90.7	96.2	100.5	104.0	104.4
YARRIAMBIACK SHIRE COUNCIL	5.3	5.6	6.0	6.5	7.1	7.2	7.4	7.5	7.6	7.7	7.7
	1211.4	1561.5	1956.3	2439.3	2952.5	3127.9	3269.0	3410.5	3517.8	3608.1	3618.4

This contributes to the following reductions in summer peak demand by terminal station.

Figure 4: Reductions in summer peak demand by terminal station

	PV Impact (MW) - POE 50											
Terminal Station	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	SPARE
RCTS_22kV	1.46	1.65	1.86	2.13	2.41	2.51	2.58	2.66	2.72	2.77	2.78	
RCTS_66kV	5.16	5.84	6.61	7.55	8.54	8.89	9.16	9.44	9.64	9.82	9.84	
WETS_66kV	11.61	12.83	14.19	15.87	17.64	18.25	18.74	19.23	19.60	19.92	19.95	
KGTS_22kV	0.69	0.72	0.75	0.79	0.83	0.84	0.86	0.87	0.88	0.88	0.88	
KGTS_66kV	10.10	10.69	11.36	12.17	13.04	13.33	13.57	13.81	13.99	14.14	14.16	
HOTS_66kV	10.55	11.67	12.93	14.48	16.12	16.68	17.13	17.58	17.92	18.21	18.25	
BETS_22kV	2.75	3.23	3.77	4.42	5.12	5.36	5.55	5.74	5.89	6.01	6.03	
BETS_66kV	39.61	45.99	53.17	61.97	71.31	74.51	77.08	79.65	81.61	83.25	83.44	
SHTS_GNTS	39.10	43.27	47.97	53.72	59.83	61.92	63.60	65.28	66.56	67.64	67.76	
HYTS_TGTS_APD	23.36	27.00	31.12	36.15	41.50	43.33	44.80	46.28	47.40	48.34	48.44	
BATS_ELTS	29.48	36.18	43.73	52.97	62.79	66.14	68.84	71.55	73.60	75.33	75.52	
MLTS_GTS_PTH	43.45	53.51	64.85	78.72	93.46	98.50	102.56	106.62	109.70	112.30	112.59	
ATS_West	19.13	31.03	44.44	60.86	78.30	84.26	89.06	93.87	97.52	100.59	100.93	
ATS_BLTS	6.15	8.24	10.59	13.46	16.51	17.56	18.40	19.24	19.88	20.42	20.48	
BLTS_22kV	1.79	2.43	3.16	4.05	4.99	5.31	5.57	5.83	6.03	6.20	6.22	
KTS_East	24.39	28.34	32.80	38.26	44.06	46.04	47.64	49.24	50.45	51.47	51.58	
KTS_West	44.36	56.52	70.23	87.00	104.82	110.91	115.81	120.72	124.45	127.58	127.94	
WMTS_66kV	15.65	23.25	31.82	42.30	53.44	57.24	60.31	63.38	65.71	67.67	67.89	
WMTS_22kV	2.57	2.75	2.96	3.20	3.46	3.55	3.63	3.70	3.75	3.80	3.81	
BTS_22kV	7.01	11.68	16.94	23.37	30.21	32.55	34.43	36.31	37.74	38.95	39.08	
FBTS_66kV	3.44	6.97	10.95	15.83	21.00	22.77	24.19	25.62	26.70	27.61	27.72	
RTS_66kV_Bus1and4	2.46	6.22	10.45	15.64	21.14	23.02	24.54	26.05	27.21	28.17	28.28	
RTS_66kV_Bus2and3	14.56	25.32	37.46	52.31	68.08	73.47	77.81	82.16	85.46	88.24	88.55	
RTS_22kV	1.31	2.95	4.80	7.07	9.48	10.30	10.96	11.62	12.13	12.55	12.60	
SVTS_66kV	3.08	4.78	6.69	9.03	11.52	12.37	13.05	13.74	14.26	14.70	14.75	
TSTS_66kV	6.16	9.55	13.38	18.06	23.04	24.74	26.11	27.48	28.52	29.40	29.50	
Spare	-	-	-	-	-	-	-	-	-	-	-	
Spare	-	-	-	-	-	-	-	-	-	-	-	
	369.40	472.61	588.98	731.37	882.67	934.36	975.97	1,017.67	1,049.30	1,075.94	1,078.96	-