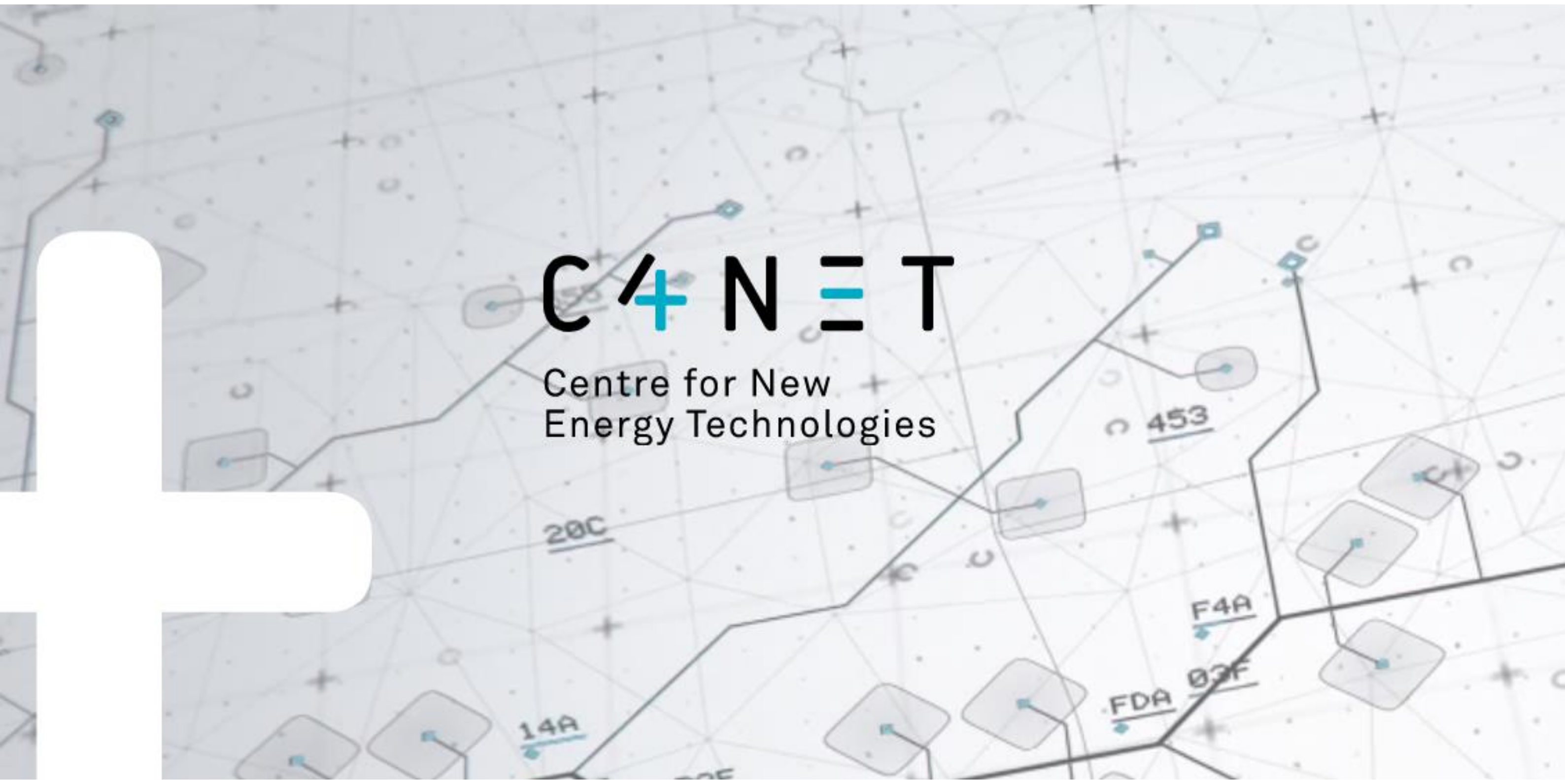

Solar Homes Program Impact Measures (Pilot)

Report for Solar Victoria, the Department of Environment, Land, Water, and Planning

25 March 2021

Centre for New Energy Technologies Ltd | ABN 56 626 202 480
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1.1. Key people

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1.2. Acknowledgments

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  - AusNet Services, who generously provided data and insights to support this investigation
  - Solar Victoria for their insights and feedback to help make the investigation more useful
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    - Jemena
    - Powercor, representing Citipower and United Energy
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    - Federation University Australia
    - Monash University
    - RMIT University
    - Swinburne University
    - The University of Melbourne

1.3. Executive Summary

The Centre for New Energy Technologies Ltd (C4NET), supported by one of its Core Participants, AusNet Services, was engaged by Solar Victoria to conduct a pilot assessment of certain impact measures relating to the installation of solar systems for recipients of the Solar Homes rebate. The pilot assessment assessed the impact to date for a sample of recipients and informed the feasibility of a prospective larger-scale program-wide assessment.

Solar Victoria identified a cohort of 188 residential sites of rebate recipients located in the AusNet Services distribution zone who had solar PV installed within five days of each other in late September 2019. The date range was chosen to ensure availability of at least 12 months electricity interval meter data before and after solar was installed. AusNet Services extracted the sites' data and provided to C4NET on a deidentified basis to conduct the pilot assessment. The data was screened and C4NET identified 129 suitable sites with sufficient meter data to enable a like month-month assessment.

Grid import and export data was as metered through Victoria's AMI smart meter infrastructure. Solar generation had to be estimated based on the location and size of the solar system. Retail tariff rates were unknown so assumed to be the equivalent of the readily available discount rates of major suppliers.

Victorian households had around 20% higher electricity use for many months of 2020 due to the change in behaviours associated with the COVID-19 restrictions. These were accounted for to get a more representative before and after impact assessment.

The key findings were that solar households in the sample set:

- Had an average solar system size of 6.16 kW_p
- Reduced their grid electricity use from the grid by ~30%
- Exported an average of ~5100 kWh/a
- Exported 50% more electricity to the grid than they consumed from it
- Exported 10% more electricity than the average of all Ausnet Services residential sites
- Were net exporters to the grid from September to April inclusive
- Increased their electricity use in the summer months after installing solar, but otherwise matched use from the previous year
- Consumed 27% of the solar they generated, and in doing so met 38% of their household electricity use
- Each saved an average 2000 kg CO_2-e across the year directly from consumption of the solar they generated, and exported solar to the grid that would save other electricity users 5500 kg CO_2-e
- Reduced their annual electricity bills by an average of $1073 or 61% per household
- Had 55% of the bill savings achieved through export credits, and the balance from the avoided cost of grid imports.

However, it is important to note that a wide range of results across the above metrics and therefore caution should be applied to using these findings to inform the likely outcome for any individual site.

The pilot assessment indicated that a program-wide assessment was quite feasible on most measures due to the availability of AMI data through Victoria's smart meters, if billing approximations are performed for a statistical sample only. Error ranges could be reduced through the availability of some reference metered generation sites and customer bills. Deeper insights could be gained with the addition of qualitative customer behavioural assessments to match with the quantitative data assessment.

1.4. Table of Contents

1.5. Glossary of Terms

- **AEMO** – The Australian Energy Market Operator
- **AER –** The Australian Energy Regulator
- **AMI –** Advanced Metering Infrastructure
- **B Channel** – Electricity meter channel recording the solar exported to the grid; half hourly 48 intervals per day
- **C4NET** – Centre for New Energy Technologies
- **DELWP** – Department of Environment, Land, Water and Planning
- **DNSP –** Distribution Network Service Provider, or distribution business. Victoria has five Distribution zones ("patches").
- **E Channel** – Electricity meter channel recording the solar exported to the grid; half hourly 48 intervals per day
- **ESC** – Essential Services Commission (Vic)
- **Export** - Amount of solar generated electricity (kWh) surplus to the instantaneous household electricity demand returned to the grid
- **Import** – Amount of electricity (kWh) drawn from the grid
- **kWh** – kilowatt hour, the measure of electricity consumed/generated/exported per hour
- **kW_p** – kilowatt peak, the nominal power rating of a solar array as determined under standardised conditions
- **Metro** – Premises with postcodes in the Melbourne greater metropolitan area
- **NMI** – National Metering Identifier, a unique numerical identifier for each electricity meter
- **PV -** Photovoltaic, the form of solar panels that convert light (photons) to electricity
- **Regional** – Premises with postcodes outside of major metropolitan areas. The regional areas are divided into Northern Victoria and Southern Victoria, roughly north or south of the Great Dividing Range. These areas were separately analysed to understand better the geographical impacts of parameters observed in this report
- **Solar** – Photovoltaic solar system
- **VDO** – Victorian Default Offer, introduced by the Victorian Essential Services Commission 1 July 2019. Electricity retailers must make the VDO available to customers who request it, but can continue to offer customers contracts that differ through their market offers. Electricity Retailers are required to calculate any discounts from the VDO tariff

2. Introduction

2.1. Background

The Solar Homes Program (the Program) was designed to help eligible Victorian households to take charge of their power bills, adopt renewable energy and provide a cleaner, better energy future for all Victorians. Launched in 2018, the Program makes it easier for customers to get solar with rebates for solar PV panels, solar hot water and solar batteries along with new incentives including interest-free loans for solar PV.

The Program was a key initiative in the Victorian Government's commitment to reduce energy costs, boost energy supply, create new jobs in the renewables sector and tackle climate change. The Program aims to enable 770,000 homes to access solar PV over the program's 10-year life and is delivered by Solar Victoria, a portfolio entity within the Department of Environment, Water, Land and Planning (DELWP).

The program has been strongly supported by Victorian residential electricity customers since its inception in August 2018, and by the end of 2020 was on target to have supported the installation of solar PV on over 100,000 Victorian homes.

The objectives of the Program included:

- encourage the adoption of renewable energy technology across Victoria,
- enable 770,000 Victorian residences to take charge of their power bills and to create a better future, through the installation of solar panels (PV), solar hot water systems or batteries,
- save an average of $890 per house that installs solar PV under the program,
- cut Victoria's carbon emissions by almost four million tonnes – the same as taking one million of Victoria's 4.6 million cars off the road – and generate an eighth of Victoria's 40 per cent target for renewable energy by 2025, and
- promote and maintaining the highest possible standards in safety and quality using accredited providers and approved products

2.2. Scope and Objectives

Solar Victoria monitors a range of program delivery metrics for the Solar Homes Program. In addition, Solar Victoria seek to assess its impact on rebate recipients throughout the life of the program as performance data becomes available.

Sufficient time has now passed to enable the data-led evaluation of the impact of the Program's solar PV installations on certain measures, such as:

1. Household cost savings
2. Reduction of grid-supplied electricity
3. The amount of renewable electricity contributed back to the grid through solar exports
4. Household emission reductions

To test the feasibility and optimise the design of this impact evaluation, it was proposed that a pilot be conducted on a sample of rebate recipients to date. The pilot aims to assist Solar Victoria to inform the development of an independent, transparent (defensible) and logical program-wide evaluation by considering the key issues of:

- How many households should be evaluated (all or a representative sample)
- Which data is required
- What is the impact of extracting and reporting such data
- Limitations on data analysis (what metrics does this data analysis not sufficiently inform)
- Frequency of monitoring and updating measures
- Delivery costs

3. Methodology

3.1. Summary of key assumptions and approaches

Key assumptions and analysis approach were:

- Sites with unexplainable anomalies in electricity use patterns have been excluded.
- The year pre solar was that to October 2019, and the year after from November 2019 to October 2020
- The COVID impact on residential electricity use and seasonal corrections were made
- Generation of solar was unknown therefore was estimated based on:
  - one of three geographic regions (metro, northern regional or southern regional)
  - 95% of the forecast northern facing array prediction (to allow for sub-optimal conditions such as partial shading, orientation and tilt)
  - seasonal variation adjustment for all sites has been to a single weather station (Melbourne Airport)
- Retail prices were unknown so approximated using reference prices in market at relevant times
- Retail tariff types were unknown so have been assumed to match the DNSP rate structure for each site
- All sites had the ESC mandated minimum Feed-in-tariff (FiT) rate for solar export, and they were assumed on the single FiT rate structure
- A single emissions intensity factor has been used to estimate the emissions impact.

Further details of these are explored in the remainder of this section. The depth of detail provided is to support the analysis approach. This includes to inform a better understanding of the challenges and opportunities if a program-wide analysis was to be pursued.

3.2. Raw data and screening of suitable sites

The pilot study sought a representative sample of at least 100 customers where National Metering Identifier (NMI) electricity data could inform the household electricity use for a year before and after the installation of a solar system.

Data was sought from one of the five Victorian DNSP areas to simplify the data extraction and resource requirement. AusNet Services (AusNet) manage ~860,000 residential customers spanning metro and regional areas across eastern Victoria and volunteered to support this analysis.

Solar Victoria provided 188 customer sites (customers had agreed to the Solar Homes General Terms and Conditions) by street address to AusNet and had records of solar installed between 25-29 September 2019.

Of the 188 records provided by Solar Victoria, AusNet observed:

- 7 duplicate addresses
- Of the 181 remaining, only 4 had NMIs provided, and of those 4, three matched the street address on AusNet's database
- Of the 177 remaining without an NMI provided, 160 had exact address matches.

After further analysis, AusNet identified 177 of the original 188 which matched the address records of the Solar Victoria sample.

AusNet extracted the relevant data of the 177 sites for C4NET including:

- Customer ID (deidentified numeric indicator)
- Customer type (residential or business)
- Read date
- Meter channel (import and export)
- Interval total (Daily total kWh by meter channel)
- Interval data (48 daily 30-minute intervals for each meter channel)
- PV kW_p (solar array size, kW, according to AusNet records/ Distributed Energy Register)
- Date of first export.

Separately, AusNet provided C4NET

- the postcode for each of the sample sites (to assist with solar generation forecasts)
- the daily residential grid import tally for all ~860,000 residential customers in the AusNet patch (to assist with seasonal and COVID-19 variation assessment).

C4NET cleansed datasets to ensure only representative data was analysed. Site with anomalies that could have impeded a like-for-like analysis of before and after solar was installed were removed. This reduced the total sample from 177 to 129 customers. Sites that were excluded had:

- no export data (four sites)
- solar installed before 1 January 2019 as evidenced by export data (five sites)
- more than one consecutive month of zero or very low consumption (<100 kWh/month) in the year prior to install (indicating a renovation or other interruption to supply)
- no export after the installation of solar (two sites)

3.3. The date of first solar activity

Solar installation date is an unreliable indicator of when the system becomes operational. Following installation, solar systems in Victoria require a certificate of electrical safety compliance to be issued and permission from the DNSP for the system to export to the grid. These may take some time after installation. In practice, some solar systems operate prior to these criteria being satisfied. For this analysis, the date of first solar export was deemed the start of solar operation and only the export and import data from this date has been used for the "after solar" analysis. The distribution of the first export data of the solar systems[1] is illustrated in Figure 1.

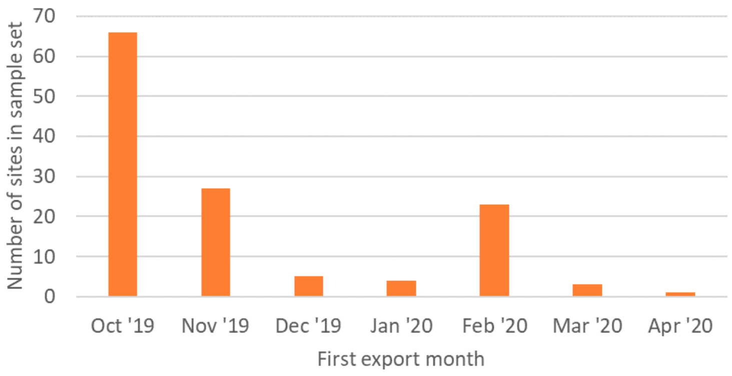


Figure 1 - Month of first solar export metered from sample sites

[1] 2 of which AusNet's records showed first export as August 2017, but no export recorded in interval data until February 2020

3.4. Sample sites - degree of representation

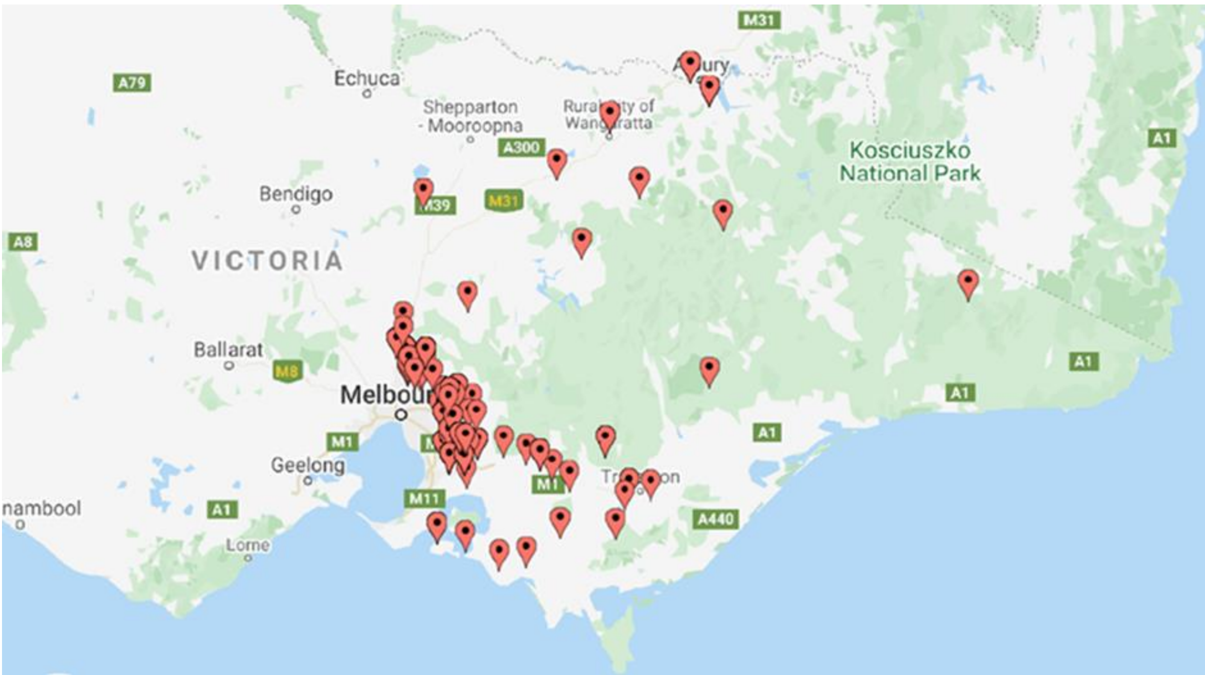


Figure 2 - postcode location of sites in the sample set

The sample sites were scattered across the AusNet distribution network area, with a higher density in the Melbourne Metro area together with a spread of regional locations, as illustrated in Figure 2[2]. The sample sites were selected based on when they had solar installed rather than any geographic bias and appear representative of the broader AusNet residential site population.

The monthly average daily grid import (kWh/d) of each of the sample sites were compared to that of all AusNet's residential customers (Figure 3). The sample sites appeared to have a near identical electricity use profile by month, with a tendency of all to use more electricity in winter than summer, and spring and autumn being the seasons with lowest usage. The sample sites tended to have slightly higher consumption compared to the general population of AusNet residential sites. This was expected, as larger electricity users have higher electricity bills and therefore a greater financial incentive to install solar.

The impact of solar systems beginning operation on some of the sample sites in October 2019 can be seen through the resultant decrease in use of electricity from the grid at these sites.

[2] Image generated on batchgeo.com from postcode data supplied by AusNet

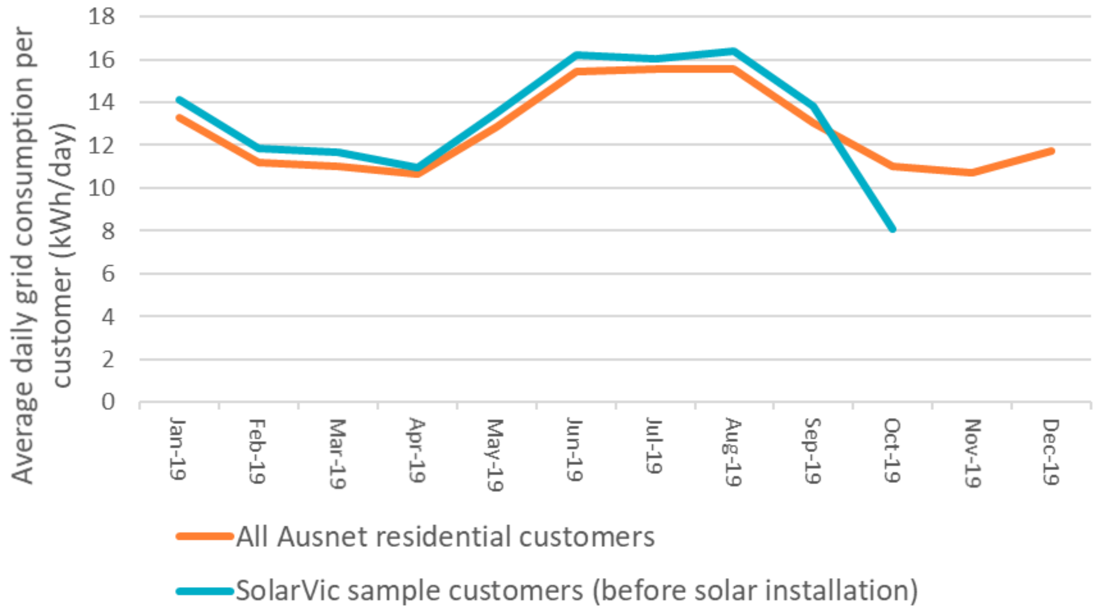


Figure 3 - Average electricity use of sample sites relative to all AusNet residential sites

Figure 4 shows the spread of annual electricity use of the sample customers compared to the average of all AusNet residential customers. There are some outliers with very high and very low use that may warrant further investigation to determine their impact on the results.

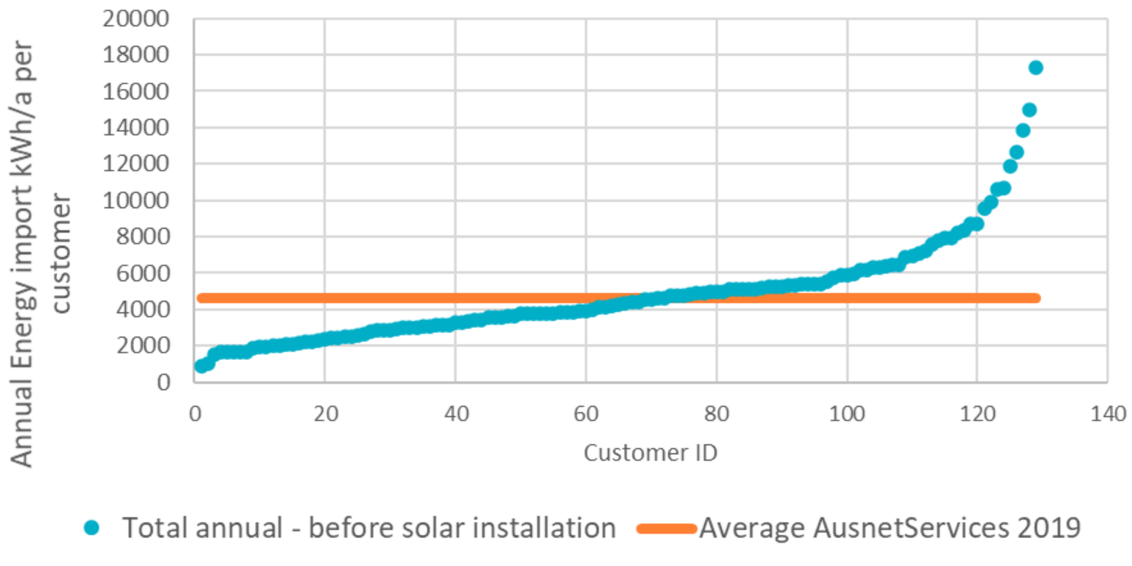


Figure 4 - Spread of annual electricity use of sample sites before solar installed relative to the average of all AusNet residential sites

In the views of the authors, the pilot sample sites appeared consistent and representative of all Victorian residential sites that have installed solar systems.

3.5. Impact on consumption of grid-supplied electricity by solar homes

The reliability of analysed data between install (late September 2019) and first export (October 2019 - April 2020) can be impacted by uncertainty as to when the solar system became operational. It is possible to perform a detailed analysis of the imported electricity for each individual site to algorithmically infer the most likely date of first operation, but the value of doing so would need to be assessed. The error only occurs at the outset and therefore would be diluted out if the same sites were to be analysed in future years.

For the pilot, the analysis has minimised the uncertainty by only assessing electricity import prior to install up to October 2019, then only including the electricity import post install being from the date of first export. This has the effect of removing sites from the analysis for the intervening period. The first few months of assessment post install is therefore on a subset of the sample sites.

The average daily import of electricity from the grid per month was determined by taking the mean of the relevant sites import data (E channel total). Data from pre- and post-solar install were compared to illustrate the impact on grid imports. The monthly comparison was done to the same month of the previous year to retain intra-year seasonal variance impact.

Variation in year-to-year household electricity use tends to be correlated to average temperature. It is otherwise stable. 2020 was an exceptional year due to the COVID-19 related shift to work from home. The impact of this and the way it has been accounted for in the analysis are further detailed in this report.

3.6. Electricity exported to the grid by solar homes

The average daily export of electricity to the grid per month was determined by taking the mean of the relevant sites export data (B channel total).

3.7. Changes to household electricity consumption following solar installation (including calculation of solar generation)

The household electricity consumption pre-solar installation is the electricity import from the grid.

The household electricity consumption post-solar installation is a combination of the electricity import from the grid plus the consumption of solar generated.

$$Total\ household\ electricity\ consumption = grid\ import + solar\ self\text{-}consumption$$

where

$$Solar\ \text{self-consumption} = \ solar\ generation - solar\ export$$

Solar export is defined as metered electricity export to the grid. Solar generation is not metered via the AMI meter data. While some sites may record or meter the site’s generation, this data was not available for analysis. The monthly solar generation is highly predictable on a multi-year basis, as over the longer-term the average sunlight hours are well established.

$$Solar\ generation = average\ solar\ generation\ by\ location\ \left(\frac{kWh}{kW_p}\right) \times Solar\ array\ size\ (kW_p)$$

The solar array size and postcode of each site in the sample group was known. The average monthly generation was taken from the LG Energy Solar Calculator[3] which is based on sunlight data from the Australian Bureau of Meteorology from most Australian weather stations from 1990 to present, allows for typical system losses for inverter and cable losses, slight dust and that panels are aligned north but not True North, and generation data from the Clean Energy Council (CEC). There are many reliable calculators available and the LG Energy calculator was used due to its ease of use and brand reputation. However all calculators have a degree of error.

Area	Reference postcode	Average monthly generation (kWh/kW_p)[4]												Daily average (kWh/Kw_p)
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Northern regional	3691	203	172	144	101	68	49	55	77	112	154	182	203	4.16
Southern regional	3840	175	148	118	82	55	45	50	73	98	131	157	174	3.58
Metro	3977	181	157	121	82	54	44	50	72	99	132	162	179	3.65

Figure 5 - Solar generation forecasts by location

Victoria's annual insolation north of the Great Dividing Range is higher than south of it, but otherwise solar insolation varies little between adjacent suburbs. C4NET selected postcodes based on location to be representative of northern and southern regions.

Note the allocation on the urban fringe between metro and southern regional is arbitrary. However, as they have similar generation profiles the impact is immaterial. The postcode allocation roughly aligns with the CER solar zones.

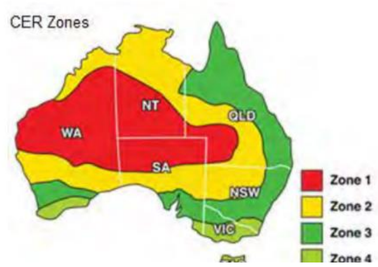


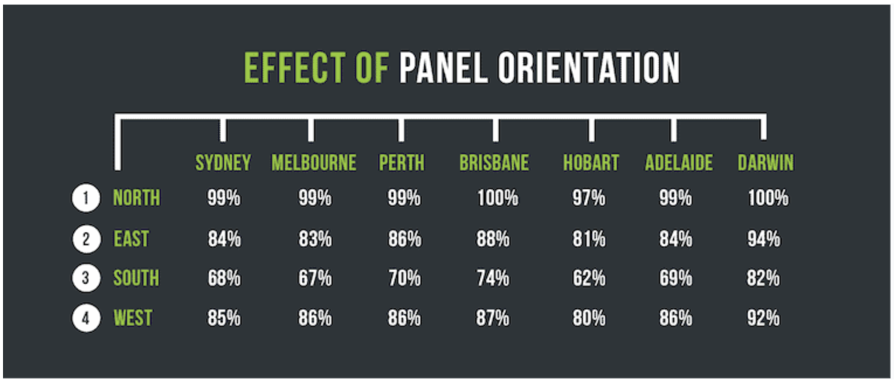
Figure 6 - CER solar generation zones in Australia (Haghdadi et al*, APVI)*

Area allocated	Site postcodes
Northern Regional	3608, 3672, 3677, 3678, 3690, 3691, 3700, 3717, 3722, 3750
Southern Regional	3091, 3756, 3813, 3816, 3818, 3820, 3823, 3840, 3870, 3922, 3925, 3978, 3995
Metro	3074, 3075, 3076, 3082, 3083, 3087, 3088, 3095, 3134, 3135, 3136, 3137, 3138, 3152, 3153, 3156, 3178, 3752, 3753, 3754, 3782, 3791, 3795, 3803, 3805, 3806, 3810, 3825, 3844, 3888, 3975, 3976, 3977, 3996

Figure 7 - C4NET postcode allocation to region for sample sites

[3] Lgenergy.com.au/solar-calculators/solar-system-output-calculator last accessed 28/1/21.
[4] Haghdadi *et al*, Operational performance analysis of distributed PV systems in Australia

The generation forecast above assumes a northern alignment on a pitched roof, even if not perfectly aligned at each postcode. However, there will be a mix of east or west facing panels, a range of pitches and shading impacts all of which impair generation. Most systems will generate at least 80% of the base forecast as installations are optimised for the site location and systems tend to self-clean. For the pilot assessment, the **default for all sites has been selected at 95%** of the base forecasts in Figure 5.



EFFECT OF PANEL ORIENTATION

	SYDNEY	MELBOURNE	PERTH	BRISBANE	HOBART	ADELAIDE	DARWIN
1 NORTH	99%	99%	99%	100%	97%	99%	100%
2 EAST	84%	83%	86%	88%	81%	84%	94%
3 SOUTH	68%	67%	70%	74%	62%	69%	82%
4 WEST	85%	86%	86%	87%	80%	86%	92%

Figure 8 - Effect of Panel Orientation on solar generation for panels at 25º pitch (solarcalculator.com.au/solar-panel-orientation/)

Solar generation is directly proportional to the daily global solar exposure. Seasonal variation sees the degree of global solar exposure vary from month-to-month, as illustrated in Figure 9 for 2020 in Melbourne against the average observations for all years.

For the pilot assessment, the forecast generation was corrected for the respective month for the 2020 observation at Melbourne Airport compared to the long term mean, regardless of site location.

Statistic	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Mean	21.3	23.8	24.1	21.0	16.4	11.3	7.7	6.3	7.0	10.0	13.6	17.8
Lowest	17.5	20.8	20.4	17.1	13.6	9.0	5.4	5.1	5.3	8.6	10.3	15.3
Highest	23.8	27.3	29.6	25.1	19.2	13.4	9.4	7.5	8.5	13.4	15.5	23.2
2019/20	19.7	24.3	21.8	17.6	14.8	10.2	8.4	7.4	7.6	10.5	14.6	15.3
Correction applied in pilot	83%	89%	90%	84%	90%	90%	109%	117%	109%	105%	107%	86%

Figure 9 - Variability in mean daily global exposure by month, Melbourne airport weather station, Bureau of Meteorology

3.8. Household emissions impact of having installed solar

The CO_2 emissions related to household electricity use are direct proportional to the amount of electricity used and the emissions intensity of the electricity source.

$$\sum_{i=1}^{n} electricity\ consumed_i \times emissions\ intensity_i$$

The emissions intensity of solar is zero, so the emissions intensity of all electricity sources used by the house is reduced directly proportional to the amount of household electricity use sourced from solar self-consumption.

There are a number potential emission intensity references for grid electricity by location. The emissions intensity reference used for the pilot assessment was the Australian Government's emission factor for consumption of purchased electricity, as reported in the national greenhouse accounts[5]. For the purposes of this assessment the average across 2020 has been used against all grid imports.

3.9. Estimated household bill savings from having installed solar

The sample sites' retail rates were not known. Each customer's rates are held by their selected Retailer and requires permission from the site's occupants to disclose. The assessment performed by C4NET was on a de-identified basis so there were no means to identify or contact site occupants.

The authors selected a representative temporal reference price and the typical discount generally available in market as the range of prices to inform the bill savings. The interval data was then used to replicate the billing structure daily and summed over the period of data availability to quantify site bills before and after the installation of solar.

The approach is explained in further depth below.

3.9.1. Rate structure

Retailers tend to structure their rates to match the DNSP tariff structure for a site. AER Authorised Retailers and Exempt Sellers are the only parties allowed to sell electricity to a site. They effectively then pay the component charges of the retail bill to the respective parties, including the distribution network charges to the DNSP. The DNSP's make certain tariff structures available for each site, and the Retailer can request which of these is preferred for the customer.

The DNSP's network tariff code was known and used as a proxy for the unknown retail tariff structure.

Of the 129 sites in this assessment, none were on Flexible (or "Time-of-Use") tariffs, or those that involved demand charges which simplified this assessment and is discussed further when addressing the program-wide assessment considerations. The breakdown of rate structure for the Sample sites is shown in Figure 10.

	# sites in sample	Description	AusNet application
Single rate	122	A single charge per kWh regardless of when used	Inclining block 1 = first 1020 kWh/quarter Inclining block 2 = all additional consumption
Two rate	7	Peak and off-peak time periods	Peak: 07:00-23:00 Monday to Friday Off-peak: public holidays and all other times

Figure 10 - Breakdown of network tariff structures for sample sites

3.9.2. Export prices

Victorian residential customers who export their excess solar to the grid receive a solar feed-in-tariff (FiT) as credit to their account. Retailers are free to set what rate they wish, subject to satisfying minimum criteria set by the ESC[6]. Most offers in market tend to just satisfy the minimum and therefore that has been the rate assumed for the assessment.

The FiT can be either single or variable rate. The variable rate has:

- peak rates on weekdays during the hours of 15:00-21:00,

[5] https://www.industry.gov.au/sites/default/files/2020-10/national-greenhouse-accounts-factors-2020.pdf last accessed 28/1/21
[6] esc.vic.gov.au/electricity-and-gas/electricity-and-gas-tariffs-and-benchmarks/minimum-feed-tariff

- off-peak rates 22:00-07:00 every day, and
- shoulder rates at other times.

It was not known which FiT structure the sample sites were on, although anecdotally the uptake of the variable rate is believed to be very low. The impact under both options has been assessed, but for the household savings figures all sites have been assumed to be on the single FiT rate.

3.9.3. Retail comparison rates

Electricity retail pricing is complex with over 30 Retailers operating in Victoria with a range of offerings for customers, and tariffs being updated at least annually. The Victorian Government mandated the use a Victorian Default Offer (VDO) from July 2019 that all Retailers selling in Victoria must reference and make available to their customers[7]. The introduction of the VDO has seen the typical range in discount offers shrink from ~45% to less than 15%. The range of Retailer's tariffs pre-VDO launch in the AusNet area can be seen from the St Vincent de Paul Society's study into Victorian Energy Prices in January 2019[8] in **Error! Reference source not found.**, and the types of conditional offers generally available in market from the same report, Figure 12, noting that each Retailer tended to offer many different offers concurrently.

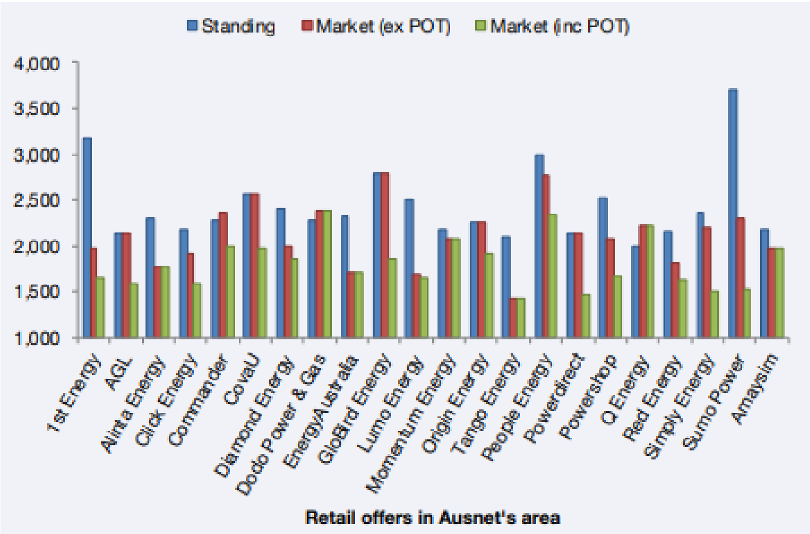


Figure 11 - Estimated annual electricity bills (inc. GST) for a range of offers in Jan 2019 including standing and market offers with discounts

Retailer	Name	Effective from	Guaranteed discount	Pay on time discount
1st Energy	Market Offer	10/12/18	no	20% off usage
AGL	Savers	1/1/19	no	33% off usage
Alinta Energy	Fair Savers	12/1/19	30% off usage	no
Click Energy	Garnet	3/12/18	no	27% off bill
Commander	Market offer	1/10/17	no	20% off usage
CovaU	Smart Saver	1/1/19	no	30% off usage
Diamond Energy	Pay on time discount	1/1/18	no	7% off bill
Dodo Power & Gas^	Dodo Electricity	23/2/18	no	no
EnergyAustralia	Anytime Saver	13/12/18	32% off usage	no
GloBird Energy	Glosave	8/12/18	no	34% off bill
Lumo Energy	Value	19/12/17	no	3% off bill
Momentum Energy	SmilePower	1/1/19	no	no
Origin Energy	Saver	1/1/19	no	20% off usage
Tango Energy	Home Select	5/2/18	no	no
People Energy^	On time saver	1/7/17	no	20% off usage
Powerdirect	Market Offer	1/1/19	no	41% off usage
Powershop*	Autopay with Power Saver	1/7/18	no	19.5% off bill
Q Energy	Flexi Saver Home	1/1/19	no	no
Red Energy	Living Energy Saver	1/1/19	no	10% off bill
Simply Energy	Plus	26/9/18	no	40% off usage
Sumo Power	Pay on time	1/12/18	no	43% off usage
Amaysim	Electricity as you go	14/1/19	no	no

Figure 12 – Sample electricity market offer features January 2019

When the VDO was introduced the range of discounts tightened significantly, and then expanded, but not to the same extent as pre-VDO. The last retail price discounts observed researching this report were at ~15%.

The Victorian Electricity market is dominated by three retailers, Origin, AGL and EnergyAustralia with a combined 54% of the market. Of these, AGL is the biggest electricity provider in Victoria, claiming

[7] esc.vic.gov.au/electricity-and-gas/prices-tariffs-and-benchmarks/victorian-default-offer, last accessed 28/01/21
[8] vinnies.org.au/icms_docs/301871_Victorian_Energy_Prices_January_2019.pdf, last access 28/01/21

over 20% of the market[9]. Historic retail prices and discounts can be difficult to source publicly. For this assessment, C4NET selected AGL's standing and market offers as the reference price, with the standing offer being the same as the VDO after 1 Jul 2019. To illustrate the variety of offers still in market, in Jan 2021 AGL alone had 98 combinations of energy plans and tariff type combinations on offer for residential customers in the AusNet area. Where an AGL offer was unable to be referenced a comparable offer from Origin was used, and the VDO default for 6 months. Detailed tariffs reference amounts and sources are shown in Section 6 (Appendix).

3.9.4. Solar saving estimations (bill calculations)

To estimate the bill impact of sites that had installed solar, a detailed analysis of before and after bill impacts using the previously mentioned reference pricing was performed.

Bills prior to solar – daily bills were estimated by taking the day's interval data and multiplying the relevant rate depending on the tariff type (section 3.9.1). The daily charges and GST were included to provide a full retail customer's perspective. The consumption volume (kWh) was tallied through the calendar month and the appropriate inclining block rate applied. Each site was tallied for the month and then added to provide the year's billing estimate from October 2018-September 2019

Bills after solar installed – as for bills prior to solar, but the bill was reduced by the export credit that would have been applied by the Retailer. The export impact on bills used the relevant export rate (FiT) in place during that month with the metered export volume for the day. The daily amounts were summed over the month, because when average generation rates were used, it was possible for export to exceed generation on any given day.

Bills savings after solar installed – each site's bill after their solar was installed was recalculated as if no solar was in place. To do so, the Total Daily Electricity Consumption was estimated as outlined in section 3.7, where the consumption was the metered import (corrected for COVID usage impacts, as per section 4.1) plus the self-consumed solar, which in turn was the estimated daily solar generated (corrected for seasonal variation, as detailed in section 3.7) less the metered solar export. The Total Daily Electricity Consumption was then multiplied by the retail grid meter tariff (consumption or import rate), accounting for inclining use blocks.

[9] canstarblue.com.au/electricity/largest-energy-companies-victoria/ last accessed 1/2/21

4. Findings, Observations and Discussion

The following analysis focussed on the 129 representative sites for which like-for-like meter data was available to inform the impact of solar on the usage and cost of electricity at each site. All observations in this section relate to the entire set unless otherwise noted.

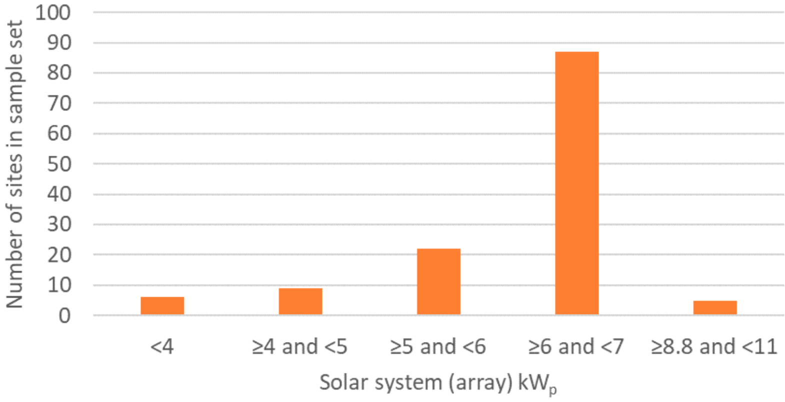


Figure 13 - Distribution of solar system sizes across sample sites

More than 75% of the solar systems installed were between 5.0 and 6.6 kW_p, with the distribution of system sizes as illustrated in **Error! Reference source not found.**.

The average solar system size was 6.16 kW_p.

An aggregate of 795 kW_p was installed across the 129 sample sites.

4.1. Impact on consumption of grid-supplied electricity by solar homes

The installation of solar was expected to reduce the amount of electricity the sites imported from the grid as each site will offset some of its former use with the solar it has generated on site. A month-for-month comparison of metered electricity import against the prior year was performed for each site and then averaged across all sites, as shown in **Error! Reference source not found.**.

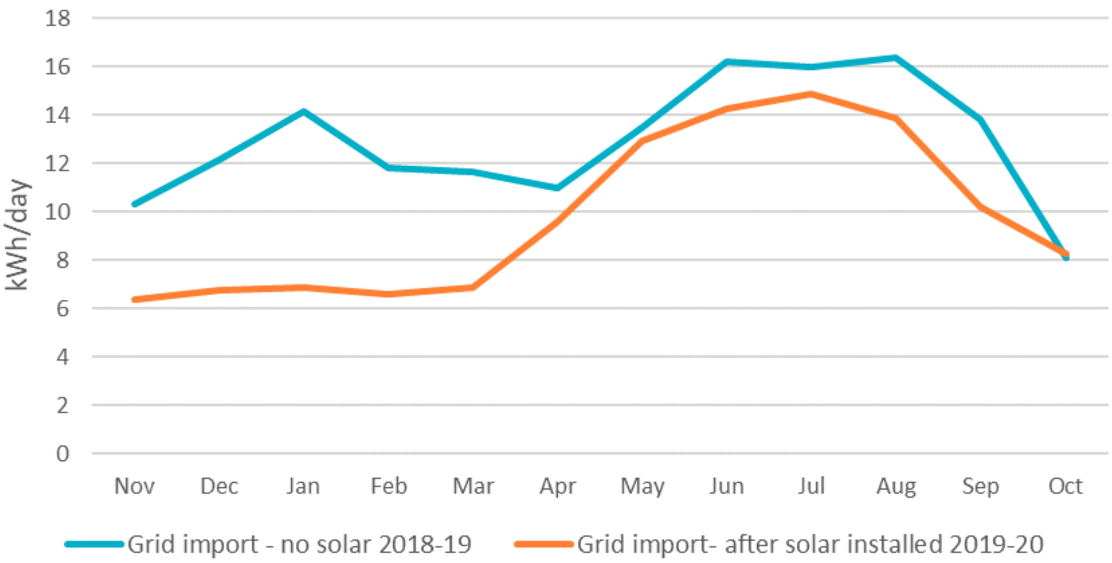


Figure 14 - Reduction in electricity imported from the grid after solar was installed.

Sites reduced their import by 4-7 kWh/d during the summer months and 1-4 kWh/d for the other months. The reduction was surprisingly small compared to the amount of solar generated.

However, 2020 was not a typical year for Victorian residential electricity consumption. The major impacts were:

- Shift to work-from-home due to COVID-19 restrictions. Between March and October 2020 residential electricity rose ~20% in the AusNet patch, with similar impacts observed across Victoria, and
- The early months of 2020 were a few degrees cooler on average than 2019. Residential electricity use is strongly correlated to average temperature.

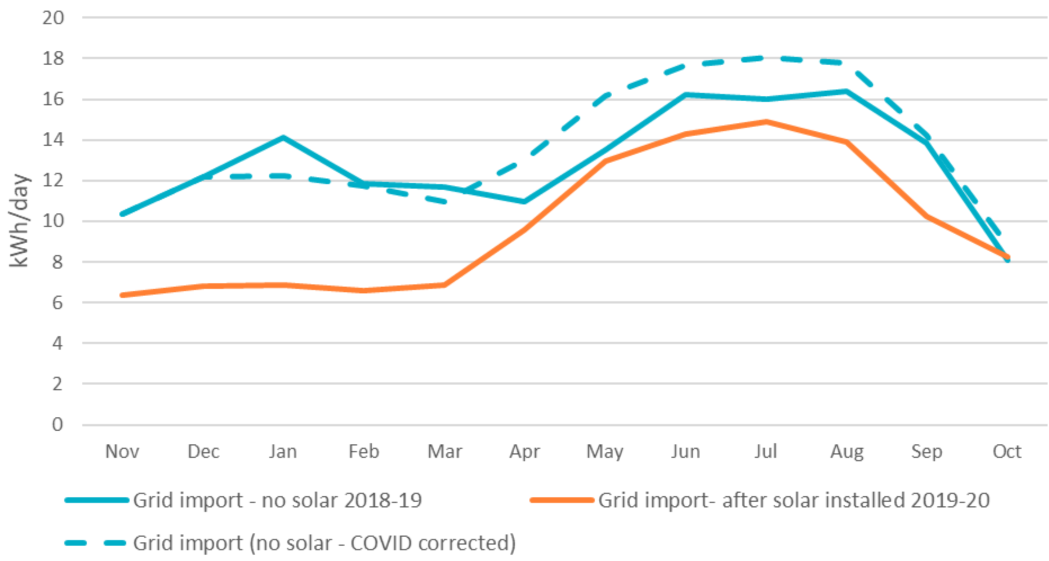


Figure 15 - Reduction in electricity imported from the grid after solar was installed (COVID-corrected)

The 2019 comparison months used were therefore adjusted to provide a better like-for-like basis, referred to in this report as "COVID-correction". The metered import of the sample sites was adjusted in accordance with the month-by-month average variation for the metered import of all AusNet residential customers between 2019 and 2020, as illustrated in **Error! Reference source not found.**.

On a COVID-corrected basis, sites that installed solar reduced their grid use by ~30%[10].

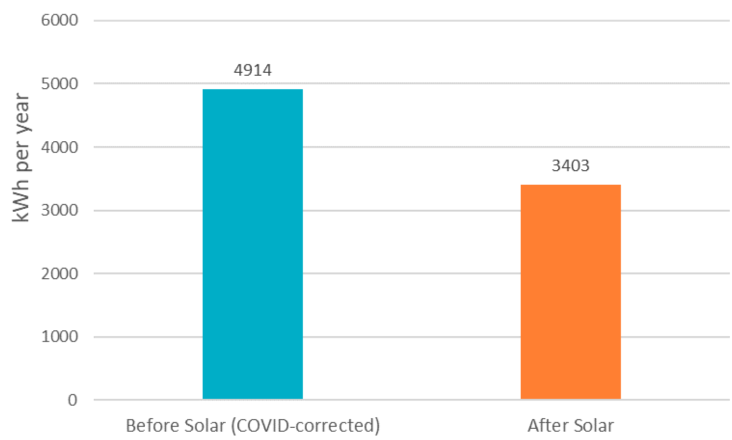


Figure 16 - Average annual site grid import before and after solar installation

[10] The descriptor "COVID-corrected" has been used to differentiate from seasonal variance relating to generation figures later in this analysis. The COVID-correction includes all causes of month-to-month variance for like sites between 2019 and 2020.

119 of the 129 sites decreased the amount of electricity they imported from the grid after the installation of solar.

The analysis of imported electricity does not consider the amount of electricity used in total by each site after solar was installed. Total electricity use is discussed in section 4.3.

4.2. Electricity exported to the grid by solar homes

The sites exported an average of 5,100 kWh/a across the year from November 2019 to October 2020, with the bulk of export occurring in the sunnier months, as illustrated in Figure 17.

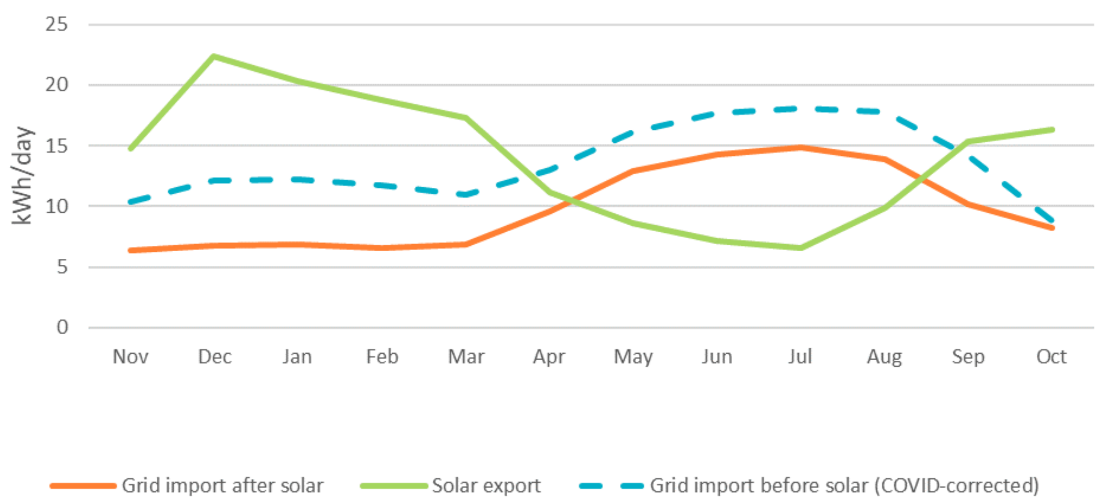


Figure 17 - Metered export of excess solar relative to the imported grid electricity

The sites' import only exceeded export for the four months from May to August. Overall, they exported 50% more electricity than they imported from the grid.

The average export per house of 5,100 kWh/a was greater than the 4,600 kWh/a average AusNet residential customer imported[11].

Larger solar system exported more than the smaller systems as illustrated in Figure 18.

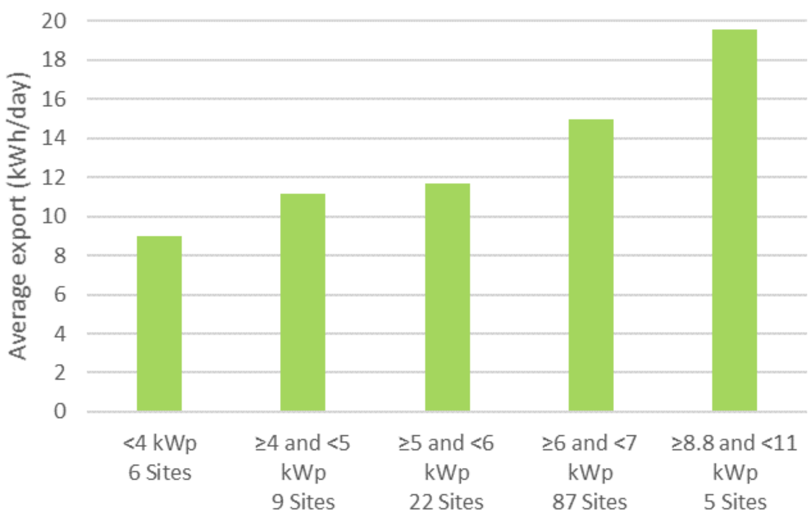


Figure 18 - Site solar export relative to solar system size

[11] Includes all residential customers, ie those with and without solar, in the AusNet Services distribution zone.

The export calculations were based on monthly totals. The impact on the grid on a daily basis is more acute as the export is only occurring during sunlight hours, and then concentrated towards the middle of the day.

4.3. Changes to household electricity consumption following solar installation

The amount of electricity generated from each site's solar system needed to be estimated to determine whether sites had changed their electricity consumption patterns after solar was installed.

The base average monthly solar generation for each site was estimated based on their location and reference solar generation kWh/kW$_p$ for that region, and then corrected for:

- seasonal variance as determined by the measured global radiation from a reference site, and
- output adjustment for elements such as orientation and shading at 95% of base

as illustrated in Figure 20.

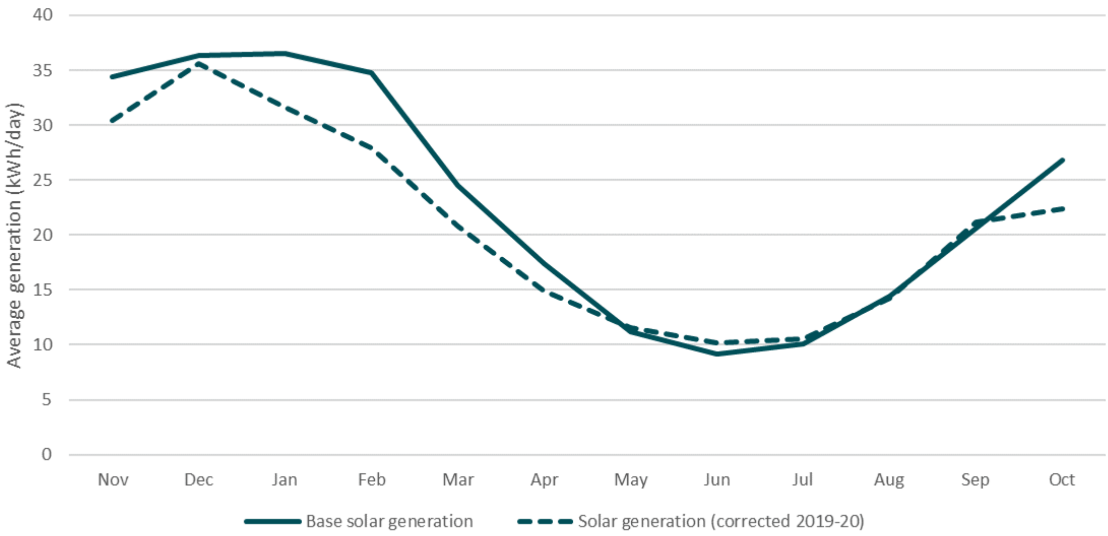


Figure 20 - Estimated average monthly solar generation per site

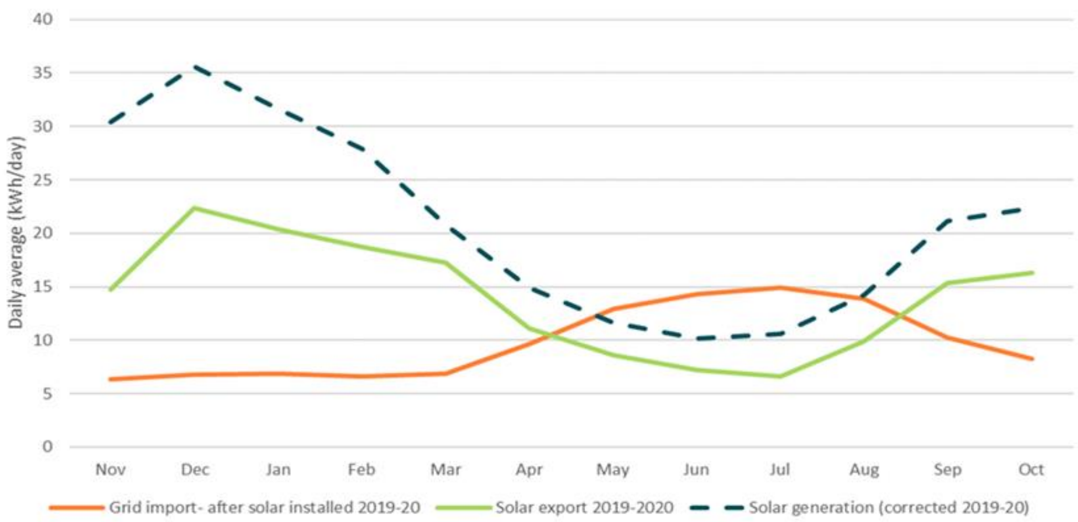


Figure 19 - Average site generation, import and export

Once the site's generation was estimated, the difference between the generation and metered export was the amount of solar self-consumption. The average monthly generation, export and import are illustrated in Figure 19.

The total household electricity consumption was in-line with previous years for March through September, however a steep increase was observed across the summer months, as illustrated in Figure 21.

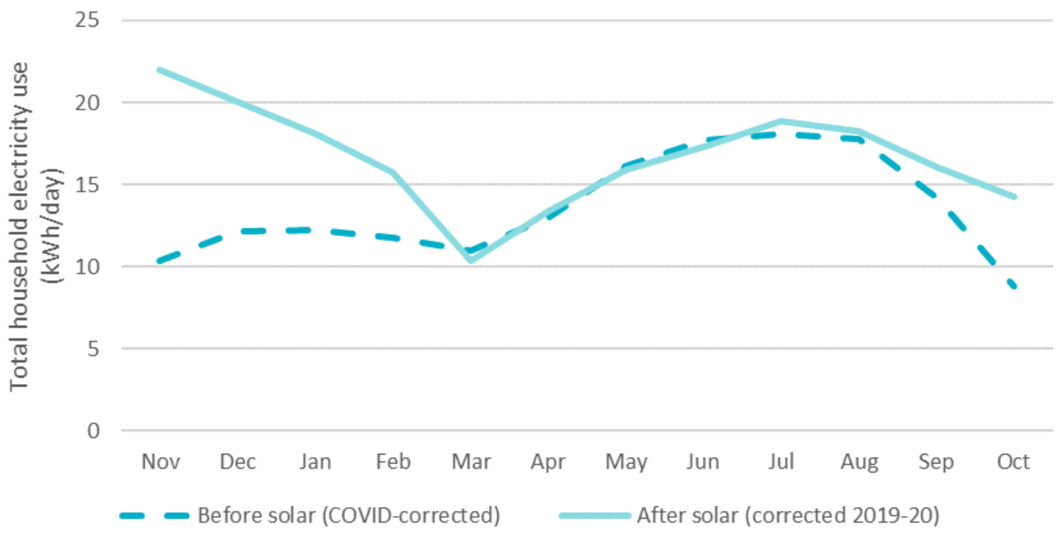


Figure 21 - impact of solar on total household electricity consumption

The scale of the increase in summer months surprised the authors and it was impossible to inform further without additional insights. Plausible explanations could be:

- The install of solar has coincided with new hardware being installed
- A change in behaviour – such as whether the installation of solar enabled the site to run their heating/cooling more vigorously
- Solar generation has been over-estimated.

In the author's experience, in the absence of a change of hardware devices such as inclusion of a pool, larger heating/cooling systems etc, the household electricity use tends not to change too much from behavioural change, or at least not on a sustained basis. This will be an interesting area for further investigation, with areas of interest being to meter solar generation and to conduct qualitative interviews with customers who have installed solar to gain behavioural insights.

4.4. Household self-consumption of solar

The degree of self-consumption is the percentage of solar generated that is consumed on site. The credit customers received for export (Feed-in-tariff, or FiT) is typically substantially less than the tariff for imported electricity. Therefore, the greater the self-consumption the greater the financial benefit from having solar for the site occupants. The higher the self-consumption the less of a challenge that solar is for distribution grid operators (the DNSPs) as exported power can stress the operating limits of embedded infrastructure.

The sample sites consumed just under 30% of the power they generated. Seasonal variation was important from a month-to-month perspective, but had little impact over the year, as illustrated in Figure 22.

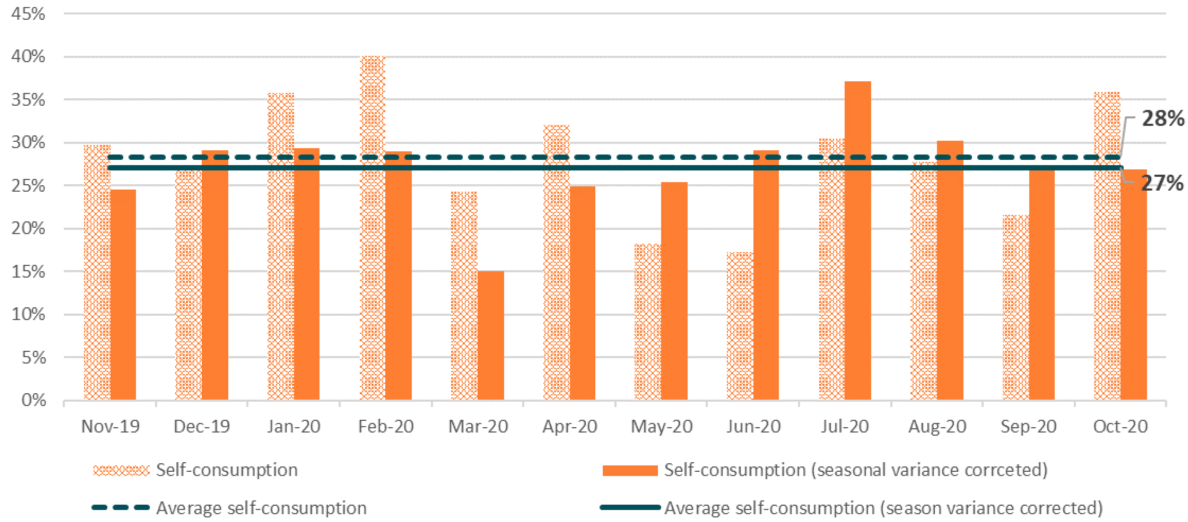


Figure 22 - Monthly variation in site self-consumption of solar (% of total generated)

There was a high degree of variance in the degree of self-consumption across sites, with the bulk of sites consuming between 10% and 46% of the solar they generated. The more the site consumed from the grid the more they tended to consume their solar (Figure 23)

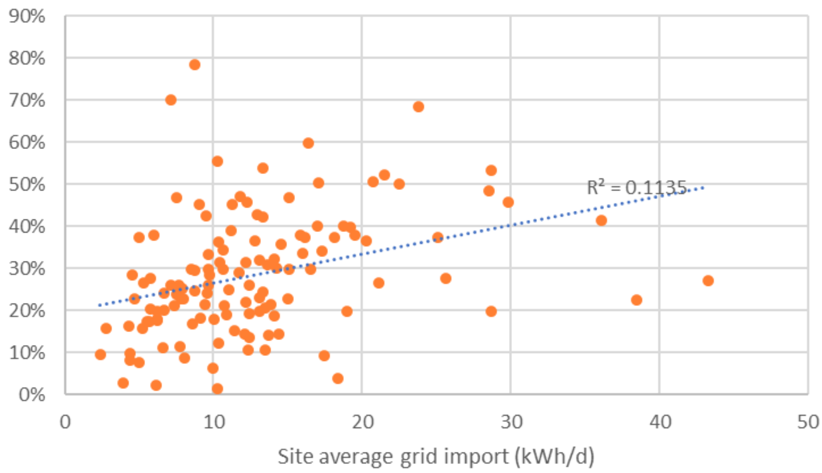


Figure 23 - Degree of site self-consumption relative to grid import

Across the year, just under 40% of the household's electricity consumption was provided by solar, with a higher percentage in the sunnier summer months than winter months, as illustrated in Figure 24.

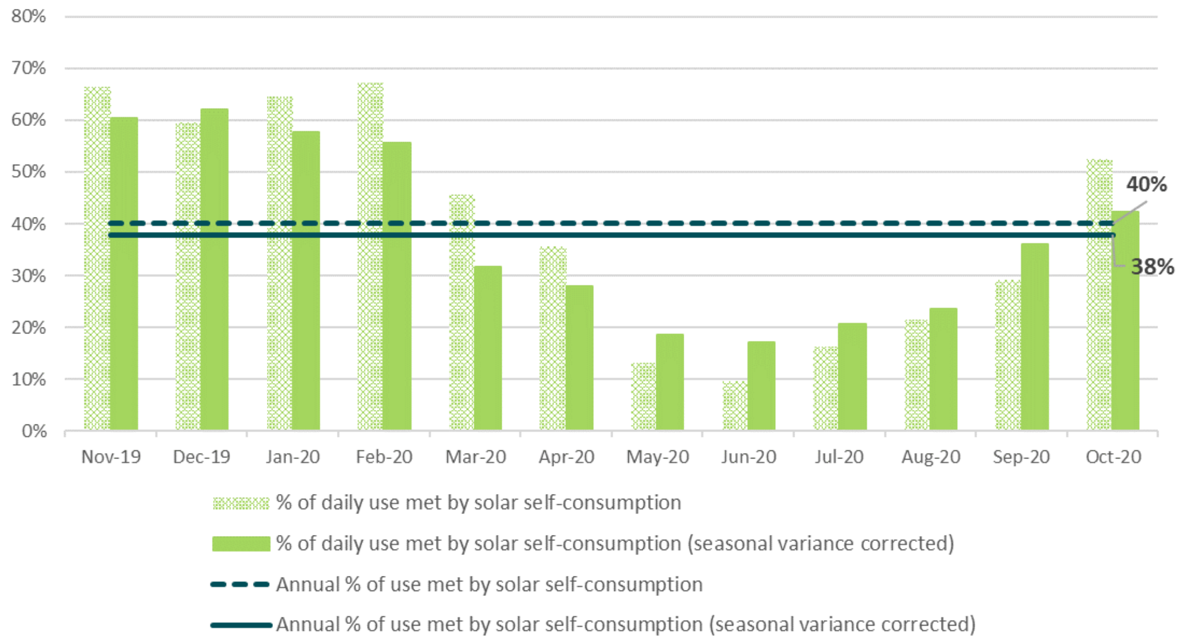


Figure 24 - Monthly % of site electricity consumption provided by solar

4.5. Household emissions impact from having installed solar

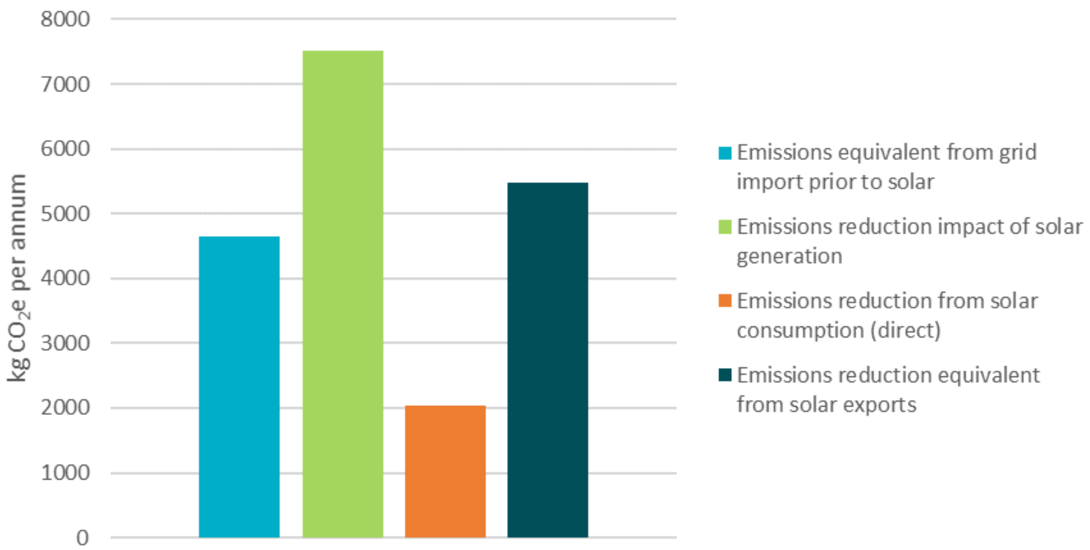


Figure 25 - Emissions impact from having adopted solar (Average per household)

The emissions impact reduction from each site that installed solar is proportional to the amount of solar generated on site. Across the sample sites, the average house directly reduced their emission impact by about 2000 kg CO_2e as any solar consumed on site has the equivalent reduction in electricity imported from the grid, as illustrated in Figure 25. The emission factor for consumed grid electricity has been assumed to be 0.98 kg CO_2-e/kWh[12]. The sites had an indirect reduction to other grid users by exporting the green solar electricity in the order of 5500 kg CO_2e [13].

4.6. Estimated household bill savings from having installed solar

Estimation of bill savings is a challenging area in the absence of known customer bills as there are a wide range of tariffs available in market. The reference rates and the methodology employed is detailed in section 3.9. In summary, the methodology was:

1) Determine the most likely tariff structure for each site (based on the DNSP tariff structure)
2) Establish a representative retail price point for each type of tariff structure (based on readily available retail offers from tier-1 retail providers, including discounts, and ESC set minimum solar feed-in-tariffs)
3) Determine what the bill would have been if the site hadn't had solar on the basis of total consumption (i.e. metered grid import + estimated solar consumed)
4) Determine what the bill would be with solar (metered grid import and metered solar export)
5) Recreate monthly bill amounts for each site as above once solar was operational during the period of November 2019 to October 2020 and then determine the average site values.

The results are documented in Figure 26, and show the average customer was estimated to have achieved considerable savings across the year, more than halving their electricity bills.

	Yearly	Monthly
Retail bill if solar hadn't been installed	$1765	$147
Retail bill with solar	$692	$58
Savings	$1073	$89
Savings (%)	61 %	

Figure 26 - Summary of the average estimated bill impact of adopting solar for the year from November 2019 to October 2020 (per site, single-rate customers)

The savings illustrated in Figure 26 are estimated for the 122 singe rate customers as there was potential for a greater error in bill estimation for two-rate customers. To accurately determine two-rate customer bills further assumptions are needed to inform the time interval of solar production. Should the seven two-rate customers be included the average annual savings increased by ~$25/site.

	Nov – Dec 2019	Jan – Jun 2020	Jul – Oct 2020
Supply charge (Daily rate)	106.86 c/d	98.10 c/d	98.10 c/d
Consumption (first 1020 kWh/m)	25.97 c/kWh	26.42 c/kWh	26.42 c/kWh
Consumption (all other)[14]	29.26 c/kWh	28.41 c/kWh	28.41 c/kWh
Discount included	6%	14%	14%
Solar export Feed-in-Tariff (FiT)	12.00 c/kWh	12.00 c/kWh	10.20 c/kWh

Figure 27 - Retail pricing assumptions used for bill saving estimations (GST inclusive)

The reference rate used for the supply and consumption charges was a discount to the VDO relevant rate on the assumption that most solar sites will have tenants who have engaged with their Retailer and accessed readily available discount rates in market. The discounts were those of retailers with

[12] https://www.industry.gov.au/sites/default/files/2020-10/national-greenhouse-accounts-factors-2020.pdf (pp19, accessed 28/1/21)
[13] Distribution grid losses have been excluded
[14] The inclining block rate structure is only applicable in the AusNet Services area for residential customers

leading market shares, noting there were a wide range available. Customers who accessed higher discounts would have smaller savings but also lower bills if solar had not been installed, and those who have not accessed discounts would have had higher solar savings, but against higher bills if solar had not been installed.

Across the sample set there are a wide range of annual savings observed for the single rate customers, as illustrated in Figure 28. The standard deviation for the savings across the sites was ~$300.

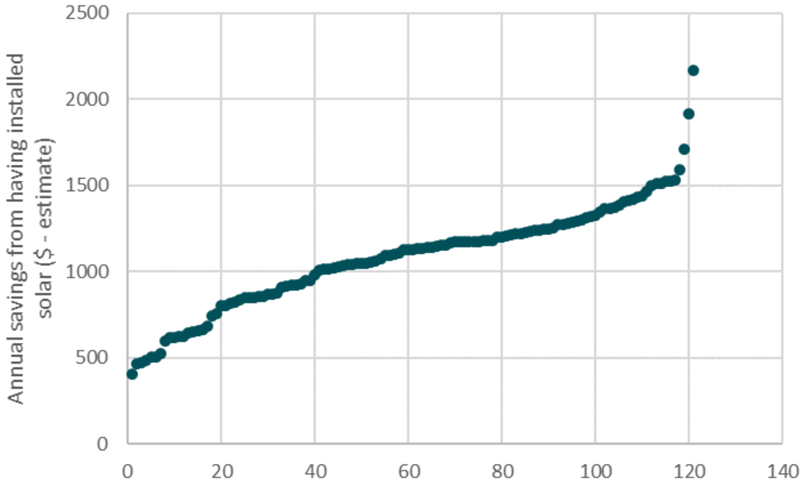


Figure 28 - Spread of customer solar savings by site (single rate customers)

As expected, the larger savings tend to be experience by sites that have:

- higher self-consumption, as the value of self-consumed solar electricity is higher than the value of export (Figure 29), and
- larger solar systems as the greater amount of solar electricity generated (Figure 30)

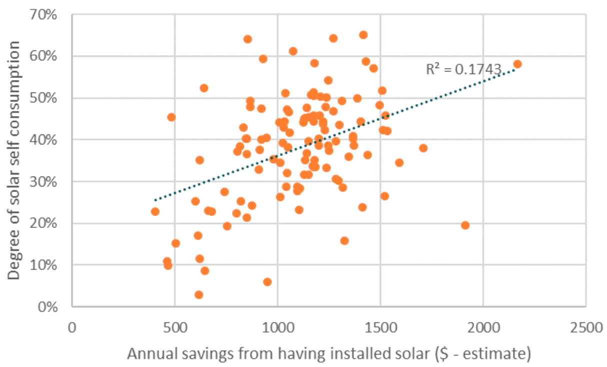


Figure 29 - Annual savings against site self-consumption

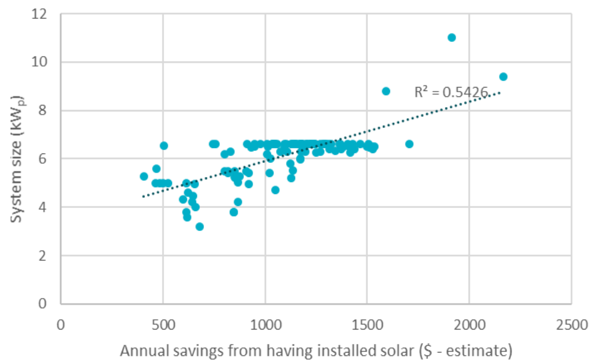


Figure 30 - Annual savings against site solar system size

The feed-in-tariff basis of each site was unknown. There were two FiT rate structures available to customers:

- a single rate where every kWh of export is credited at the same rate, and
- a time-of-use rate (ToU) where the rate credited depends on the time of day that it was exported.

To inform the sensitivity of the findings of this report to this unknown, the average customer data was remodelled to each of the two structures, as illustrated in Figure 31. The difference between the two was negligible and therefore not considered material to the savings calculations.

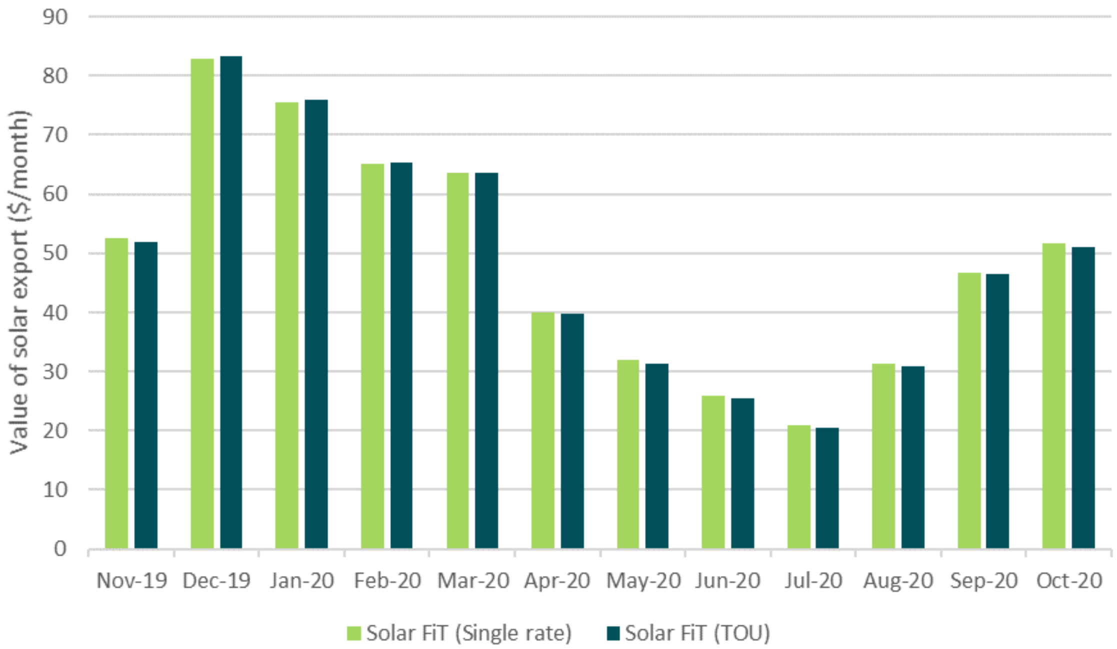


Figure 31 - modelled solar export value depending on whether customers' Feed-in-Tariffs (FiT) are on single or ToU rate structures

The largest bill impact of solar was when generation was at its highest in the sunnier summer months, as illustrated in Figure 32. Many customers would have experienced very low summer bills and some will have experienced bill credits. Note, nothing should be concluded about the savings potential between single and two-rate customers from this illustration as the two populations had different average electricity usage.

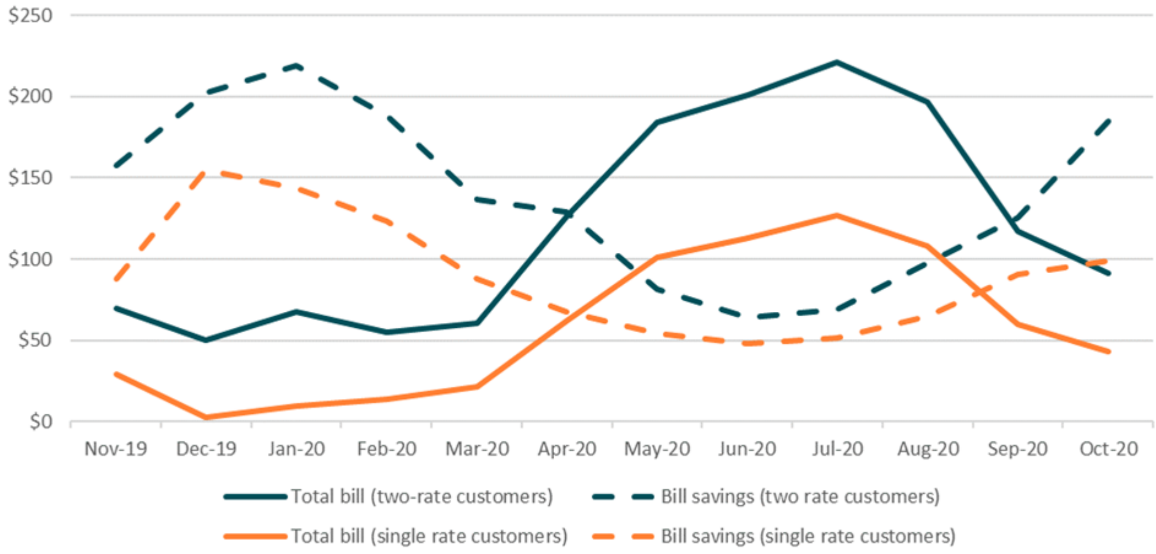


Figure 32 - Estimated bill solar savings by month and customer rate structure

Across all 129 sample sites (i.e. inclusive of both single rate and two-rate customers), 55% of the average savings ($587) were due to the FiT contribution, and the balance was the avoided cost of grid import ($485)[15].

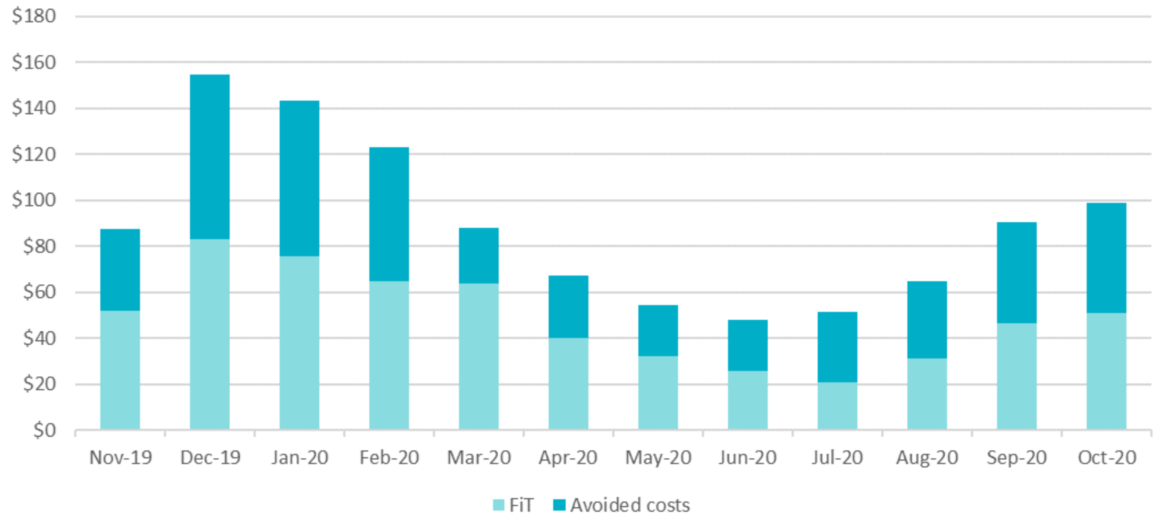


Figure 33 - Relative contribution to estimated savings of the Feed-in-Tariff bill credit (FiT) and the avoided cost of electricity import due to self-consumption

An area for further investigation may be to investigate the elasticity of self-consumption behaviour with respect to the FiT rate, and also the degree of consumer awareness about the how to increase self-consumption. Increased self-consumption benefits customers at solar sites directly, and also benefits all electricity consumers by reducing the pressure on the distribution system which eventually has to be solved by either increasing capital investment, curtailment of solar export or limitations on additional solar customers being connected in the distribution networks. In addition, as the number of sites with export limitations increases, a methodology will need to be developed for the estimation of their savings as without export data it is impossible to inform the solar self-consumption[16].

The analysis above is dependent on the assumptions made around two key unknown elements, the retail prices and the solar generation which is unmetered. The retail prices have no impact on usage or emissions, and the savings can be directly scaled by applying any retail rate applicable. The impact of generation assumptions are less straightforward as they both direct and indirect effects. Figure 34 Illustrates the relative impact on generation of various assumptions, and the sensitivity to the annual average site solar savings is then tabled in Figure 35 .

[15] Post analysis, it was announced that the FiT rate would be 7.1 c/kWh. If this had have been the FiT rate during the analysis period, the annual average savings per site would have been $220 lower.
[16] Of the 178 sites, 3 had no solar export data. The reason for this is unknown but may be due to a DNSP imposed export limitation. If this was the case these sites are estimated to have saved an average of $341/a each. It is not recommended that any conclusion be drawn from this number due to the small sample size, and there should be no reason to expect this cohort to have a different level of avoided cost saving compared to solar customers with export permitted.

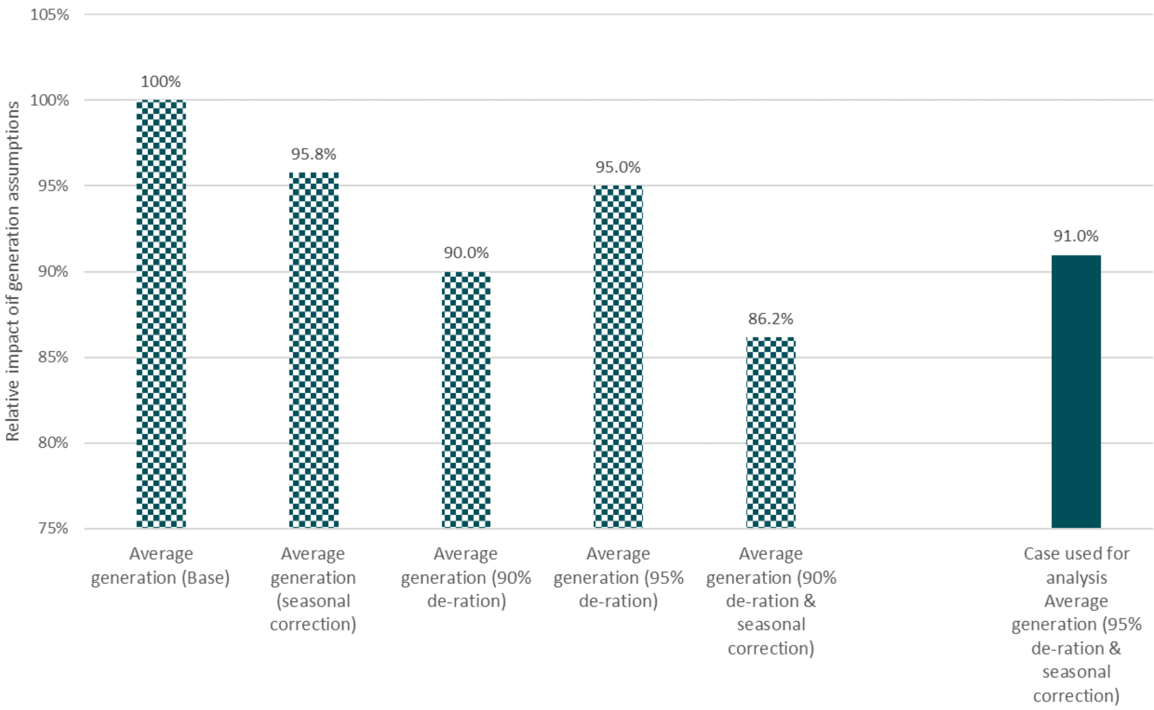


Figure 34- Impact of various assumptions on the relative generation of solar to a base. The case used for this analysis is on the far right.

Base generation	Seasonal correction	90% de-ration	95% de-ration	90% de-ration & seasonal correction	Case used for analysis 95% de-ration & seasonal correction
$1,251	$1,169	$1,050	$1,151	$977	**$1,073**

Figure 35 - Impact on estimated annual site solar savings for various generation assumptions

5. Insights for ongoing Program-wide impact measures

The Solar Homes Program has supported the installation of more than 100,000 solar systems across Victoria to date. Understanding the impact of the solar uptake under the program is important as the program has many years to go and is dynamically managed to meet the contemporary needs as they change.

The pilot conducted an analysis of 177 customers, of which 129 were analysed in depth. The analysis covered one year prior to solar and one year post with full interval data (30 minute). On this basis alone there were ~85,000 data points per customer per year. Shortly, interval data will move to five minute intervals which will increase the potential size per customer. The interval data was required to recreate the bill structure.

In addition to the computing resources, data extraction from the DNSP databases consumes resources in designing queries, running them, and checking the results prior to release. The time increases significantly if anomalies need to be investigated. Further, if the data files become too large they require specialist processing capabilities and hardware to be manageable.

As a result of conducting the pilot, C4NET believes it is quite plausible to conduct a much broader review of rebate recipients' electricity behaviour using Victoria's AMI smart meter data, and have this updated on a regular basis to detect longer term impacts. The authors offer the following key considerations and recommendations:

1. **Capture site NMI details accurately as part of the Solar Homes rebate application process** – address information is notoriously difficult to match across different databases and frequently has errors. Matching NMI is the simplest means of matching sites for an extraction from the DNSP databases. A potential alternative would be to just rely on the DNSP's DER data for solar installs and make an assumption of the proportion of these that have been installed under the Solar Homes Program, but this would compromise the accuracy of informing program specific metrics. All customers have ready access to their NMI via their electricity bill.

2. **Screening of data sites is important** – the screening of anomalous sites had a significant impact on the results. Where all 177 sites were analysed the average annual use prior to solar was 14% lower than for the 129 sample set. The sites removed from the analysis often had periods of prolonged abnormally low use and their inclusion would have diluted the true like-for-like impact of the solar installation. Further analysis may identify means to refine the exclusion criteria so that the removed sites were not as high as the pilot (48 of the 177, or 27%).

3. **Use monthly import and export totals to inform impacts of installing solar on grid import and export** – work with DNSPs to utilise data that they will have on their system without having to recreate from interval data. Monthly totals of import and export are used for billing needs and should be readily extracted. Using monthly totals greatly reduces the

volume of data and should enable all sites to be monitored over the life of the program to inform longer-term behaviour patterns and identify sites suitable for future opportunities, such as batteries, demand management, demand response, or others that may be considered. A methodology will need to be developed for sites that are export limited.

4. **Limit bill comparison to a representative sample of all sites with solar installed** – the most challenging aspect of the analysis is to determine the bill savings. Retail tariffs change over time and the number of permutations and combinations of them available across the population. The pilot analysis was limited to the AusNet patch and there are some differences in tariff structures used in other patches that could impact savings. The selection of a representative sample customer cohort with coverage across each DNSP patch for detailed analysis should be able to be extrapolated to inform the results across all rebate recipients.

5. **Improve accuracy of generation estimation** – the estimation of solar generation is well established. The reliability underpins the provision of financed solar products in the market by third party owners, such as PPAs and leases. However, the generalised approach used in the pilot analysis could be improved by calibrating the estimation to known results, such as where sites had reliable generation monitoring in place. C4NET or others could help source such data if desired in future. The use of other reference points, such as those used in the Victorian Energy Compare (VEC) program may also improve consistency when reporting across various methods.

6. **Improve accuracy of bill saving estimation** – the bill saving estimation would improve with calibration of estimates against known sites. To do so the consent of the site occupant would be required, and for them to provide a series of bills over time. Consent is provided by a number of electricity customers under the VEC program however whether there are sufficient solar customers data available, and the practicalities of monitoring over time, would need to be investigated. An alternative would be to get major retailers to provide a de-identified randomised sample of billing rates their residential solar customers to better inform the uptake and depth of discounts. This may be a commercially sensitive area for the retailers so the feasibility would need to be tested with them.

7. **Ensure sites with batteries are identifiable** – as the number of batteries increases, the impact they will have on the program metrics measured in the pilot will become increasingly relevant. The presence of a battery can materially change the degree of self-consumption, hourly usage profiles across each day and the dynamics of any export from the site. Sites with batteries should be assessed as a distinct category.

8. **Update periodically** – once the data queries fields are established it is relatively simple to re-run the extract, especially if there is some flexibility for the extraction to be scheduled at a non-critical time for the DNSPs. An update annually or semi-annually would provide contemporary data and provide insights of the impact of any temporal changes – such as changing system sizes, export limitations, battery uptake, consumer preferences etc.

9. **Consider side-by-side trials** – the availability of meter data and the ability to have it analysed on a de-identified basis opens a range of opportunities for program developers. Should they wish to run side-by-side trials, the meter data can provide prompt real-world feedback on effectiveness. For example, Solar Victoria may wish to trial a few different forms of communication to encourage an increase in self-consumption. As long as they are able to identify the cohort by NMI then the impact of any such messaging could be measured to see which one had greatest impact.

6. Appendix – Detailed retail electricity rate reference prices

The reference sources by the respective time periods for the rates on the following page were:

- 1/1/18 – 1/12/18 - https://www.agl.com.au/-/media/agl/residential/documents/plans-and-pricing/2018/agomr00436_180101.pdf?la=en&hash=BBD999B2B4D6C6F63AFA4E4CEC91C45334183864
- 1/1/19 – 30/6/19 – (no AGL deal reference found so Origin used) originenergy.com.au/content/dam/origin/residential/docs/energy-price-fact-sheets/vic/1Jan2018/VIC_Electricity_Residential_AusNet%20Services_OriginSaver20.PDF
- 1/7/19 – 31/12/19 – (no AGL deal or other retailer market discount offer found, so VDO tariffs used with discount as per the experience of the authors as representative of the time) energy.vic.gov.au/__data/assets/pdf_file/0031/420997/Final-Advice-Victorian-Default-Offer-to-apply-from-1-July-2019.pdf
- 1/1/20 – 31/12/20 - https://www.agl.com.au/-/media/aglmedia/documents/help/rates-contracts/standard-contracts/jan-2020---vic-agl-elec-website-pricing_v1901217.pdf?la=en&hash=FD889AB53AFDCBE1D88E85E9479CC1AE

C4NET

Centre for New Energy Technologies

Month	Feed in tariffs - as set by ESC				Retail tariffs in AusNet Services area (AGL) Base (all inc GST)												
	Single rate	Variable			Single rate			ToU				Two rate ("AGL 5-Day Time-of-Use)			Discounts		
	FiT (c/kWh) - single rate	FiT (c/kWh) - peak variable rate	FiT (c/kWh) - shoulder variable rate	FiT (c/kWh) - off peak variable rate	Daily Supply Charge (c/d)			Daily Supply Charge (c/d)	Peak (c/kWh)	Shoulder (c/kWh	Off-peak (c/kWh)	Daily Supply Charge (c/d)	Peak (c/kWh)	Off-peak (c/kWh)	Discount available		Discount applies to...
Relevant time	24h	1500-2100 M-F	0700-1500 M-F 2100-2200 M-F 0700-2200 S-Su	2200-0700 M-Su	all days	First 1020	Excess	all days	1500-2100	0700-1500 M-F 2100-2200 M-F	2200-0700 M-Su	all days	0700-2300 M-F	all other times	supply charge discount	consumption charge discount	
1/01/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/02/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/03/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/04/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/05/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/06/2018	11.3				137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/07/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/08/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/09/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/10/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/11/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/12/2018	9.9	29	10.3	7.1	137.5	34.1	37.4	136.4	38.5	34.1	24.2	139.7	45.1	25.3	0	30%	Consumption only (Savers tariff)
1/01/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/02/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/03/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/04/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/05/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/06/2019	9.9	29	10.3	7.1	132.11	33.43	37.67	147.763	47.223	36.894	24.112	147.763	44.836	27.445	0	33%	Consumption only (AGL Savers tariff)
1/07/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/08/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/09/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/10/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/11/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/12/2019	12	14.6	11.6	9.9	113.68	27.63	31.13	117.777	35.893	31.955	23.276	111.375	39.347	21.78	6%	6%	all charges
1/01/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/02/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/03/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/04/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/05/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/06/2020	12	14.6	11.6	9.9	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/07/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/08/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/09/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/10/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/11/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges
1/12/2020	10.2	12.5	9.8	9.1	114.08	30.72	32.72	117.777	35.893	31.955	23.276	111.375	39.347	21.78	14%	14%	All charges