



Flexible Exports for Solar PV

Lessons learnt report 4

23/6/2022 – Version 1.0



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Glossary

Term	Definition
ARENA	Australian Renewable Energy Agency
AEMO	Australian Energy Market Operator
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
API	Application Programming Interface
BAU	Business as usual
CER	Clean Energy Regulator
CSIP	Common Solar Inverter Profile
DER	Distributed Energy Resources
DNSP	Distributed network service provider
EOI	Expression of Interest
IEEE2030.5	IEEE Standard for Smart Energy Profile Application Protocol
IP	Intellectual Property
MEG	Medium Embedded Generator
MSO	Model Standing Offer
NEM	National Electricity Market
PV	Photovoltaics
SA	South Australia
SEG	Small Embedded Generator
SIRG	Solar Industries Reference Group
SWER	Single Wire Earth Return
THC	Tactical Hosting Capacity

Acknowledgement

The “Flexible Exports for Solar PV” project (‘the Project’) is a collaboration between SA Power Networks, AusNet Services, Fronius, SMA, Solar Edge and SwitchDin. The Australian Government, through the Australian Renewable Energy Agency (ARENA), is providing \$2.09m towards to this \$4.84m project under its Advancing Renewables Program.

Disclaimer

This Project received funding from ARENA as part of ARENA’s Advancing Renewables Program. The views expressed herein are not necessarily the views of the Australian Government, and the Australian Government does not accept responsibility for any information or advice contained herein.

1 Background

1.1 Introduction

On 1st July 2020 ARENA and SA Power Networks entered into an Advancing Renewables Program Funding Agreement number 2020/ARP009, under which SA Power Networks, and all collaboration partners, have obligations to consider and issue quarterly lessons learnt reports. Lessons will be captured throughout the lifecycle of the Project and are expected to cover a range of topics. These may include commercial, technology, policy, community engagement learnings and more. The intended audiences for these lessons learnt reports are:

- ARENA, AEMO, AEMC, AER - to understand the performance of distributed energy resources (DER) projects and impact on the market.
- Victorian and South Australian Governments and policy makers - to understand policy and regulatory barriers and opportunities associated with DER.
- Energy industry - to understand market opportunities associated with DER impacts and business models.

This fourth lessons learnt report will cover the activities undertaken during the operational phase of the trial. The trial became operational on 23 September 2021 and we have worked to understand experiences regarding customer recruitment, customer experience, analysis of system performance and learnings from initial installations.

1.2 Project summary

The Flexible Exports for Solar PV project is a demonstration project seeking to help integrate more rooftop solar into Australia's electricity network. Most current rooftop solar systems across Australia lack the ability to intelligently control the amount of electricity exports to the network. At certain times in the year, too much electricity is generated in the middle of the day and exported back to the network. As a result, the local distribution networks in areas with high rooftop solar uptake can become congested. To avoid exceeding the technical limits of the network and manage this issue today, some energy networks impose zero or near-zero energy export limits on new solar systems in congested areas.

As more Australian households install rooftop solar and network constraints increase, more new solar customers will face limits that prevent them from exporting electricity back to the network. This can create an inequitable system where early adopters of rooftop solar 'use up' the available grid capacity, and late adopters are constrained.

The aim of this project is to provide a new option for customers connecting solar PV in areas of the network that are already at capacity, who are currently required by Distribution Network Service Providers (DNSP) to limit their systems with a permanent zero or near-zero export limit.

This new flexible option enables customers to export energy most of the time, and only reduce exports during specific periods when the network is constrained, thus maximising export capacity for solar customers and making more low cost, renewable energy available for all electricity customers.

SA Power Networks, in collaboration with AusNet Services, three market-leading inverter vendors (Fronius, SMA and SolarEdge) and one inverter gateway provider (SwitchDin) are co-developing an end-to-end technical solution, using smart inverter technology. This enables a customers' smart solar inverter to download a dynamic export limit from the DNSP which varies based on the time of year and day and their location on the network. A diagram of the simplified communications is shown in Figure 1.

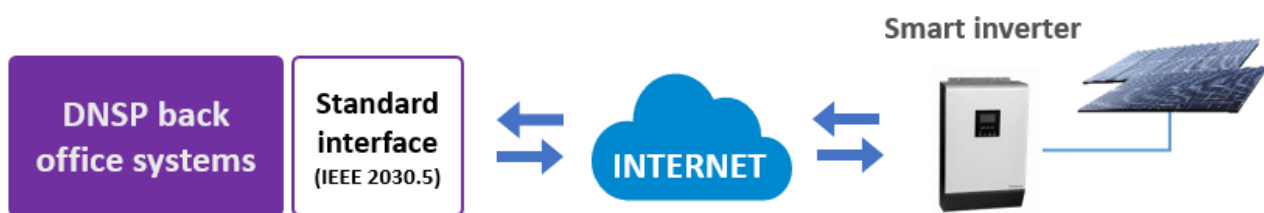


Figure 1 Flexible exports communication concept

The Project will also develop a new flexible customer connection offer, and test customer understanding and acceptance during a 12-month field trial with a minimum of 300 customers

1.3 Project timeline

The project delivery is spread across 4 key delivery phases shown in the timeline below.

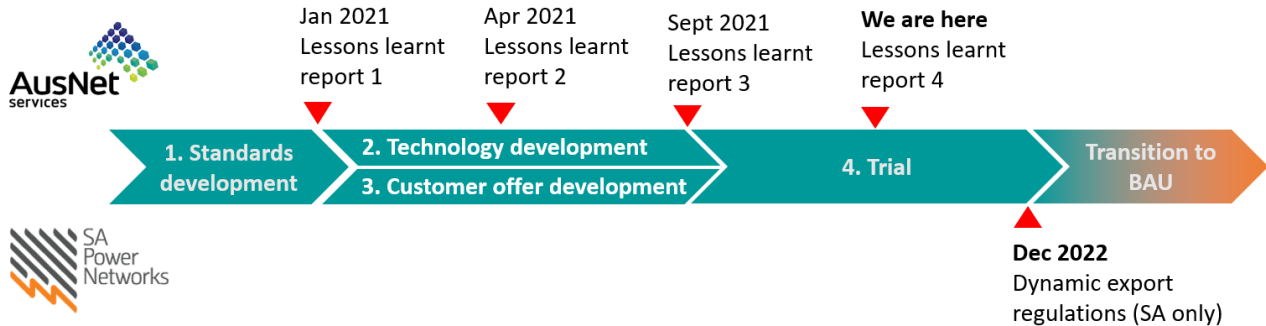


Figure 2 Timeline of trial extending to business-as-usual service

The standards, technology and customer development phases are now complete, and the project is now nine months into the 12 month field trial.

Three previous knowledge sharing reports have been developed which cover the earlier phases of the project¹. A summary of the contents of these reports is below:

Lessons learnt report 1:

- Activities at project kick off, standards development and early stages of the technical development.

Lessons learnt report 2:

- Activities during project development such as creating effective customer messaging, modifying the model standing offer (MSO), adopting the agile delivery methods to deliver the trial and improvements that could be made to the CSIP-AUS implementation guide.

Lessons learnt report 3:

- Activities during project development, such as implications of an aggregation integration model for OEMs, and findings from the initial field tests and solar industry engagements on how the end-to-end process can be improved.

1.4 Flexible Exports trial customer offers

Since 2017, SA Power Networks have offered customers installing small embedded generator (SEG) an automatically approved fixed export limit of 5kW/phase regardless of where they are located on the network. On 23 September 2021 select zone substation areas in the SA metropolitan distribution network were classified as congested. These substations have a high penetration of rooftop PV and are reaching the limits to host solar exports during certain times the year and at certain times of day. Customers connecting new solar or upgrading their systems in these areas are offered a Flexible Exports connection, which automatically varies between 1.5kW and 10kW, as an alternative to a reduced, fixed export limit of 1.5kW per phase.

AusNet Services have an existing automatic assessment process for embedded generation applications <10kW per phase in capacity. The assessment process results in a fixed export limit generated for the customer of 0kW-5kW per phase depending on the hosting capacity available in the area. Export limits are a small, but growing, issue on the

¹ <https://arena.gov.au/knowledge-bank/?keywords=SA+Power+Networks+Flexible+Exports+for+Solar+PV+Trial>

AusNet network as more customers continue to install solar PV. AusNet Services have developed two Flexible Exports customer offers for the trial:

- A retrofit option for customers who have been assigned a fixed export limit of <3kW
- An opt-in offer for new solar customers who receive a fixed export offer of <3kW.

The first retrofit customer install occurred on 16 August 2021, and the expression of interest for new customers to join Flexible Exports was launched on 23 September 2021. Table 1 compares the offers from SA Power Networks and AusNet Services.

Table 1 Comparison of SA Power Networks and AusNet Services customer offer

	SA Power Networks	AusNet Services
Existing export limit arrangements (DER SEG <30kVA)	Automatic approval for 5kW per phase export limit, regardless of network location.	Automatic assessment for export limit between 0kW-5kW per phase, depending on available local hosting capacity.
Offer	All new and upgrading customers in congested areas have a choice between: <ul style="list-style-type: none"> • Fixed export (1.5kW per phase) • Flexible export trial (1.5-10kW per phase) Exports expected to be at 10kW for 98% of the time.	Single phase (non-SWER) customers with existing zero export/reduced export may join the 12-month trial to receive up to 5kW Flexible Export.
Eligibility	Available in congested zone substation areas. Zone substations classified as congested are: <ul style="list-style-type: none"> - Sheidow Park - Blackpool - Blackwood - Oaklands Customers must install a compatible equipment and have an internet connection ² .	Customers who have an auto assessment outcome of <3kW export ³ . This includes: <ul style="list-style-type: none"> • Existing 'retrofit' customers with a compatible inverter + internet • New customers choosing a compatible inverter + internet Two-step eligibility assessment process: <ul style="list-style-type: none"> • Hosting capacity assesses available 'headroom' on a substation + network health • Engineer assesses 12 months of substation Power Quality data
Approach	All inverter manufacturers, retailers and installers able to participate, aiming to mirroring BAU conditions beyond the trial. Customers offered Flexible Exports for the life of their installation, or revert to 5kW in the event Flexible Exports is not continued beyond the trial.	Currently offered as a 12-month trial – Trial agreement is an addendum to the standard connection offer MSO. Additional exports made available for 12-months only. 'Retrofit' customers already installed and eligible for the trial identified by AusNet and directly recruited to the Trial. New installations with restricted export limits encouraged to submit an EOI. Trial promoted direct to installers and to customers through website, social media and word of mouth.

² Internet connection already required for remote disconnection requirements introduced in the Smarter Homes program [insert link]

³ <3 kW static export chosen as eligibility criteria as these customers are predicted to receive most value from flexible export connection up to 5kW.

To participate in the trial, a customer or their installer must install inverter equipment compatible with Flexible Exports as provided by the trial inverter manufacturers and technology companies. Table 2 shows the inverters which are currently trial compatible.

Table 2 Flexible Exports Compatible Inverters

Inverter manufacturer	Inverter model	Capacity (kW)	# Phases	Flexible connection
Fronius	Primo (SnapINverter)	3.0-8.2	1	SwitchDin Droplet
Fronius	Symo (SnapINverter)	3.0-20.0	3 ⁴	SwitchDin Droplet
SMA	Sunny Boy AV-41	3.0-6.0	1	SwitchDin Droplet
SMA	Sunny Tripower AV-40	3.0-10.0	3 ³	SwitchDin Droplet
GroWatt	MIN TL-X	2.5-6.0	1	SwitchDin Droplet
ABB Fimer	UNO-DM-PLUS-Q	3.3-6.0	1	SwitchDin Droplet

At time of writing, all systems require the installation of a SwitchDin Droplet to achieve Flexible Exports capability. Fronius, SolarEdge and SMA are currently working on “native” integrations which have the capability inbuilt into the inverter software and do not require an external device to participate. Table 3 shows the list of upcoming technology compatibility from the trial partner inverter manufacturers and technology companies.

Table 3 Flexible Exports compatible equipment under development (from trial partners)

Inverter manufacturer	Inverter model	Capacity (kW)	# Phases	Flexible connection	Indicative availability
Fronius	Primo Gen24+	3.0-6.0	1	Native*	Q3 2022
Fronius	Symo Gen24+	6.0-10.0	3	Native*	Q3 2022
SMA	Sunny Boy and Tripower	3.0-10.0	1-3	Native*	TBC
SolarEdge	EnergyHub	3.0-10.0	1	Native*	Q3 2022
SolarEdge	Genesis	3.0-10.0	1	Native*	Q3 2022
SolarEdge	EV Charging Inverter	3.0-5.0	1	Native*	Q3 2022
SolarEdge	Three Phase	5.0-33.3	3	Native*	Q3.2022

*Does not require additional hardware to participate

⁴ Note the AusNet Services trial is not yet testing 3-phase inverters

2 Lessons learnt

The lesson learnt documented in this report cover the first nine months of the SA Power Networks and AusNet Services field trials, broken down into areas of Customer recruitment, Customer experience, Customer system performance and Installation experience

2.1 Customer recruitment learnings

The approach to customer recruitment taken by SA Power Networks and AusNet services has been different due different historic export arrangements (as described in Table 1, p. 5). In South Australia the Flexible Exports offer is available to all new and upgrading solar customers who are located within congested network areas as an alternative to a reduced fixed export limit. This offer is open to all solar retailers and installers to participate, and SA Power Networks has relied on retailers to pass through the Flexible Exports offer to customers and explain the benefits over alternative arrangements.

In Victoria, the offer is open to customers who have otherwise received a fixed export limit through the connection assessment process and is therefore not targeting specific areas of the network. AusNet Services performs an assessment for individual sites based on network data to ascertain if they will be eligible to participate. A retrofit option is available for customers who have existing systems on export restriction and in this case, the customer must have installed an inverter that is compatible with Flexible Exports with the addition of the SwitchDin Droplet device. For the retrofit customers a discussion from AusNet services occurred to present the offer.

As of end of May 2022, we have a total of 209 customers signed up to the trial. This includes 168 new applications in SA and 7 new installs and 34 retrofit installs in Victoria. There are currently 103 systems installed and operational. Figure 3 shows the uptake of Flexible Exports offers in the SAPN and AusNet Services regions since launch. The remainder of this section explores recruitment learnings from the first 9 months of the trial.



Figure 3 Cumulative Flexible Exports customer recruitment, SA Power Networks and AusNet Services

2.1.1 SA Power Networks recruitment learnings

2.1.1.1 Recruitment process

SA Power Networks trial was structured to mirror a business-as-usual service offering to ensure a smooth transition to scale at the end of the trial. There was a deliberate objective to not target specific installers to work on the trial and therefore relied on solar retailers and installers to recruit customers to the new connection option. Figure 4 below shows the changes to the end-to-end solar journey introduced by the Flexible Exports, with steps 1-3 relating to the recruitment of customers to the offer.



Figure 4 Changes to end-to-end solar journey

SmartApply options check: SmartApply is SA Power Networks DER connections approval platform. A new “options check” step has been added to SmartInstall to enable a solar retailer or installer to determine whether a customer is located in a congested area and whether Flexible Exports is available. This presents a key change for the solar industry, where historically all applications in South Australia were auto-approved for 5kW per phase export, solar retailers must now check what export options are available for their prospective customer prior to making a sale.

1. **Sales:** Flexible Exports enables customers to export much more energy into the network as compared to a fixed export option (1.5kW or 5kW per phase). This option has an impact on the value proposition of a solar system and should be incorporated into the solar sales process by a solar retailer to determine whether it makes sense for the customer’s specific circumstances.
2. **SmartApply SEG approval:** Once the customer decides to proceed with the system purchase, the solar retailer/installer must seek Small Embedded Generator connection approval from SA Power Networks. This is the point at which the flexible or fixed export option is selected and automatically approved. If Flexible Exports is selected, the customer is officially signed up for the trial and enters into a connection agreement with SA Power Networks.

2.1.1.2 Recruitment findings

Since the trial went live on the 23 September 2021, 168 customers have been signed up to the Flexible Export connection option in South Australia. This high level of participation indicates that the solar industry has been able to understand the new offer and its benefits and successfully communicate this to customers. SA Power Networks have also received numerous requests from installers and customers outside of eligible congested areas about whether they can participate or when the offer will be available in their area.

Trial research partner, SEC Newgate, have been engaged to survey participating customers on their sentiment towards Flexible Exports. As part of this survey, customers were asked about their reasons for choosing Flexible Exports, the results of which are shown in Figure 5. The main reason cited is that Flexible Exports enables additional exports the alternative fixed export option. Other early findings of this research are explored further in section 2.2.

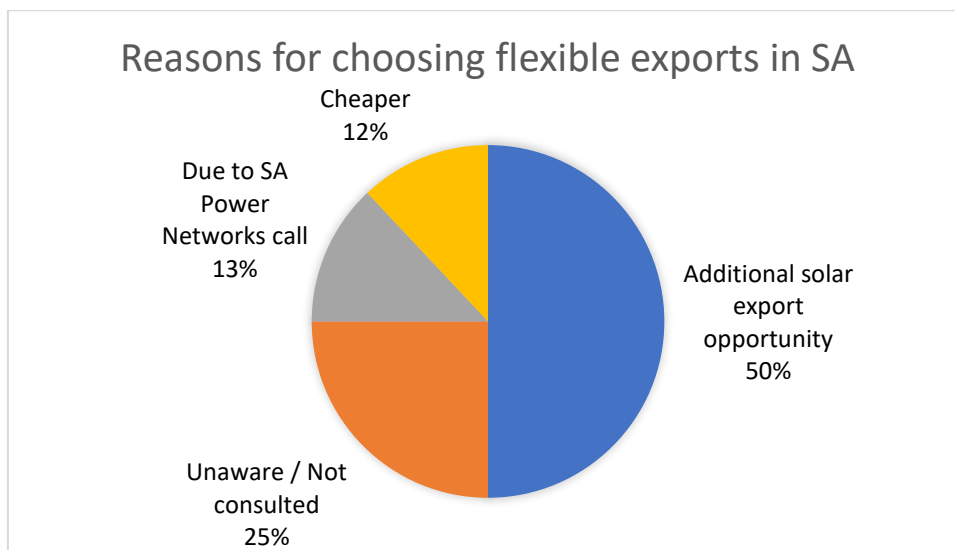


Figure 5 Reasons for choosing flexible exports in SA

Approximately half of all connection approvals in the congested areas to date have been for Flexible Exports compared to the fixed export limit of 1.5kW. From our customer and solar retailer engagement, the main barriers cited for picking fixed over Flexible Exports includes:

- **Lack of awareness:** Several solar retailers are not aware that this new offer applies and are therefore not passing it on to customers as part of the sales process. In these cases, retailers are not checking the SmartApply options check prior to sale and are not selling equipment compatible with Flexible Exports. An early benchmark survey found that 7 out of 10 customers who chose fixed exports were not aware of the Flexible Exports offering, and a further two did not have enough information to choose Flexible Exports.
- **Limited compatible technology:** Technology compatible with Flexible Exports is currently limited to solutions developed by the trial technology providers. As some solar retailers only sell certain technologies, they may not be well placed to offer Flexible Exports to their customers. This is an issue unique to trial conditions and should be largely resolved by new Dynamic Export requirements that will apply in South Australia from 1 December 2022. These new requirements will ensure all new or upgraded solar installations are compatible with Flexible Exports⁵. SA Power Networks is currently working with the majority of technology providers to ensure a broad selection of compatible equipment is available ahead of the December deadline.
- **Additional costs to participate:** Given all Flexible Exports installations currently require a SwitchDin droplet at additional upfront expense which not all customers are willing to accept. Also, some installers do not like adding additional hardware to installations because it can add time to the installation and trigger follow-up calls from customers. This issue should be alleviated by the introduction of native inverter installations that do not require additional hardware.

Given these limitations, the recruitment figures for Flexible Exports during the trial is a great outcome and shows the perceived benefits by customers. It is worth noting that during the trial, six customers have switched their application from fixed to flexible upon learning about this option.

2.1.1.3 Shift to direct customer engagement

Since lack of customer awareness has been discovered as a barrier to customer uptake, SA Power Networks has begun trialling some methods of direct customer engagement to ensure customers were aware of their export options prior to speaking with a solar retailer. This engagement took the form of:

- Letterbox drop of information to potential customers within congested areas;

⁵ https://www.energymining.sa.gov.au/industry/energy-productivity-and-technical-regulation/smarter-homes/regulatory_changes_for_smarter_homes

- Social media promotion including information about the project targeted to congested areas.

The Letterbox drop was tested first with 3,961 letters sent to customers in the congested areas and received limited response, resulting in only one telephone enquiry and no perceivable increase in trial participation. The lack of traction with this method led to the decision to shift the focus to exploring social media.

The social media promotion included a paid social media and search engine marketing campaign to promote and build awareness of Flexible Exports targeting eligible geographic areas. Some example social media graphics from the promotion can be found in Figure 6.



Figure 6 Example social media tile graphics

An initial promotion was presented state-wide then a second delivery where the trial locations were targeted. The first half of the campaign resulted in 7,898 visits to the website page (wider audience) the second half of the campaign resulted in 1,231 visits to the website (geolocation targeted audience).

The campaign included placing ads on Facebook and Google. Once people click on the ads, they will be taken to SA Power Network's Flexible Exports landing page⁶ which was set up specifically to track the effectiveness of the social media promotion. The landing page included links to:

- Informative video introduction to Flexible Exports
- Checklist for questions to ask a solar retailer about export options.

This checklist is used as a call to action / indicator to measure effectiveness of the digital campaign in lieu of calling every customer to find out how they heard about Flexible Exports.

The following sentiment has been expressed through comments responding to the social media:

- Customers are interested in the changes happening in their area and understanding if or when Flexible Exports will be available to them.
- Misconception regarding roles and responsibilities of electricity distributors and energy retailers. This is reflective of the complexity of the energy industry.
- Indication that customers are looking for a trustworthy party who can help them with Flexible Exports and related solar and energy issues.

It is challenging to correlate the number of clicks through to the Flexible Exports landing page with the actual Flexible Exports conversion rate given that solar retailers being intermediaries. An indicator of the effectiveness of the promotion is the number of customers who downloaded the call to action checklist which indicates intent to pursue a solar retailer discussion. To date the checklist has been downloaded 269 times. SA Power Networks considers this promotion more effective in reaching customers than mailout and is something we intend to continue in the future.

Through customer research it has been found that there is a high level of appetite from customers for this service, with strong understanding of the benefits in participating when compared to fixed export limits that apply all year

⁶ <https://www.sapowernetworks.com.au/industry/flexible-exports/why-flexible-exports/>

round. The financial benefit is not seen as the only driver with customers also citing the community and environmental benefits associated with unlocking more solar on the network. During the remainder of the trial the approach to customer recruitment will be based on the feedback and learnings from the customer research and the response to social media campaigns. As SA Power Networks plans to roll Flexible Exports out as a standard service at the end of the trial, there is an opportunity to further leverage the learnings from trial recruitment and customer research to better target messages that resonate with consumers.

2.1.2 AusNet Services customer recruitment learnings

2.1.2.1 Recruitment process

The trial in AusNet Services considered eligibility criteria across all customers across the network with fixed export limits of <3kW. This process identified approximately 170 customers with <3kW export limit, a compatible inverter already installed and with sufficient hosting capacity available to enable additional exports under a Flexible Exports connection. These customers received direct outreach from AusNet (including email, phone calls, and sometimes even an approach through the original installer) to offer them a place on the trial. Customers joining the trial for a 12-month period have a SwitchDin Droplet installed at AusNet's expense. The majority of the retrofitted customers who have joined the trial had a 0kW export limit, so the trial has allowed them to benefit from receiving a feed-in-tariff for energy exported during trial.

Customers who apply for new installations are advised that they will have zero or near zero exports, those who were willing to install compatible hardware are invited to submit expressions of interest (EOI) for the trial. The trial EOI was publicised through the solar connection tool, an online platform used by solar installers at the time of application, and through direct engagement with solar installers. There is no cost for customers to submit a trial EOI and AusNet has also subsidised the cost of the Droplet device. The trial has been a well-received additional option for customers who otherwise receive a zero-export connection. Where this is chosen, the project team works with the installer to assist with the installation and ensure they understand the project on a case-by-case basis.

2.1.2.2 Recruitment findings

Trial eligibility is the biggest challenge facing AusNet Services customer recruitment. The main issues with the trial recruitment have been:

- Existing unauthorised exports and enterprise data issues;
- incompatible inverters and trial length;
- customer eligibility found through the hosting capacity assessment.

Despite export restrictions being a growing issue on the AusNet network, the trial parameters (compatible inverter and hosting capacity assessment) are prohibitive and reduce the number of opportunities identified, the breakdown of which is shown in Figure 7. Of the retrofit customers assessed on the network, only 2% of all restricted export customers installed in 2021 calendar year were eligible to offer a place on the trial.

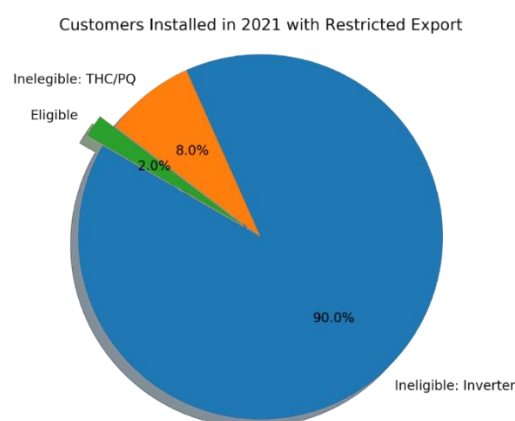


Figure 7 The first eligible 'retrofit' customers identified across the AusNet Services network

The hosting capacity assessment used in the trial, is at a stage of development which only safely predicts available export capacity for 30% of customers. One of the biggest factors adversely affecting the hosting capacity assessment and customer's willingness to join the trial is unauthorised exports. Customers with unauthorised exports on congested networks prevent the hosting capacity algorithm from returning valid results. Worse yet, on networks where a customer is on the Flexible Exports trial and receiving a dynamic export limit, any unauthorised exports installed on the network reduce the available network capacity for the flexible customer and their export limit is restricted as a result.

When assessing retrofit customers to join the trial it was found that the quality of information provided to AusNet about the installations was inaccurate. Many customers with export limited connections have not installed the required gate meter to restrict their exports (the gate meter is required for the trial) and in some cases the installed inverter models were found to be different to what was reported to AusNet and information listed on the system.

A number of otherwise-eligible customers were found to have existing unauthorised exports and were unwilling to join the trial as they were already receiving a feed-in-tariff. Many of these customers were unaware that their connection agreement with AusNet was for a reduced export limit and therefore not currently compliant.

The limited number of inverters compatible with the trial has resulted in a smaller pool of eligible retrofit customers (with compatible inverters already installed). The decision to join trial for new customers is complex, with a lot of information they need to understand and consider. There has also been the perception of a low value proposition from some, due to the additional exports enabled only being guaranteed for the 12-month trial, especially when there may be an additional upfront cost for them compared to revenue they may make from 12-months of additional feed in tariff. AusNet received many EOIs from installers whose customers were unwilling to change their choice of inverter to join the trial, citing that the cost is prohibitive. One new customer who was willing to participate paid \$1,100 more than originally quoted in order to install a compatible inverter model to join the trial. This customer understands they will not recoup the additional cost through the 12-months of feed in tariff. Understandably this is not a decision taken by other new customers installing solar.

Installer engagement challenges have also been a barrier to increasing trial participation. Despite having over 1,000 solar retailers on AusNet Services database there has been limited support from any installers who are invested in making a 'sale' rather than participating in the trial of new technologies. These installers are often working across multiple DNSP areas in Victoria with differing connection processes. Additionally, the majority of retailers who may be aware of the Flexible Exports offering, use contracted installers and thus communicating with these stakeholders is a challenge.

Despite providing a free and immediate online pre-approval tool for residential solar connections, some installers do not apply for pre-approval and inform the customer of an export restriction until after they have already installed a system, it has also been identified that some customers remain entirely unaware of export restrictions. EOIs for Flexible Exports are often received post-installation and the majority, at this stage, have non-compatible inverters. One installer switched the customer's inverter model at their own expense so that they could join the trial, as the customer was outraged with the export restriction and would not have progressed with their installation had they had been informed of this restriction up front.

In Victoria, through the benchmark survey, when customers were asked the main reason they signed up to Flexible Solar Exports trial, they indicated their reasons were:

- concerns that they were limited in exporting energy;
- to increase green energy for everyone;
- to support the community, no reason not to, to stop exports going to waste and to have their solar system working to its full potential.

There is an echo of the sentiment of the South Australian context where customers are seeking to contribute to the broader community and environmental benefits of trial. Key messaging to AusNet customers has been "help us improve our network", which has resonated well with customers, but not installers.

2.2 Customer experience learnings

A key objective of the trial is to explore the customer experience of Flexible Exports offer and test customer acceptance.

In earlier phases of the trial initial research was undertaken to develop and test the messaging that resonates with customers and encourages them to participate. This led to the development of website materials and collateral which was provided to solar retailers and later targeted directly at customers.

SEC Newgate research services have been engaged to directly survey consenting customers on their experience with Flexible Exports, including:

Initial benchmark survey

- An initial benchmarking survey at the beginning of the trial to test the sales, installation and commissioning process and any early thoughts on the operation of the system.

Qualitative phone interviews with trial customers

- A small number of in-depth interviews with select customers across SA Power Networks and AusNet services trial participants.
- Aim to give early guidance on issues.

Final quantitative survey

- A short online survey provided to participants to track key metrics from the benchmark survey to see how experiences have shifted over the duration of the trial.
- Capture key data to inform customer understanding and satisfaction of the Flexible Exports service.

Survey questions are tailored to the regions due to differences in the customer offers in SA Power Networks and AusNet Services network areas.

With a number of customers' systems now online and operating, a number of initial benchmarking surveys have been conducted and initial findings explored in this section. Note that the total number of surveys conducted is less than the number of systems enrolled due to the time lag between enrolment and installation.

Full results and analysis by SEC Newgate will be available alongside the project's final knowledge sharing report.

2.2.1 SA power Networks customer experience learnings

2.2.1.1 Summary of key findings

Some of the headline insights found in the initial survey with 21 customers indicate they:

- Are satisfied with their solar installations and with choosing Flexible Exports.
- Understand what Flexible Exports is and the reasons for doing this.
- Can articulate in their own words understanding of Flexible Exports.
- Understand that there is a requirement for internet connection on their systems, however there was limited understanding that maintaining that connection and ensuring it is live for the system to operate most effectively.

2.2.1.2 Detailed survey results

Figure 8 shows summary metrics from early benchmark surveys from the first 21 participants. These findings show customer satisfaction for offer is high, and majority of customers would recommend the offer to their friends, family and neighbours.



Figure 8 Early benchmark survey, summary metrics

Figure 9 provides more detailed survey results across various aspects of the customer’s experience with solar and Flexible Exports to date.

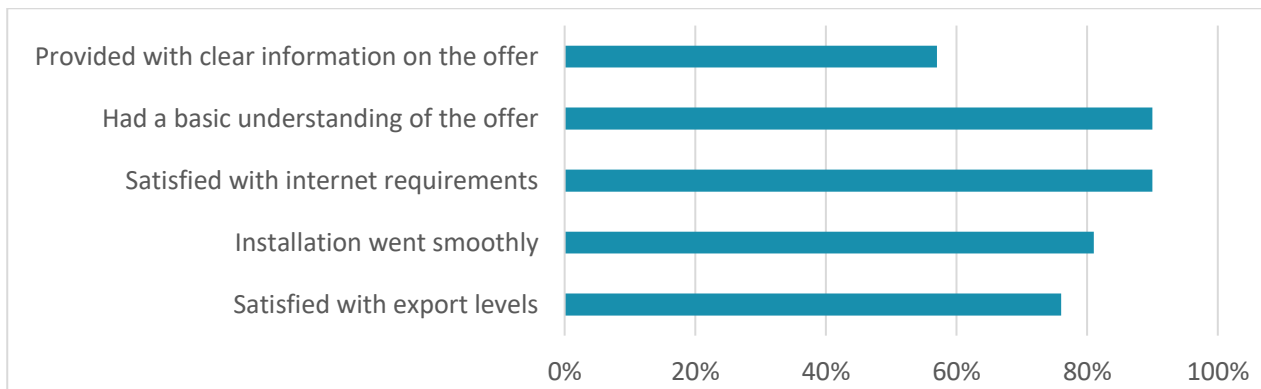


Figure 9 Early benchmark survey results

Despite less than 60% of respondents indicating they were provided clear information on the offer from their solar retailer or installer, more than 90% were able to demonstrate a basic understanding when prompted. Examples of some of the responses received when customers were asked to explain Flexible Exports in their own words can be found below.

- Dynamic adjustment/variation of exports to protect the grid/ avoid overload
- Ability to increase exports to the grid (depending on conditions)
- Ability to increase exports up to 10kW
- Other comments include – More granular monitoring of network and better network management, benefitting all energy users through more renewable energy on the grid

Most customers found their solar installation (including Flexible Exports) went smoothly, and the majority are satisfied with the export levels they are receiving on the Flexible Exports connection.

2.2.2 AusNet Services customer experience learnings

A strong focus of the messaging for AusNet customers has considered their role in helping to progress the transmission network, and a focus for surveys has been centred on building social licence for export management. Some customers (4) stated that their reason for joining the trial was that they were 'unable to export anything otherwise', most were also motivated to 'increase green energy for everyone', to 'support the community' and to 'stop exports going to waste'.

Customer satisfaction has been positive, with Victorian customers rating the Flexible Exports experience 8.4 out of 10. For the overall satisfaction with the experience of installing a solar system survey, respondents gave an average rating of 7.9 out of 10 (with one person 'outlier' providing a rating of 1 out of 10 as their device was not yet online and still restricted to zero exports).

The main reasons given for high satisfaction included:

- Lower power bills than expected (2 people)
- perceptions of the trial being a good initiative for network/grid management (1 person)
- less wastage of exports (1 person)
- reducing carbon footprints of households (1 person).

All participants said they had at least a basic understanding of the reasons for Flexible Solar Exports being trialled and what the equipment does (a mix of basic and good understanding). All Trial customers could explain Flexible Exports to some extent and were comfortable with the DNSP having visibility of their exports and managing the export limits.

As the AusNet have targeted information to customers who may be eligible and potentially interested in participating in the trial. The main information sources that customer cited for their awareness of the trial were direct outreach from AusNet, word of mouth, and the website. Very few customers were referred from their installer, but they would be looking to increase awareness and have more opportunities to develop communications for customers when Flexible Exports becomes BAU across the network.

2.3 Customer system performance learnings

Another objective for the trial is to quantify and prove the value unlocked for trial customers who would otherwise have been subject to zero or near-zero export limits. This is achieved by analysing the five-minute import/export power data provided by the devices over the communication interface to calculate the total energy exported when compared to static export arrangements.

With a large proportion of devices only coming online over the past few months, this analysis presents an early snapshot of findings. SA Power Networks and AusNet Services have differing approaches to generation of flexible exports limits based on network configuration, existing solar penetration, input data available to the flexible export calculation and hosting capacity business rules.

Detailed analysis of system performance across the life of the trial will be presented in the final knowledge sharing report.

2.3.1 SA Power Networks customer system performance learnings

2.3.1.1 Introduction to system benefits

The key measure of value unlocked for customers in the trial is the exports achieved greater than what would have been available under the 1.5kW fixed export offer. The example chart Figure 10 shows site monitoring data for one of SA Power Networks' trial customers over four days in March.

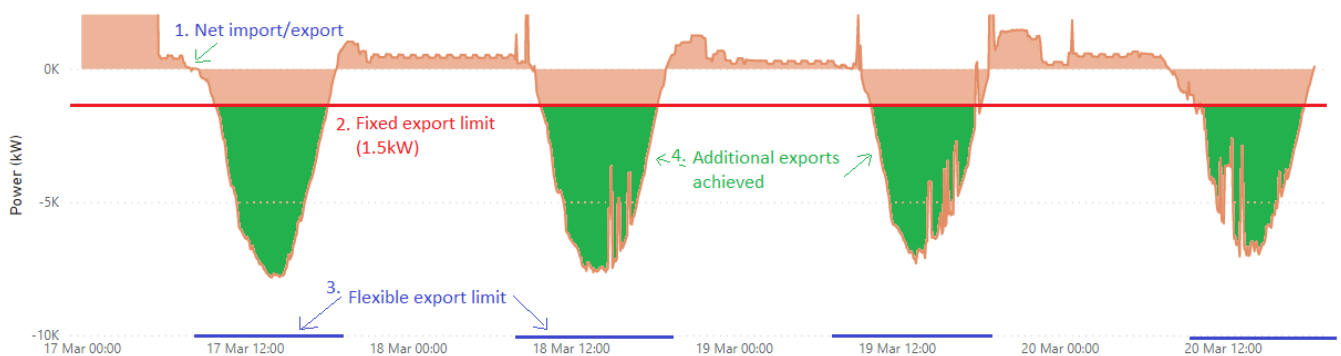


Figure 10 Example Flexible Exports site metering

In the chart:

1. The orange line represents the customers' net import/export from the distribution network. Positive values represent power imported from the network; negative values represent power exported to the network from the solar system.
2. The red line represents the 1.5kW fixed export limit which would apply to the customers system all year round if they had not chosen to participate in Flexible Exports.
3. The blue line represents the flexible export limit that is communicated to the customers inverter during daylight hours. The flexible export limit is at 10kW for this four-day period.
4. The green shaded area represents the additional energy the customer has been able to export by participating in Flexible Exports in contrast to what would have been under the fixed export limit. For this period, the customer has exported 170kWh, more than triple the 53kWh achieved under the fixed export option, resulting in greater feed-in-tariff earnings.

2.3.1.2 Summary of benefits

At time of writing, Flexible Exports has enabled an additional 44MWh of energy to be exported to the network across the 77 systems installed⁷, with the average customer more than doubling their exports compared to the alternative fixed export limit. Customers have been provided a 10kW export limit for 100% of time to-date, but this is expected to decrease to 98% over the congested spring months. The distribution of benefits across all customers by month is shown in Figure 11 below.

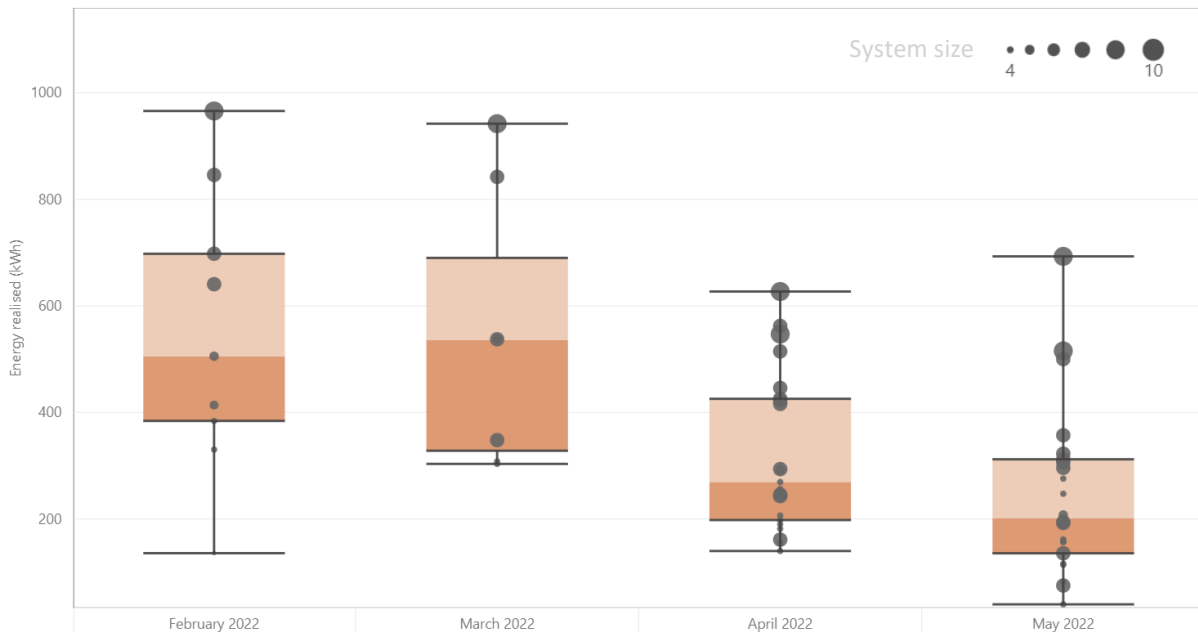


Figure 11 Distribution of benefits for trial participants to-date (energy exports achieved above 1.5kW)

This figure shows a large spread in customer benefit which is largely driven by the capacity of a customer's solar installation, and other factors such as rates of solar self-consumption. For example, customers who have installed 8.2kW inverters on the trial have benefited from being able to export on average more than triple the additional energy over 1.5kW as compared to those with 5kW systems. The figure also illustrates the expected decrease in solar system performance during the transition from summer to autumn. Peak solar output, and therefore maximum benefits from Flexible Exports, are expected in spring and summer which will be included in the final knowledge sharing report.

2.3.1.3 Case studies

Table 4 shows example system performance for trial customers over four months of operation compared to the static export limit. These two customers represent the typical system configurations observed in the trial to-date:

- Single phase customer with a typical 5kW inverter system (6.6kW panel capacity)
- Single phase customer with a larger than typical 8.2kW inverter system (10.9kW panel capacity)

This further demonstrates the large quantum of energy unlocked by participating, which is even greater for larger system sizes.

⁷ Systems have been installed progressively across the trial, some only for a limited time. Some systems are not providing correct telemetry data, so their benefits are not included in these totals.

Table 4 Exports achieved from 8 March to 31 May (84 days) for two example sites

System installed	Exports achieved under 1.5kW/phase limit	Exports achieved with flexible export limit	Percentage increase	Estimated earnings above 1.5kW (@7c FiT)
5kW inverter	1,260 kWh	2,370 kWh	89%	\$78
8.2kW inverter	1,450 kWh	3,910 kWh	170%	\$172

This data is based on a small snapshot of customer systems but demonstrates a high level of value of participating in Flexible Exports compared to a reduced static export limit. Performance data will continue to be analysed as the participant numbers increase and the results of which will be shared in the project’s final knowledge sharing report.

2.3.2 AusNet Services system performance learnings

For AusNet Services, the target customers for the Flexible Exports trial are in the most constrained areas of the network, where customers are often restricted from exporting or have minimal export permitted. Thus, the key measure of value unlocked for these customers is either a notable increase over their current limit, or the ability to export any energy to the grid.

The export limit engine generates a flexible export limit for all customers on a weekly basis, with a single 24-hour export profile varying hourly based on the available hosting capacity of the substation applied to every device every day of the week. This means that a customer’s overall peak export level is updated weekly, with their actual export limit updated every hour according to the generated 24-hour profile. Where Flexible Export customers do not share a distribution substation with other Flexible Export customers, they are assigned the maximum capacity and therefore receive a flat export profile that does not vary throughout the day.

For one example customer, Figure 12 shows their PV generation and export to the grid over five days in February 2022, noting that no data is available from the inverter whilst it shuts down overnight. The PV generation is shown in blue, the export to the network shown in orange and the flexible export limit transmitted to the inverter is shown in purple. This customer previously had a zero-export limit and thus all negative energy shown in orange represents earning potential for the customer via their feed-in tariff.

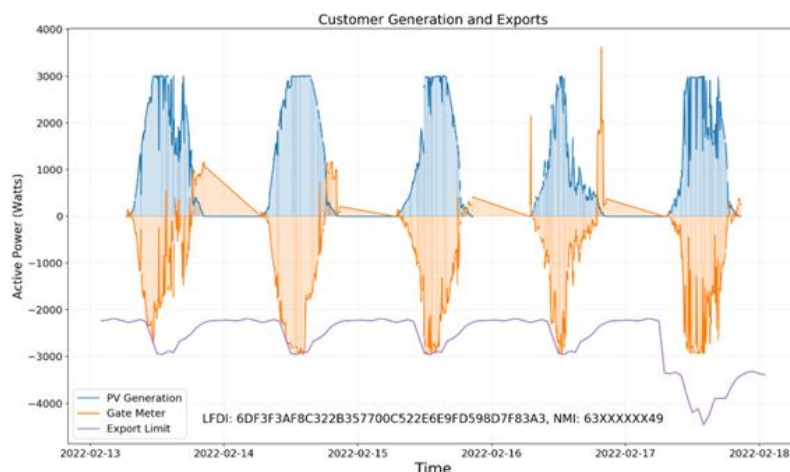


Figure 12 Example customer generation and exports over five day period

At the time of writing, AusNet’s Flexible Exports trial has enabled an additional 54.4 MWh of energy to be exported to the network across all systems installed. The cumulative amount of export energy is shown in Figure 13 below.

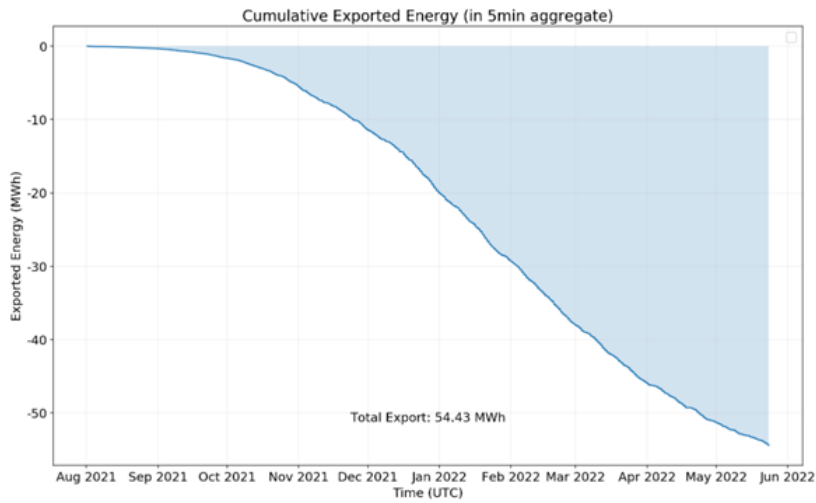


Figure 13 Additional exports enabled on AusNet Services trial to date

AusNet Services Flexible Exports algorithm gradually increases export limits for a given customer over time after they are onboarded. The export limit can be seen for a particular customer in Figure 14, showing how the export is slowly allowed to increase as confidence their export is not detrimental to the network increases.

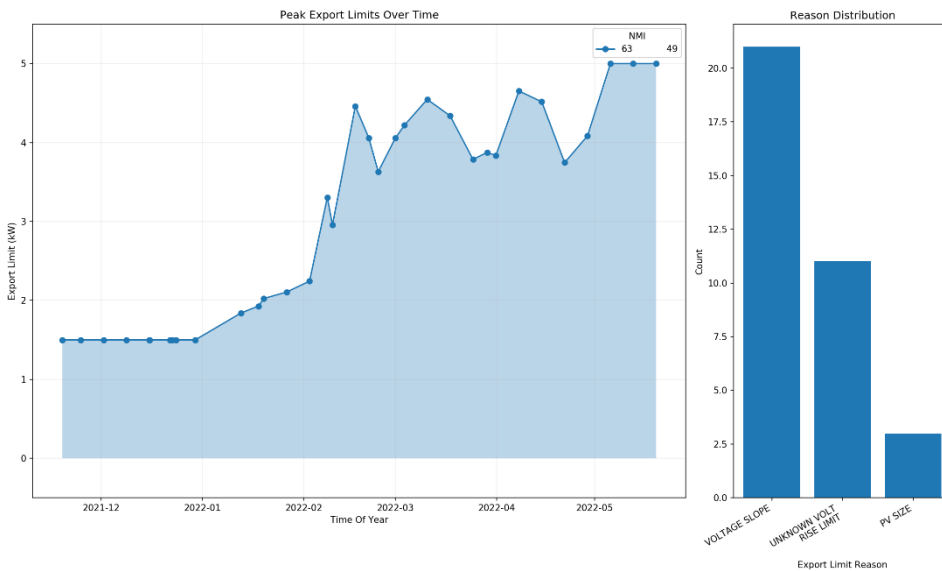


Figure 14 Export limit increases over time for individual customer

There are three customers participating in the trial who were previously assigned a fixed limit other than zero. Based on the previously assigned export limit, customer one who was originally limited to a 2.09kW export capacity has realised a 56% increase in their exported energy to the network.

Table 5 Customer limit increase and estimated earnings enabled through trial to date

Customer	Existing Export Limit	Energy Realised Under Existing Limit	Additional Energy Realised Under Flexible Exports	Increase %	Estimated Earnings Increase (@ 7c FiT)
Customer 1	2.09 kW	1599 kWh	900 kWh	56.28 %	\$63

Figure 15 shows the energy gained over a five day period in April 2022 for the Customer 1 in Table 5.

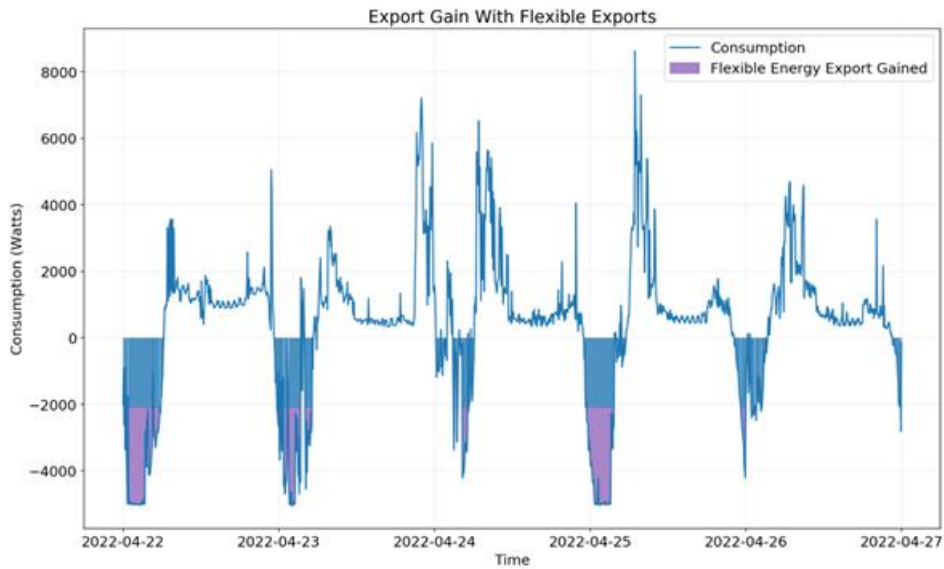


Figure 15 Additional export achieved by individual customer

A useful comparison for AusNet Services customers in Table 6 who have received a zero-export limit is the proportion of exports that have been made available under Flexible Exports compared to the business rules limit of 5kW export that would be assigned to a customer in an unconstrained area of the network.

Table 6 Proportion of allowable exports compared with business rules limit 8 9 10

Customer solar system size	Average Export Limit over the last three months	Number of customers	Percent of maximum business rules limit realised
3 kW	1.50 kW	1	30 %
4 kW	3.89 kW	1	78 %
5 kW	3.31 kW	15	66 %
8.2 kW	4.16 kW	2	83 %
10.0 kW	4.91 kW	1	98 %

⁸ Calculations are based on the average of all export profiles assigned over the last three months and are not time weighted

⁹ Calculations include all registered NMs that are known to be working correctly at the time of writing

¹⁰ Not all systems have been active for the same period of time, and some may have become active during the three-month period

2.4 Installation and installer experience

There are additional steps required for an installer on Flexible Exports sites compared to a typical solar installation. These include:

- Installation of additional hardware (if required)
 - Site monitoring device (common for existing export limited installations)
 - Droplet gateway device (if required)
- Connecting the system to the internet
- Registering and commissioning the system for Flexible Exports

This section explores some of the early findings across the installations to date.

2.4.1 SA Power Networks installation learnings

To further mirror BAU conditions, SA Power Networks have enabled all installers to sell and install Flexible Exports systems in the trial, rather than contract installations from a specific sub-set of specially trained installers.

Prior to launching the trial, a number of ‘friendly’ field tests were conducted with volunteer installers from SA Power Networks’ Solar Industry Reference Group (SIRG) to test and refine the installation and commissioning process and support materials. This led to rework of a number of equipment quick reference guides and a software change to the SwitchDin Droplet installer wizard.

SA Power Networks’ New Energy Services (NES) team also made outbound calls to the top 40 installers by installation volume to test their understanding of Flexible Exports ahead to the trial launch. This survey identified a high level of understanding, with more than 80% of installers indicating knowledge level of medium or higher.

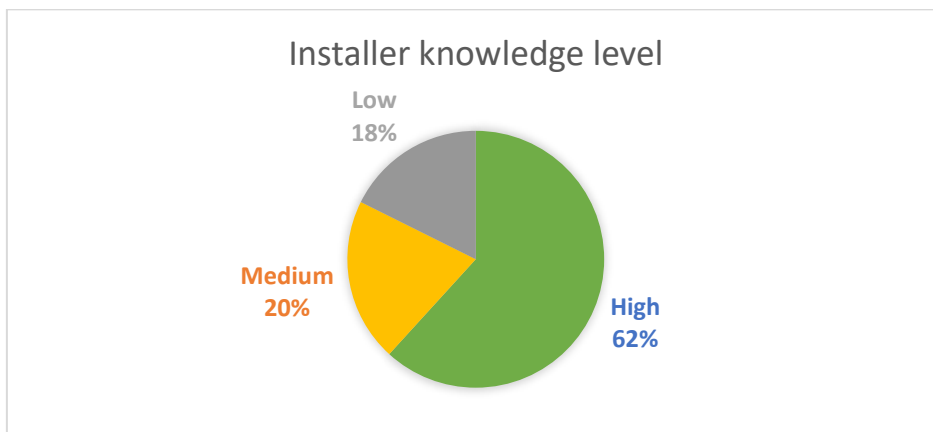


Figure 16 Installer knowledge level of Flexible Exports prior to trial launch

Since the trial went live on 23 September 2021, 83 systems have been successfully installed and commissioned into Flexible Exports by 44 unique solar retailers. In this time the New Energy Services team at SA Power Networks have been fielding support calls from installers and have made numerous outbound calls to understand the installers’ experience. Some of the key anecdotal findings from these discussions include:

- The quick reference guides and materials are reasonably straight forward to follow;
- Inclusion of “native” inverter options that do not require additional hardware like the Droplet would make installations more straight forward;
- Having timely support to help troubleshoot issues is critical when onsite;

- Some solar installers don't have experience with communications wiring which can make troubleshooting a challenge.

Compliance to technical standards and DNSP connection requirements is significant talking point within the solar industry. In 2021 the Clean Energy Regulator (CER) completed an integrity review of the rooftop solar PV sector¹¹ to understand some of the challenges and make a series of recommendations to increase compliance. The recent introduction of AS4777.2:2020 has highlighted its importance from a system security¹² perspective. This is reflected in the compliance observed for Flexible Exports connections, where a proportion of sites have outstanding issues. As the complexity of the industry increases, the importance of compliance is expected to further escalate.

To address this, SA Power Networks is working closely with the solar industry through the SIRG and other avenues to ensure systems and processes are as simple as possible and the industry has the right skills and processes to support Flexible Exports beyond the trial. It is recognised that installers are a key group that needs to be engaged and upskilled to support the transition from passive to smart connected DER.

2.4.2 AusNet Services installer learnings

Installer engagement is a new experience for AusNet Services. They have worked to ensure building effective relationships with these stakeholders to help them view the relationship as one of partnership. The biggest issue that has been faced in Victoria has been in managing relationships with the solar retailers and the solar installers. AusNet Services have very good engagement practices and can communicate effectively with small solar retailers who are also installers. However, most solar installations on AusNet Networks are being delivered by contract installers employed by large solar retailers. AusNet has found this to be a very difficult audience to communicate with, resulting in a high proportion of compliance issues.

Since Flexible Exports requires specific compatible hardware, the installer needs to be aware that a customer will be joining the trial before they sell a system to be installed. AusNet provides an instant online pre-approval tool which currently informs whether a connection is export restricted, and in a future BAU implementation would also offer customers a flexible export connection. However, this pre-approval relies on installers following the correct connection process and using the pre-approval tool prior to quoting a customer for their installation, and especially before undertaking an installation. Upskilling installers to help them succeed working on the network is an ongoing task. Communicating the flexible export option to installers will be easier for AusNet once there is a standard offer developed in the future, after the trial.

Most installations have required some degree of support and issues have varied on a site-by-site basis. For the actual installation, AusNet works very closely with the solar retailer to ensure that they have quoted the customer on the correct hardware components (including a gate meter for export limiting should the Droplet lose connection) and providing installation guides. The SwitchDin Droplet can only be setup and commissioned by a user who has completed the online training and received an email accreditation. In some instances, we are aware that the retailer has set up this registration on behalf of the installer, so the installer has not done the training and has not learnt how to connect the device properly. In other instances, the solar retailer has not communicated the training requirements to the contractor doing the installation and sometimes not even sent through the installation guidelines. As AusNet became aware of this disconnect in operations, we have reinforced the way that we work with solar retailers to ensure that we are communicating directly with the subcontractor.

It is anticipated that the process of supporting solar retailers and solar installers with flexible export sales and installations will become easier once Flexible Exports is implemented as a standard connection offer, and as it is rolled out across other networks in the future. It is expected that this will coincide with an increase in compatible hardware offered by inverter manufacturers and native inverters which do not require additional export management devices (droplets), facilitating an easier process for installation and commissioning.

¹¹ <http://www.cleanenergyregulator.gov.au/RET/Pages/About%20the%20Renewable%20Energy%20Target/Rooftop-Solar-Sector-Review.aspx>

¹² System security refers to the security of an electricity grid is its technical resilience namely its ability to quickly respond and remain stable when unexpected events occur. Examples of such events include generators breaking down or transmission lines failing.

3 Next steps

Flexible Exports for Solar PV will continue execution of the field trial phase. Key activities include:

- Development and trials with ‘native’ inverter capability that does not require additional hardware to participate
- Continued data gathering and analysis of system performance across all participating customers over an extended time period. This will form the basis for a number of case studies.
- Two further customer surveys will be undertaken by SEC Newgate
- Continued work with customers and the solar industry to raise awareness and understanding of the new offer

Learnings from these activities and from the broader trial will be captured in the final knowledge sharing report. Other knowledge sharing activities will continue including the project DNSP working group, DER API working groups and insights forum. Recordings of the insights forum will be made publicly available on the SA Power Networks website¹³.

In parallel to the trial, both SA Power Networks and AusNet Services are working on transitioning Flexible Exports to a business as usual (BAU) service offer. This is supported in South Australia by new State Government Dynamic Export regulations that require all new and upgrade solar systems in South Australia to be dynamic exports capable.



¹³ Previous insights forum and future insights forums are available for viewing at: [Flexible Exports for Solar PV Trial - SA Power Networks](https://www.sapowernetworks.com.au/future-energy/projects-and-trials/flexible-exports-for-solar-pv-trial/r)
<https://www.sapowernetworks.com.au/future-energy/projects-and-trials/flexible-exports-for-solar-pv-trial/r> PV Trial - SA Power Networks