2022

Cadency Consulting

AER SUBMISSION - INCENTIVISING AND MEASURING EXPORT SERVICE PERFORMANCE

This paper provides a technical and benchmarking submission to the AER's Incentivising and measuring export service performance consultation paper.

Contents

1 Executive Summary

This submission proposes a raft of three complementary areas of data collection. These areas are co-dependent, and progress in all three areas is important to avoid adverse outcomes for consumers.

The areas for data collection are:

1. Static export limits
2. Voltage curtailment
3. Dynamic export limits

It is strongly recommended that all three areas of data collection and reporting are undertaken in parallel to avoid the creation of unbalanced incentives on the DNSPs. For example; the capture and reporting of static export limits without voltage reporting could lead to worsening voltage outcomes for all consumers. The potential for these adverse outcomes would be increased were some of these measures included in some sort of incentive framework and some not.

The proposed data collection models would support the benchmarking of performance – both over time and between DNSPs. Comparative performance benchmarking can have a strong incentive power.

The data collection model could also support the development of an economic incentive framework in the future. This outcome would require greater levels of data accuracy and consistency than are available today as well as the development of a history of performance.

1.1 About the author

Anthony Seipolt is a utility consultant with extensive experience in the utility management and regulation including significant international expertise. Anthony has over 30 years' experience in the utility industry and is the director of Cadency Consulting.

Anthony holds a Master of Business Administration, is a former advisor to the AER, and National Manager and Director of Parsons Brinckerhoff Associates. Anthony has developed and delivered benchmarking reviews for over 200 electricity companies across the world including the US, UK, Europe, Canada, Singapore, Indonesia, Philippines, Hong Kong, New Zealand and Australia.

2 Sources of customer export curtailment

Most residential customer export today is sourced from Solar PV, although this is expected to change as more home batteries and electric vehicles are purchased by consumers.

There are many ways that customer export can be constrained. The primary identified areas are:

1. Static or zero export limits
2. Voltage curtailment
3. Dynamic export limits (emerging).

These export constraints are discussed below.

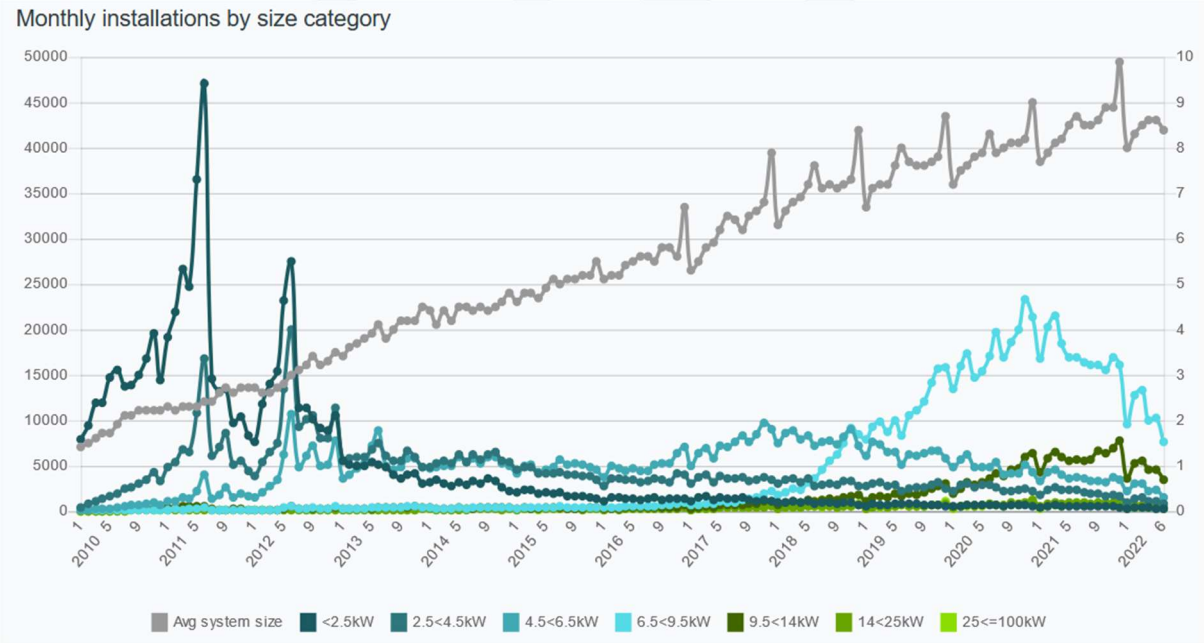
Customers, or their agents, can also choose to limit their exports. While this is uncommon at present, this is likely to increase as communications and control systems are deployed. Customer self-curtailment is not considered in this paper.

2.1 Static Export limits

When a customer installs a new solar PV installation, they are provided with a static export limit by their DNSP. This static limit sets the maximum level of export that the customer is allowed and applies at all times of the day and night.

The average size of a small-scale solar PV installation in Australia is increasing and has passed 8kW.

Figure 1 - Australian PV Institute market analysis



Meanwhile, the standard export limit for a customer in the NEM has remained relatively static at 5kW for many years now. In some locations, DNSPs are applying limits that are lower than 5kW or even zero limits in some locations. Higher limits are also available upon request – fees may apply.

At present, static export limits are the primary source of CER export curtailment.

2.2 Voltage curtailment

Solar PV cells convert energy from the sun into direct current (DC) electrical energy. This energy is then converted into alternating current (AC) energy that is safe and compliant with the local electrical grid.

Inverters that perform this conversion from DC to AC are required to meet Australian Standards[1] and protect the grid from exceeding tolerances. If the voltage on the network is either too high or too low, the inverter is programmed to reduce or halt production altogether.

The nominal design voltage for customer devices is 230V. However, due to historical factors, the average voltages on the electricity networks are typically in excess of 240V. These higher average voltages mean that there is less "headroom" for exports into the grid.

A number of studies[2] have looked into this area of voltage curtailment and identified it as a material loss of overall PV production. These reports also identified that some customers are losing up to 20% of their total solar PV production.

Voltage related losses can impact all PV production as they act on the PV inverter, not just the volume of exports to the grid.

2.3 Dynamic export limits

A recent report by the Australian Renewable Energy Agency[3] has identified that all DNSPs are in the process of developing or implementing Dynamic Operating Envelopes (DOEs). When implemented these DOEs will support greater levels of export for PV owners. In addition, they will allow DNSPs to curtail PV exports when they deem it necessary.

The DOE model will therefore provide DNSPs with the means to curtail some or all PV exports. This functionality is expected to be in place for all DNSPs by 2024[4].

[1] AS4777.2:2020

[2] Curtailment and Network Voltage Analysis Study (CANVAS), Succinct report 2021, RACE 2030
Voltage Analysis of the Low Voltage Distribution Network in the Australian National Energy Market: A report prepared for the Energy Security Board (ESB). 2020.
Fair consumer outcomes in the balance: Data driven analysis of distributed PV curtailment. Renew Energy 2021

[3] Dynamic Operating Envelopes Working Group Outcomes Report, ARENA March 2022

[4] Either in trial, partial offering or offered to all customers.

3 How to measure export curtailment

The following chapter considers how to measure export curtailment.

It is strongly recommended that all three areas of data collection and reporting are undertaken in parallel to avoid the creation of adverse incentives on the DNSPs. For example; the capture and reporting of static export limits without voltage reporting could lead to worsening voltage outcomes for all consumers. The potential for these adverse outcomes would be increased were some of these measures includes in some sort of incentive framework and some not.

3.1 Static Export limits

The measurement of static export limits is relatively straight forward. DNSPs already make connection offers to new PV installations and keep records of these offers to ensure that customers remain within their connection agreements.

It is recommended that annual data is collected from DNSPs that captures:

- Total number of export connection applications
- Average size (kW) of the export connection request
- Average size (kW) of the final connection agreement.

This data could be further categorised into the current reliability zones (CBD, Urban, Rural-long and Rural-short). This would support an improved understanding of impacts on different customer groups as well as recognition of different DNSP topologies.

3.2 Voltage curtailment

As noted above, voltage can reduce the export from a customer's PV system. Voltage also impacts the overall consumption from consumer appliances, greenhouse gases and the life of consumer appliances[5].

As such, voltage is a key metric in terms of the overall quality of the electricity service, not just exports.

With the increasing provision of smart meters in the NEM it is recommended that the AER develop a model for collecting and reporting voltage data. While DNSPs do not have complete access to voltage data today, the level of access is rapidly increasing as more CER/DER devices are installed in consumer homes.

Recommended annual voltage data collection would include:

- 10m average data (count) for all voltages between 207V and 260V – i.e. 53 boxes
- Count of active smart meters in period (that the DNSP had voltage access to)
- Based on this data:
    - Reporting of average voltages
    - Reporting of percentage exceedances (below 216V and above 253)
    - Trend in average voltages

[5] https://engage.vic.gov.au/download/document/27023

- Consideration should also be given to a means for estimating the export curtailment (customer losses) based on this voltage data.

This data could be further categorised into the current reliability zones (CBD, Urban, Rural-long and Rural-short)

While Victorian smart meters are capable of providing this data today, other states and territories will need to build their reporting capabilities over time.

3.3 Dynamic Export Limits

While dynamic operating envelopes offer the potential for a significant improvement to overall export levels, they will also require regulatory oversight to ensure efficient, fair and equitable outcomes for consumers.

Recommended annual (or monthly) DOE export limit data collection includes:

- Count of customers on DOEs
- Average export upper limit (kW)
- Average time that upper limit was not available (Hrs)
- Potential exports curtailed by DOE (kWh)
- Potential exports curtailed by DOE (kWh) due to accepted exclusions (i.e. AEMO or TNSP directive)

This data could be further categorised into the current reliability zones (CBD, Urban, Rural-long and Rural-short)