Low-voltage Network Visibility

Summary of neighbourhood battery trials

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1 Introduction

In 2023 the Energy Security Board (ESB) Data Strategy tasked the AER to improve third party access to network data through the Low-voltage Network Visibility project.[1] Improved access to network data supports investors, planners and policy makers to make informed decisions for the connection of Consumer Energy Resources (CER) to distribution networks. Empowering non-network parties to provide services within distribution networks may help to improve network efficiency, ultimately reducing costs that are passed through to consumers. Though some distribution networks themselves have reduced visibility of parts of their low-voltage network, where data is available there is limited inherent incentive for them to freely share this with interested third parties.

The Low-voltage Network Visibility project is being undertaken in three phases:

- **Phase 1** defined the network data that is required by stakeholders making CER planning decisions.
- **Phase 2** (this report) tests the challenges and value in delivering the data sets identified in Phase 1 through a range of real-world trials.
- **Phase 3** will propose a pathway for ongoing delivery of priority datasets to the market, informed by the trials and considering the varied opportunities and challenges for different networks.

Phase 1 was completed in July of 2023, and its outcomes are available on the AER website.[2] This report is on the outcomes of the data trials undertaken during phase 2. A final recommended pathway for improved low-voltage network visibility will be published under phase 3.

1.1 The Neighbourhood Battery Initiative (Victoria)

Phase 2 involved a trial to provide data to support the Victorian Neighbourhood Battery Initiative (NBI). The NBI is administered by the Victorian Department of Energy, Environment and Climate Action (DEECA) and seeks to support the deployment of 100 neighbourhood batteries across urban and regional Victoria. Neighbourhood batteries were selected for the trials as they are one of the more challenging forms of CER to install on distribution networks, as they both import and export energy and operate at low-voltage network locations. Victorian Distribution Network Service Providers (DNSPs) are suitable participants in the data trials due to their access to data from their high degree of smart meter penetration.

A neighbourhood battery, sometimes referred to as a community battery, is a mid-scale battery installed on a low voltage line of a distribution network. Neighbourhood batteries are typically larger than household solar batteries but smaller than utility scale batteries.
The location of a neighbourhood battery can have material impacts on the operations and realisable benefits of the battery project. While many of the battery benefits can be realised through energy markets and customer involvement, the local network conditions can act to

[1] Energy Security Board, *Data Strategy*

[2] Australian Energy Regulator, *Network Visibility*

limit operations (and income) or provide an additional stream of income for the project where the battery relieves network constraints.

1.2 Accessing DNSP data

The National Electricity Rules currently require DNSPs to release some data for public access. This includes through:

- Regulatory Information Notices (RINs) that are submitted to, and subsequently published by, the AER.[3]
- Distribution Annual Planning Reports (DAPRs) published by DNSPs.

A number of DNSPs implement online data portals that allow their network data to be visualised geographically. In Victoria, these portals include:

- AusNet Services' Gridview portal[4]
- CitiPower and Powercor's network visualisation portal[5]
- Jemena's DAPR mapping portal[6]
- United Energy's network visualisation portal.[7]

Interested parties may submit requests to DNSPs for data that isn't publicly available. DNSPs may choose not to provide information that they consider to be difficult to produce, or that would violate customer privacy.

Some information, such as whether a proposed new connection is able to be made, is available to external parties only after submitting a connection application and paying associated fees to cover assessment costs by DNSPs.

In addition, CitiPower, Powercor and United Energy have begun using the Piclo Flex platform.[8] Piclo Flex is an online marketplace that identifies and advertises those parts of the network that are subject to certain network constraints, what the value of alleviating the constraint is and the forecast period over which the constraint could be managed through the provision of third-party based non-wire alternatives and facilitates non-network parties to bid to remove those constraints.

In the data trials, NBI participants primarily accessed DNSP data through data portals, data requests and connection applications.

[3] Australian Energy Regulator, *Regulatory Information Notices*

[4] AusNet Services, *Gridview Portal*

[5] Citipower and Powercor, *Network Visualisation Portal*

[6] Jemena, *DAPR Mapping Portal*

[7] United Energy, *Network Visualisation Portal*

[8] Piclo, *Piclo Flex Australia*

1.3 Data trials participants

The data trials were undertaken in consultation with 4 NBI participants and 5 DNSPs, as outlined in Table 1. In general, this paper does not seek to attribute views to any single participant.

Table 1 Data trials participants

NBI participants	• Indigo Power • Merri-bek City Council • Yarra Energy Foundation • Boom Power
Victorian DNSPs	• AusNet Services • CitiPower • Jemena • Powercor • United Energy
Other	• Australian Energy Regulator • Victorian Department of Energy, Environment and Climate Action • Cadency Consulting (technical advisor)

2 Summary of data trials findings

The data trials found that data available to NBI participants was not suitable to meet their needs. Noting that a balance is needed between additional work by DNSPs to provide data visibility and the extent of costs that are ultimately passed on to consumers, the key issues and outcomes identified through the data trials are:

Issue 1: Detailed DNSP data at the distribution feeder level was not consistently available to NBI participants without the submission of a connection application. This limited the participants ability to make low-cost assessments of suitable installation sites. While this data is available within DNSPs, DNSPs reported that there is significant time and cost associated with making it suitable for public viewing. Without sufficient data it is difficult for non-network businesses to compete with DNSPs in installing CER such as neighbourhood batteries.

Outcome 1: Wider access to more detailed DNSP data is likely to enable additional competition for the installation of CER by non-network parties and therefore be beneficial to consumers in the long run. The suitability of networks providing this data at no cost to the applicant (i.e. as a Standard Control Service) is to be investigated in phase 3.

Issue 2: NBI participants reported cost uncertainty for network connection and augmentation. Connection applications to confirm available network capacity may cost applicants thousands of dollars, and network augmentation and site installation costs may cost tens of thousands of dollars or more. The process for determining network engineering assessment and connection costs was not clear to applicants.

Outcome 2: Phase 3 of the project will consider whether better visibility of network application, connection and augmentation cost data should be provided by DNSPs.

Issue 3: Lack of up-to-date data increased the likelihood of unsuccessful connection applications. Annual data provided by DNSPs may be out of date by the time NBI connection applications are submitted to DNSPs. This can lead to applications at NBI participants expense which may not be successful.

Outcome 3: Phase 3 of the project will consider providing up-to-date data to applicants at-cost (i.e. as an Alternative Control Service). The appropriate balance of the currency of data against network costs must be considered. As discussed in the Network Visibility phase 1 report, continual up to date data that is funded by all consumers through a Standard Control Service may not be of value to consumers.

Issue 4: Data provided by DNSPs required detailed technical assessments by NBI participants to determine site suitability, requiring substantial expertise and leading to significant time and cost.

Outcome 4: No action proposed. When data is released, third party platforms or services may be developed that assist NBI and other CER providers in rapidly assessing connection locations.

Issue 5: Data platforms are not always user friendly. Some DNSP platforms were difficult for users to navigate. Early versions of some DNSP platforms required repeated permissioned sign-ups.

Outcome 5: DNSPs generally responded well to feedback and have resolved, or are working to resolve, known issues. The AER will continue to monitor feedback from users on the usability of DNSP platforms as they are developed. Usability should be a core principle of network data platforms.

Issue 6: Privacy requirements of customers limit the level of detail able to be released in data. DNSPs typically did not release data if release of that data breached the privacy of any individual customer, or if the data related to fewer than 10 customers.

Outcome 6: DNSPs identification of customer privacy as a priority is appropriate. Data should not be released if it violates customer privacy. However, whether 10 customers is the appropriate threshold for data privacy will be considered in phase 3 of the project.

Issue 7: Network Visibility recommendations must address continually changing circumstances for DNSPs and NBI participants. Business models for neighbourhood batteries are still being developed, and data needs to suit these business models may change in the future. Concurrently, DNSPs continue to undertake activities that improve the ready availability of their data. DNSP data platform quality visibly improved over the course of the trials, although overall process for NBI participants to access DNSP data remained insufficient for NBI participant needs. As DNSPs develop capabilities to provide dynamic export and import limits[9] as options for customers, the likelihood of significant static connection limits imposed by DNSPs will decrease.

Outcome 7: Uncertainties from evolving business models, consumer technology and network technology will be considered in the recommendations of phase 3 of the Network Visibility project. DNSPs may need to be required to release data publicly as it becomes cost-effective in the future.

Issue 8: Actions to mitigate network augmentation were not viewed as profitable by NBI participants. NBI participants primarily saw potential for cost-effective investment by trading wholesale electricity. Some participants considered that the resolution of network constraints should be driven by the need to deliver benefits to the community, rather than for financial gain.

Outcome 8: No immediate action is proposed. Platforms that allow non-network parties to identify and bid to provide network support services are in early stages of use and their utility should be assessed over a longer period of time. Technology and business models may evolve in the future to improve profitability.

[9] Dynamic export and import limits are often referred to as “Dynamic Operating Envelopes”.

3 Data trials meetings

The AER oversaw the data trials through three working group meetings with data trials participants in 2024. Each meeting had a targeted focus:

- **Meeting 1:** Focused on getting agreement on the approach to data trials and discussed data requirements of NBI participants.
- **Meeting 2:** Provided DNSPs with an opportunity to present on the availability of network data for NBI participants.
- **Meeting 3:** Provided NBI participants with an opportunity to discuss their experiences of using network data.

Working group members met on a fourth occasion to comment on this summary report. Specific outcomes of that meeting are not documented in this report.

3.1 Working group meeting 1 - Data needs of NBI participants

The first data trials workshop identified the datasets to be requested from DNSPs by NBI participants. The importance of identifying optimal battery locations was highlighted by the NBI participants, and a set of key information points were identified that would aid in selecting more optimal sites for battery locations. NBI participants generally agreed on 7 key areas where network visibility would enhance their ability to identify, analyse and select NBI locations:

1. Spatial mapping
    a) A low-voltage network map graphically showing Distribution Substations, low-voltage feeders, and service lines
    b) Low-voltage network configuration – Low-voltage switches and fuses with Open or Closed status
2. Substation capacities
3. Conductor/Cable ratings
4. Number of customers - solar/non-solar/business
5. Solar generation – capacity (kW) and exports (kWh)
6. Network constraint identification – Max, avg and min demand curves
7. Voltage data - Voltage curve at the Distribution Substation terminals and/or customer voltage summary

These datasets included some additions to the datasets proposed in phase 1 of the network visibility project.

Table 2 Datasets proposed in phase 1 of the network visibility project

Data category	Item	Details
Import capability	Current and forecast remaining electricity delivery capability	kW or kVA by season for High-voltage (HV) feeder and distribution substation
	Network augmentation plans	kW or kVA by feeder and distribution substation
	Indicative annual deferral value	$/kW or $/kVA by HV feeder and distribution substation
Export capability	Current and forecast remaining electricity export capability	kW static limit for export Export capability by season and time of day
	Network augmentation plans	kW or kVA by feeder and distribution substation
	Indicative annual deferral value	$/kW or $/kVA by HV feeder and distribution substation
	Curtailment[10]	kW reduction in inverter capacity by duration of curtailment by network element, season, time of day and reason
Network connection	Voltage levels	Historic average voltage by distribution substation and HV feeder
	Historic reliability	Historic SAIFI and SAIDI by distribution substation and HV feeder
Network operation	Real-time outage information	• Cause • Location and DNSP assets affected • Number of customers affected • Estimated time for restoration • Planned/unplanned

3.2 Working group meeting 2 - DNSP responses to data requests

In workshop 2 the Victorian DNSPs were given an opportunity to lead a discussion on their perspective of providing the data identified in workshop 1. Points of discussion included:

- In general, the provision of the NBI data was considered reasonably accessible by DNSPs, although not all of this data was accessible via a portal at the time.
- Spatial mapping, substation capacities, conductor ratings and customer composition were generally considered to be accessible by DNSPs (subject to privacy and security obligations).
- Demand curves and constraint profiles were considered to require more effort to collect and share, but were generally available.

[10] Curtailment data is sourced from original equipment manufacturers rather than network businesses and is therefore not a focus of the data trials.

- Voltage data was available, but the process to aggregate the voltage data was identified by all DNSPs as being time consuming.
- Privacy of individual consumer information was identified as a priority. Data that describes a cohort of less than 10 customers was considered the lower limit for sharing. Obtaining consent from customers was an option for overcoming this limitation, although this was considered to be expensive and time consuming.
- Security and accuracy of data were identified by the DNSPs as being areas that required consideration.
- DNSPs are progressing the delivery of information platforms that will improve identification and delivery of network support services. These platforms are not available today and much of this process currently requires manual intervention.
- DNSPs discussed issues of data accuracy. The low voltage parts of the networks are highly configurable and therefore subject to change. Annual reporting of data may provide an inaccurate representation of the current network state.
- NBI participants noted the need for longer contract terms to provide surety of returns and support capital raising. This was at odds with many of the current network support contracts as well as the flexible nature of the low voltage network.
- The costs of NBI connections were discussed. There can be a high variability in the connection costs, especially if augmentation is required.
- One DNSP noted their discussions with UK firm Piclo around the Picloflex platform that enables non-network parties to identify and bid to provide network support services at both the high- and low-voltage level.

3.3 Working group meeting 3 - Participant experiences

In workshop 3 NBI participants provided an outline of their experiences in working with the data provided from DNSPs. Network businesses responded to the NBI participants data requests to varying degrees. In some cases, the data was readily available and provided to the NBI participants directly. However, in many cases, the data was not able to be provided, or else not provided in a timely fashion.

The NBI participants noted that where data was available in electronic format, it was generally valuable. Geospatial data (i.e. network visibility maps) provided information in a format that was generally useful. Despite the advances that Victorian DNSPs have made in network visibility products, the underlying datasets generally did not allow NBI participants to understand likely allowed connection capacity or conditions of connection. There are a number of reasons that requested data was not able to provided, including;

- The data was not available in the format requested.
- Privacy of customer data meant that the data was withheld.
- The volume of data requested was too large for the DNSP manual processes.
- The cost to the NBI proponent for the data exceeded the value of the data.

Other points raised during discussions were:

- NBI participants generally have a preference for actionable information on network import and export capacities, rather than raw data which they have to interpret themselves.
- The criteria for assessing network connection capacities were not clear to NBI participants. The process appears as a “black box” where available capacity can’t be known without submitting a connection application to the DNSP.
- DNSP offers for connection typically require acceptance within 30 days, which may present challenges for NBIs making assessments of project viability. DNSPs note that providing a longer period for acceptance would require that network capacity to be reserved (and not offered to another customer) for that period of time.
- NBI participants without access to network information may need to submit numerous applications that they do not follow through with. This has cost implications for the NBIs and resource implications for DNSPs.
- NBI participants did not express opposition to time-based export and import limits. Tariff-based incentives and direct network capabilities for reducing asset demand were both discussed. There does not appear to be an agreed upon method of imposing time-based limits in the short term. In the longer term dynamic operating envelopes (DOEs) may play a role.
- NBI business models are still being developed. One NBI proponent noted that their business models are not likely to prioritise solving network constraints, although these may eventuate in the future. Conversely, another NBI proponent noted that they were less focussed on commercial outcomes and are more interested in solving network constraints.

4 Next steps – Phase 3

We will build on the findings documented in this report to develop a pathway for the ongoing delivery of network visibility to the market. The phase 3 report of the low-voltage network visibility project will provide recommendations to achieve this pathway.

Glossary

Term	Definition
AER	Australian Energy Regulator
CER	Consumer Energy Resources
Curtailment	Any reduction on the capacity of an inverter to generate power. This could be caused by the inverter tripping in response to voltage disturbances or formally imposed through network static or dynamic voltage limits.
Connection agreement	An agreement between a DNSP and a customer by which the customer is connected to the distribution network and receives distribution services.
DAPR	Distribution Annual Planning Report
DNSP	Distribution Network Service Provider
Export	Electrical Energy that flows from a customer's premises to a distribution network via the connection point.
Export capacity	The maximum amount of electricity a customer's system is capable of exporting to the distribution network in accordance with the connection agreement.
HV	High-voltage
kVA	Kilovolt-ampere
kW	Kilowatt
NBI	Neighbourhood Battery Initiative, a program that seeks to support the deployment of 100 neighbourhood batteries across urban and regional Victoria.
NER	National Electricity Rules
SAIDI	System Average Interruption Duration Index, a normalised measure of the average length of time that a customer experiences network outages.
SAIFI	System Average Interruption Frequency Index, a normalised measure of the average number of network outages experienced by customers.