ENERGY SECURITY BOARD

Benefits of increased visibility of networks

Consultation paper

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List of abbreviations

AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AMI	Advanced Metering Infrastructure (Victorian smart meter rollout)
ARENA	Australian Renewable Energy Agency
AS	Australian Standard
CBA	Cost Benefit Analysis
CEC	Clean Energy Council
CER	Clean Energy Regulator
CER	Consumer Energy Resources
DAPR	Distribution annual planning report
DEIP	Distributed Energy Integration Program
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
DOE	Dynamic Operating Envelope
DRSP	Demand Response Service Providers
DxSub	Distribution substation
FEL	Flexible Export Limit
ECA	Energy Consumers Australia
ESB	Energy Security Board
FEL	Flexible Export Limits
FRMP	Financially Responsible Market Participant
HEMS	Home Energy Management System
HV	Distribution High Voltage (see Appendix 6.2)
IEEE	The Institute of Electrical and Electronics Engineers
IEEE 2030.5	IEEE Standard for Smart Energy Profile Application Protocol
IP	Internet Protocol
IRP	Integrated Resource Provider
ISC	DEIP Interoperability Steering Committee
ISP	Integrated System Plan
LAN	Local Area Network
MVFeed	Medium voltage feeder
NBN	National Broadband Network
NECF	National Energy Customer Framework
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NERO	National Energy Retail Objective
NER	National Electricity Rules
MASP	Market Ancillary Service Providers
MSGA	Market Small Generation Aggregator
OEM	Original Equipment Manufacturer

PV	Photovoltaic
SAPN	South Australia Power Networks
SRES	Small Scale Renewable Energy Scheme
SWG	Stakeholder Working Group
TNSP	Transmission Network Service Provider
VPP	Virtual Power Plant

Executive Summary

The ESB Data Strategy identified as a key priority greater access to data on the performance of low-voltage (LV) networks. Access to this data is particularly useful to decision makers seeking to optimise benefits for consumers from Consumer Energy Resources (CER), such as CER investors, planners and policy makers.

This consultation paper seeks stakeholder views on the likely value of making specific network-related data sets available to market and policy makers, making CER planning decisions and managing network-related risks.

The data sets have been identified by considering the needs of decision makers through a wide range of use cases, and a review of the network-related data sets that are currently available or likely to become available.

Context

Consumer-driven rapid growth of CER (such as roof-top solar, batteries, electric vehicles, and active demand management) is creating a range of new benefits and choices for consumers and CER investors. But at the same time, it is creating new challenges for managing the low-voltage distribution (LV) networks, where historically there has been little visibility or control.

To address this, work is continuing across the industry to improve how LV networks are monitored and managed, to ensure that networks and system operators have the capabilities they need to securely manage the system. This includes better usage data across smart meters and network assets, data direct from new customer devices and new service providers, and the development of a range of supporting modelling approaches.

However, while networks are gaining greater access to this data, decision-makers outside of the network still have limited visibility. There are few requirements on networks to release data for the low-voltage network, with Distribution Annual Planning Reports (DAPR) limited to higher levels in the network. While networks will voluntarily release some data, a lack of common definitions of what is needed makes requests diverse and costly to respond to.

As a result, these non-network decision makers have little ability to manage network risks. For example, potential CER investors considering risks to CER performance, such as export constraints and curtailments, or to capture opportunities to support the grid by improving its performance or reducing costs.

Targeted non-network decision makers are diverse, complicating their data needs, and include large parties who can impact system balance, such as aggregators and large energy users investing in demand response or who have reliability concerns; investors in medium-scale assets which can impact local capacity limits, such as community batteries and public EV charging networks; and smaller parties seeking to manage local risks like household service providers and households themselves.

To positively engage the market and promote benefits for all consumers during the ongoing rapid deployment of CER, CER investors, market service providers and CER investment planners need access to data about the grid – and particularly the LV network – and how CER will affect and be affected by conditions in it. Policymakers, researchers and regulators are also actively engaged in processes that need this input as they seek:

- to reform market arrangements to support growing CER

- an effective transition with investments in community batteries and EV charging, and the results of a wide range of technology and business mode trials
- to ensure new market arrangements and consumer protections are fit for purpose.

Objectives and Scope

ESB Data Strategy identified **Network Visibility for the Market** as one of the key workstreams to resolve priority data gaps.

Network Visibility Objective: Optimise benefits from CER and network assets for all customers by informing market and policy stakeholders making CER planning decisions and managing network-related risks.

Network Visibility Outcomes: Develop a pathway to deliver visibility of the low-voltage network to the market, including clear use cases and benefits, definitions of the data needed and appropriate arrangements for it to be delivered.

This workstream will be undertaken in three phases:

- **Phase 1:** seeks to define the data sets concerning the performance of the LV network and CER that is needed by market and policy stakeholders making CER planning decisions and managing network-related risks, through examining the needs and use cases for this data and considering related challenges in accessing it.
- **Phase 2**: will test 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 data sets to the market, informed by the trials and considering varied opportunities and challenges for different networks.

Relationship to other work and limits on Scope

The rapid take-up and use of CER have resulted in a greater need for data in decision-making to manage a safe and secure market. But more than this, to ensure CER benefits all consumers and the electricity supply system remains affordable, the ESB has identified the need for new arrangements to coordinate the growing diversity more effectively in supply and demand, such as increasing amounts of storage and PV in the system — and the potential for electric vehicles as both loads and storage. These changes will increasingly require more active data capabilities and smarter systems.

There are many processes underway, including the ESB's CER integration workstreams and related work across the agencies, ARENA, and businesses, that are considering various arrangements to support this more active coordination of high levels of CER and the data that is available to network operators. These include flexible export limits, protocols, and standards for communicating with CER systems and interoperability requirements for CER at the device level, as well as the faster deployment of smart meters. This study does not seek to duplicate or pre-empt this work. Accordingly, data sets specifically needed to support active visibility and coordination arrangements for CER and related data needed by network operators are out of the scope of this study.

While important work on these new standards and arrangements is ongoing, the focus of this study is on the LV network data that is needed for effective planning, market decisions and operations by CER investors, market service providers, policymakers, and regulators. Data identified in this study aims to contribute not only to better CER planning today but also to understanding and assessing many of the future requirements for coordinating CER (discussed above) and getting policies, planning and consumer protections right for those future data needs.

Similarly, there is a range of further use cases and data sets needed to support market and system operation and regulation. Examples of these use cases have been provided in Attachment 6.5 for completeness Exploration and resolution of these use cases are being progressed through existing data gathering arrangements, engagement with network providers and industry, and reforms that are already underway. These use cases are therefore excluded from the scope of this consultation to avoid duplication. However, some of the data sets recommended in this paper for wider market users may also contribute to meeting the needs of these use cases.

How have relevant use cases and data sets been identified

Oakley Greenwood Pty Ltd (OGW) was engaged to identify the data sets of most interest to non-network stakeholders. They convened four workshops – one each with three different categories of stakeholders – large end customers and the intermediary businesses that assist them with CER implementation and use; representatives of and advisers to small end customers regarding CER implementation and use; and planners, researchers and state and local government bodies.

The workshops were used to identify the specific questions these market stakeholders have regarding the deployment of CER and the information they need to answer those questions. The questions essentially defined the stakeholders' use cases. The workshops also identified other characteristics regarding the information the different types of stakeholders want and need regarding CER including information about the level of geographic granularity of the information and how frequently it needs to be updated to meet the needs of these stakeholders. In total, 31 people representing 25 organisations attended these workshops.

Once the use cases and the nature of the information needed by market stakeholders regarding them had been identified, OGW conducted two further workshops with organisations that hold or have access to information that could meet the needs of the market stakeholders. These workshops were attended by 25 organisations that hold data about or relevant to electricity distribution networks, including network businesses from most jurisdictions, CER and metering data providers, National Broadband Network (NBN) and AEMO.

These workshops concentrated on identifying the specific data items that could provide the information needed by different types of stakeholders to answer the questions they have regarding each of the use cases of interest to them as well as the best sources for obtaining that data.

The use cases

In total, 23 use cases were identified by the various types of market stakeholder that attended the workshops[1]:

- Customers and CER investors identified 10 use cases that dealt with information they need for planning investments in and operating CER.
- CER service providers, advisers and installers identified 3 use cases of particular interest to them around the ability to install CER devices. They also noted that the use cases of customers were

[1] Another 11 use cases were identified that support market and system operation and regulatory processes. These are summarised briefly in Attachment 6.5, but are not considered in detail here given the focus of this project on the information LV network needs of non-network stakeholders, and because other reform processes are underway to consider these use cases. However, some of the data sets recommended in this paper for wider market users may also contribute to supporting market and system operation processes.

also relevant to them as they are often asked to provide information on these matters by end-use customers.

Identifying data sets from use cases

0Analysis of these use cases and the specific questions stakeholders are concerned about revealed common needs across the use cases, such that it would only require 4 data sets to address the 10 topics of interest in the 23 use cases identified by market stakeholders.

The following table summarises the overlapping information needs identified by the various stakeholder groups that participated in the workshops.

Table 1 Topics that target audience groups want information on

Topics on which data is needed	Current and potential CER system owners and CER providers	CER providers, advisers and installers	AEMC, policy and planning bodies (including state level governments and regulators)
Current and remaining headroom for consumption	•		•
Network plans for augmenting capacity	•		•
Value of deferring/avoiding network capacity	•	•	•
Current and remaining headroom for export	•	•	•
Plans to increase CER hosting capacity	•	•	•
Value of deferring network expenditure to increase hosting capacity	•	•	•
Level of historical and current CER curtailment	•	•	•
Historical and current-voltage levels	•		•
The historical and current level of network reliability	•		•
Outage events	•		•

As shown in Figure 1 and Figure 2 below, these use cases have shown that many datasets are needed and are common across stakeholders, with four categories of data identified.

Figure 2 Summary data sets recommended for consideration

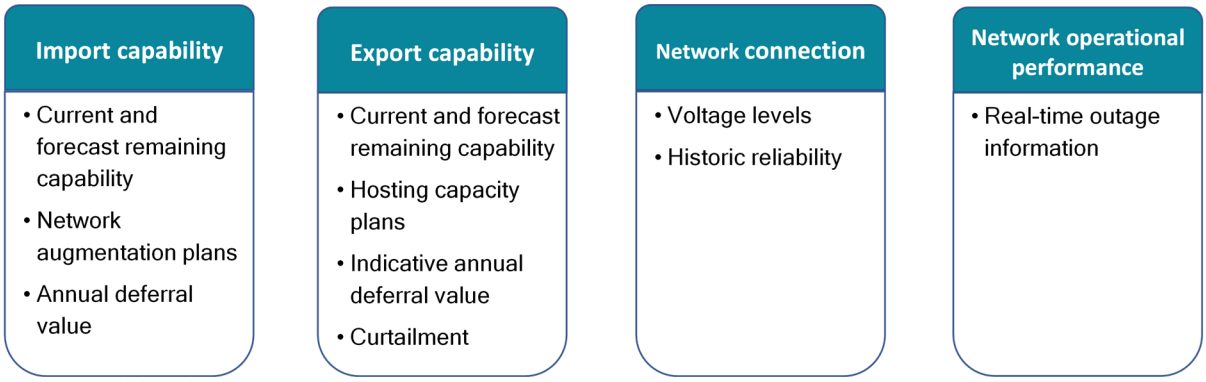
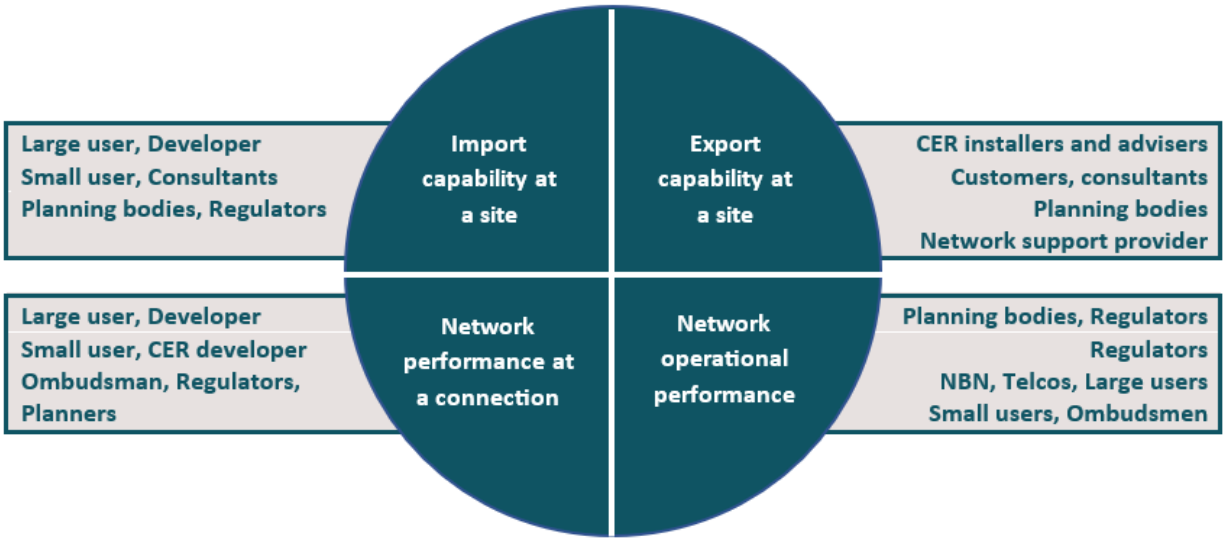


Figure 2 below shows the relative interest of different stakeholders in each of the four data sets discussed above.

Figure 2 Relative interest in the four data sets by different stakeholders



The same underlying data can often be used to meet the needs of different users with multiple use cases. However, different stakeholders may need the data provided in different forms, or at different levels of geographic and/or temporal granularity. Different stakeholder groups are also likely to have different needs and/or preferences regarding the level of pre-processing and presentation of the same information. Options for how data can be best be processed, presented and hosted for a range of users and needs will be explored further in Phases 2 and 3.

Special Cases: real-time data and curtailment

Two special cases of data of potential interest to stakeholders were identified:

- **Real-time operational data:** Market stakeholders frequently said they needed real-time data about various network operating characteristics. However, after further discussion almost all of the stakeholders agreed that it would be more accurate to say that what they actually want, in most cases, is a means for predicting likely network conditions. This requires a view of the real-time operation of the network over an appropriate timeframe (i.e., a timeframe that includes a relevant amount of history and is updated frequently to include recent operation)

that can then be used by market stakeholders to assess trends in network operating characteristics. This sort of data can also be used by research organisations as inputs in developing predictive models that can benefit DNSPs, the market operator and planners, as well as CER investors and consumers in general.

The exception was where a user has a large number of sites across several distribution areas, such as utilities like NBN or Telstra or emergency services providers. These key users need to be able to quickly process and respond to outage information across potentially thousands of sites, sometimes in emergency situations. This data does already exist and is available from electricity distribution businesses essentially in real time. But it is provided in diverse, inconsistent forms and is difficult to engage with systemically. The need in these cases is not for new data but rather more timely access to data that is already being generated by networks in a consistent format across distribution areas.

- **Curtailment**: Whereas much of the information sought on CER impacts, such as hosting capacity, can be provided by the local network, curtailment of CER export is a physical measurement of how often CER is being constrained and a much better indicator over time of limits that network export capacity may place on the benefits of CER to end users.

  Some inverters can provide information on this data item, although cannot currently be provided in all locations. Where smart meters provide voltage information (as currently in Victoria), curtailment may be estimated, but often with limited accuracy.

  Some inverters can provide information on curtailment at the device level. This information, where available, is generally held by the inverter manufacturer and generally includes information about the time and duration of curtailment and some cases, an indication of the reason for the curtailment. The amount of export curtailed is generally not available. Access to inverter OEM data – unlike network information or smart meter data – is not currently regulated or subject to the rules of the NEM. Access to this source of data would require new obligations or voluntary arrangements to be negotiated.

Considerations for selecting the data elements to be included within the data sets

In identifying the specific data elements to be included in the data sets, the following considerations were applied to minimise unnecessary costs and maximise the ability of market stakeholders to get the information they need in the near term:

1. Rely to the maximum extent possible on data/information that is already being generated or will be generated through existing or ongoing activities (non-additional costs), including the growing body of data that will be available from the increasing deployment of smart meters and CER.
   - CER continues to be rolled out rapidly through consumer choice, and all new CER installations (other than EV chargers) must be accompanied by a smart meter. Most could also provide more detailed inverter data through OEMs.
   - Smart meters continue to be rolled out throughout the NEM. Draft recommendations of the AEMC meter review propose that they be essentially universally deployed by 2030. The AEMC has also recommended that "DNSPs be given a provision to procure power quality data (voltage, current, and power factor) from MCs" at commercially determined prices. Based on this, we have assumed that smart meter data that can provide better visibility of the LV network will be available at a reasonable cost.
   - Both of these trends will increase the amount of information available over time. But it is also the case that the level of information available now will vary from area to area. For example, smart meters are almost universally deployed in Victoria, but their penetration will vary significantly by suburb in other states.

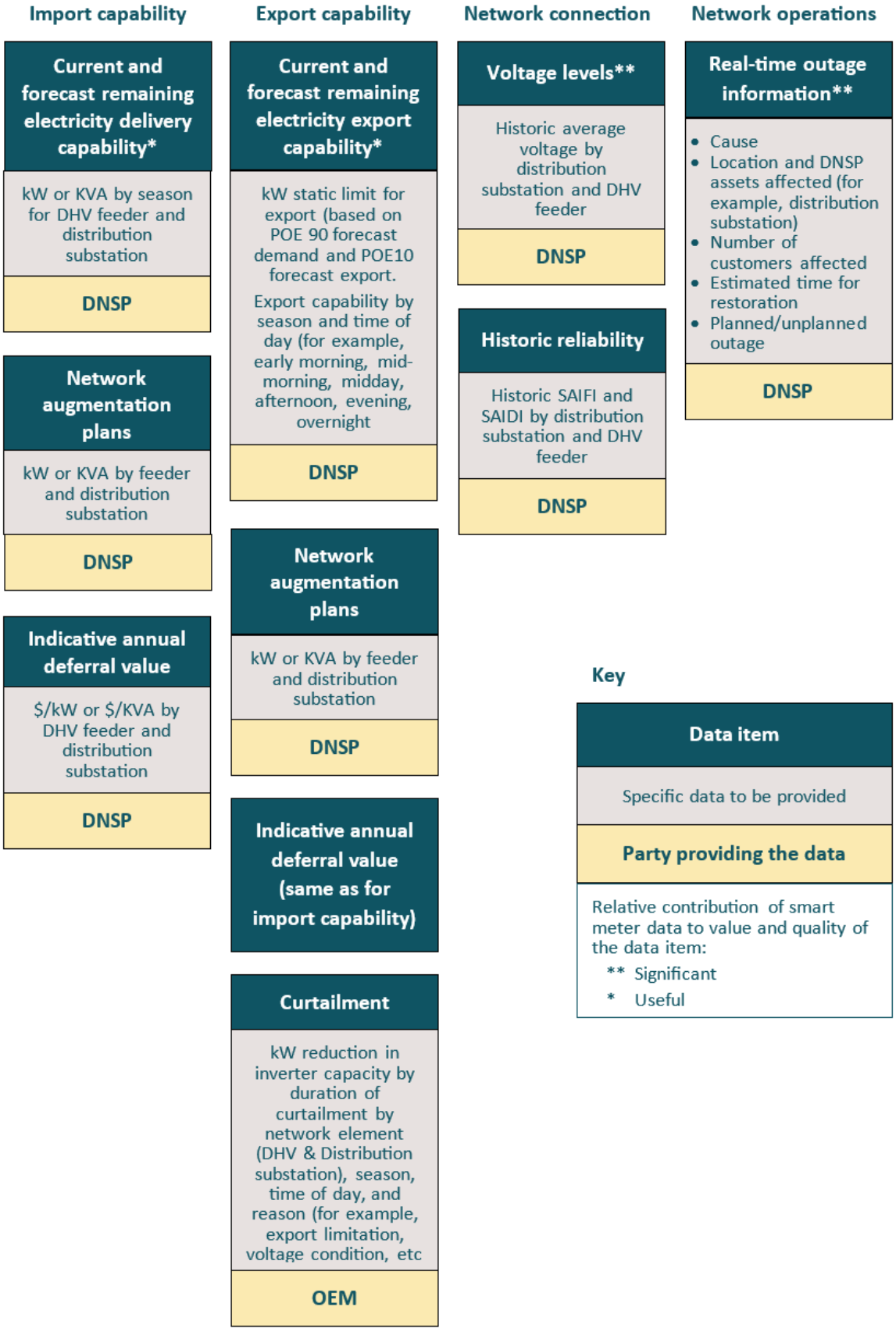
    - Concentrating on using data that is already available – and that becomes available – also minimises the cost of addressing the information needs of the various groups of potential data users.
2. Collect and store data in structured, machine-readable form, at the most granular and shortest interval data that is currently available or becomes available over time.
    - Detailed data can be aggregated at a relatively low cost to a wide range of formats appropriate to different users. It is usually most efficient for data providers to provide the data once.
3. Data does not have to have 100% coverage to provide useful information; availability at different levels of coverage can still provide value.
    - Work is currently being undertaken to identify the percentage penetration of smart meters needed to provide a suitably accurate and robust information base to address a range of questions relevant to the use cases identified in the consultation undertaken in the Phase 1 study[2].
    - All information made available to users should come with supporting information about its accuracy and robustness (metadata)
4. Consider where existing data reporting can be expanded on or improved to meet new needs.
    - For example, every DNSP is required to publish a Distribution Annual Planning Report (DAPR) every year, providing information on all infrastructure projects the network is planning at the zone substation level. It is likely that these reports are based on information or modelling at more granular geographic levels relevant to CER investment, as they are usually aggregated up from assessments undertaken at distribution substations that typically serve about 200 households. This information should be provided to assist market stakeholders but should be accompanied by the metadata mentioned above to allow the users of this information to assess its reliability and accuracy. Publication of this data would also potentially act as a spur to DNSPs to improve its quality wherever possible.
    - Similarly, it may be useful to provide this information more often in areas where CER investment is increasing rapidly.

Figure 3, below, presents, in summary form, the specific data sets that have been developed based on the input provided by the stakeholders that attended the workshops that were undertaken, and that this consultation paper is seeking further comments on. The full information is contained in Section 3, boxes 1 to 4 on pages 38 to 41.

A complete discussion of the data sets, and the specific data elements within each, is provided in Sections 3 and 4 of this Consultation Paper.

2 In verbal communication a Victorian DNSP noted that the information from a 15% penetration of smart meters is as accurate as that from 80% penetration.

Figure 3 Data sets and data items in those sets



1 Context

This consultation is for potential data sets to be further considered as part of the ESB's Data Strategy. It is part of a larger piece of work that will be prosecuted during the remainder of 2023 and into 2024.

The objective of the ESB data strategy is to:

- Manage changing data needs in the energy transition.
- Optimise the long-term interests of energy consumers in a digitalised society.

Network visibility seeks to help optimise the benefit of CER and network assets for consumers.

The objective of Phase 1 is to identify data sets needed by non-network stakeholders, to be tested in Phases 2 and 3.

1.1 Background

Digitalisation and data are critical foundations to the energy transition. Coordinating a secure and affordable energy system of diverse renewable and distributed technologies, with consumer services at the centre, is achievable — but depends on the opportunities that digital technologies and data bring.

The ESB Strategy plays a critical role, integrated with the broader energy reform program. It provides overarching consideration of the energy sector's existing and future data needs, supporting the needs of consumers, industry and policy makers in the energy transition.

1.2 Why a Data Strategy?

The Data Strategy responds to an urgent need for energy-sector data reform to enable benefits to be realised for consumers as the sector transitions.

- Data and digitalisation provide unprecedented opportunities to transform the sector into a smarter, more flexible and affordable system which is responsive to consumer needs.
- Existing regulation and capabilities have not kept pace with the digital transition. Decision-makers across the sector need better access to data — enabling improved outcomes for consumers in the form of reduced costs and fit-for-purpose customer protections. Changes are needed to enable accessing and sharing of data to support efficient decision-making.
- Emerging technologies and services increasingly depend on better use of data and digitalisation to be affordable, reliable and sustainable. Unlocking access to data is critical to improving consumer outcomes through more efficient planning, lower costs, reduced consumer risks and increased innovation.

The Strategy provides a necessary coordinated sector-wide approach that supports Post 2025 market reforms.

- Economy-wide digitalisation and national data reforms create significant opportunities for energy, and energy data capabilities are growing rapidly across the sector.
- Despite this progress, existing markets and governance are not resolving identified needs due to a range of regulatory barriers, market failures and coordination challenges.

- As the digital and energy transition continues, new technology and data needs will continue to emerge. New arrangements are needed to identify emerging gaps, risks and opportunities for customers and decision-makers. Reforms to regulatory frameworks are needed to put in place adaptive principles-based approaches that support data sharing and enable flexibility to meet changing consumer needs.

1.3 ESB Data Strategy

The ESB Data Strategy recommendations were released on 27 July 2021, along with the ESB's Post 2025 Market Design. Jurisdictions agreed to support the implementation of the Strategy on 3 December 2021.

The ESB Data Strategy objectives are to:

- Manage changing data needs in the energy transition.
- Optimise the long-term interests of energy consumers in a digitalised economy.

The Data Strategy has also agreed on New Energy Data Principles to guide and align reforms and decision-makers. These principles seek to support a paradigm shift in energy data policy, towards more open and transparent data to inform decision-makers. These principles state that frameworks governing management and use of data across the energy sector should:

- Drive outcomes consistent with the energy market objectives and the long-term interest of consumers.
- Ensure appropriate privacy and security safeguards are maintained.
- Capture the benefits of a transparent, innovative and informed digitalised energy market.
- Be fit-for-purpose, flexible and cost-effective for a digitalised market
- Be coherent with wider national reforms on data.

The Strategy has two key focuses, with a range of workstreams agreed to deliver on each:

- **Energy data access & sharing** reducing barriers to data access needed to inform policy, planning and research.
- **Priority data gaps** designing options to address priority emerging data needs for the transition.

1.3.1 Energy Data Access & Sharing workstream

- **Initial regulatory reforms**: to reduce barriers to data access for policy makers and research. These reforms allow AEMO to share data with a range of identified trusted bodies and are well progressed to be implemented before the end of 2023.
- **New Data Services**: to provide new capabilities, resources and processes needed to facilitate greater access and sharing of data. The ESB has consulted on options and proposed a new Data Service Unit within AEMO with a stakeholder advisory group. An implementation plan is being developed, aiming to support these services by the end of 2023.
- **Common Guidelines**: to streamline negotiation of data sharing agreements, including new AEMO data sharing under initial reforms, as well as sharing network data for research and consent agreements for consumer research.
- **New Energy Data Framework**: proposes a longer-term fit-for-purpose regulatory framework to support agreed Energy Data Principles and provides ongoing flexible management of emerging data needs and capabilities. This could cover wider data beyond AEMO and is proposed for future consideration after initial reforms have been implemented.

1.3.2 Priority data projects

Five initial priority data gaps to be addressed were agreed upon and focused on supporting effective planning for Consumer Energy Research (CER) and consumer protections in the energy market transition. These workstreams are all progressing being progressed over 2022-2023.

1. **EV Supply Equipment Standing Data**: to provide greater visibility of installed EV chargers to support efficient planning for and management of EV demand growth.
2. **Network visibility for the market**: to provide greater access to data on the performance of low-voltage (LV) networks, particularly for decision-makers seeking to optimise benefits for consumers from Consumer Energy Resources (CER), such as CER investors, planners and policymakers. This is the subject of this consultation paper.
3. **Overvoltage impacts**: to support a more efficient assessment of network monitoring systems by developing methods to estimate the benefits of addressing over-voltage in local networks.
4. **Billing transparency**: to inform regulators and policymakers on "what consumers pay" to support better consumer protections and understanding of consumer needs in the market transition.
5. **Consumer metrics**: addressing critical gaps in understanding changing consumer needs and behaviours in the market transition through a more coordinated approach to ongoing consumer research.

1.4 Network visibility for the market

With the rapid ongoing growth of Consumer Energy Resources (CER) (such as roof-top solar, batteries, electric vehicles and active demand management), managing the changing demand-supply balance in localised low-voltage distribution networks is becoming increasingly challenging. Optimising local grids is significantly hampered by the current lack of visibility of those networks and CER performance, with limited monitoring across most of the low-voltage systems.

This could create significant risks for all consumers, as the LV grid makes up the largest proportion of the network and the largest input into electricity costs. It is critical that we optimise the benefits of CER while ensuring investment in the grid remains efficient.

Much work is underway to improve how we monitor and manage the LV network with a wide range of research collaborations and reform processes. However, most of this is focused on ensuring that networks and system operators have the capabilities they need to securely manage the system. In order to meet the ESB's goal of greater consumer benefits through the integration of CER, it's also critical that the market and wider policy and regulators can contribute to optimising CER and the existing assets in the LV network. This means providing CER investors, market service providers, policymakers and regulators with the visibility they need for effective planning and capturing opportunities for CER and supporting the grid. This is the focus of this workstream.

Network Visibility Objective: Optimise benefits from CER and network assets for all customers by informing market and policy stakeholders making CER planning decisions and managing network-related risks.

Network Visibility Outcomes: Develop a pathway to deliver network visibility to the market, including clear use cases and benefits, definitions of the data needed and appropriate arrangements for it to be delivered.

All regulated monopoly businesses face a range of transparency requirements or incentives to ensure effective market and consumer protections and efficient regulation. Electricity networks already have

many such obligations, but until now, they have not needed to cover detailed performance in the low-voltage network.

However, considering network visibility requirements in low-voltage networks creates some challenges:

- CER services and two-way network management arrangements are still emerging – many stakeholders requiring data do not have mature requirements, and many data definitions are still being explored. The lack of common data definitions already creates challenges for networks in trying to support these needs. Work is needed to define what data should be required, including consideration of how this might vary over time.
- Network data is currently limited – networks themselves often lack the data that market stakeholders seek, managing network constraints through conservative estimates. All networks are working to expand their data capabilities, but their internal needs, priorities and approaches vary. It's important that any requirements consider the implications for investment in monitoring or data systems. Any new investments should be well targeted, justified by the benefits and not impose unnecessary costs to be passed on to consumers.
- Network data currently held by different networks varies widely – so creating common definitions or requirements is challenging. Flexibility and a range of approaches may be needed, but also balanced against common approaches needed to reduce costs for data users.

To manage these challenges, the workstream will be undertaken in three phases, as shown below:

- **Phase 1**: seeks to define the data sets concerning the performance of the LV network and CER that is needed by market and policy stakeholders making CER planning decisions and managing network-related risks through examining the needs and use cases for this data and considering related challenges in accessing it.
- **Phase 2**: will test 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 data sets to the market, informed by the trials and considering varied opportunities and challenges for different networks.

Phase 1 Define use cases and data sets required	**Phase 2** Trial data sets	**Phase 3** Recommend pathway to deliver data sets
•Use cases are identified, assessed and prioritised on value to data users •Data definitions are driven by use cases •Alternative approaches are considered	•Real-weorld trials using existing data, collaborating with existing network trials/research •Test challenges in delivering the data sets using alternative approaches and considering challenges faced by different networks •Release trial data to data users as part of testing value to the market	•Informed by the trials, assess options for ongoing delivery of data •Ensure clear requirements/incentived for network to deliver •Ensure efficient pathways across networks with different existing data sets and challenges •Support clear access and visibility for users

1.5 Phase 1 objective and scope

The focus of Phase 1 is the identification and definition of the data sets concerning the performance of the LV network and CER that is needed by market and policy stakeholders making CER planning decisions and managing network-related risks through examining the needs and use cases for this data and considering related challenges in accessing it.

Relevant stakeholders include:

- End-use customers using or wanting to use CER, including households and larger users.
- CER equipment providers and installers.
- Aggregators, VPPs and other market service providers.
- Policy makers, planners and government departments and state-level regulators.

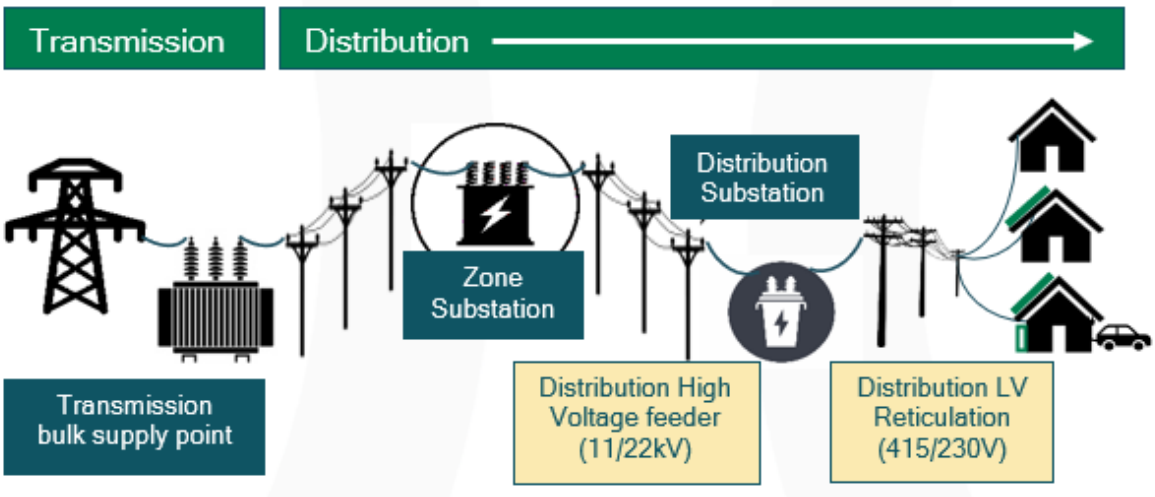
The specific objectives of Phase 1 are to:

- Identify the use cases that will define the requirements for the data.
- Develop the data sets and their definitions to meet the requirements.
- Determine what relevant data on networks can be provided today and what data is being developed, noting that:
    - The data could come from a range of sources, including data held by networks, AEMO, and meter providers.
    - Some of the data may be available today — the issue may be optimising the delivery.
- Perform a high-level assessment of the data sets, noting that:
    - Timeliness is an issue.
    - The focus is to maximise the data available to address stakeholder information needs without increasing DNSP costs.

1.5.1 The distribution network

The relevant part of the power system being considered for this project is the distribution system. Customers are connected to either the Distribution High Voltage (HV) or Distribution Low Voltage (LV) network. The focus of this work is the LV network; Figure 3 contains a simplified diagram of the distribution network and the location of the LV network within it.

Figure 4 Simplified distribution network



1.6 Approach and activities undertaken

The project, at its core, was to explore what information could be effectively provided to users at reasonable costs to assist them in their decisions and operations. Shown below:

The identified data sets will be used for phases 2 and 3 where they will be fully assessed.

1.6.1 The questions to be addressed

The questions asked at each stage of the analysis were:

1. What users require data?
2. What do they require the data for (the Use Case)?
3. What specific data is required to satisfy the use case, which required consideration of:
    - What is the detailed data (specification)?
    - Who is best placed to provider it (the provider)?
    - How is it best accessed (how should it be hosted)?
    - What are the benefits of providing the data?
    - What is the likely relative cost, including practical difficulty, of providing the data?
4. What combinations of data and hosts are recommended as being of net benefit?

1.6.2 Development of use cases

Questions one and two were addressed by:

- Identifying and grouping potential stakeholders. The stakeholders were grouped based on what was expected to be common use cases. Three groups were identified and invited to workshops:
    - Larger enterprises including property developers, electricity retailers focussed on larger customers, grid-side battery owners/operators, large end users (including EV charging facility operators) and businesses with multiple sites in diverse locations (e.g., NBN, Telstra, Ampol)
    - Smaller enterprises (and enterprises that focus on smaller CER users) including equipment providers, VPPs, and electricity retailers focussed on smaller customers
    - Research organisations & state and local government/planning bodies
- Developing use cases. This we achieved by:
    - Developing a starter set of use cases. This was done by Oakley Greenwood, assisted by the DSSC.
    - Adding and refining the use cases during workshops conducted with each of the stakeholder groups. The workshops were tailored for each group of stakeholders, but all of the use cases were distributed to each of the stakeholders regardless of group.
    - The agenda of each workshop was tailored to ensure a primary focus on those use cases expected to be of interest to the stakeholder group in question. Time was left in each stakeholder meeting to ensure all relevant use cases on the list – and any others identified by the stakeholders – were discussed and included.
    - In total, 30 organisations participated in the three workshops convened with these groups. The organisations that participated are listed in Appendix 6.3.

    - Requesting further feedback from the stakeholders after the workshops
- The final set of 23 use cases was then prepared. It is attached as Appendix 6.4.

1.6.3 Identifying the data

Question three was explored by consulting with various types of organisations that can provide information about networks such as AEMO and the DNSPs themselves.

Again, Oakley Greenwood established an initial data set and worksheet in conjunction with the DSSC and the data set was expanded and refined in two workshops with the data providers. These workshops focused on the identified data needs of users, as evidenced by the use cases, and developed the data requirements to meet those needs in terms of:

- The characteristics of the data:
    - The timeframe of the data. For example, historical data, a current snapshot, a quick forecast or a full forecast.
    - Granularity. How small a region or location should be covered by the data, for example, a feeder or a locality.
    - Frequency. Should it be provided in near real-time, on a daily basis or in some other time frame?
- Who should provide it? It was noted that a range of parties held data that could be of use:
    - AEMO collects data needed to operate the power system securely and reliably, including a range of relevant data such as meter data and the DER Register
    - DNSPs have and collect data for their operations.
    - Other parties, such as meter and equipment providers, collect data that could be of use to stakeholders.
- How it should be made available? For example:
    - Should there be a portal or specific ways to access the information?
    - Should it be an automated feed of information?
    - How tailored should the information be?

While ideas were generated about how the data should be made available, these alternatives were only for noting. No decisions on how the data should be presented were meant to be made in this part of the Network Visibility project. Rather, they will be further considered and potentially trialled in Phases two and/or three.

Twenty-four organisations attended the two workshops. The intent of these workshops was that the participants would attend both days to allow the data to be refined as the process proceeded.

1.6.4 Defining the data sets

The actual data sets that were to be recommended for further use in Phases two and three of the project were then defined. The Oakley Greenwood team, with the support of DSSC members:

- Established a draft of the key data sets for consultation with potential providers of the data of interest to stakeholders.
- Developed a set of criteria to assess those sets.
- Conducted workshops with organisations that can provide data to explore the availability and available temporal and geographic granularity of the data of interest to stakeholders.
- Undertook a qualitative assessment of the data sets.

Note that the project did not involve a cost-benefit analysis as the data sets will be further developed and tested in Phases 2 and 3.

2 Use Cases

2.1 Process used and stakeholder groups involved

As shown in Figure 2 above, the key step was to create a set of user/use case combinations identifying which types of stakeholders require data and the specific types of data they require.

Use cases identified

In total, 23 use cases were identified by the various stakeholders that attended the workshops:

- Customers and CER investors identified 10 use cases that dealt with the information they need for planning investments in and operating CER.
- CER service providers, advisers and installers identified 3 use cases of particular interest to them around planning and operating CER. They also noted that the use cases of customers were also relevant to them as they are often asked to provide information on these matters by end-use customers.
- AEMC, policy and planning bodies (including state-level government and regulators) identified three further use cases that reflected the information needed in their planning and review functions.

Participants in the workshops noted that the use cases were not specific to an organisation or defined user. A single organisation or user may be interested in several use cases, each a facet of organisational activity. The use cases that are identified for a specific user or organisation type should therefore be considered descriptive rather than definitive.

The list of these use cases is attached as Appendix 6.4.

It was noted during the workshops that the level of detail required for establishing and altering connections was not relevant to this work. These data elements were not discussed further.

Other processes underway

Another 11 use cases were identified to support market and system operation and regulatory processes but are not further considered in this report given:

- The focus of this project is on the information needs of market stakeholders
- Other reform processes are already underway to address these data requirements. These use cases are provided in Appendix 6.5.

Form of the data

During the workshops, data users noted that the detail and form of the data were important and could vary by user. For example:

- Presentation and detail: While many use cases related to site data for planning purposes, end-use customers may want a simplified, easy-to-follow presentation, while advisers and large users would want more detail (as well as the relevant metadata) so that the information can be better contextualised and understood.
- Machine-readable, structured data: Most users are looking to have the relevant data available in a form that can be readily used and at a location that can be easily accessed. It was noted that DNSPs are increasingly making their data available via websites and downloadable in standard formats. Similarly, stakeholders suggested that the data should be available in standardised formats, user-selectable time frames and at a variety of locational granularity.

The form of the data and how best it should be provided to the data users will be addressed in more detail in Phases 2 and 3.

2.2 Examples of the analysis of use cases

All of the use cases are presented in Appendix 6.4. This section provides an expanded discussion of three use cases as examples of the components and the differences that different users of network data are likely to want/need in terms of the types, granularity, timeframe and presentation of network data.

A homeowner thinking about installing CER

Questions	Source of useful information	Timeframe	Geographic granularity	Presentation
How big a PV system should I install?	Tariffs - Current & expected changes (TSS) Feed-in Tariffs available Load profile – Interval metering or questionnaire	Now and forecast Current and expected lifestyle changes	DNSP and solar radiation zone	Simple payback on conservative assumptions with different objectives: • Maximise self-use • Maximise export
Would a battery be a good idea?	Same as above	Same as above	Same as above	Same as above
How likely is it export from my CER will be curtailed?	Historical information on curtailment from network Current and forecast number and capacity of PV Remaining export capability and planned expansions	Now and forecast	Distribution transformer	Simple/graphic – e.g., traffic lights depicting the degree of curtailment to be expected for an average-size system in that area

An owner/occupant of a commercial building

Questions	Source of useful information	Timeframe	Geographic granularity	Presentation
Cost of getting supply to my site (and/or alternative sites)	Network connection charges	Now / near term	Feeder	Initial cost per MW connected
Benefits of CER	Tariffs - Current & expected changes (TSS) FiTs Remaining export capability and planned expansions	Now / Forecast (5 years)	DNSP	Tariff structure and levels

Questions	Source of useful information	Timeframe	Geographic granularity	Presentation
Value of including means to provide load flexibility	Remaining import capacity Forecast demand growth Planned capacity expansions Indicative, annual deferral value)	Now / Forecast (5 years)	Feeder / ZSS	Peak MW MW/yr MW and year $/kVA/yr

VPP operator

Questions	Source of useful information	Timeframe	Geographic granularity	Presentation
Value of CER assets in the portfolio – level of internal backup required	Curtailment history	Historical data for use in forecasts	Distribution substation or locality that can be referenced to VPP asset locations	% curtailment • Curtailment profile
Constraints on the operation of the VPP, primarily exports. Note that this has been identified as an issue during the VPP trials	Remaining export capacity Voltage levels in the network	Historical data for use in forecasts	Distribution substation or locality that can be referenced to VPP asset locations	kVA remaining in a dispatch profile (5 mins) Voltage profiles at Distribution Substations
Value of network support services as an alternative to WDRM	Indicative value of network deferral	Near term forecast	Distribution substation	$/kVA.

Question for stakeholders

1. Is the set of use cases in Appendix 6.4 representative of the use cases that you are aware of?
2. What additional use cases should be added?

3 Data Sets

3.1 Current and potential sources of data

The data provider organisations and individuals that attended the workshops represented the range of potential data sources relevant to this project. This included:

- Distribution Network Service Providers (DNSPs). A key focus of network data provision is the range of current and potential types of data that is held by or available to and could be supplied by DNSPs. The data a network needs to manage its own network and its interaction with connected parties can be useful in virtually all of the use cases of interest to each of the stakeholder groups. Key pieces of data that are already published by DNSPs include:
    - Tariffs, which should indicate the relevant cost impacts of the deployment and use of CER (cost-reflective pricing)
    - Distribution annual planning reports on an annual basis
    - Connection information for CER users

- Smart meters also provide good data at the connection point. To the extent that smart meters are rolled out in the NEM, the availability of data at this level of granularity will improve.
- Equipment providers (OEMs). Equipment providers already provide a range of information to their customers. They also collect a lot of information to assist them in meeting their customers' needs. This information could be useful to other parties and, in many cases, is already available. This data includes a range of site information, but particularly:
    - On-site generation data
    - Status and information about storage
    - Curtailment of exports from a site (by cause of curtailment)
    - Site voltage.

- Market bodies. AEMO and the AER, and to a lesser extent the AEMC, collect data as part of their market functions (hence having data use cases). Much of their data is provided to market participants and the public in performing their functions. For example:
    - AEMO routinely publishes:
        - Market data on a real-time basis and a historic basis
        - An annual Statement of Opportunities, which may be updated mid-year
        - The Integrated System Plan (ISP) draws together a wealth of forecast information about CER and the generation sector.
    - The AER gathers data for its work and publishes reports on events and selected network statistics.
    - The data from AEMC reviews and from the Reliability Panel is sometimes, but not always, published.

Much of this data, subject to Rule and privacy constraints, could be of use to stakeholders if hosted correctly and in usable forms.

- **Data users**: Some data users gather large amounts of data for their own use that may be of interest to others, for example:
- **Telecom providers:** require data for their sites which may be of use to other parties. For example, NBN is negotiating access to network outage data that could be disseminated to others
- **Researchers**: in NEM operations gather data for their research.

3.2 Framing parameters for defining the data sets

The workbook provided to the data providers in advance of the workshop refocused the use cases defined by the data users to allow it to be drilled down to the level of the data that was needed. The key characteristics were:

- When is the data used? The use cases focused on three timeframes:
    - Before a connection is made: This planning information is required by many stakeholders, including end-use customers and advisors, to assist in making locational and equipment decisions.
    - During operations at a site: Information on network and site operations could be used by many types of stakeholders to make efficient operational decisions and to regulate activity.

During the workshop, this aspect was simplified to the nature of the information, for example, planning information and operational information.

- What is the data for? For example, information on curtailments is useful for network and system planning as well as customer decisions on equipment sizing. The question(s) that each data item would be used for was explored.
- Who would use it? This aspect links back to the use cases, noting that many users have similar requirements.
- What is the data? This section elicited the exact data elements that were required to inform the user. For example, the number of curtailments that have occurred or are to be expected due to network voltage excursions is something many stakeholders want.
- How often would it need to be updated? This is a key factor for the cost of data provision. Much of the information required by users is routinely collected but only updated to meet specific obligations or needs. Making data available more often may be relatively inexpensive if it corresponds to the timeframes in which it is already being gathered.
- How granular does the information need to be? For example, some information, such as voltage, could be available at the device level (from OEMs), at the connection point (from smart meters) or at distribution substations. Depending on the stakeholder and use case, each of these may be useful at this level or aggregated up to postcode or DNSP district for, say regulatory purposes.

During the workshops, it was noted that different potential data providers may have the same data but at different granularity. As noted in the previous paragraph, an OEM can supply data at the device level while the network (through the use of smart meters) can supply similar but not identical data at the connection point. The use of the data would determine the best source of the data.

- Data timeframe. This characteristic relates to how often a particular data element is recorded. For example, data usage at a house with a smart meter may be recorded at 5-minute intervals but retrieved by the Meter Data Provider only on a daily basis. In addition, it may only be used weekly (summed up) for settlement. This means that this factor has two parts:
    - How finely is it measured?
    - How is it aggregated over time for different uses?

This is, of course, related to how often it needs to be updated for provision to users. For example, site loads could be measured every 5 minutes, uploaded to a data store every day and then published weekly for settlements.

- Source: As alluded to above, the best source for data may be an OEM, a meter data provider or a network. During the course of the workshop, this aspect was refined into two parts:

- The source of the data (Source): The party that can most easily gather the primary data. In many cases, the source will be the OEM for CER, while the DNSP will be the best source for site or network data.
- The location where users would access the data (the Host). While the OEM may be best placed to gather the primary data, it would be inconvenient for many stakeholders to access it from a range of these third parties. Where the data is used by another party, for example, AEMO or a network, it may be more convenient for data users to access it from that party.

In some jurisdictions, data is made available via a portal where data owners upload their data to an independent provider, who makes the data available to users. The AER's Energy Made Easy website is an example.

This distinction means that later stages of the Network Visibility for the Market workstream will need to examine hosting options. This is outside the scope of this project, but it is worth noting that all hosting decisions will need to consider:

- The cost of aggregating the data for use, as well as collecting the primary data
- The cost of structuring the data for use, which could include multiple access options.
- Metadata. All data has specific characteristics that are important for some uses and need to be reported. For example:
  - Data quality is important for many use cases and is comprised of accuracy and reliability. Energy use data can be gathered by a number of meters: at the inverter, at the connection point meter or by add-ons to the meter.

Each of these has a level of accuracy that is relevant for specific purposes:

- Only connection point meter data is considered accurate enough for settlements
- Inverter or meter add-ons can be used to provide data for households and others on the usage on site.

Reliability may also vary, for example, data gathered by user telecom systems (and Wi-Fi) is less reliable than that from Meter Data Providers.

3.3 Process used to abstract data requirements from use cases

The output of all the workshops was then examined to determine factors to be considered in the high-level assessment of the data sets.

A focused group of OGW staff and some key resources from the DSSC worked through the information that had come out of the data provider workshops. The group focused on:

- What are the detailed characteristics of the data?
- What information is available now, i.e., information that is already collected or available?
- How can the provision be improved? Given the use cases and requirements identified, what changes to the way the data is provided could be made?
- What are the factors that govern:
  - Better provision of the data
  - How difficult or costly it would be to improve the provision of the data?
- How would the data be practically used? For example, data on-site curtailments would only be of interest to an actual user (or a VPP manager) in real-time, but that data is already available to the

site owner. The curtailment data, in detail, would be of interest to the DNSP in planning its network and, more generally, to others for planning and regulatory purposes.

- How is it best provided? During the data provider workshops, it became apparent that granular data from inverters is best available from OEMs. The data is already collected and stored. Detailed information on network loadings, however, is best available from DNSPs but may not be available to the accuracy required until smart meters or equivalent monitoring is in place.
- How would it be hosted? As noted above in section 3.2, in many cases, a more centralised provision than the actual source of the data would be preferable. While the detailed hosting arrangements are not part of this project, it was assumed for the assessment, that the data would be hosted at the DNSP level.

3.4 Data sets defined

Analysis of use cases

The use cases demonstrated that users need data that is shaped to their use. For example:

- A small customer or small business needs simplified data tailored to their analytical capabilities. This may mean a simple visualisation, such as a traffic light display of export capability for their site and a simplified graph of the data over time.
- A more sophisticated user, a larger user or an adviser would be able to use more detailed data and may prefer to analyse it in their own systems.
- Planners and regulators would require more specific data that is tailored to their use, including all the metadata, so that they can use it for their purposes.

This is primarily an issue of presentation. The same data would need to be available to produce all these forms of data for users. Therefore, the data specification should be for the most detailed use of the data that is available and then tailored in its presentation for the needs of different users.

Sources of data

Networks manage their systems using the data available to them. In Victoria, for example, the high penetration of AMI meters allows the networks to have good visibility of their networks down to the household level. In other jurisdictions, the visibility is less, but system engineers use available measuring tools and approaches that allow them to infer the state of their systems.

Where closer monitoring is required, networks may justify the installation of additional equipment. This may be:

- Sampling meters in the network or at customer facilities. This can include data feeds from meters that have been installed for customers' own uses. This increases the ability of DNSPs to infer the operation of their networks.
- Substation and network metering. In some cases, networks can install metering to different levels of their systems.

Better meter data

With the advent of smart or AMI meters, networks and the market operator have more granular and timely data. In general, the penetration of smart meters is around 35%. But this is not evenly distributed across all areas. Two key benefits of smart metering are:

- Increased visibility of the network. This allows DNSPs to better manage their systems.

- Better usage data being available to customers that can improve their decision-making. This allows better tariffs to be developed and customers to make better choices about tariffs that suit their usage.

The penetration of smart meters is increasing both through mandates and the normal evolution of the power system. While full coverage of a network with smart metering is the preferred outcome, the data from a lower penetration will, in most cases, provide enough meter data to allow an accurate representation of the network. Experience in Victoria suggests that a 15% to 20% penetration of smart meters allows conclusions to be made about network operating characteristics at just about the same level of statistical precision as penetration of 80%[3].

Inverter data

As noted above, the high penetration of CER is leading to a large amount of equipment-level data being available. Smart meters are also installed when CER is installed (in the main). This means that better data on key network parameters is becoming available, particularly where the deployment and use of CER are creating constraints or additional costs in the distribution network.

This increase in data availability should be reflected in the network data that DNSPs can make available to network users and planners.

Development of the data – noting that networks' access to relevant data differs

This project is not suggesting that networks need to install additional equipment in order to provide the data stakeholders need, but rather should use the data at hand and the methods they use to plan their networks to do so.

This is important as the intent of the workstream is to provide stakeholder-focused data while being mindful of the costs. As smart meters are rolled out and networks install equipment for their normal operations, improved data will become available.

Understanding the quality of the data

The fact that network data will not be of uniform quality and that improvements to the data will not occur at the same rates in different networks means that the data that is provided must include information (metadata), explaining how reliable and accurate the data is, including plans to improve it. This would include the source of the data and any manipulations that have been made to the data.

Data formats

It is assumed that the data will be available in a machine-readable, structured format, but consideration needs to be given to:

- Common data structures
- Standardised delivery formats (such as CSV or XML)

Much of the work defining standards for data delivery has been done in projects such as the ACCC Consumer Data Right and the US "Green Button" program, and this should be leveraged and assessed in Phases 2 and 3 of this project.

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3 Verbal communication from a Victorian distribution business.

Specific data sets identified for analysis

Four data sets were identified, each with specific data items:

- Import capability at a site
- Export capability at a site
- Network performance at a connection
- Network operational performance.

Each of these data sets is discussed in terms of:

- The question(s) the data set addresses
- The stakeholders that are interested in it
- The specific data items to be included and where they will be sourced from
- The differences in the level of aggregation and presentation are likely to be relevant for each stakeholder group.

The following discusses these characteristics regarding each of the four data sets.

3.4.1 Import capability at a site

Where customers are acting as a load, the available headroom for imports into a site is important to allow site planning. If the headroom is insufficient, costs will be incurred to allow the connection or development at the site to proceed. Customers can also assess the value of installing CER at the site.

This type of data is required by:

- Customers and developers for their own planning
- Advisors for providing advice to customers
- Planners and regulators (for aggregate data) to assess network augmentation and expansion requirements.

The specific data required within this dataset is:

Current and forecast remaining capability

Current and forecast of remaining import capability* (kW or kVA), by season, at the following levels:

  - Distribution High Voltage Feeder (HV)
  - Distribution substation (DxSub).

* This is the difference between the existing load at the distribution substation and the capability of the substation to transfer energy.

Collection: This data is already collected by DNSPs at some levels of the network and will be available at lower levels as smart meters, and network monitoring equipment is deployed.

Provision: Raw underlying data to be provided annually by DNSPs in a common, agreed machine-readable form.

***Improvement options*:**

- Ability to map user NMI and/or address to DxSub and/or HVFeeder.
- Traffic light presentation of remaining capacity

Network augmentation plans

The $ spent, additional MW capacity and timings by:

- Distribution High Voltage Feeder (HV)
- Distribution substation (DxSub)

Collection: This data is already collected by DNSPs, although it may not be at the granularity required.

Provision: Raw underlying data to be provided annually by DNSPs in a common, agreed machine-readable form.

Indicative annual deferral value

The $/kVA value of deferring augmentations or replacements by:

- Distribution High Voltage Feeder (HV)
- Distribution substation (DxSub)

Collection: This data is already produced by DNSPs.

Provision: Data to be provided annually by DNSPs in a common, agreed machine-readable form.

This data set should be initially updated on an annual basis to assist in transition but over time as new technologies create more variability in grid usage, more frequent updates should be provided where material changes occur within the year.

3.4.2 Export capability at a site

Where parties are considering installing CER at a site or augmenting existing CER, the level of exports that can be supported at a site without constraint is important to the valuation of the CER. This includes the level of curtailment that can be expected.

The ability to export from a site and the level of exports from a site would be useful to:

- CER installers and advisers
- Planners
- in a simplified form, to customers.

Four types of data are required in this data set:

1. **Current and forecast remaining export capability (kW).** The measured difference between the actual level of export into the network and the capability of the distribution transformers and other network elements to absorb the energy.

Collection: The DNSP will have to collect and assess this information to develop DOEs and define their static limits. Therefore, this information will become increasingly available over time.

Provision: Raw underlying data provided by DNSPs in an agreed, common format and provided in machine-readable form. Data to be updated 6 monthly. Where this data item is expected to change rapidly, more frequent updating should be made.

2. **Hosting capacity plans**. Plans by networks, expressed as the $ spent, the MW increase in capability and timing of the changes by:
    - Distribution High Voltage Feeder (HV)
    - Distribution substation (DxSub)

Collection: DNSPs already produce these forecasts as part of their planning.

Provision: The raw underlying data that is used to generate the reports for regulators would be provided in a machine-readable, agreed format. The data would be updated annually.

3. **Indicative annual deferral value**. This is identical to the data element for import capability.
4. **Curtailment by locality or substation**. The kWh value of curtailment, measured in inverter capacity reduction (kW) and duration (Mins) by:
    - Network element (HV, DxSub)
    - Season
    - Time of day
    - Reason for curtailment (export limits, voltage etc).

Collection: This data is collected by OEMs, who can provide it to DNSPs

Provision: The data should be available on a collated basis by DNSPs. It should be provided as the raw underlying data in a common, agreed format as machine-readable data. The data should be updated every 6 months. In the long run, it should be available via a graphical interface.

3.4.3 Network performance at a connection

The record of the key network parameters at connection points is of use to end-use customers, advisors, VPPs and other agents, developers, planners and regulators.

This requires two parameters:

1. Power system quality, primarily Voltage, at the connection point

The record of voltage levels at the:

- Distribution High Voltage Feeder (HV), and
- Distribution substation (DxSub)

Collection: DNSPs collect this information, and it could readily be made available.

Provision: Initially DNSPs should provide the data in a machine-readable file that is in a common, agreed format. The data should be reported in weekly blocks and updated every six months. Longer-term improvements should be an interoperable database via a user interface that would map the information to the NMI level (or the DxSub or HV Feeder) and have a traffic light presentation (as per AS61000).

2. Outages (SAIFI, SAIDI) information.

Historical information is collected now. The defined reliability metrics in each jurisdiction are reported at the level of:

- Distribution substations
- Medium voltage feeders.

Collection: This is currently collected by networks.

Provision: The raw underlying data that is used to generate the reports for regulators should be provided in a machine-readable, agreed format. The data should be updated annually.

3.4.4 Network operational performance

Near real-time outage data, which is useful to AEMO*, customers and VPP operators (where it impacts operations). The NBN and Telcos identified this as a particular need.

The outage data set would contain:

- Location of the outage and network assets impacted.
- Cause of the outage, if known. This should be updated as the cause(s) are identified. This should include if the outage is planned or unplanned.
- Number of customers affected.
- Estimated restoration time.

Collection: The data is available to DNSPs and should be collated for users.

Provision: The data should be tailored to user needs:

- Real-time data is discussed below, noting that large users with specific needs are already arranging feeds of this data through discussions with DNSPs.
- For customers with a specific need, the data should be available in agreed, preferably common, data formats. Where relevant this should be a push notification of machine-readable data.
- For general users, specific recorded information or data that can be interrogated on a website is likely to be enough. A standard, machine-readable format should be used.

The data should be current and refreshed as new data is available with the changes time stamped.

Note that many DNSPs are providing this general service but a standardised approach would assist the users of the data. The standard of the information should be improved so that all DNSPs provide as much data as possible.

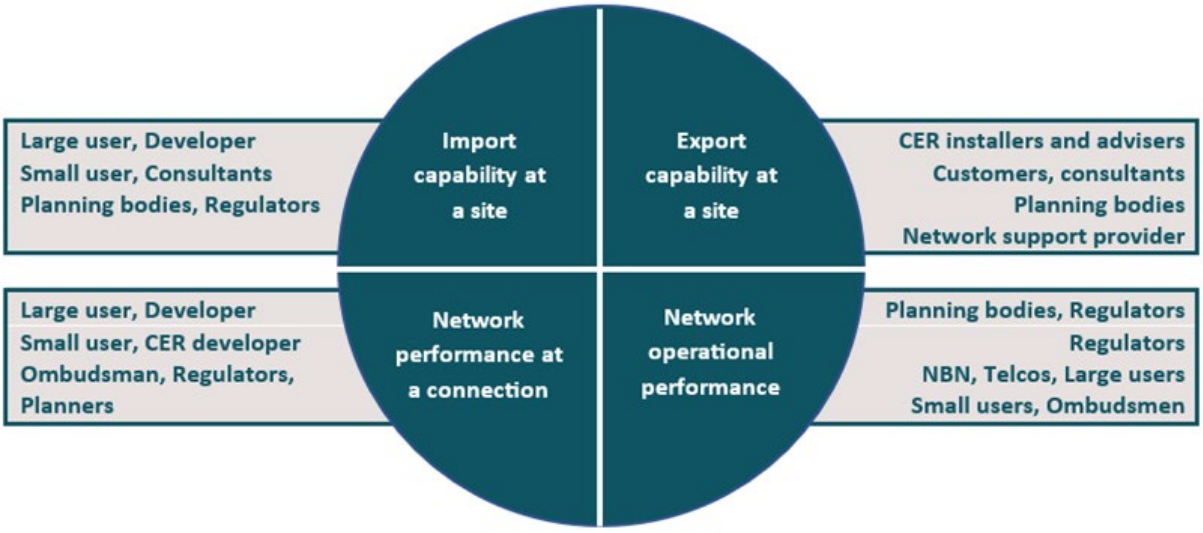
* Note that not all of AEMO's real-time data requirements are captured in this project.

3.5 Application of data to specific use cases

Figure 3 shows the use cases applicable to each user type described in Appendix 6.4. As noted in the appendix, any particular organisation may be more than one user type. For example, an organisation looking to establish a new factory site may want to know how much it is going to connect and any likely issues with supply to a location (the large user type). They may also be interested in how much opportunity there is to export from the planned PV array on the room, for periods when the energy demand from their operations will be less than the expected output from the array, say after 2.30pm each day and on weekends (the CER investor type).

If they are a smaller organisation, they may employ a consultant to advise them, who would require the same information but possibly in a more granular form so that they can include it in their analysis.

Figure 6 Use cases mapped to data sets



3.6 The special case of real-time data

Data providers and data users tended to focus on data for investment or planning purposes. Little need for real-time data was identified. In fact, data providers queried if any use would be made of DNSP or other sources of real-time data.

What is real-time data

Real-time data is collected by key market bodies and participants to manage the power system. AEMO for example uses SCADA, among other things, to monitor network loadings and generation at 4-8 second intervals.

Real-time data, therefore, pre-supposes the level of capability available to record the data essentially continuously or in very small intervals. Once recorded it can be provided in timeframes and formats suited to different uses. As noted, very few users need to see real-time data at the same time it is being captured. By contrast, many users can benefit from analyses of real-time data.

Who needs real-time data

The workshop attendees identified very few uses for the provision of real-time data as or very close to the point of its capture. Two examples that were identified were:

- NBN and telecoms value real-time information on outages where it will impact the provision of their services. These customers have SCADA-level data that they can use, but DNSPs could provide more detailed information on how the network was to be restored and any immediate plans for switching or load shedding.
- Similarly, emergency services could use real-time information on network operations to the extent that those operations could potentially create a demand for emergency service or impact how emergency service operations.
- AEMO already uses a range of real-time data for the management of the power system, including the network, and much of this data is made available via market management systems and the AEMO website.

AEMO is currently examining how best to gather the data it requires to support power system operation with increasing CER penetration. A discussion of this work is outside the scope of this phase.

While these may be of high importance for the specific users, it was not felt these needs would justify the general provision of real-time data, noting:

- The users of this data are large and have specific needs. It would be more efficient for them to provide their specific requirements to the network and work with the network to identify and arrange specific solutions.
- Generalised provision of this data where it is not seen as useful for customers would be an unnecessary cost.

This could be further examined in Phase 3 if a specific need is identified.

The most common need for real-time data is during outages, where all users need to verify the loss of power is due to network or generation failure and would like to know restoration times. This is generally provided by networks now but is being improved and automated by some networks; this improvement should be generalised. We note that NBN is establishing a protocol for gaining that sort of information from DNSPs in a standardised format.

It was noted, however, that in none of these cases was a new set of data required but rather a larger volume of data across multiple sites and with specific granularity. The main additional requirement — rapid access — could be provided by standardised, machine-readable structured data, which is discussed above.

We, therefore, consider that these use cases are important but consider that they do not require a unique or separate data set. Rather, the issue is the provision of efficient access to available data in standardised formats that can be readily aggregated and analysed as needed by these users.

Other users need real-time data to be collected but made available in planning timeframes. This forms the basis for information (for example, export capability) that is useful to a wide range of users and the hosting and formats for its provision should be assessed.

3.7 Key considerations and learnings in defining the data sources to be used to populate the data sets

Three key considerations emerged in defining the specific data sources to be used to populate the four data sets for addressing the ten topics that were identified as being of interest to the various sub-groups within the target audience:

1. The fact that in many cases, the same raw data can be used to address the information needs of different data users and different use cases – this simplified the number of data items that will need to be available, though that data may be sliced, diced and presented differently to meet the needs of different groups within the target audience.
2. The fact that the granularity and amount of information available varies across the DNSP within the NEM – this means that different DNSPs will have access to different types of information that they can make available to address the interests of the target audience, but also recognises that more and better information will become available over time which will enrich the information resource that can be made available.
3. The fact that consumers have a right to their own data and for it to remain private – this means that strict confidentiality provisions will need to be maintained that may, in some cases, limit the granularity of information that can be made available even where de-identification processes are used.

1. The same data can serve the needs of multiple data users and multiple use cases

The same data can meet the needs of different users for different use cases, in some cases the data needs to be presented differently, but the underlying data is the same. Therefore, a small number of data sets will provide the data for most of the use case requirements.

2. DNSPs are the best source of the information needed and the information available from them will improve over time

The information provided by data users and data providers strongly suggests that much data is available now and more will become available over time that will help address the main requirements of users as identified in the use cases and as translated into the data requirements.

In this regard, the following considerations are of key importance:

- All DNSPs are on a journey to acquiring network data at the lower voltage levels of the network (see Figure 4). This data will serve a number of purposes including improving network operations, supporting more CER and renewables, enhancing network protections, etc. Reducing costs of data acquisition, communications, storage and processing will support the ability of DNSPs to acquire more and better data about network operations and needs.
- Smart meters are one of the key means of acquiring this data, but there are other sources as well including DNSP monitoring and third-party data. Some networks, such as those in Victoria, already have access to near 100% customer point-of-connection data via the smart meter rollout. Over the next 5- to 10-year period, it is expected that all other DNSPs in the NEM will gain a similar level of access to this type of data. and be able to make that data available for use by non-network stakeholders.
- As this data becomes available, we consider that it will be available at essentially no incremental cost to be made available to address the data needs of the various groups in the target audience defined in this report. the costs to then share this data via a portal (or other means) should represent a relatively low-cost outcome.

In summary, most of the data that is needed is available from the DNSPs now or will become available over time. In either case, it will be able to be collected relatively easily and at a low cost for inclusion in the information to be provided to the target audiences. The impact of the requirements in terms of additional data collection is therefore likely to be low.

The key issues regarding cost are related to the level of pre-processing and temporal and geographic granularity needed by different users. How it is processed, presented, and hosted will be more thoroughly explored in Phases 2 & 3.

OEMs have been identified as a key source of information about certain aspects of CER performance – particularly the frequency, duration and reasons why curtailment takes place. Issues to be resolved regarding this information include gaining access to it (as OEMs are not regulated) and then being able to map it to the relevant network asset levels.

3. Customers' rights and responsibilities

Customers have a right to own and control their own data. They also have a right to privacy. These two points mean that customers have a right to withhold their data where it is being used in a manner that is intrusive or unnecessary.

That said, information from customer sites is necessary for managing the grid and is useful for informing other participants, including other CER users (or would-be users) and operators, planners, regulators, DNSPs and the market operator. To balance these needs, customers need to be aware of

what data is being collected. As well as the use of the data must, as much as possible, protect the privacy of individuals, noting that:

- This is already a requirement under the NER
- The identified data sets are at an aggregate level so that individual data is not being reported.

Questions for stakeholders

3. Are there other sources of data that should be considered?
4. Do you agree with the framing parameters that were used? If not, why, and what should have been included or left out?
5. Are the data sets that have been identified and prioritised the correct ones? Are there others that are needed? Are any of the ones listed NOT needed?
6. Do you agree with the conclusions reached regarding the need for real-time data?
7. Are there more issues that should be considered regarding the balance between customer protection and reasonable data collection?
8. Is there any other feedback on the data set definitions?

4 Further consideration of the data sets

We believe that making the data we have outlined more broadly available would be of benefit to the targeted stakeholder audience because, in most cases, this data is already being captured by networks or other parties who could potentially make it available to networks. As such, the incremental costs of capturing the data that we are recommending be made available are very likely to be minimal.

It should be noted that this phase of the project was not intended to include a full cost-benefit analysis of the provision of information to stakeholders. Phases 2 and 3 will demonstrate and test the costs, stakeholder value and impacts of different approaches for collating, analysing, presenting, hosting and providing access to this data.

Rather, this project was intended to identify relevant data sets that should be considered further through trials. Key criteria likely to be most useful in assessing the overall value of these data sets to the market are:

Value

The key question for examining the data sets is how valuable the provision of the data would be. This is a function of:

- Which users, and how many users, need the information in the data? As discussed above, there is a range of users, but the number of actual uses of the data is significantly smaller.
- What is the value of the information provided by the data; that is, to what degree would access to this data:
    - aid decision-making regarding CER by members of the various stakeholder groups potential investors, their agents and market bodies and government departments, and
    - improve operational efficiency in the electricity supply system.

Quality

Having access to high-quality data is important. This criterion is, however, subject to the actual use case. It was noted that there are two relevant factors:

- Accuracy - data should be sufficiently accurate for the purpose for which it is intended. As noted above, accurate data can be simplified for presentation such that the same data can be made to meet the needs of different users.
- Focus - the data needs to be relevant to the user's requirements. For example, customers are generally seeking data that is related to their sites, while planners generally need aggregate data that allows them to characterise different categories of sites. The discussions showed that data collected at a high level of granularity (time and location) can readily be aggregated into coarser information.

Availability

More and/or better data can be expected to become available over time as the result of existing or likely policies or the natural evolution of the market. For example, as the penetration of smart meters and the adoption of PV and local storage increase, the availability of valuable, granular data will increase as a direct result. Some value can be made of this data as it increases and prior to when it is available universally.

It should be recognised that any decision to use other means to hasten the availability of this data (or some proxy of it) would need to be justified by the value of the earlier use of that data – not its full value, which would have been realised in any case, but later.

Cost

The cost of providing the data is an important factor. As noted above, in Phase 1 we have emphasised the use of data that DNSPs have or develop as part of their continuing efforts to enhance their visibility and operation of the LV network. This should reduce the cost of collecting data to address stakeholders' information needs to very close to zero.

Other costs may be incurred for collating, analysing, presenting and hosting the data, including the development of formats to allow easy access to the data. These will be explored in Phases 2 and 3.

Tables 1 to 4 on the following pages consider how the data sets identified in this paper might ultimately be made visible in formats that accord to the needs of the various stakeholder groups. This includes moving from data creation/capture, through to data transfer and on to data processing, and finally to data dissemination and presentation. Each step potentially contributes to the overall cost of any policy decision related to making data more visible to the market, whilst the last step (data presentation) contributes to the overall benefits of making that data visible in the first place (e.g., good data, presented badly, provides little or no benefit).

Noting:

- The delivery model underlying these tables assumes that network visibility is provided in an incremental or staged approach. As DNSPs acquire data at a more granular level, this data is then incorporated into customer portals or other formats.
- The timing of the upgrade of these portals and other formats will vary between DNSPs based on the availability of the underlying input data. For example, as smart meter data and OEM inverter data become available over time.

Questions for stakeholders

9. Do you agree with the criteria?
10. Do you see value in these data sets being made readily available to the public?
11. Is any important data missing?

Table 1 Import Capability

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Current and forecast remaining import capability* (kW or kVA), by, season, and by: • HV Feeder **(HVFed)** and • Distribution substation **(DxSub).** The difference between the measured load at the distribution substation and the capability of the substation to transfer energy.	If currently available data is used* DNSPs already capture and produce relevant data annually as part of their normal planning processes. ** The reference to 'low cost' assumes that DNSPs use the data that they currently have and are not required to install new systems and equipment for network visibility purposes. Section 3.7, above, discusses this point.*	Data host and data provider the same Assumes that DNSPs gain smart meter data for other purposes	DNSPs would not have to undertake a significant additional level of processing / data cleansing to create raw data set.	**Raw underlying data**: Provided by all DNSPs annually in a common, agreed (by DNSPs and key users), machine readable form. **Medium Cost** **Interrogatable database via User Interface**: • Ability to map user NMI and/or address to DxSub and/or HVFed. • Traffic light presentation of remaining capacity	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs **Medium term**: Once raw data capture/dissemination established.	Benefits prospective customers assessing potential locations for their facilities, by making the underlying capacity of network more visible, noting that the DAPR mainly provides information to ZSS level. Examples of parties who might benefit include: • VPP and EV customers • EV charging stations • Grid-connected electrolysers • Large customers Grid-side battery operators

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Network augmentation plans* by: • HV Feeder and • Distribution substation. *[*$, MW, timing]*	Forecasts already being produced for planning and regulatory purposes	As above	As above	**Raw underlying data**: Provided in a common machine-readable form by all DNSPs.	**Short term**: Mandatory, once common machine readable form agreed by DNSPs	Exposing detailed network augmentation plans allows prospective customers to understand the cost impact of adding load different parts of the network, which might influence where they connect (e.g., EV charging stations, grid-side batteries). Exposing the types of investments the DNSP is forecasting (e.g., network support, network augmentation, grid-side battery), could present a catalyst for alternative investments to be considered (particular when considered in light of the "Indicative annual deferral value" proposal.

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Indicative annual deferral value ($/kVA)* by: • HV Feeder and • Distribution substation *[*A common approach should be agreed and adopted. For example, the estimated LRMC of supply, using the Average Incremental Cost (AIC) approach, could be adopted.]*	Low cost, as the two key inputs to any LRMC (indicative deferral value) calculation, namely forecast costs, and forecast future demands driving those costs, are already being produced.	As above	Minimal additional processing required.	**Results**: Provided in a common machine-readable form by all DNSPs.	As above	Allows prospective customers to understand the potential value of offering flexibility to a DNSP in different locations.

Update frequency:

- In our opinion, DNSPs should initially be required to only update this information annually, with the timing aligned to when the DAPR is updated. Alignment should lead to some economies of scope.
- Over time, as new technologies such as EV's, EV charging stations, and grid-side batteries, are connected to the LV network in greater numbers, import capability is likely to become more variable within our proposed 12-month reporting period. Where this is the case, Users of the data may likely benefit from DNSPs adopting more frequent reporting of import capability.
- To operationalise this, we would recommend that DNSPs be encouraged to report import capability on a 6-monthly basis for HV Feeders and Distribution substations:
    - Where remaining import capability reaches less than 5% of the installed capacity; and/or
    - Where, based on information that is available to them, indicates that either EV or orchestrated behind-the-meter battery penetration reaches 10% of their customer base.

Table 2 Export Capability

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Current and forecast remaining export capability* (kW): • Static limit on export capability (based on POE90 forecast of demand and POE10 forecast of export); or • Export capability, varying by season, period of day (e.g., early morning, morning, daytime, afternoon, evening, overnight). The measured difference between the actual export into the network and the capability of the distribution transformers and other network elements to absorb the energy.	If currently available data is used* DNSPs will have to have regard for information such as this to develop DOE's, hence the incremental cost of capturing it for NetVis purposes is assumed to be marginal. * *The reference to 'low cost' assumes that DNSPs use the data that they currently have and are not required to install new systems and equipment for network visibility purposes. Section 3.7, above, discusses this point.*	Data host and data provider the same	DNSPs would not have to undertake a significant additional level of processing / data cleansing to create raw data set.	**Raw underlying data:** Provided by all DNSPs 6-monthly in a common, agreed (by DNSPs and key users), machine readable form. **Medium Cost** **Interrogatable database via User Interface**: • Ability to map user NMI and/or address to DxSub and/or HVFed. • Traffic light presentation of remaining export capacity	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs. **Medium term**: Once raw data capture/dissemination established.	Benefits both prospective and existing customers assessing potential locations for their facilities that might export into the grid, as underlying export capacity of the local network more visible. Examples of parties who might benefit include: • Customer looking to install PV systems • VPP operators, assessing the value of enrolling customer in a particular area into their VPP • Grid-side battery operators

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Hosting capacity plans* by: • HV Feeder and • Distribution substation. *[*$, MW, timing]*	Forecasts already being produced for planning and regulatory purposes	As above	As above	**Raw underlying data**: Provided annually in a common machine-readable form by all DNSPs.	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs	Exposing detailed network hosting capacity allows prospective customers to understand the potential cost impact of adding exporting facilities parts of the network, which might influence where and what they connect (e.g., PV?, smaller PV system, adding battery to PV system). Exposing the types of investments the DNSP is forecasting (e.g., grid-side battery), could present a catalyst for alternative investments to be considered (particular when considered in light of the "Indicative annual deferral value" proposal).

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Indicative annual deferral value ($/kVA)* by: • HV Feeder and • Distribution substation *[*A common approach should be agreed and adopted. For example, the estimated LRMC of supply, using the Average Incremental Cost (AIC) approach, could be adopted.]*	Low cost, as the two key inputs to any LRMC (indicative deferral value) calculation, namely forecast costs, and forecast future levels of curtailment that are being alleviated by the proposed hosting capacity investment, will already need to be produced for regulatory and internal business case purposes.	As above	Minimal additional processing required.	**Results**: Provided annually in a common machine-readable form by all DNSPs.	As above	Allows prospective customers to understand the potential value of offering solutions that might assist the DNSP in alleviating export constraints in different locations.

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Medium Cost**	**Medium Cost**	**Low Cost**		**Medium**
Curtailment, as measured by kW reduction in inverter capacity * duration of curtailment, by: • Network element (HV Feeder and Distribution Substation) • Season; • Time of day band (morning, daytime etc); and • Reason (e.g., export limits, voltage, etc).	Many OEMs already capture this type of information for their own purposes and are already disseminating it to their end customers. There would be no expectation that all OEMs would have to provide this information only those that have existing capability would be required to. This information would be provided to DNSPs, who would be the primary host for this historical information.	Our initial thinking is that OEMs would not transmit this information in real time, but batch transfers would occur weekly. DNSPs could also develop models to estimate these values based on sampling a voltage data.	DNSPs would have to process this information such that it aligns to the network elements that we are proposing data be aggregated to for publishing (e.g., HV feeder and Distribution Transformers). The published historical data would need to be accompanied by an assessment of the statistical validity of that data (e.g., statistically significant sample size)	**Raw underlying data**: Provided by all DNSPs 6-monthly in a common, agreed (by DNSPs and key users), machine readable form. **Medium Cost** **Interrogatable database via User Interface**: • Ability to map user NMI and/or address to DxSub and/or HVFed. • Traffic light presentation of curtailment across different seasons.	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs. **Medium term**: Once raw data capture/dissemination established.	Allows prospective customers and market players to understand the historic levels of curtailment of CER devices in different areas, which may guide: • Customer in terms of their sizing considerations for PV or appetite for adding a battery when investing in a PV system, and • Battery installers to focus on areas where adding a battery to a site might alleviate curtailment (increases the value of a battery in these areas); and • AEMO, for the purposes of calibrating models related to operational forecasting of PV; and • Policy makers, regarding overall levels of curtailment (which may, for example, drive their analysis of future PV-related policies as well as battery-related policies).

Update frequency

- In our opinion, DNSPs should be initially required to only update this information every 6 months, with the timing of every 2nd update aligned to when the DAPR is updated. Alignment should lead to some economies of scope.
- We are proposing that this be updated more frequently than import capability, as this is likely to be subject to much more variability across a 12 month period, given how impactful the fast-paced take up of CER is on remaining export capability available on the network.

Table 3 Connection – Network performance

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Medium**
Historic average voltage, by: • Distribution substation • HV Feeder	Only require DNSPs to report data that is available to them, not new/additional data.	Data host and data provider the same	It is our assumption that DNSPs would not have to undertake a significant additional level of processing / data cleansing to create raw data set.	**Raw underlying data**: Provided by all DNSPs 6-monthly in a common, agreed (by DNSPs and key users), machine-readable form. Data would be reported in weekly blocks. **MediumCost** **Interrogatable database via User Interface**: • Ability to map user NMI and/or address to DxSub and/or HVFed. • Traffic light presentation of compliance (as per AS61000)	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs. **Medium term**: Once raw data capture/dissemination established.	For planners and regulators, shows network compliance and, as a trend, likely future needs. For AEMO, indicates risk of network tripping distributed generation. **In the long run**, this may be required to manage security and minimise AS costs. For an advisor/installer indicates where installation of new PV or storage may have a positive or negative benefit.

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Low Cost**		**Low**
Historical reliability (SAIFI, SAIDI), by network asset: • Distribution substations • HV Feeder	Only require DNSPs to report data that is available to them, not new/additional data.	Data host and data provider the same	It is our assumption that DNSPs would not have to undertake a significant additional level of processing / data cleansing to create raw data set.	**Raw underlying data**: Provided by all DNSPs 12-monthly in a common, agreed (by DNSPs and key users), machine readable form. Data would be reported in weekly blocks.	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs.	There is likely to be some benefit to customers from DNSPs reporting historical reliability at distribution substation level and HV feeder level. In particular, customers, for whom reliability is an important consideration, may have regard for this when considering the connection location decisions (to the extent that they have some flexibility over those decisions). Moreover, in conjunction with other data elements we are suggesting be made more widely visible to market participants, in particular import and export capability, reliability data may assist connecting customers in determining the types (and sizes) of behind the meter devices they should invest in.

Table 4 Operational – Network performance

Data Specification	Data Capture (by provider)	Data Transfer (to host)	Data Processing (by host)	Data Dissemination and Presentation	Assumed Transition Path	Potential Benefits
	Low Cost	**Low Cost**	**Low Cost**	**Medium Cost**		**Medium**
Real time performance data by exception (i.e., where there is an outage) specifically: • Cause • Location and network assets affected (e.g., distribution substations affected) • Number of customers affected • Estimated restoration time. • Whether it is planned or unplanned	DNSPs to only report upon data that is available to them, based on current data capture systems / approaches.	Data host and data provider the same	Should be limited, as many DNSPs already report this or similar data.	**Raw underlying data:** → Provided in real time in a common, agreed (by DNSPs and key users), machine-readable form to allow monitoring by external parties such as NBN. **Data visualisation:** → Data visualisation overlaid with relevant information	**Short term**: Mandatory, once common machine-readable form agreed by DNSPs. **Short term**: Mandatory, once common machine-readable form agreed by DNSPs.	The provision of data in a common, agreed form, may enable Users of the data who have multiple sites across different regions (e.g., NBN, Telcos) to develop a common system / process to capture that data and report relevant information internally within their business. Single site customers would also benefit, if their DNSP is currently not providing this information in manner that is easily digestible / understandable.

5 Next steps

At their May meeting, Energy Ministers agreed that the time is right to transition to a new operating model for the Energy Security Board (ESB) to meet the challenges of the energy transformation in the NEM. Ministers agreed on a new model, with the Energy Advisory Panel (EAP) to coordinate market bodies' advice to governments under the National Energy Transformation Partnership, on issues relating to the security, reliability, and affordability of Australia's east coast energy system with the new arrangements to take place from 1 July 2023.

As part of this transition, the remaining work under the Post-2025 reforms, including the Data Strategy, will be transferred to a lead market body for completion.

From 1 July 2023, the Australian Energy Regulator (AER) will be the lead market body on the network visibility work and the key point of contact for interested parties and stakeholders to engage with.

5.1 Submissions

The AER invites comments from interested parties to this consultation paper by Friday 1 September 2023. While stakeholders are invited to provide feedback on any issues raised in this paper, specifically the key questions for consultation raised. Submissions will be published following a review for claims of confidentiality.

Submission information	
Submission close date	Friday 1 September 2023
Lodgement details	Email to: NetworkVisibility@aer.gov.au
Naming of submission document	[Company name] Response to Network Visibility Consultation Paper
Form of submission	Clearly indicate any confidentiality claims by noting "Confidential" in document name and in the body of the email.
Publication	Submissions will be published following a review for claims of confidentiality.

Alternatively, you may mail submissions to:

Mr Hrishikesh Desai
Chief Data Strategist
Australian Energy Regulator
GPO Box 3131
Canberra, ACT, 2601

5.2 Questions for consultation

Section	Questions
2.2 Examples of the analysis of use cases	Q1. Is the set of use cases in Appendix 6.4 representative of the use cases that you are aware of?
	Q2. What additional use cases should be added?
3.7 Key considerations and learnings in defining the data sources to be used to populate the data sets	Q3. Are there other sources of data that should be considered?
	Q4. Do you agree with the framing parameters that were used? If not, why, and what should have been included or left out?
	Q5. Are the data sets that have been identified and prioritised the correct ones? • Are there others that are needed? • Are any listed not needed?
	Q6. Do you agree with the conclusions reached regarding the need for real-time data?
	Q7. Are there more issues that should be considered regarding the balance between customer protection and reasonable data collection?
	Q8. Is there any other feedback on the data set definitions?
4 Further consideration of the data sets	Q9. Do you agree with the criteria?
	Q10. Do you see value in these data sets being made readily available to the public?
	Q11. Is any important data missing?

6 Appendices

6.1 Scope of the project and consultation

The specific outcomes sought from this project are:

- Explore use cases: that demonstrate different types and forms of distribution network data that are needed across the range of market and policy stakeholders and to identify the benefits that can be expected from making this data available.
- Definitions for a range of possible data sets: to meet the requirements demonstrated by these use cases, exploring alternative approaches where there are variations in available data and the data audience, considering complexity and accuracy requirements.
- Criteria for evaluating data sets and approaches for the provision of the data against the requirements identified in the different case studies. This will include value, quality, accuracy, cost, constraints, as well as other relevant factors.

These outputs are to be presented in the form of a public consultation paper to allow for wider stakeholder input.

Use cases

Use cases are expected to be developed, and the related benefits tested, in consultation with a range of market and policy stakeholders, through a range of interviews and/or workshops. Examples should include:

- Investors in network-scale technologies – such as the Victorian Community Batteries program or commercial-scale DER sites.
- Market services managing network-scale solutions – such as Virtual Power Plant trials and aggregators.
- Investors in household-scale DER – such as householders or small businesses seeking to understand emerging constraints.
- Market services providing household-scale services – such as equipment installers advising on options and risks or traders offering contracts subject to local constraints.
- Larger users and new connections – such as planning for new EV charging networks as undertaken by NSW and SA Gov, property developers planning embedded networks or any new commercial-scale property development.
- Users with real-time reliability needs – commercial users like NBN and disaster management.
- Local planning and forecasting needs – including proposals for network expansions and inputs into system-level planning or planning for edge-of-grid or micro-grid solutions.
- Regulation and consumer engagement in network pricing or DER constraints – transparency on how FEL/DOE and export pricing are determined.

6.2 Definitions of technical terms

Term	Definition	Comments
Ancillary services	Ancillary services are services that are essential to the management of power system security, facilitate orderly trading in electricity and ensure that electricity supplies are of acceptable quality	NER clause 3.11.1(a)
Curtailment	Reduction in PV inverter output from an instruction from a network or market operator.	Related to AS4777.1
[Distribution] High Voltage	Voltages used between Zone Substations and Distribution Substations (pole top and pad mount transformers. Typically, 22 or 11kV but can be lower.	High Voltage is the commonly used term but technically it is Medium Voltage, as defined in AS60038 and AS61000.
Dynamic operating envelope (DOE)	a systemwide approach to varying DER import and export limits over time and by location in response to prevailing network conditions	Report to the AER — DOE Policy in the NEM, FTI consulting (2022), page 14, based on ESB recommendations to governments.
[Export] Hosting capacity	Ability of a connection to accept export from PV or storage devices. From NER 11.141: "export level means a threshold (calculated by reference to capacity, energy or other measure permitted in a distribution determination) … "	Primarily applied to PV as storage can improve as well as consume hosting capabilities.
Basic [export] hosting capacity	The export capability at a connection point based on the current and forecast supply of energy through that connection point	Adapted from NER 11.141. This is the expected export for which no charge would normally apply.
Machine readable structured data	TBA	
Network support services	A service for which a participant may receive a network support payment either under NER5.3A.12 or via an avoided TUOS payment	Adapted from NER 5.3A.12.
Outage	Any full or partial unavailability of equipment or facility	NER 10 Glossary
Standing data/DER Generation information	Standing data in relation to a small generating unit (or any facility at a connection point)	See definition for DER Generation information, NMI Standing Data and the schedules to chapter 5
[Power] Transfer capability	The maximum permitted power transfer through a transmission network or distribution network or part thereof.	From the NER, Chapter 10 Glossary

6.3 Organisations that attended workshops

Data user workshops
AEC
AEMC
AEMO
AER
AGL
C4Nnet
City of Melbourne
Clean Energy Council
CSIRO
DELWP
Department of Industry
ECA
Emergency Management Australia
ENA
Energy Web
EVC
Greensync
Jet Charge
Middleton Group
NBN
NSW Department of Planning and Environment
NSW Department of Treasury
RACE
Service Stream
Shopping Centre Council of Australia
Simply energy
Switchdin
Telstra
University of Technology Sydney
Wollongong Uni

Data Provider Workshops
AEMO
AER
ANU (ACTEW)
ARENA
Ausgrid
Ausnet
C4Nnet
Citipower/Powercor
CSIRO
ENA
Endeavour
EnergyQ
Grid Qube
Jemena
NBN
Plus ES
RACE
Redback Technologies
solar analytics
Solar edge
Vector Metering
Western power
Wollongong university
Zepben

6.4 Use case listing

Note that an organisation may have requirements for multiple types of use cases.

	Organisation	Use case
1	AEMC	Information to support Rules development
2	Aggregators/VPP providers	Region wide issues and network issues impacting aggregation
3	CER investors	Network issues, including likely curtailment
4	CER service providers (who do things with the technology)	Connection information but focused on equipment and services required
5	Consumers and consumer advocates (see also installers)	Information on • service quality, emerging issues and network issues • Information to support consumer decisions, including balancing poor information from installers/sellers
6	Data provider (Telstra, NBN, else?)	Information on energy usage and value – distribution network and constraint data: demand, constraints costs/price, outage information
7	Data providers, for example ABS, representative organisations	Source of general information to support other. A common source of data linked to demographics — AEMO + ABS + Industry data.
8	Electricity dependant, geographically spread services	Real time operational information and information on operational state for own service status information. Location and planning information for site planning
9	Embedded generator	Seeking connection information, including potential locations
10	Emergency services	Real time operational information and information on operational state. Location and planning information for emergency response planning
11	Investors in EV charging for any location • Normal/street charging • Fast charging	Seeking connection information, including locations and tariffs Forecasts and costs for augmentation
12	Investors in network support	Options for network support by location, network issues to be addressed
13	Investors with sites looking to add EV charging	NMI/Site information, forecasts and load hosting capability and costs
14	Large Property Developer	Seeking connection information for a location. Alternative approaches, for example SAP
15	Large user	Seeking connection information, including potential locations
16	Local and jurisdictional planners • General planning • PV/EV/Storage impact planning	Data for planning • load and export hosting capability • forecasts by feeder/locations
17	Retailers	Information for innovative tariffs
18	Ombudsmen & Governments	Information on service quality issues and complaints

	Organisation	Use case
19	Safety regulators	Understand where systems are reaching limits or deteriorating. Impact of CER on networks
20	Smaller property developer/residential developers	Seeking information on own sites and for refits.
21	Startup and innovators	Market gaps and potential and emerging issues
22	Solar and battery installers and consultants	Issues with connecting at various locations
23	Storage provider (community)	Seeking connection information at a location

6.5 AEMO and AER use cases

The table below lists some use cases that were identified as being of use to support market and system operation and regulatory processes. This is not intended to be an exhaustive list but to provide an indication of the type of data that would be useful for those processes.

Organisation	Use case
AEMO	CER data for planning, including: • what is installed, forecasts, • Exports and • impact of local network constraints
	Voltage impacts of CER operation and CER voltage requirements
	CER forecasts and operations • What is required and what for? • Storage and generation forecasts
	CER installation compliance • Settings vs compliance
	Impact of distribution network constraints on semi-scheduled operation • Impact of DOE on regional dispatch • Impact of semi scheduled generation
AER	To understand demand and tariff responsiveness (in absence of EV specific tariffs) and inform review of expenditure proposals
	To understand the level of curtailments in the system, timing and location — and where work is being done • To aid assessment of a capital expenditure application • To identify the potential for unplanned/additional asset requirements • To identify the likelihood of stranded assets
	Understand how installation size and curtailment levels change across the network(s), to better assess equity and consumer impacts of decisions
	Capex and Opex expenditure proposals to identify efficient investments in hosting capacity, including FELs
	Evidence base to support customers seeking a change to export limits.
	Scanning and preparation for energy transition by better understanding the types and scale of CER investment in the network.

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