DRAFT DER integration expenditure guidance note

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AUSTRALIAN ENERGY REGULATOR

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Contents

Shortened forms

Shortened Form	Extended Form
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
CECV	Customer Export Curtailment Value
DER	Distributed Energy Resources
DNSP	Distribution Network Service Provider
EFA	Expenditure Forecast Assessment
FCAS	Frequency Control Ancillary Services
FiT	Feed-in tariff
NEL	National Electricity Law
NEM	National Electricity Market
NEO	National Electricity Objective
NER	National Electricity Rules
RIN	Regulatory Information Notice
RIT-D	Regulatory Investment Test - Distribution
VaDER	Value of Distributed Energy Resources
VPP	Virtual Power Plant

1 Introduction

1.1 Structure of this guidance note

This guidance note is structured as follows:

- Section 2 – The AER's role. This includes context for the development of this guidance note and where it will fit in the AER's expenditure assessment toolkit. It also summarises our process for finalising the guidance note.
- Section 3 – Presentation of the business case. This includes guidance on how DNSPs should present a concise DER integration strategy for their customers.
- Section 4 – VaDER methodology. Here we provide a high level introduction to the VaDER methodology – the way DNSPs will determine the value of an investment to increase hosting capacity.
- Section 5 – Defining the base case scenario. This includes guidance on how DNSPs should assess existing levels of hosting capacity on their networks.
- Section 6 – Quantifying DER benefits. This includes guidance on the types of applicable DER benefits and how DNSPs should quantify them.

2 The AER's role

The National Electricity Law (NEL) requires us to perform our economic regulatory functions in a manner that will, or is likely to, contribute to the achievement of the National Electricity Objective (NEO). The NEO is:[1]

> …to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to—
>
> (a) price, quality, safety, reliability and security of supply of electricity; and
>
> (b) the reliability, safety and security of the national electricity system.

The NEO places an overarching requirement on the AER to make distribution determinations that will deliver efficient outcomes that benefit consumers in the long term. The revenue and pricing principles support the NEO and ensure a framework for efficient network investment exists.[2] We must take the revenue and pricing principles into account whenever we exercise discretion in making those parts of a regulatory determination relating to direct control network services.[3]

Our expenditure forecast assessment guideline[4] describes the process, techniques and associated data requirements for our approach to setting efficient expenditure allowances for network businesses. It provides overarching guidance about how we assess a business's revenue proposal and how we determine a substitute forecast when required. For businesses to show their proposal is efficient and prudent, we generally expect the proposal to demonstrate the overall forecast expenditure will result in the lowest sustainable cost (in present value terms) to meet the legal obligations of the DNSP. Where businesses claim higher levels of investment are efficient relative to those required to meet their legal obligations, for example due to market benefits, the proposal should demonstrate the investment is the most net present value positive of the viable options.

For our assessment of augmentation capex, we typically consider a DNSP's demand forecasts, the proposed projects and programs to meet forecast demand and the associated forecast capex. Other triggers of such capex include voltage control issues, and net market benefits. Our assessment of such capex may also incorporate modelling of cost measures for such projects, and detailed engineering reviews.

DER integration expenditure is not explicitly addressed by our existing guidance. DNSP proposals for DER integration expenditure have varied in nature, with different approaches taken towards the types of DER benefits and the quantification of these

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1 NEL, s. 7.

2 NEL, s. 7A.

3 NEL, s. 16(2)(a)(i).

4 AER, 'Expenditure Forecast Assessment Guideline for Electricity Distribution', November 2013.

benefits. This is partly due to differences in network topographies, network visibility and access to network data. Our assessment of these proposals has largely been in line with our RIT-D guideline, however this guideline does not explicitly cater for investments intended to increase DER hosting capacity.

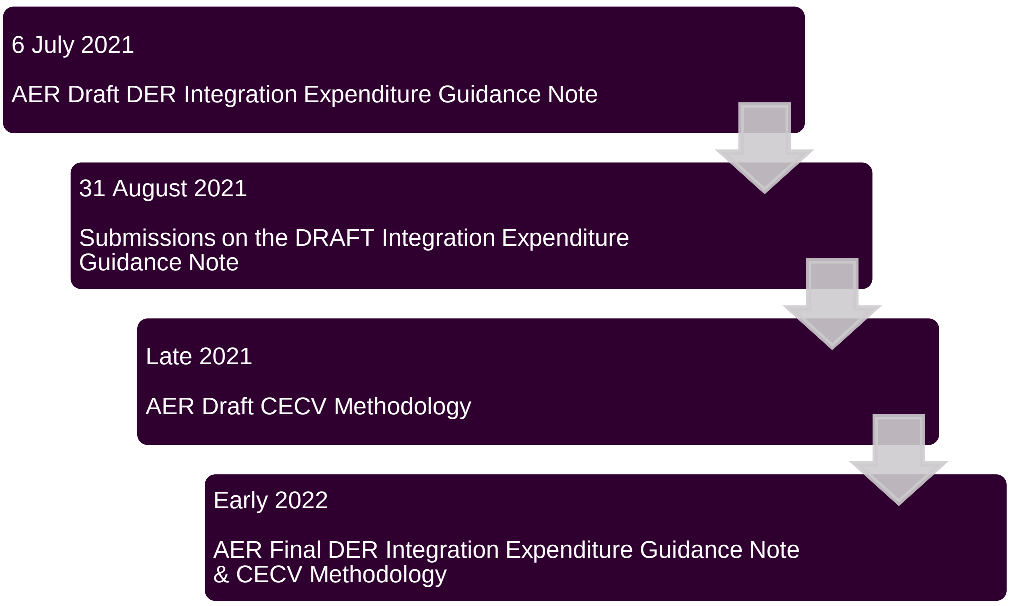
This guidance note improves our expenditure assessment toolkit by providing clarity and certainty to DNSPs and their customers about what we expect to see in DER integration investment proposals, and how we will assess these proposals. It does not replace any of our existing guidance, but ensures that we have the right tools to assess this emerging area of network expenditure.

The accompanying explanatory note discusses our rationale for this guidance note and contains questions for consultation with stakeholders. We will consider submissions and reflect these in our Final DER integration expenditure guidance note.

Rule reforms

On 25 March 2021, the AEMC made a draft determination for electricity and retail rules to integrate DER, such as small-scale solar and batteries, more efficiently into the grid.[5] The draft rules require the AER to develop and consult on a customer export curtailment value (CECV) methodology and publish CECVs annually. We will undertake this consultation process separately after the AEMC makes its final determination.

Figure 1: DER integration expenditure guidance note timeline



[5] AEMC, 'Access, pricing and incentive arrangements for distributed energy resources, Draft rule determination', 25 March 2021.

3 Presentation of the business case

This section provides guidance on the contents of a DER integration strategy, the format of the business case, the selection of input assumptions and options analysis.

3.1 DER integration strategy

Relationship with other aspects of the regulatory proposal

Proposals for DER integration expenditure should align with a broader and longer term DER integration strategy. This strategy should:

- Include DER penetration forecasts for the electricity distribution network over the medium to long term (at least 10 years) and the future implications of these forecasts on the network;
- Provide evidence of how tariff reform will be used to accommodate the forecasts of DER made above and reduce the need for network investment. The AEMC's draft rule change will enable export pricing and require the AER to consult on and publish Export Tariff Guidelines.[6] The rationale of cost reflective pricing is to link network tariffs to the underlying drivers of network costs. DNSPs should demonstrate how their proposed pricing structures will manage the demand for consumption and export services, make best use of existing network hosting capacity and potentially defer network investments;
- Provide a clear breakdown of the various elements of DER integration expenditure, in terms of augmentation, ICT capex and opex. Where the DNSP has identified deferred augmentation and/or replacement expenditure as a benefit associated with its proposed investment, it should demonstrate that its forecast of augmentation and/or replacement expenditure has been adjusted in a consistent manner;
- Identify any related expenditures proposed under the Demand Management Innovation Allowance;
- Identify any jurisdictional obligations outside the NER and their impact on expenditure forecasts (for example, the impact of a mandated export level for all DER customers);
- Include details of the DNSP's plan (if any) for the implementation of dynamic operating envelopes. Details may include the timing of trials, methods for capacity allocation and consumer engagement; and

Evidence of historical DER integration activities

DNSPs should provide the following in their proposal for DER integration expenditure:

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[6] AEMC, 'Access, pricing and incentive arrangements for distributed energy resources, Draft rule determination', 25 March 2021.

- Details of activities undertaken and actual expenditure in the current regulatory period to manage DER integration; and
- Evidence of what these activities have delivered for customers – for example, whether current activities have increased network hosting capacity, improved network visibility or managed voltage issues.

Transparency of proposal

Aside from providing a clear breakdown of the elements of DER integration expenditure, for completeness, DNSPs should provide references to expenditure items in the reset RIN.

3.2 Format of business case

In support of a proposal for DER integration expenditure, the DNSPs' business case for a DER integration project(s) should explicitly identify the following:

- Base case scenario. DNSPs should consider the proposed solution against a credible base case scenario, in line with our guidance (Section 5).
- Benefits derived from the project. DNSPs should detail the types of benefits, the value of these benefits, and how these benefits have been calculated (Section 6).

We do not propose to prescribe a particular template or format for the DER integration expenditure business case, as we encourage DNSPs to submit proposals that are innovative and best reflect their customers' expectations. However, we consider that as a minimum, the abovementioned aspects of the proposal should be clearly articulated and detailed in order for the proposed expenditure to be assessed.

3.3 Input assumptions

As with other types of network expenditure, it is important that DNSPs select credible input assumptions in their proposals for DER integration expenditure.

In line with the RIT-D application guideline[7], we consider that as a principle, DNSPs should use:

- Inputs based on market data where this is available and applicable
- Assumptions and forecasts that are transparent and from a reputable and independent source. In particular:
    - Material that the Australian Energy Market Operator (AEMO) publishes in developing the National Transmission Network Development Plan (NTNDP), Integrated System Plan (ISP), or similar documents should be a starting point.

[7] AER, 'Application guidelines: Regulatory investment test for distribution', December 2018.

  - Material that AEMO publishes in any up-to-date ISP or equivalent document, where that document has been adopted in the NER and/or NEL, should be used as a default.
- Up-to-date relevant information. For instance, it might be appropriate to depart from information that AEMO has published where there is evidence and good reason to demonstrate that alternative sources of information are more up-to-date or more appropriate to the particular circumstances under consideration.

DNSPs should adopt a net present value analysis period of 20 years when considering the costs and benefits of the proposed investment. This time period is in line with our assessment of repex and augmentation expenditure.

3.4 Options analysis

DNSPs' proposals for DER integration expenditure should demonstrate that they have considered all credible options and selected the option that addresses the identified need at the lowest cost over the life of the investment. The options considered should explore different investment timing and staging scenarios, to demonstrate the potential impacts on net economic benefits.

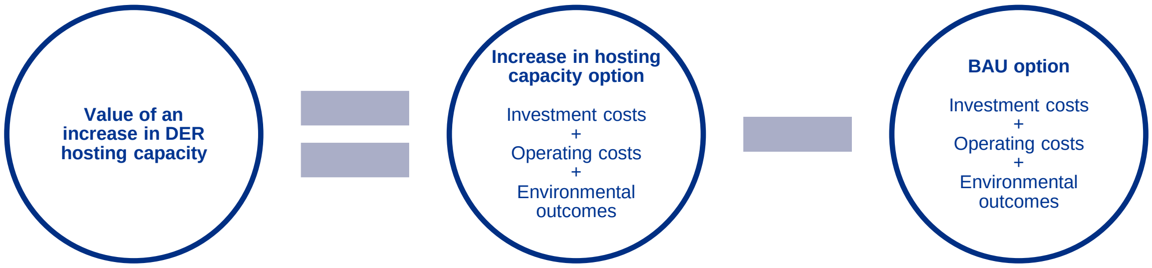
A credible option should be an option that addresses the identified need, is commercially and technically feasible and can be implemented in sufficient time to meet the identified need. For DER integration investments that include augmentation expenditure, DNSPs should demonstrate the consideration of opex or ICT capex options, such as dynamic voltage management systems to improve low-voltage network visibility and better utilise existing network hosting capacity. Where the selected investment option involves a combination of these types of expenditure, DNSPs should explicitly identify the benefits associated with each component of the investment option.

4 VaDER methodology

The methodology for determining the value of an increase in hosting capacity compares the total electricity system costs as a result of increasing hosting capacity with the total electricity system costs of not doing so.

Electricity system costs include the investment costs, operational costs and environmental outcomes (to the extent that the environmental outcomes impart a direct cost on the system) of large-scale generation, essential system services, network assets and DER installed by customers.

Figure 2: VaDER methodology



DNSPs should clearly articulate their assumptions about changes in investments, operations, and environmental outcomes in both the base case and investment scenario.

5 Defining the base case scenario

DNSPs must demonstrate that the sum of all net benefits associated with its proposal to increase DER hosting capacity (the investment scenario) exceed the sum of all net benefits associated with the BAU option, or base case scenario.

5.1 How to determine the base case scenario

Although DNSPs may assume a static export limit in their base case scenario, they should demonstrate that this limit is not arbitrary. DNSPs could undertake sensitivity analysis to demonstrate that the investment case is preferable when compared to a range of business as usual export limits. This may demonstrate that the assumed export limit is not selected arbitrarily.

DNSPs that employ more advanced techniques to understand network behaviours (such as a DVMS or dynamic operating envelopes) should demonstrate how these techniques have informed the export limit selected in the base case scenario.

DNSPs should provide a baseline forecast of DER adoption in terms of number, capacity and type of DER systems adopted over the investment life. In general, our assumption is that networks will invest to integrate forecast DER and not actively recruit and grow DER adoption beyond projected adoption, however there may be some exceptions to this.

These exceptions may occur when it is assumed that the proposed investment will automatically permit additional DER exports. For example, a proposed investment to increase hosting capacity may enable an increase in default connection export limits and allow existing DER owners to export more electricity. Where DER adoption forecasts do not match those in the investment case, DNSPs should provide evidence of analysis to support their assumptions. This analysis should detail whether the assumed difference in DER adoption forecasts is due to customers purchasing DER, existing DER owners being provided additional capacity to export electricity, or both. We note in section 6.5 that where DER adoption forecasts are different, DNSPs may need to quantify the costs and benefits associated with changes in customer investment in DER.

5.2 Guidance for assessing hosting capacity

5.2.1 How to assess hosting capacity

Analysis of hosting capacity can be deterministic or probabilistic and can be undertaken using a range of modelling and analysis methods.

DNSPs must demonstrate that net customer benefits under the investment case (to increase hosting capacity) exceed those under the base case, and properly defining the base case relies on a good understanding of the existing level of hosting capacity.

In considering whether DNSPs have demonstrated the best possible understanding of DER hosting capacity, we will consider the following criteria:

- **DER penetration –** as an overarching principle, the level of hosting capacity analysis undertaken by DNSPs should be commensurate to current and forecast levels of DER penetration on the distribution network, as well as the amount of hosting capacity to be unlocked by the proposed investment. That is, DNSPs with high levels of DER penetration (both currently and forecast over the price control) should demonstrate a comprehensive understanding of DER hosting capacity. This is because a greater number of current and prospective DER owners are impacted by the DNSP's decision to invest or not invest in increasing DER hosting capacity.
- **Investment in network visibility** – DNSPs that have made investments to better understand the nature of their LV networks (in terms of voltage and thermal constraints) should demonstrate a thorough understanding of DER hosting capacity. DNSPs that have been previously funded for investments and activities of this nature should demonstrate value for money to their customers, and part of this value is the presentation of a suitable base case scenario to compare proposed investments against.
- **Access to AMI data** – DNSPs with access to AMI data should make use of this data in their assessment of DER hosting capacity. AMI data may be used in econometric models to estimate DER hosting capacity.

6 Quantifying DER benefits

Under the VaDER methodology DNSPs must identify which costs and benefits associated with an increase in hosting capacity can be included.

6.1 Wholesale market benefits

DER integration can deliver the following wholesale market benefits:

- Avoided marginal generator SRMC – Increased DER generation substitutes for generation by marginal centralised generators, which may have higher short-run marginal costs, in the form of fuel and maintenance costs.
- Avoided generation capacity investment – Increased DER generation reduces the need for investment in new/replacement centralised generators.
- Essential System Services (including FCAS) – Increased DER capacity enables more DER participation in ESS markets, reducing investment in new/replacement centralised ESS suppliers.

6.1.1 How to undertake electricity market modelling

As we discuss in the accompanying explanatory note, the AEMC's recent draft determination will require the AER to develop and consult on a customer export curtailment value (CECV) methodology and publish CECVs annually. Our current view is that the CECV methodology will provide the method for calculating wholesale market benefits.

We do not consider it appropriate to prescribe a particular model or methodology prior to our consultation on the customer export curtailment value (CECV) methodology.

6.2 Network benefits

For network benefits of additional DER, there is generally only one way to calculate network benefits which is the normal network planning processes as described in the RIT-T and RIT-D guidelines. However, there may be some circumstances where a network might use an average avoided cost rather than a specific avoided project cost.

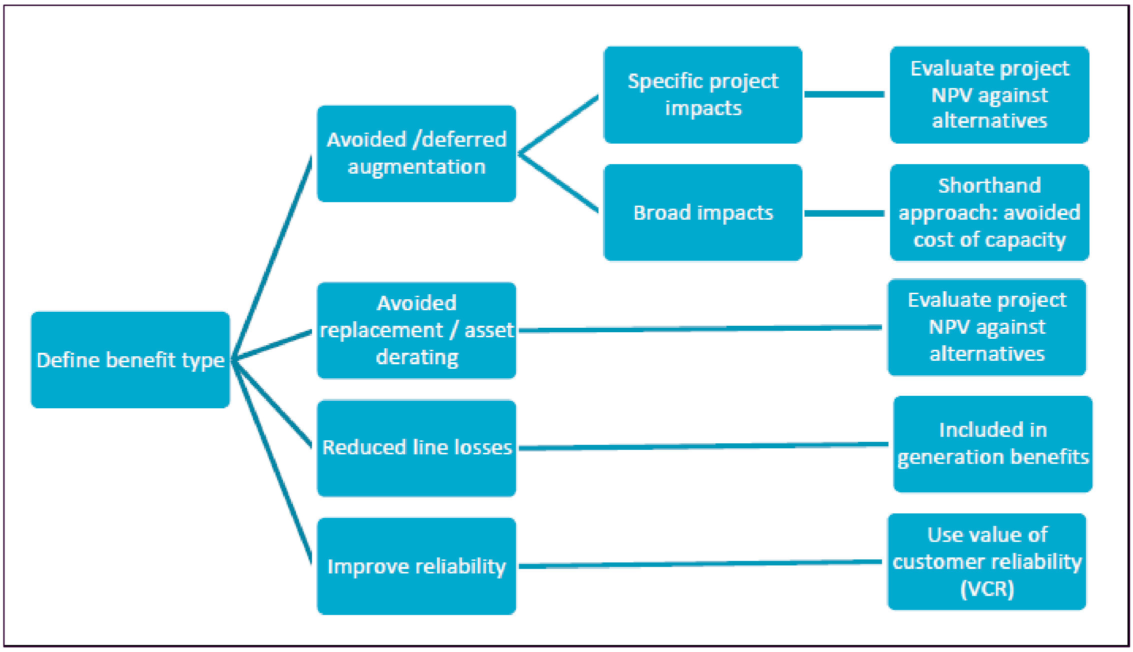
The methodology that DNSPs should use for quantifying network benefits depends on the particular value stream and which of the following is enabled by the proposed network investment:

- Increase in variable energy generation – energy generated by passive DER systems with a profile dictated by technology type and resource conditions (e.g. solar PV, wind)

- Increase in flexible energy generation – energy generated by active DER systems with a profile dictated by tariff structures and/or market conditions to maximise customer returns (e.g. batteries)
- Increase in flexible capacity – active DER capacity available to provide services to wholesale markets (generally Essential Services such as FCAS) or network services including demand management (e.g. batteries and demand response).

The recommended approach for selecting network methods is based on the type of network benefit and whether it derives from a specific network project affecting specific assets or a broad-based project with wider and longer lasting impacts. Figure 3 summarises the recommended method selection process for network sector benefits.

Figure 3: Summary of method selection process for quantifying network sector benefits



6.2.1 Avoided/deferred augmentation

Increased DER capacity may lead to avoided/deferred transmission augmentation as it may reduce the amount of load supplied from within distribution networks and reduce peak demand at transmission connection points. It may also lead to avoided/deferred distribution augmentation, as it increases the amount of load supplied from within distribution networks and may reduce peak demand at upstream network assets.

If the proposed investment enables an increase in variable energy generation or flexible energy generation, DNSPs may only quantify avoided/deferred transmission and distribution augmentation where generation aligns with the peak[8], and do so based on the RIT-T guidelines, RIT-D guidelines, or average LRMC approaches.

If the proposed investment enables an increase in flexible capacity, DNSPs may quantify the avoided/deferred augmentation for investments based on the RIT-T, RIT-D or average LRMC approaches.

In deciding whether to adopt an approach under the RIT-D/T guidelines or an average LRMC approach, DNSPs should consider whether there are known short-medium term constraints (specific project impacts). If so, DNSPs should follow the RIT-T or RIT-D guidelines. If there are no known constraints (but rather broad impacts), DNSPs may adopt a shorthand approach such as calculating the average LRMC. To do this for avoided/deferred transmission augmentation, each kW of reduced peak demand contributed by the distribution network to the transmission network is valued at the annualised LRMC of the transmission network. For avoided/deferred distribution augmentation, each kW of reduced peak demand is valued at the annualised LRMC of the distribution network. Both values can be estimated from historical demand growth and augmentation expenditure data.

As noted in section 3, where a DNSP quantifies avoided/deferred augmentation as a benefit associated with a DER integration investment, it should demonstrate that its augmentation expenditure forecast has been adjusted in a consistent manner.

[8] Or the probability that it will align with the peak, based on the timing of past maximum demand events.

Deferred and avoided network augmentation with specific project impacts

A DNSP forecasts that increased solar PV connections in a number of areas of its network will cause voltages to increase. These areas of the network will require future augmentation to accommodate further increases in solar PV and maintain voltage compliance.

As part of its base case scenario, the DNSP forecasts a program of capex that involves low voltage line augmentation, circuit rearrangement and transformer replacement. For simplicity, we assume that the capex program will occur in 2 years, at a total cost of $15 million. The current discount rate is 4%.

The DNSP investigates implementing a dynamic voltage management system (DVMS), allowing it to adjust voltages at zone substations. The cost of the DVMS is $1 million and the investment would occur in the first year. It estimates that this option will avoid the need to undertake half of the capex program in the base case scenario (costing $7.5 million), and defer the remaining capex program by 2 years.

- In the base case scenario, in year 2:

$$PV = \frac{\$15\ million}{(1.04)^2} = \$13{,}868{,}343$$

- In the investment case, in year 4:

$$PV = \frac{\$7.5\ million}{(1.04)^4} = \$6{,}411{,}031$$

The benefit of the delayed and reduced transformer augmentation program due to the implementation of the DVMS is:

$$\$13{,}868{,}343 - \$6{,}411{,}031 = \$7{,}457{,}312$$

The net benefit is reduced by the cost of implementing the DVMS:

$$\$7{,}457{,}312 - \frac{\$1\ million}{(1.04)^1} = \$6{,}495{,}773$$

6.2.2 Avoided replacement/asset derating

Increased DER capacity can lower the average load on network assets, enabling asset deratings and when replacement is required, smaller, cheaper assets can be installed. DNSPs may quantify these benefits where the proposed investment to increase hosting capacity leads to changes in other parts of the network where:

- peak demand is not growing over time at the relevant network asset
- peak demand coincides with times when DER exports are enabled
- network asset longevity can be improved by reducing loads.

Any potential benefits in this category are likely to be asset specific, and so DNSPs should quantify the avoided replacement benefits based on the RIT-D guidelines.

As noted in section 3, where a DNSP quantifies avoided replacement/asset derating as a benefit associated with a DER integration investment, it should demonstrate that its replacement expenditure forecast has been adjusted in a consistent manner.

6.2.3 Reduced line losses

Increases in DER generation may result in avoided transmission and distribution losses. DER generation can supply loads within the distribution network, reducing the supply from centralised generators connected to distribution networks by transmission lines, which avoids energy being lost to heat when transported over transmission lines. It can also reduce the distance the energy travels across the distribution network compared to centralised generators, which reduces the amount of energy lost to heat when transported over distribution lines.

The avoided transmission and distribution losses should be built into the calculation of wholesale market benefits. The avoided losses themselves are not an economic benefit, but the avoided generator SRMC is an economic benefit.

6.2.4 Improve reliability

DER can supply individual customers and/or local networks after network faults, where it can be islanded, reducing unserved energy and outage duration.

This benefit is only quantifiable if the proposed investment enables an increase in flexible energy generation and/or flexible capacity, and only where additional batteries have been enabled. Specifically, this value stream may be quantified where:

- The proposed investment includes or incentivises additional investment in battery storage (which would otherwise not be installed)
- The additional battery investment is able to be islanded during a fault
- Outages of up to a few hours are common.

The benefit can be calculated by assessing the expected value of unserved energy for each customer that has invested in additional battery capacity as a result of the network's DER integration investment. The assessment of avoided unserved energy must consider whether the battery will have the necessary stored charge to meet household demand for the duration of a typical outage. This could be done by reviewing the proportion of outages that occur at different times of the day and assuming no benefit for the proportion of outages that occur between certain hours (such as late at night when the battery has finished discharging). Each avoided kWh of unserved energy is to be valued using the appropriate VCR value.

6.3 Environmental benefits

Environmental benefits broadly encompass the benefits of avoided greenhouse gas emissions due to additional DER. These benefits may only be quantified if there is an identifiable tax, levy or other payment associated with environmental or health costs which producers are required to pay or where jurisdictional legislation directs DNSPs to consider the impact of these externalities and has provided a value that is to be used.

Renewable energy targets and/or a potential carbon price for generators should be incorporated into the DNSP's calculation of wholesale market benefits. If there is a jurisdictional requirement to consider the price of carbon, the DNSP should calculate the carbon benefits associated with its proposed investment. To do this, DNSPs should identify an emission intensity profile for each half hour period over the investment lifespan, and a carbon value that is consistent with the value set jurisdictionally. While AEMO does not currently publish this information, an electricity market model could be used to derive this information consistent with AEMO's Integrated System Plan (ISP) Central Scenario.

6.4 Intangible benefits

Other perceived or intangible DER benefits are excluded from the VaDER calculation. DNSPs should not include any intangible benefits. We acknowledge that some customers may value these intangible (or non-monetary) benefits, however in line with the RIT-D principles, credible options should maximise the present value of the net economic benefit to all those who produce, consume and transport electricity in the NEM.[9]

6.5 Change in DER investment

The treatment of DER investment costs only changes the calculation of benefits if the DNSP varies its forecast of DER adoption between the base case and investment case. In general, DER adoption forecasts in the base case scenario should match those in the proposed investment case, as noted in section 5.1. In these cases, DNSPs should not include costs or benefits associated with changes in DER investment in

[9] NER, cl. 5.17.1(b).

their VaDER calculation. However, there may be some exceptions to this, and DNSPs may be permitted to quantify costs and benefits associated with changes in DER investment.

DNSPs should include an estimate of the costs and benefits associated with changes in DER investment when:

- they assume different DER adoption forecasts in the base case scenario and investment case; and
- any of the difference is due to customers purchasing DER.

DER subsidies that the customer receives should be netted off from investment costs.