IPART

Independent Pricing and Regulatory Tribunal

New South Wales

# Review of distribution reliability standards

Issues Paper

Electricity

March 2020

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# Tribunal Members

The Tribunal members for this review are:

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Ms Deborah Cope

Ms Sandra Gamble

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# Invitation for submissions

IPART invites written comment on this document and encourages all interested parties to provide submissions addressing the matters discussed.

**Submissions are due by 24 April 2020**

We would prefer to receive them electronically via our online submission form <www.ipart.nsw.gov.au/Home/Consumer_Information/Lodge_a_submission>.

You can also send comments by mail to:

**Review of distribution reliability standards**
Independent Pricing and Regulatory Tribunal
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Late submissions may not be accepted at the discretion of the Tribunal. Our normal practice is to make submissions publicly available on our website <www.ipart.nsw.gov.au> as soon as possible after the closing date for submissions. If you wish to view copies of submissions but do not have access to the website, you can make alternative arrangements by telephoning one of the staff members listed above.

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If you would like further information on making a submission, IPART's submission policy is available on our website.

# Contents

# 1 Introduction

The Independent Pricing and Regulatory Tribunal (IPART) has been asked to recommend reliability standards for the NSW electricity distributors.

Over the past decade, there has been significant investment in electricity distribution network infrastructure in NSW. This has been driven in part by the high levels of reliability required by the distributors' reliability standards. However, the costs of these investments have been passed onto customers through higher electricity bills.

While the reliability of the distribution network is important and outages can have wide-spread effects, customers may be willing to accept a slightly lower level of reliability if it results in lower electricity bills. In addition, new technologies offer opportunities for the distributors to evolve and offer more cost-effective solutions than traditional network investment and for customers to provide further generation and reliability themselves. For future investment, it is important to strike a balance between the costs that distributors incur in providing a reliable and secure network and the value that customers place on experiencing fewer and shorter outages.

## 1.1 What we have been asked to do

Our terms of reference require us to recommend any changes to the existing reliability standards that could deliver bill savings to NSW electricity customers. In making our recommendations, we are to apply an economic assessment to evaluate how the efficient costs vary with different levels of reliability and compare them to the values that customers place on reliability.

In addition, if we identify any other measures that could be imposed on or implemented by the distributors that would reduce network prices, we are to include recommendations on them.

In undertaking the review, our terms of reference state that we are to have regard to several matters including the objective of the NSW Government to improve electricity affordability while maintaining a safe and reliable network, the differences in the costs and benefits of delivering reliable network services to different networks and different parts of the network, (including CBD, rural, and regional areas) and consistency with national incentives and obligations with respect to distribution reliability.

For our full terms of reference, see Appendix A.

## 1.2 How we will conduct the review

For this review we will conduct a public consultation process and our own research and analysis. We will also consult individually with the three NSW distributors – Ausgrid, Essential Energy and Endeavour Energy – and other stakeholders including consumer groups, industry bodies, government agencies and regulators such as the AER.

This Issues Paper is the first step in our public consultation for the review. It describes and seeks comment on our proposed approach for the review. We invite all interested parties to make submissions in response to this paper by 24 April 2020. Details on how to make a submission are provided on page iii at the front of the paper.

We will release a Draft Report at the end of September 2020, and conduct further consultation before making our final recommendations and releasing a Final Report in December 2020.

Our original terms of reference required us to complete the review and provide a Final Report by October 2020. However, following the impact of 2019-20 bushfire season on the NSW distributors' networks, the NSW Government has provided an additional three months so that all stakeholders have sufficient time and resources to contribute to this important review.

We are proposing that any changes to the standards would apply from 1 July 2024. The revised timetable will still provide the distributors with adequate time to plan and comply with any proposed changes to the standards in this time.

**Table 1.1 Indicative timetable for the review**

| Key milestone | Proposed timing |
|---|---:|
| Release Issues Paper | 3 March 2020 |
| Submissions to Issues Paper due | 24 April 2020 |
| Release Draft Report | September 2020 |
| Public hearing | October 2020 |
| Submissions to Draft Report due | Early November 2020 |
| Release Final Report | December 2020 |

## 1.3 How this paper is structured

The rest of this Issues Paper provides more information on the review and our proposed approach:

- Chapter 2 outlines key contextual information for this review
- Chapter 3 sets out our approach for making our recommendations
- Chapters 4 to 6 discuss the key steps in this approach in more detail including:
  - Considering how to express the reliability standards such as what measures to use and the types of outages that should be included
  - Deciding how to apply an economic assessment to setting reliability standards such as the approach we will use and the inputs and assumptions we will need to make.

- Recommending changes to the standards including the need for state-based standards, when any new standards should take effect, and the appropriate compliance and monitoring framework for reliability standards.

## 1.4 Issues on which we seek comment

The questions on which we seek stakeholder comment are set out in the chapters that follow. Stakeholders may address all or some of these issues, and are also free to raise and discuss any other issues relevant to the terms of reference. For convenience, these questions are also listed below:

# 2 Context

To undertake analysis and provide input to this review, it is important to understand the context in which the distributors operate. The sections below provide more information on the following:

- the role of the distribution networks,
- the current reliability standards and the businesses' historical performance against them, and
- requirements of the National Electricity Rules and the AER and how they impact on distributors' reliability.

## 2.1 Role of distributors in the electricity supply chain

Distribution networks are a key part of the electricity network system. As Figure 2.1 illustrates, they take high voltage electricity from the transmission network, transform it to a lower voltage and deliver it to residential, commercial and industrial customers.[1]

Outages which cause an interruption to a customer's electricity supply can be caused by a lack of generation supply, transmission network outages or distribution network outages.[2] While historically the distributors have provided a high level of reliability, analysis by the Reliability Panel shows that 94 per cent of interruptions to customer supply (both planned and unplanned) in the past decade were caused by distribution network outages.[3]

In NSW, there are three licensed distributors:

- Ausgrid distributes electricity across Sydney, the Central Coast and Hunter Valley, and is the largest distributor by customer numbers (see Table 2.1).
- Endeavour Energy distributes electricity across Sydney's Greater West, the Blue Mountains, Southern Highlands, the South Coast and Illawarra.[4]
- Essential Energy distributes electricity to the remaining 95% of NSW and some parts of Southern Queensland.

1 Distributors also deliver electricity to a small number of customers who are not connected via distribution feeders. These are typically large industrial customers.

2 AER, Values of Customer Reliability - Final Decision, 2019, p 4, Available from https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf.

3 AER, Values of Customer Reliability - Final Decision, 2019, p 4. Available from https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf.

4 Endeavour Energy Distribution Annual Planning Report, 2019 DAPR, December 2019, p 6.

## Figure 2.1 Electricity supply chain


Electricity is generated through various sources including water, wind, sun and fossil fuels. The generated electricity is converted using transformers to very high voltages for transfer over long distances.

The transmission network then transfers the electricity at very high voltages of up to 500 kV (1000 volts (V) = 1 kV) to bulk supply substations (large load centres) where it is transformed to lower voltages of up to 132 kV. The electricity then goes into the distribution network to supply zone substations through subtransmission feeders (high voltage power lines). A substation is electrical infrastructure which contains transformers that use electromagnetic induction to either increase or decrease the voltage of the electricity as required. Some high voltage customers are supplied directly from zone substations.

Otherwise, it is at the zone substation that the electricity is transformed from voltages of up to 132 kV to lower voltages, generally at 11 kV for supply to distribution substations. The overhead wires or underground cables that transfer the electricity from the zone substation to the distribution substation are what we refer to as feeders for the purposes of this review.

The distribution substations transform the electricity to even lower voltages that are suitable for domestic use. That electricity is then delivered to properties through the low voltage network that is made up of overhead poles and wires, and underground cables.

**Table 2.1 NSW distributor network characteristics**

| | Ausgrid | Endeavour Energy | Essential Energy |
|---|---|---|---|
| Land area (square km) | 22,275 | 24,980 | 737,000 |
| Feeders | 2,373 | 1,556 | 1,465 |
| Customers | 1.8 million | 1.0 million | 855,000 |
| Zone substations | 182 | 164 | 339 |
| Distribution substations | 32,301 | 32,349 | 138,539 |
| Power poles | 511,656 | 429,000 | 1,390,806 |
| Total length of power lines (km) | 44,000 | 59,300 | 183,612 |

**Note:** The distributors have reported that some of these figures are approximated and Essential Energy's total length of powerlines refers to overhead lines only.

**Source:** Ausgrid Distribution and Transmission Annual Planning Report - December 2019, Endeavour Energy Distribution Annual Planning Report 2019 DAPR - December 2019, Essential Energy Asset Management Distribution Annual Planning Report - December 2019.

Distribution network charges account for about a third of the average electricity bill for residential and small business electricity customers.[5] Other components of the bill include wholesale electricity costs, transmission network charges, environmental policy costs and retail costs.

## 2.2 Current reliability standards

Reliability refers to the extent to which customers have a continuous supply of electricity.[6] Reliability standards establish the level of reliability that a distributor is required to provide.

### 2.2.1 Distributors' licences contain four reliability requirements

The Minister for Energy and Environment (the Minister) has issued each distributor with an operating licence which details the requirements they must meet in order to operate a distribution network in NSW. There are currently four requirements that impact on reliability:

5 AER, Final Decision – Ausgrid distribution determination 2019-24, p 17, Available from https://www.aer.gov.au/system/files/AER%20-%20Final%20decision%20-%20Ausgrid%20distribution%20determination%202019-24%20-%20Overview%20-%20April%202019.pdf , Accessed 11 February 2019, AER, Final Decision – Essential Energy distribution determination 2019-24, p 8, Available from https://www.aer.gov.au/system/files/AER%20-%20Final%20decision%20-%20Essential%20Energy%20distribution%20determination%202019-24%20-%20Overview%20-%20April%202019.pdf, AER, Final Decision – Endeavour Energy distribution determination 2019-24, p 8, Available from https://www.aer.gov.au/system/files/AER%20-%20Final%20decision%20-%20Endeavour%20Energy%20distribution%20determination%202019-24%20-%20Overview%20-%20April%202019.pdf

6 AEMC, Fact sheet: what is transmission reliability?, 2013, Available from: https://www.aemc.gov.au/sites/default/files/content/da1fd25e-0b20-4c1a-8a29-5fa182173f50/Information-sheet-What-is-transmission-reliability.PDF , Accessed 20 February 2020.

- **Network overall reliability standards**: require the distributors to ensure that the average duration and frequency of unplanned interruptions over the whole network do not exceed specified levels. These overall standards apply to different feeder types[7] (Sydney CBD, urban, short-rural and long-rural feeders) and are measured using two indices:
  - System Average Interruption Duration Index (SAIDI), calculated as the average of the sum of the durations of each sustained customer interruption (measured in minutes), divided by the total number of customers.
  - System Average Interruption Frequency Index (SAIFI), calculated as the total number of sustained customer interruptions divided by the total number of customers.

  Certain types of interruptions that are generally considered outside the control of the distributors are excluded from both SAIDI and SAIFI (see Box 2.1).

- **Individual feeder standards**: require the distributors to ensure that the average duration and frequency of unplanned interruptions on each feeder do not exceed specified levels.

  These levels are also measured using SAIDI and SAIFI for each feeder and disregard excluded interruptions.

  The distributors are required to monitor performance of individual feeders, consider whether it is economically feasible to improve performance on feeders failing to meet reliability standards and report to the Minister where they determine that it is not feasible to bring performance up to the required standard.

- **Individual customer standards:** require the distributors to ensure that the average duration and frequency of unplanned interruptions for some large industrial customers that are directly connected via sub-transmission feeders do not exceed specified levels.

  As is the case for individual feeder standards, the distributors are required to monitor performance of individual customers, consider whether it is economically feasible to improve performance where they are not meeting reliability standards and report to the Minister where they determine that it is not feasible to bring performance up to the required standard.

- **Customer service standards**: provide for eligible customers to apply for a payment of $80 each where the distributor exceeds the interruption duration and or frequency standard. The distributor must also meet specific timeframes in relation to the determination of any such claim and make reasonable efforts to make customers aware of the payments available under this licence condition.

Distributors are required to report quarterly to IPART on their performance against the standards. Their results must be independently audited after the end of each financial year.

The current levels of performance are summarised in Appendix B.

See Box 2.1 for more information on the levels specified in the standards and the types of interruptions that are excluded.

7 Feeders are the lines that transfer electricity from a distribution substation to a distribution transformer.

**Box 2.1 Distribution reliability standards excluded interruptions**

For the purpose of reporting against **overall network**, **individual feeder** and **individual customer** reliability standards under a distributor's licence, the following types of interruptions are excluded interruptions:

(a) an interruption of a duration of three minutes or less;

(b) an interruption resulting from:

(i) load shedding due to a shortfall in generation;

(ii) a direction or other instrument issued under the *National Electricity Law*, *Energy and Utilities Administration Act 1987*, the *Essential Services Act 1988* or the *State Emergency and Rescue Management Act 1989* to interrupt the supply of electricity;

(iii) automatic shedding of load under the control of under- frequency relays following the occurrence of a power system under-frequency condition described in the Power System Security and Reliability Standards made under the National Electricity Rules;

(iv) a failure of the shared transmission system;

(c) a planned interruption;

(d) any interruption to the supply of electricity on a Licence Holder's distribution system which commences on a major event day; and

(e) an interruption caused by a customer's electrical installation or failure of that electrical installation.

A major event day is defined statistically to allow major events to be examined separately from daily operation, and in the process, better reveal trends in a daily operation that would be hidden by the large statistical effect of major events.

For the purpose of reporting against **customer service** standards under a distributor's licence, the following types of interruptions are to be excluded:

(a) an interruption resulting from the following external causes:

(i) a shortfall in generation;

(ii) a failure or instability of the shared transmission system;

(iii) a request or direction from an emergency service organisation;

(b) a planned interruption;

(c) an interruption within a region in which a natural disaster has occurred and:

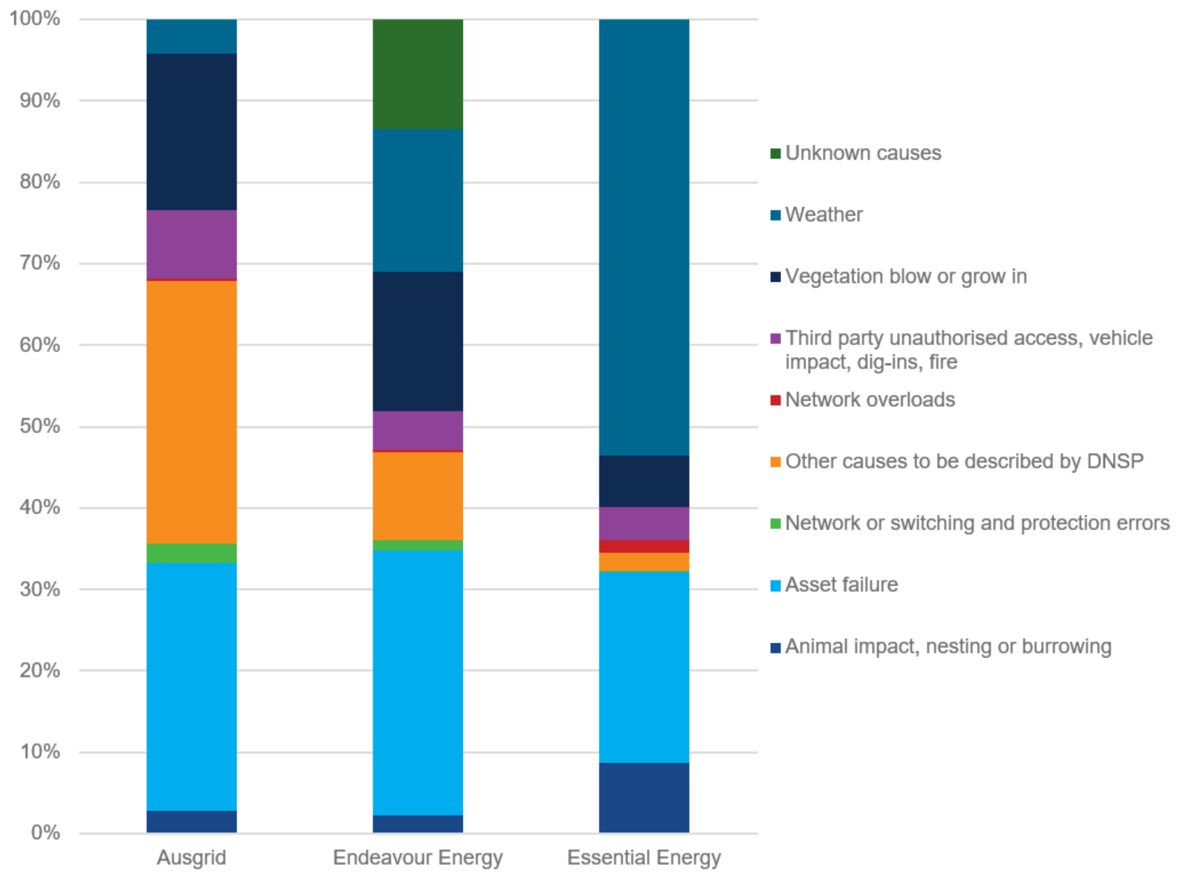
(i) the responsible Minister has made a declaration of a Natural Disaster enabling the NSW Disaster Assistance Arrangements to apply in respect of that natural disaster for that region; and

(ii) the interruption occurred during the period for which a declaration of a Natural Disaster and NSW Disaster Assistance Arrangements were in effect;

(d) an interruption caused by the effects of a severe thunderstorm or severe weather as advised by the Bureau of Meteorology. These effects may include the necessary operation of a circuit protection device which interrupts supply to customers in areas not directly impacted by the severe thunderstorm or severe weather.

Unplanned outages on a distribution network can occur for several reasons. Some factors can be directly influenced by the distributor (eg, equipment failure due to age or condition) while others are outside of the distributor's control (eg, outages on the transmission network or as a result of insufficient wholesale supply). In addition, some factors are a result of extreme events (eg, third-party damage, extreme weather). The most common causes of unplanned outages are asset failure, vegetation and weather (Figure 2.2). However these vary by distributor.

**Figure 2.2 Distributor causes of unplanned outages**




**Data source:** Australian Energy Regulator, 2018-19 Category Analysis RIN responses from Ausgrid, Endeavour Energy and Essential Energy, October 2019, sheet 6.3 Sustained interruptions.

**Note:** There are differences in the way that each of the distributors classifies Other causes.

The SAIDI and SAIFI levels specified in the current network overall reliability and individual feeder reliability standards have not changed since 2014. Prior to this, the distributors were also required to meet enhanced design planning specifications and reliability standards. These specified security (or redundancy) levels - often referred to as deterministic or N, N-1, N-2 standards – as well as acceptable customer interruption times for different parts of the network.

Deterministic standards specify how much redundancy needs to be built into a network. Standards are expressed using 'N-x' notation, where N refers to the number of elements in a part of the network and x is the number of elements that can fail at the same time without causing an interruption to power supply. For example, a network built to a strict N-1 standard will be able to supply peak load with one element not operating, even if it is the largest element in the network.

Several reviews have identified the pre 2014-deterministic standards as one of the reasons for the high level of investment in NSW distribution networks.[8] For example, in 2018 the ACCC noted that in NSW, Queensland and Tasmania there had been significant over-investment in state-owned networks, driven primarily by excessive reliability standards and a regulatory regime tilted in favour of network owners at the expense of electricity users. It reported that customers in those states continue to pay for over-investment in networks, estimated to amount to $100 to $200 per residential customer per annum.[9]

### 2.2.2 Distributors' overall network reliability performance is better than the standards

Since 2007-08 the distributors have generally provided higher levels of overall network reliability than is required by their licences.[10]

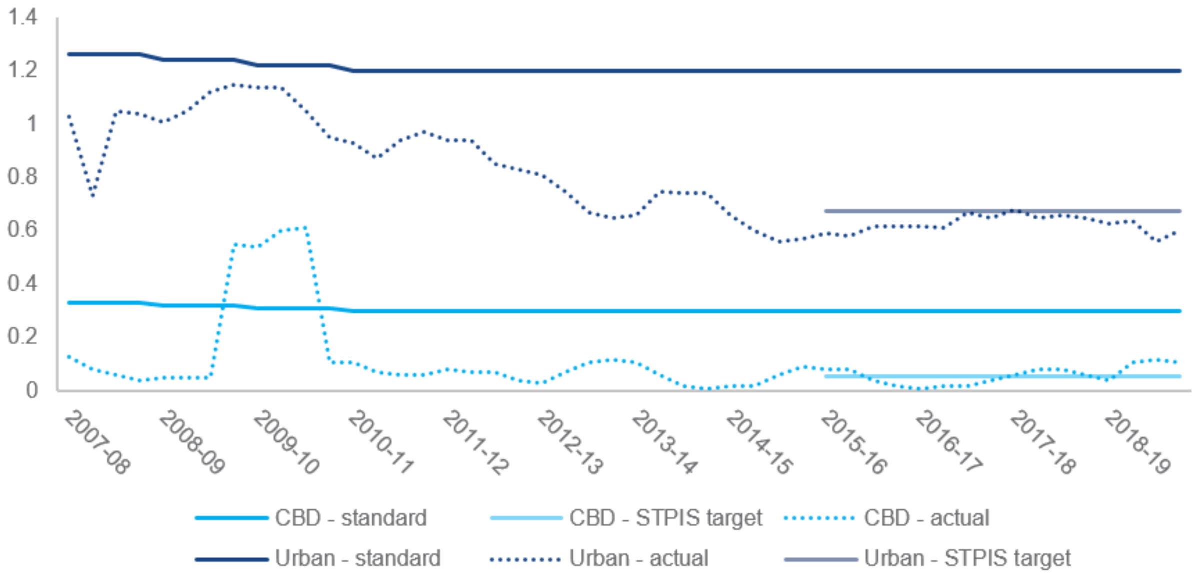
For example, Figure 2.3 shows Ausgrid's overall network reliability performance for SAIFI for Sydney CBD and urban feeders. The standard for urban feeders allows for customers on average to experience around one unplanned outage each year (ie, SAIFI of 1.2). Over the last five years, these customers have experienced higher levels of reliability with around one unplanned outage every two years (ie, SAIFI of around 0.6). Since 2015-16 these levels of reliability have been more consistent with the levels set out in the AER's Service Target Performance Incentive Scheme (STPIS) (see section 2.3 below for further information).

8 For example see AEMC, Final Report – NSW Workstream Review of Distribution Reliability Outcomes and Standards, p 17, Available from: https://www.aemc.gov.au/sites/default/files/content/a5bbc0be-e7e3-4fcd-b856-feaf4088d38a/NSW-workstream-final-report.pdf, Accessed 21 February 2020, ACCC, Restoring electricity affordability & Australia's competitive advantage, 2018, p 166, Available from: https://www.accc.gov.au/system/files/Retail%20Electricity%20Pricing%20Inquiry%E2%80%94Final%20Report%20June%202018_0.pdf , Accessed 21 February 2020.

9 Ibid, p ix

10 We note that in some years the distributors have had non-compliances with network overall reliability standards due to minor contraventions related to excluded interruptions.

**Figure 2.3 Ausgrid - SAIFI performance CBD and urban 2007-08 to 2018-19**

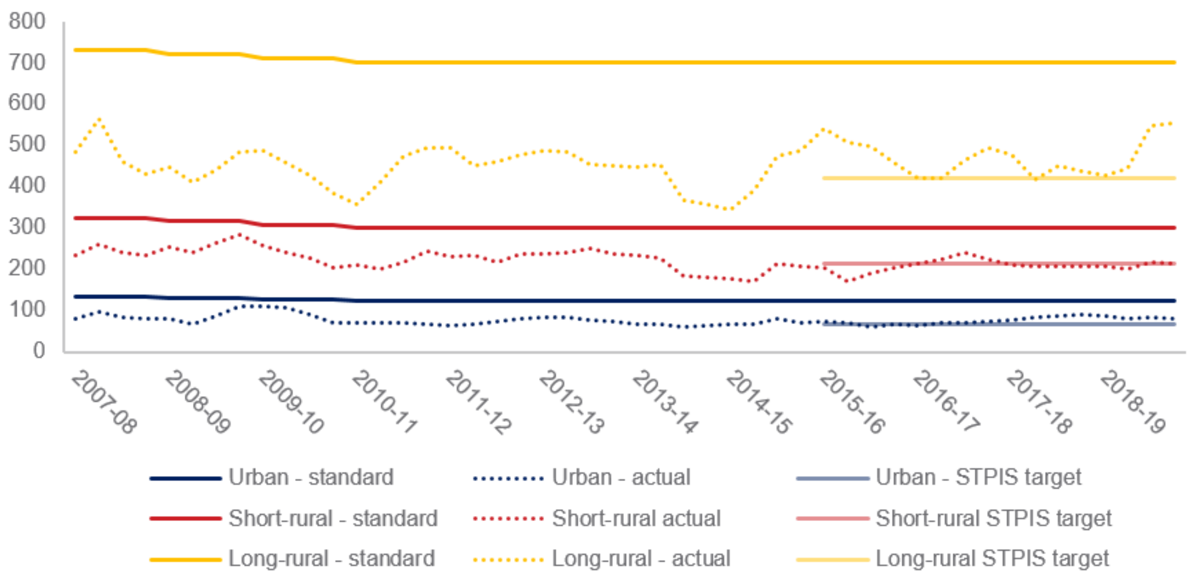



**Data source:** IPART analysis of information provided by Ausgrid.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

Similarly, Essential Energy's SAIDI standards allows for long rural feeder customers on average to experience 700 minutes of unplanned outages each year. Over the last five years, these customers have experienced higher levels of reliability with around 400 to 500 minutes of unplanned outages each year.

**Figure 2.4 Essential Energy SAIDI performance 2007-08 to 2018-19**



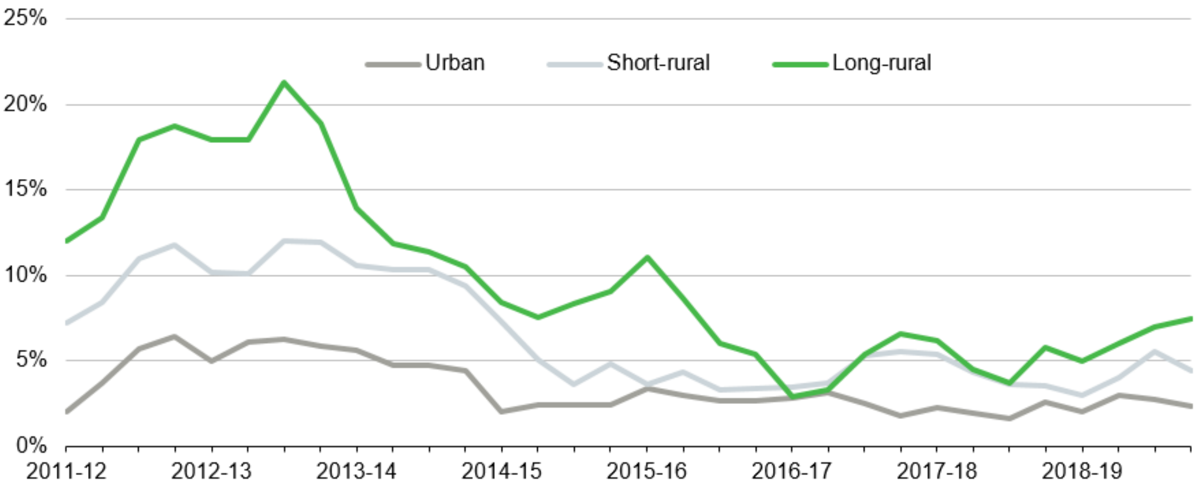

**Data source:** IPART analysis of information provided by Essential Energy.

**Note:** Financial incentive for STPIS were introduced from 2015-16.

Each of the distributors have some feeders that do not meet the individual feeder standards. As noted above, the standards require the distributors to report on individual feeders, consider whether it is economically feasible to improve performance on feeders failing to meet reliability standards and report to IPART where they determine that it is not feasible to bring performance up to the required standard. It is not a requirement for every feeder to meet the individual standards.

For example, Figure 2.5 shows the proportion of each feeder type for Essential Energy where the levels of SAIDI and SAIFI are above the levels specified in the individual feeder standards. Recently, this percentage has decreased to less than 5% of feeders for urban and short-rural feeders and around 7% for long-rural feeders.

**Figure 2.5 Essential Energy percentage of feeders above individual feeder standards 2011-12 to 2018-19**




**Data source:** IPART analysis of information provided by Essential Energy

Attachment B contains further information on the distributors' performance against each of their reliability licence conditions.

## 2.3 AER's role in maintaining reliability

Traditionally, distribution services have been considered natural monopolies but with 3rd party Stand-alone Power Systems (SAPS) and distributed generation, distribution network roles are changing. To protect customers from excessive prices, the AER sets the amount of revenue a distributor can collect from its customers.

### 2.3.1 AER determines the revenue distributors need to meet their standards

The AER determines the total revenue for the distributors, which includes forecasts of operating expenditure and capital expenditure required to meet the standards in their licences. The AER recently completed its determinations for the 2019-24 period.[11]

[11] Australian Energy Regulator, *AER decisions deliver efficient costs for NSW electricity distributors*, 30 April 2019 https://www.aer.gov.au/news-release/aer-decisions-deliver-efficient-costs-for-nsw-electricity-distributors accessed 25 February 2020

In their 2019-24 proposals, all three distributors proposed maintaining current levels of reliability.[12] For example, Endeavour Energy's customer engagement found that the majority of customers are not prepared to sacrifice reliability for lower charges, and there is also low appetite to pay more for improved reliability.[13]

### 2.3.2 The AER also regulates to maintain reliability through STIPS

The National Electricity Rules (NER) rule 6.6.2 requires the AER to develop and publish a service target performance incentive scheme (STPIS) to provide incentives to maintain and improve reliability. In developing and implementing STPIS, the NER requires the AER to take into account a range of matter including:

- Consult with the NSW Department administering the NSW electricity jurisdiction
- Ensure the scheme does not put at risk compliance with the relevant service standards in the distributors' licences
- Ensure the benefits to customers are sufficient to warrant a reward or penalty
- Consider the past performance and reliability requirements of the distributor
- Ensure the incentives are sufficient to offset any financial incentives to reduce the costs at the expense of service levels
- Consider customer willingness to pay for improved delivery of services.[14]

The current design of STPIS is intended to balance incentives to reduce expenditure while maintaining or improving service quality, measured by SAIDI, SAIFI and speed at which telephone calls are answered. The distributors receive a reward or penalty based on their performance against targets. The design of the 2019-24 STPIS for all three distributors:

- Sets risk at ±5% of revenue
- Segments the networks based on CBD, urban, short rural and long rural feeder categories using the similar definitions as the licence
- Sets performance targets based on the average performance by each distributor over the past five years (i.e. the 2014-19 determination period)
- Excludes specific upstream events from the target in a similar way to the licence conditions.

In its 2019-2024 determination, the AER found, based on non-NSW distributors, STPIS was incentivising greater improvements on SAIFI than SAIDI. As a result, it updated its STPIS to put more weight on SAIDI performance.

12 For example see Ausgrid, Attachment 5.01 – Ausgrid's proposed capital expenditure – April 2018, p 21, Available from https://www.aer.gov.au/networks-pipelines/determinations-access-arrangements/ausgrid-determination-2019-24/proposal

13 Endeavour Energy, *Customer and Stakeholder Engagement Activities and Findings – Part A*, p 90, https://www.aer.gov.au/system/files/Endeavour%20Energy%20-%205.01A%20Customer%20and%20Stakeholder%20Engagement%20Activities%20and%20Findings%20-%20April%202018%20%E2%80%93%20Public.pdf accessed 25 February 2020.

14 NER, Chapter section 6.6.2, Available from https://www.aemc.gov.au/sites/default/files/content/NER-v94-Chapter-06.PDF, Accessed 28 February 2020.

The major change in the STPIS for NSW distributors in 2019-24 is the increase in revenue at risk from 2.5% to 5%. Our analysis of reliability over the past suggests that the STPIS at 2.5% was effective at incentivising distributors to maintain reliability at the STPIS level, above licence requirements. For example, as previously shown in Figure 2.3 and Figure 2.4, distributors' SAIDI and SAIFI performance has been around the levels in STPIS.

Given that STPIS was effective at 2.5%, we expect that doubling the incentives will lead to the networks prioritising meeting the STPIS targets.

### 2.3.3 The AER is currently considering the impacts of DER

Distributed Energy Resources (DER) is the collective term for customer-side investment in electricity generation, storage or management. DER encompasses a range of consumer-level technologies used by households and businesses, such as inverter connected generation and storage systems (which at present consist mostly of rooftop solar PV and battery storage systems), energy management systems, controllable loads, and electric vehicles and their charging points.[15]

Electricity consumers are increasingly seeking to generate their own power. People with the ability to generate electricity may still need to source power from the grid or they might choose to sell their excess electricity back to the market.[16]

In systems without DER, voltage is highest at the substation and decreases as the network gets further from the substation. In systems with DER, voltage is increased at every location that is exporting locally generated electricity. This makes it more difficult for the network to manage, as it is difficult to predict how much electricity will be exported at any given time. Failure to maintain power quality (of which voltage is one important part) can also damage the system and lead to supply interruptions.[17]

In the most recent NSW 2019-2024 AER determinations distributors did not propose large expenditures for DER. For example, in its 2019 pricing proposal, Endeavour Energy proposed to spend $250,000 each year on monitoring solar generation on its feeders and substations.[18] However, South Australia and Queensland are the two states with the highest penetration of embedded generation (primarily rooftop solar PV systems). Box 2.2 below summarises how they have impacted their AER determinations so far.

15 Australian Energy Market Operator, *Technical Integration of Distributed Energy Resources*, April 2019, p 10.

16 AEMC, *What is embedded generation?*, December 2015, Available from: https://www.aemc.gov.au/sites/default/files/content//ERC0191-AEMC-Embedded-Generation-Infographic_FINAL.PDF , Accessed 20 February 2020.

17 Energy Security Board, The Health of the National Electricity Market, 209, p 18, Available from https://prod-energycouncil.energy.slicedtech.com.au/sites/prod.energycouncil/files/publications/documents/The%20Health%20of%20the%20National%20Electricity%20Market%20V01.pdf , Accessed 27 February 2020.

18 Endeavour Energy, *10.16 Capex Listing (PIP) – Public,* April 2018, https://www.aer.gov.au/system/files/Endeavour%20Energy%20-%2010.16%20Capex%20Listing%20%28PIP%29%20-%20April%202018%20-%20Public.xlsm accessed 20 February 2020.

**Box 2.2 The impact of distributed energy resources on AER's current price reviews**

The AER is currently reviewing the revised regulatory proposals of the South Australian and Queensland businesses. This should provide some information on the impacts of embedded generation on system reliability and security.

The AER did not agree with South Australia Power Networks' (SAPN) original distributed energy proposal capital expenditure on reliability projects. In its revised proposal, SAPN has proposed:

- Spending $18.9 million on low voltage transformer monitoring so it can monitor changing loads on the network in real time, and react accordingly.
- Spending $42.2 million on a quality of service program to receive and act on customer inquiries.[a]

The AER accepted Energex's (the distributor in South East Queensland) proposed augmentations to manage voltage issues related to solar PV. There are no references to solar PV in Ergon Energy's revised proposal.[b]

The AER's final decisions are expected to be published in April 2020.

**a** SA Power Networks, *Attachment 5 Capital Expenditure, 2020-25 Revised Regulatory Proposal,* 20 December 2019, pp 44-47, https://www.aer.gov.au/system/files/SAPN%20-%20Revised%20Proposal%20-%20Attachment%205%20-%20Capital%20expenditure%20Updated%20-%2020%20December%202019.pdf accessed 20 February 2020.

**b** Australian Energy Regulator, *Draft decision, Energex Distribution Determination 2020 to 2025, Attachment 5 Capital Expenditure,* October 2019, pp 22-23, https://www.aer.gov.au/system/files/AER%20-%20Energex%202020-25%20-%20Draft%20decision%20-%20Attachment%205%20-%20Capital%20expenditure%20-%20October%202019_0.pdf accessed 20 February 2020.

### 2.3.4 AER reviews the value customers place on reliability

The AER is also responsible for determining the values different customers place on having a reliable electricity supply. This is referred to as the Values of Customer Reliability (VCR). In December 2019, the AER released its Final Report for VCR for unplanned electricity outages of up to 12 hours in duration (i.e. standard outages). These values were calculated in accordance with a methodology which builds upon the Australian Energy Market Operator (AEMO)'s 2014 review of VCR.

VCRs are an important input to help ensure customers pay no more than necessary for safe and reliable energy. VCRs seek to reflect the value different types of customers place on a reliable electricity supply under different conditions and are usually expressed in dollars per kilowatt hour ($/kWh). Thus, they highlight the competing tensions between reliability and affordability which customers face. VCRs are an important input in identifying efficient levels of network expenditure and in determining the National Electricity Market (NEM) reliability standard and market settings.[19]

AER found that in general VCRs are similar between the 2014 and 2019 studies (see Table 2.2). Other key findings were:

- Businesses value reliability of their electricity supply more than residential customers

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19 AER, *Values of Customer Reliability*, p 3, Available from: https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf, Accessed 21 February 2020.

- Residential customers value reliability and prefer fewer outages during peak times, localised outages rather than widespread and short rather than long duration outages
- Industrial business customers' value of reliability has increased since the last survey in 2014.

The AER is continuing further work on VCRs for widespread and long duration outages and intends to publish results in early 2020.[20]

**Table 2.2 Residential NEM and State VCR comparison to AEMO 2014 Review (real $2019)**

| Region | AER 2019 residential VCR ($/kWh) $2019 | AEMO 2014 residential VCR ($/kWh) $2019 |
|---|---:|---:|
| Northern Territory | 18.31 | N/A |
| National Electricity Market | 24.08 | 27.95 |
| Queensland | 23.76 | 27.38 |
| New South Wales | 25.85 | 28.57 |
| Australian Capital Territory | 21.38 | N/A (included as part of NSW) |
| Victoria | 21.43 | 26.66 |
| South Australia | 30.31 | 28.95 |
| Tasmania | 16.96 | 30.78 |

**Source:** AER, *Values of Customer Reliability*, 2019, p 16, Available from: https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf , Accessed 21 February 2020.

**Note:** Tasmania only has one climate zone – regional climate zone 7 with a VCR of $16.96/kWh

20 AER, *Values of Customer Reliability*, p 84, Available from:https://www.aer.gov.au/system/files/AER%20-%20Values%20of%20Customer%20Reliability%20Review%20-%20Final%20Report%20-%20December%202019.pdf, Accessed 21 February 2020.

# 3 Proposed approach

As Chapter 1 discussed, our terms of reference require us to apply an economic assessment to evaluate how costs vary with different levels of reliability and compare this with the values that customers place on reliability. It also requires us to have regard to all the matters specified in our terms of reference (see Box 3.1). This chapter summarises our proposed approach to this review. It sets out the matters we are required to consider under the terms of reference, our objectives for the review, the key steps in our proposed approach and how we will make our recommendations.

## 3.1 Matters we are required to consider

The terms of reference for this review require us to recommend any changes to the existing reliability standards that could deliver bill savings to NSW electricity customers. We are also required to recommend any other measures that could be imposed on or implemented by the distributors (within the current regulatory framework) that would be likely to reduce network prices and are consistent with the National Electricity Objective.[21]

In making our recommendations, we are to apply an economic assessment to evaluate how efficient network capital and operating costs would vary with different levels of reliability, and compare this level of costs with the value that customers place on reliability.

In undertaking this review, the terms of reference state that we are to have regard to several matters (see Box 3.1) including improving energy affordability and considering new technologies that may offer more cost effective solutions than traditional network solutions, such as stand-alone power systems.

21 The National Electricity Objective as stated in the National Electricity Law (NEL) is:

"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:

- price, quality, safety and reliability and security of supply of electricity
- the reliability, safety and security of the national electricity system."

**Box 3.1 Matters we are required to consider as part of the review**

In undertaking the review, IPART is to have regard to:

1. the objective of the New South Wales Government to improve electricity affordability while maintaining a reliable and secure network;
2. the potential impact on customer bills, assuming current regulatory arrangements, from:
   a) any change in the distribution network reliability standards;
   b) any other measures that would reduce network prices and are in the long term interests of customers;
3. the value customers place on having a reliable and secure network including the Australian Energy Regulator's (AER) Values of Customer Reliability (VCR) estimates and any other published values;
4. changes that would assist the NSW distribution networks to evolve and take advantage of new technologies that may offer more cost-effective solutions than traditional network investment (such as a stand-alone power systems);
5. the differences in the costs and benefits of delivering reliable network services to different networks and different parts of the network, including CBD, rural, and regional areas;
6. the NSW distribution network businesses' safety and security obligations;
7. a stable regulatory environment;
8. consistency with national incentives and obligations with respect to distribution reliability;
9. the AER's regulatory determinations for the 2019-24 regulatory period;
10. the relevant recommendations of the 2018 State Infrastructure Strategy and the Australian Competition and Consumer Commission's Retail Electricity Price Inquiry and reports which outline the pressures and experiences felt by NSW consumers such as Turning off the Lights: The Cost of Living in NSW by the NSW Council of Social Services and Close to the Edge by PIAC.

## 3.2 Our objectives for this review

Having taken into account the terms of reference for this review, we consider that the recommended distribution reliability standards should achieve the following objectives:

- Assist the distributors in applying risk-based (or probabilistic) network planning and focusing on what customers value. As noted in Chapter 2, the existing networks have been built to achieve a high level of reliability and the existing standards were not developed with reference to the value that customers place on reliability.
- Assist the distributors in adapting to the changes in energy supply arrangements such as the development of embedded generation (such as solar PV rooftop panels) and battery storage) as well as the impacts of climate change on the resilience of the network.
- Allow for the standards to be met using non-network solutions and emerging technologies such as stand-alone power systems (SAPS). This will allow the distributors to deliver the necessary levels of reliability for lowest cost.

- Provide an appropriate balance between making changes to the existing levels of reliability and the degree of uncertainty involved in estimating some inputs (for example VCRs). In our 2016 review of transmission reliability standards we applied an economic approach to setting reliability standards for the first time. As a result, we applied a conservative approach in making our recommendations so as not to introduce a significant change to the level of reliability required.

## 3.3 Overview of proposed approach

To meet our objectives we have established a proposed approach to this review consisting of three key steps:

- Step 1: Deciding how to express the reliability standards, including what measures to use and the types of outages that should be included or excluded in measuring performance.
- Step 2: Applying an economic assessment to estimate the efficient level of reliability, including considering the approach and inputs we will use and any assumptions we need to make.
- Step 3: Recommending changes to the standards and how often they should be reviewed.

These steps are outlined below. Chapters 4 to 6 discuss Steps 1 to 3 in more detail, including the issues we will take into consideration, our preliminary views (where we have them) and the issues on which we are seeking stakeholder feedback.

## 3.4 Deciding how to express the reliability standards

The first step in our proposed approach is to decide on the format for expressing distribution reliability standards. This involves considering what measures to use and the types of outages that should be included or excluded in measuring performance.

We will review the current standards, exclusions and customer service payments to ensure they provide an appropriate balance between the costs to the distributor and the value customers place on reliability. As part of this review we will consider how different measures or types of standards affect the distributors' incentives for maintaining and improving reliability. We will also consider the interactions between these different measures and their exclusions and the AER's determinations of revenue and STPIS.

We note that our estimate of the efficient level of reliability (discussed in Step 2 below) will yield a measure of expected unserved energy (in megawatt hours (MWh)). We could set reliability standards based on this measure or we could use it to calculate an allowance for expected unserved energy in total minutes per year or converted to an allowance in minutes per customer (similar to SAIDI). We could also convert expected unserved energy to an allowance in terms of the number or frequency of interruptions per customer (similar to SAIFI).

Reliability standards also need to account for the evolution of the network and allow distributors to take advantage of new technologies. As part of this review, we will consider if and how reliability standards need to change and whether additional measures are required to cater for changes in the network to enable two-way energy flows due to increased DER (eg, solar energy from households), and new technologies (including SAPS).

## 3.5 Applying an economic assessment to estimate the efficient level of reliability

The second step in our proposed approach is to conduct an economic assessment to estimate the level of reliability that provides the most value to customers, ie, the efficient level of reliability, having regard to the most recent VCRs published by the AER.

We propose developing a model to estimate the efficient amount of expected unserved energy per year for different parts of each distributor's network. In particular, we propose adapting the economic approach we used in our 2016 review of the NSW transmission reliability standards to the NSW distribution networks. The approach estimates both:

- The costs of owning, operating and maintaining the assets in a particular part of the network (eg, a substation and associated lines), or non-network solutions, to achieve a given level of reliability.
- The dollar value of the expected unserved energy at that level of reliability.

The sum of the costs and the value of the expected unserved energy is the total social cost[22] for a particular part of the network at a given level of reliability.

Distributors face choices about how to design different network elements (such as substations and feeders), and how to restore supply after an outage. These choices affect both network costs and the likely time to restore power after an outage. We intend modelling a wide range of distributor choices including new technologies being trialled by the distributors (such as stand-alone power systems).

We will evaluate the costs and expected unserved energy for each choice, and determine which choices lead to the lowest social cost for different parts of the network. We would base the recommended standard on the level of reliability that delivers the lowest social cost. This is the efficient level of reliability.

## 3.6 Recommending changes to standards

The third and final step in our proposed approach to this review is to recommend changes to the reliability standards to the NSW Government.

We recognise that reliability standards are only one part of the regulatory framework governing distribution services. Distributors' incentives will depend on the overall regulatory framework and the interaction of the various elements within it. Accordingly, in making our recommendations we will consider what role the reliability standards play and the interaction

22 Within the electricity market, consistent with the cost-benefit framework adopted in the NER for the RIT-D.

between the standards and national incentives under the AER's determination of revenue and STPIS.

We will also consider when any new standards should take effect, how often standards should be reviewed, who is best placed to conduct future reviews, and the appropriate compliance and monitoring framework for reliability standards.

# 4 Expressing the reliability standards

The first step in our proposed approach is to decide on the format for expressing distribution reliability standards. This involves considering what measures to use and the types of outages that should be included or excluded in measuring performance.

We will review the current standards, exclusions and customer service payments to ensure they provide an appropriate balance between the costs to the distributors and the value customers place on reliability. As part of our review we will consider:

- How different measures or types of standards affect the distributors' incentives for maintaining and improving reliability.
- The interaction between reliability standards and their exclusions and the AER's STPIS.
- If and how reliability standards need to change (and whether additional measures are required) to cater for new technologies (including SAPS) and changes in the network to enable two-way energy flows due to increased DER (eg, solar energy from households).

This chapter outlines our proposed approach to deciding on the format for expressing distribution reliability standards, including the issues we will take into consideration, our preliminary views (where we have them) and the issues on which we are seeking stakeholder feedback.

## 4.1 The current standards use measures that are consistent with national AER guidelines

As set out in Chapter 2, each distributor in NSW holds a distributor's licence issued by the Minister for Energy and Environment. The current licences include four requirements that impact on reliability.[23] In summary, the licences:

- Use a System Average Interruption Duration Index (SAIDI) and a System Average Interruption Frequency Index (SAIFI) as measures of reliability.
- Require the reporting of reliability performance at both an overall network and a regional level (ie, by feeder type).
- Include additional measures targeted at improving reliability performance for the worst-served customers.
- Make customer payments available for poor reliability performance.

SAIDI and SAIFI measure two important aspects of reliability, ie, the duration of unplanned interruptions and the frequency of these interruptions. SAIDI is calculated by summing the *duration* of each sustained customer interruption over a period of time and dividing it by the number of customers. It estimates the total duration of unplanned outages that a customer is

23 These are overall network reliability standards, individual feeder standards, individual customer standards and customer service standards.

likely to experience, on average. SAIFI is calculated by summing the *number* of unplanned sustained customer interruptions over the period and dividing this total by the number of customers. It measures the number of interruptions a customer experiences, on average.

Using SAIDI and SAIFI is consistent with the Distribution Reliability Measures Guideline (the Guideline) issued by the AER for measuring distribution network reliability, and the SAIDI and SAIFI measures specified in the current licences[24] are consistent with this Guideline. Our preliminary view is to retain SAIDI and SAIFI measures defined in line with the AER's Guideline. We are considering how the efficient level of expected unserved energy that we estimate through our economic framework (discussed in Chapter 5) could be converted into SAIDI and SAIFI measures, as a means of setting the level of the standards that incorporate these measures.

### 4.1.1 The AER's Distribution Reliability Measures Guideline

The AER is responsible for developing, publishing and maintaining a guideline establishing a set of common definitions of reliability measures for application in the NEM.[25] The reliability measures defined by the AER in the Guideline are:

- SAIDI.
- SAIFI.
- Customer Average Interruption Duration Index (CAIDI).[26]
- Momentary Average Interruption Frequency Index (MAIFI).
- Momentary Average Interruption Frequency Index event (MAIFIe).[27]
- Supply reliability levels experienced by the lowest-reliability customers.

The Guideline also defines events or incidences that are not required to be included in reporting performance against distribution reliability measures (discussed below).

A national framework and common set of definitions increases the transparency and consistency of distribution reliability measurements and allows the assessment, comparison and benchmarking of the reliability performance of all distribution businesses in the NEM. It also avoids the possibility that the NSW distributors have to measure and report reliability performance differently for the NSW Government and the AER (and the additional costs and potential confusion associated with this).

24 SAIDI and SAIFI are used in the overall network, individual feeder and individual customer reliability standards in the current licences.

25 See AER, *Distribution Reliability Measures Guideline*, November 2018.

26 CAIDI, which measures the average duration of the interruptions that occur over the period or the average restoration time following an interruption, is calculated by dividing SAIDI by SAIFI.

27 We note that, according to the AER, currently only Victorian distributors have adequate monitoring equipment to accurately report momentary interruptions. Hence, they are the only distributors subject to the MAIFI measure under the Service Target Performance Incentive Scheme (STPIS). Due to historical practice, MAIFIe is still being used instead of MAIFI for most of the Victorian distributors under STPIS. AER, *Distribution Reliability Measures Guideline*, November 2018.

The current NSW distributor's licences include SAIDI and SAIFI measures that are defined in a manner consistent with the Guideline. Our preliminary view is to retain SAIDI and SAIFI measures defined in line with the AER's Guideline.

IPART seeks comment on the following:

1 Do you agree that SAIDI and SAIFI measures should continue to be used in the reliability standards, defined in line with the AER's Distribution Reliability Measures Guideline?

### 4.1.2 Setting the level of SAIDI and SAIFI in the standards

As set out in Chapter 5, we will conduct an economic assessment to estimate the level of reliability that provides the most value to customers, having regard to the recent VCRs published by the AER. As part of this assessment, we propose developing a model to estimate the most efficient amount (in MWh) of expected unserved energy per year across different parts of each distributor's network. The most efficient amount of unserved energy is the level that provides the best balance between the cost of providing reliability and the cost to customers of supply interruptions. Expected unserved energy is a measure commonly used by network businesses when planning their investments.

While we will estimate an efficient amount of expected unserved energy per year – and we could set reliability standards based on this measure - we recognise that both the frequency and duration of outages are important to customers (and not just the total amount of power that is not supplied). The efficient amount of expected unserved energy in MWh could be used to calculate an allowance for expected unserved energy in total minutes per year or converted to an allowance in minutes per customer (similar to SAIDI). We could also convert expected unserved energy to an allowance in terms of the number or frequency of interruptions per customer (similar to SAIFI).

IPART seeks comment on the following:

2 Do you agree that we should convert our estimate of the efficient level of expected unserved energy to allowances for the duration and frequency of interruptions? How could we convert the efficient level of expected unserved energy to allowances for the duration and frequency of interruptions?

## 4.2 The types of events that are included/excluded in measuring reliability should be consistent with national guidelines and AER incentives

An outage on a distribution network can be caused by a number of factors. Some factors can be directly influenced by the distributor itself (eg, equipment failure due to age or condition) while others are outside of the distributor's control (eg, outages on the transmission network or as a result of insufficient wholesale supply). In addition, some factors are a result of extreme events (eg, third-party damage, extreme weather). The current distributors' licences define 'excluded interruptions', ie, events that are not required to be included in the reporting of performance against the reliability standards (see Box 2.1 in Chapter 2).

In general, we support the principle that events excluded from the measurement of reliability performance should be outside the distributor's control. We also consider that the exclusions in the distributors' licences should be consistent with national guidelines and incentive schemes as far as possible. However, as extreme weather events potentially become more frequent, we consider that the licence conditions should appropriately balance the costs of providing a resilient network and the value customers place on this resilience.

We will review the exclusions in the current licence to ensure that they provide an appropriate balance between the costs that distributors incur in providing a reliable network and the value that customers place on experiencing fewer and shorter outages. We also note that major event days are defined statistically for the overall network, individual feeder and individual customer reliability standards. However, similar customer service standard exclusions are defined causally, with reference to extreme or severe weather as defined by the Bureau of Meteorology. As a customer has to apply for a payment under the customer service standard, it may be preferable to use this different metric (as it is more easily identifiable by the customer than a major event day). However, if payments were automatic (as discussed in section 4.3.2 below), a consistent approach could be used across all components of the standard.

We will also consider the consistency of the licence exclusions with the AER's Guideline and national incentive schemes.

### 4.2.1 The AER's Guideline and STPIS also define excluded events

As well as publishing, administering and maintaining the Guideline, the AER is also responsible for designing the Service Target Performance Incentive Scheme (STPIS). The primary purpose of STPIS is to provide incentives for distributors to maintain existing levels of reliability and improve their performance, to the extent that customers are willing to pay for such improvements. Under STPIS, distributors are penalised financially if service performance declines and rewarded if service performance improves.

We note that STPIS came into effect after the distribution network in NSW had been built to a standard higher than currently exists. The practical outcome of this is that STPIS provides an incentive for the distributors to maintain levels of reliability that are higher than the current standard.

Both the AER's Guideline and STPIS define events that are excluded from the measurement of performance against reliability standards. While the AER's exclusions are similar to those in the distributor's licences, there are some differences. For example, the licence excludes interruptions caused by a customer's electrical installation or a failure of that electrical installation. However, this event does not form part of the AER's exclusions. The AER considered this issue recently in amending STPIS and establishing a new Guideline and formed the view that:

> There are two possible scenarios resulting from a failure of a customer's electrical installation:
>
> - The distributor's network is still intact despite the failure of the customer's equipment. Hence, only the specific customer's electricity supply is not available due to automatic protection equipment or as the result of a malfunction of the customer's installation.
> - The distributor's network is affected by the customer's equipment failure, resulting in other customers also being without supply.

> Under the first scenario, there is no loss of supply to other customers. Hence, there is no need to exclude the event when calculating reliability measures.
>
> Under the second scenario, there is a loss of supply to other customers. The distribution network can install protection equipment to safeguard its own network and protect other network users. These interruptions are therefore capable of being controlled by distributors.[28]

Subsequently the AER did not exclude interruptions caused by failure in electrical installations by customers.

We also note that the potential for an increased number of severe weather events and the impact this may have on reported reliability has been raised by distributors. For example, in its regulatory submission Essential Energy contended that:

> Long-term, climate change is expected to result in more extreme weather patterns, such as severe storms or extended dry periods. These will affect network performance by leading to events such as vegetation being blown onto conductors or bushfires. The early evidence of this occurring has emerged through an increasing trend in major event days as a result of severe weather events. Although, as specific forecasts as to the likely rate of change of major weather impacts haven't been developed currently, the Reliability Strategy has been developed with the assumption that they will have a negligible impact on network performance over the 2019/20 to 2024/25 period.[29]

The STPIS allows the impact of some major exogenous events to be excluded from measuring distributor reliability performance. Clause 3.3(a) of the STPIS provides a list of specific events leading to a supply interruption that may be excluded when calculating a revenue adjustment under the STPIS. Events which cause the daily unplanned SAIDI to exceed a pre-defined threshold may also be excluded from the STPIS.

Major event days are identified by the AER and under the distributor's licence in line with the 'Beta Method' set out by the Institute of Electrical and Electronics Engineers (IEEE) in the IEEE Guide.[30] The IEEE stated that:

> The Beta multiplier of 2.5 was chosen because, in theory, it would classify 2.3 days per year as major events. If significantly more days than this are identified, they represent events that have occurred outside the random process that is assumed to control distribution system reliability.[31]

This suggests that if severe weather events increase in frequency then they may not be captured by the definition of a major event day and they may become part of the normal day-to-day interruptions that occur within a distribution network, rather than being identified as outliers and subsequently excluded.

In its regulatory submission for 2019-24, Endeavour Energy proposed an alternative approach to calculating major event day thresholds under STPIS using the power transformation (Box-Cox) method. Endeavour Energy considered that this alternative data transformation method would result in a more normally distributed data set compared to the natural logarithm transformation method used under the Beta method.[32] STPIS allows an alternative data

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28 AER, *Explanatory Statement Final Decision Amendment to the Service Target Performance Incentive Scheme (STPIS) Establishing a new Distribution Reliability Measures Guideline (DRMG)*, November 2018, pp 18-19.

29 Essential Energy, AER Proposal 2018 Attachment 12.1.7, p 9.

30 IEEE Guide for Electric Power Distribution Reliability Indices, IEEE Standard 1366-2012 published by the Institute of Electrical and Electronic Engineers on 31 May 2012.

31 IEEE Std 1366-2012, Section B.1, p 22.

32 Endeavour Energy regulatory submission, April 2018, p 96.

transformation method which results in a more normally distributed data set and the AER accepted Endeavour Energy's proposal.

IPART seeks comment on the following:

3 Do you agree that the excluded events in the distributor's licences should be consistent with the AER's Distribution Reliability Measures Guideline and Service Target Performance incentive Scheme? Are there any additional events that should be excluded by the licence or any events that should not be excluded?

4 If there is a risk that the frequency of severe weather events will increase, how should the costs of providing a resilient network and the value customers place on this resilience be balanced and what requirements should be placed in the distributors' licences?

## 4.3 Different measures of reliability create different incentives for distributors

Under the AEMC's proposed framework, targets for distribution reliability are primarily based on the duration and frequency of unplanned interruptions (at a minimum, SAIDI and SAIFI targets for each feeder type). However, the framework allows additional reliability measures and individual jurisdictions can express distribution reliability standards to accommodate specific areas of the distribution network, including transmission and sub-transmission assets, areas of high economic importance, and areas with a history of poor reliability performance.[33]

Different types of standards provide different incentives for maintaining and improving reliability. The sections below consider the different components of the current reliability standards, how they affect the incentives on distributors to maintain and/or improve reliability and how they protect customers. We are also interested in stakeholder views on potential options for amending customer service standards, so that they play a more significant role in the reliability framework.

### 4.3.1 Overall network, individual feeder and individual customer standards create layers of protection for customers

The overall network reliability standards in the licences require the distributors to maintain an average level of reliability performance across their network. Performance under STPIS is also measured at the average network level. With an increase in the potential incentive payments available through STPIS, we expect distributors will prioritise meeting the STPIS targets. For example, Endeavour Energy has a corporate objective of maintaining reliability at current levels as defined by the AER's STPIS incentive, with a stated objective of avoiding penalties under STPIS.

The key risk with average reliability targets is that it may be more cost effective to improve average reliability by providing even better reliability to those customers that already receive better than average levels of reliability than targeting customers with poor performance. Disaggregating standards so that different targets apply to different types of feeders partially

33 AEMC, *Review of the national framework for distribution reliability, Final Report*, September 2013, pp 2-3.

addresses this issue. However, there is a limit to the level of disaggregation that is possible and customising the structure of targets to meet the characteristics of each network risks reducing the level of consistency and comparability between networks.

Thus, the licence conditions also require the distributors to comply with SAIDI and SAIFI standards for individual feeders and some individual customers.[34] The individual feeder and customer standards provide a minimum level of reliability performance for all customers. The purpose of these standards is to ensure that the level of reliability experienced by customers in the worst served areas does not fall below a specified minimum level. Distributors are required to monitor the performance of individual feeders and individual customers, and consider whether it is economically feasible to improve performance where the standards are not being met. This encourages the businesses to improve pockets of poor performance and ensure that a minimum level of reliability is being provided.

These requirements provide several layers of customer protection from poor reliability. For example, because SAIDI and SAIFI are calculated as an average across customers, a distributor is able meet the overall level required by the standard while still having individual feeders that do not meet the standards. However, the individual feeder standards require the distributor to monitor the performance of individual feeders, improve performance on feeders failing to meet reliability standards where economically feasible and report to IPART where it is not feasible to bring performance up to the required standard. Finally, the distributors are required to make payments to individual customers where customers experience a greater duration and frequency of interruptions than the levels in the standards. This is discussed in the section below.

### 4.3.2 The role of customer service standards in the reliability framework

The licence conditions also include customer service standards, which specify the circumstances where distributors are required to pay compensation to customers who have experienced poor reliability performance. Under the current standards, distributors must make a payment of $80 to each customer where the distributor exceeds the interruption duration standard and/or the interruption frequency standard. The payments are capped at a maximum of $320 per customer per year. A customer is responsible for lodging an application for a payment under the standards.

In its 2012 review, the AEMC considered that customer service standards in the NSW distributor's licences were unlikely to drive investment decisions or reliability performance to the same extent as the other reliability standards. This is because the value of customer payments is relatively low, particularly when compared to the annual allowed revenues of each distributor (see Table 4.1 below).

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34 These are particular large industrial customers who are not connected to the network via feeders and so are not covered by the individual feeder standards.

**Table 4.1 Customer claims and regulated revenue 2018-19**

| Distributor | Claims paid (number) | Claims denied (number) | Claims paid ($) | Expected revenue ($million) |
|---|---|---|---|---|
| Ausgrid | 1,469 | 229 | 117,520 | 2,024 |
| Essential Energy | 26 | 48 | 2,080 | 985 |
| Endeavour Energy | 3 | 9 | 240 | 767 |
| Total | 1,498 | 286 | 119,840 | 3,776 |

**Source:** 2018-19 Q4 reliability reports for Ausgrid, Endeavour Energy and Essential Energy, AER, Essential Energy, Endeavour Energy, Ausgrid – Determination 2014-19 – Remittal – Final Decision PTRMs.

We will consider the role of customer service standards in the reliability framework and how to set the level of payments on an economic basis. In particular, we will consider whether payments should be used to incentivise improvements in service to customers or simply to provide recognition to customers for poor reliability performance.

### Providing incentives through customer service standards

In our view, customer service standards may act as incentives to distributors to improve reliability performance if the payments to customers are higher than the cost of improving reliability to avoid making those payments. We will consider a number of issues in our review, including how to set the level of payments and whether payments should increase with the duration or frequency of outages, be made automatically and/or have a high or no annual cap.

We consider that payments under customer service standards should reflect the cost of an outage to customers. One approach would be to update the level of the payments to take account of current estimates of VCR. We note that the AER will publish VCR values for widespread and long duration outages in early 2020.[35] As part of this review, we will consider the most appropriate approach for setting the level of the customer service standard payment.

We will also consider whether the level of payment should increase as the duration (or frequency) of an outage (or outages) increases and whether payments should be automatic rather than requiring application from a customer. We note that the NSW metropolitan water businesses have a Customer Contract as part of their Operating Licence. Under Sydney Water's Customer Contract, rebates are paid automatically to customers who experience a level of service lower than the prescribed standard (see Box 4.1 below). In its customer engagement for the most recent Operating Licence review, Sydney Water found that customers strongly preferred rebates to continue to be paid automatically, rather than on application. This was seen as both fairer and easier for customers.[36]

35 AER, *Values of Customer Reliability - Final report on VCR values*, December 2019, p 84.

36 Sydney Water, *Response to IPART Issues Paper: Additional Information – Rebates in Customer Contract*, September 2018, p 3.

**Box 4.1 Rebates under the Sydney Water Customer Contract**

When will you get a rebate if there's a problem with your service?

- In most cases, Sydney Water will automatically apply a rebate to your account.
- If your water services are interrupted by planned work for over five hours, Sydney Water will apply a $20 rebate.
- If your water services are interrupted by unplanned work for over five hours, Sydney Water will apply a $40 rebate.
- If you have three or more unplanned water service interruptions, lasting over one hour in a year, Sydney Water will rebate your full water service charge, less any concessions, for the following 12 months.
- If your water pressure is lower than the required standard, at the point of connection for one hour continuously, Sydney Water will apply a $40 rebate. Sydney Water will only pay this for one event each quarter and not when it is because of a supply interruption.
- If wastewater overflows onto your property because Sydney Water's wastewater system has failed, Sydney Water will apply a $75 rebate. If it happens again within 12 months, Sydney Water will apply a $150 rebate.
- If wastewater overflows onto your property more than twice in a year, because Sydney Water's wastewater system has failed, Sydney Water will rebate your full wastewater service charge, less any concessions, for the following 12 months.
- If a problem in Sydney Water's water system stops Sydney Water supplying clean water suitable for normal household purposes, Sydney Water will apply a $40 rebate.
- If NSW Health issues a boil water alert due to a Sydney Water fault, Sydney Water will apply a $50 rebate.

**Source:** Sydney Water, *Rebates - Our contract with you*, https://www.sydneywater.com.au/web/groups/publicwebcontent/documents/document/zgrf/mdq0/~edisp/dd_044115.pdf (accessed 20 February 2020).

IPART seeks comment on the following:

5 Do you agree that payments under customer service standards should reflect the cost to a customer of an outage? How would this best be measured or estimated?

6 Should payments under customer service standards increase as the duration (or frequency) of an outage (or outages) increases? Should payments be automatic or continue to require application by a customer? If payments become automatic, should exclusions be based on the major event day measurement that currently applies to the other reliability standards or continue to be defined causally (ie, with reference to extreme or severe weather as defined by the Bureau of Meteorology).

## 4.4 Reliability standards should reflect the evolution of the distribution network

New technologies offer opportunities for distributors to offer more cost-effective solutions than traditional network investment and for customers to provide further generation and reliability themselves. In particular, stand-alone power systems[37] (SAPS) are becoming an increasingly viable option for providing electricity services to customers. SAPS are currently not generally captured under the national regulatory frameworks and the AEMC is in the process of updating the frameworks for distributor-led SAPS. As set out in Chapter 2, electricity consumers are increasingly seeking to generate their own power, and this embedded generation[38] impacts power quality.[39]

Reliability standards should also reflect the evolution of the distribution network. As part of this review, we will consider if and how reliability standards need to change, and whether additional measures are required, to cater for new technologies (including SAPS) and changes in the network to enable two-way energy flows due to increased DER (eg, solar energy from households).

### 4.4.1 Taking account of new technologies

On 19 December 2019 the AEMC published a draft report covering proposed changes to the national regulatory frameworks to enable distributors to supply their customers using SAPS where this is cheaper than maintaining a connection to the network.[40]

The new arrangements would closely follow existing frameworks to enable customers supplied by SAPS to retain all their current consumer protections, including existing reliability standards, so that they would not be disadvantaged where a distributor decides that it would be more cost-effective to supply them on a stand-alone basis.

In terms of reliability, the AEMC's position on distributor-led SAPS is that:

- Reliability, security and quality standards with equivalent principles to those for grid-connected customers should apply.
- While the standards and measures do not necessarily need to be exactly the same as those that apply to grid-connected customers, reliability standards, Guaranteed Service Level (GSL) payments and STPIS should be extended to encompass distributor-led SAPS.
- In most jurisdictions, changes to the reliability standards and GSL schemes will be required to broaden their application to cover distributor-led SAPS customers.

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37 A stand-alone power system (SAPS) is an electricity supply arrangement that is not physically connected to the national grid. SAPS can be microgrids, which supply electricity to multiple customers, or individual power systems, which supply single customers only.

38 Embedded generation, also known as distributed or local generation, is any type of individual electricity generation unit that is connected to the electricity distribution network. Embedded generation can take many forms, such as solar photovoltaic (PV) rooftop panels, wind turbines, small-scale gas generators and diesel engines.

39 In systems without embedded generation, voltage is highest at the substation and decreases as the network gets further from the substation. In systems with embedded generation, voltage is increased at every location that is exporting locally generated electricity. This makes it more difficult to manage the network, as it is difficult to predict how much electricity will be exported at any given time.

40 AEMC, *Updating the regulatory frameworks for distributor-led stand-alone power systems*, Draft report, 19 December 2019.

The AEMC considered, but did not recommend, additional reliability standards or targets for individual SAPS, as it found that applying reliability standards to individual customers is not in line with the treatment of customers in the rest of the NEM.

We note that, in its submission to the AEMC's Priority 1 Draft Report for the Review of the regulatory frameworks for SAPS, Ausgrid noted that NSW reliability standards do not currently cater for SAPS (although Ausgrid considered that equivalent, though not necessarily exactly the same, reliability standards should apply to distributor-led SAPS).[41]

We will consider how reliability standards should be expressed to accommodate new technologies, such as SAPS.

As set out in Chapter 5, as part of our economic assessment we propose to model the costs and benefits of operating the distribution network and options for restoring power after interruption. This includes consideration of new technologies being trialled by the distributors (such as SAPS) and demand side solutions.

IPART seeks comment on the following:

7 How should reliability standards cater for new technologies such as Stand-alone Power Systems?

### 4.4.2 Taking account of DER and two-way energy flows

As noted in Chapter 2, DER is the collective term for customer-side investment in electricity generation, storage or management. DER encompasses a range of consumer-level technologies used by households and businesses, such as inverter connected generation and storage systems (which at present consist mostly of solar photovoltaic (PV) and battery storage systems), energy management systems, controllable loads, and electric vehicles and their charging points.[42]

The original network was not designed for these technologies that can facilitate customers buying electricity from and selling electricity to the network (ie, two way flows). As the uptake of these technologies increases, distributors will face new technical and operational challenges in managing the future grid. While DER can provide benefits to customers and the power system more broadly, it has the potential to impose costs on the network. In particular, feeding solar energy back into the grid can create a need for distributors to manage additional voltage fluctuations. Costs to change network configurations or equipment or augment the network become necessary to maintain grid stability and reduce risks. The current regulatory framework constrains how those costs can be recovered.[43]

While the current reliability standards are designed around one-way flows, the increase in DER increases the potential for two-way flows. Clearly the reliability standards should not impede the take up of DER. However, the increase in DER also raises the question of whether

41 Ausgrid, *Submission to AEMC review of the regulatory arrangements for stand-alone power systems – draft report*, February 2019 p 5.

42 Australian Energy Market Operator, *Technical Integration of Distributed Energy Resources*, April 2019, p 10.

43 We note that measures such as export or capacity limits on rooftop solar are also available to distributors as an alternative to incurring costs. These limit the amount of electricity that customer are attempting to export.

and how reliability standards should specifically take account of two-way energy flows. In particular, should standards recognise the value that customers with DER place on the ability to export power to the network[44]? Setting reliability standards to recognise the ability of customers with DER to export power to the grid raises several consequential issues with the existing regulatory framework. In particular:

- How distributors would recover any costs associated with meeting reliability standards around DER.
- How the standards would interact with the current approach to distribution network pricing and its role in encouraging the efficient level and use of DER.

The current National Electricity Rule 6.1.4 states that 'a distribution Network Service Provider must not charge a distribution network user, distribution use of system charges for the export of electricity generated by the user into the distribution network'.

Without a change in the National Electricity Rules to allow export charging, costs would subsequently need to be recovered from the broader customer base. As some customers may not install DER it is important that any costs associated with the integration of DER are minimised. Otherwise, some customers may face increases in network charges created by investment decisions by other customers designed to create savings (or income) for them.

A related issue is network pricing and the ability of cost-reflective, location-based network tariffs to send efficient signals to customers on the costs and benefits of installing DER at their premises. The AEMC's Grid of the future program identifies implementation pathways to make distribution networks fit for the future. These include having distributors and AER focus on:

> … implementing cost-reflective network tariffs which reward customers who have invested in solar PV for using and storing electricity in ways that help the grid work most efficiently. The need for costly augmentation of the grid is reduced by making sure price incentives encourage consumers to export their excess energy back to the grid when it is most valuable. Networks and retailers have been able to do this since new rules were made in 2014. By keeping flat tariffs in place they are failing to give consumers the incentive to charge batteries or electric vehicles at times that reduce both energy bills and load on the grid.[45]

There is substantial work currently underway in the DER space. As part of this review, we will consider whether reliability standards should be set to take into account changes in the network to enable two-way energy flows, what that could look like in practice, the barriers to implementation, and what might be an appropriate transition path.

IPART seeks comment on the following:

8 Should network reliability standards take account of two-way energy flows and the ability of the network to allow customers to both buy and sell electricity? If yes, should reliability standards take into account the value to customers of being able to export or sell power to the grid? What might this look like in practice?

44 In time customers with DER may also participate in new services markets such as providing demand response, network support or ancillary services to the wholesale energy market.

45 See AEMC, *Delivering the grid of the future*, https://www.aemc.gov.au/news-centre/media-releases/delivering-grid-future, accessed 27 February 2020.

# 5 Estimating efficient levels of reliability

The next step in our proposed approach is to conduct an economic assessment to estimate the level of reliability that provides the most value to customers, having regard to the recent VCRs published by the AER.

As part of this assessment, we propose developing a model to estimate the most efficient amount of expected unserved energy per year across each distributor's network.[46] The most efficient amount of unserved energy is the level that provides the best balance between the cost of providing reliability and the cost to customers of supply interruptions.

This chapter outlines our proposed approach to estimating the efficient level of unserved energy, including how we will do this across the distributors' networks, the assumptions we will need to make and the data we will need.

## 5.1 How we will estimate efficient unserved energy

We propose adapting the economic approach we used in our 2016 review of the NSW transmission reliability standards to the NSW distribution networks. Our proposed approach would model the operation of the distribution network reflecting its design (including alternative paths for the flow of electricity through the network), the existing mix of assets and their availability, the cost of replacing those assets or non-network alternatives and the average VCR at that location. The approach estimates both:

- the costs of owning, operating and maintaining the assets in a location (for example the substation and associated lines) or non-network solutions to achieve a given level of reliability, and
- the dollar value of the expected unserved energy at that level of reliability.

The sum of the cost and the expected unserved energy value is the total social cost[47] for the location at a given level of reliability. This social cost incorporates two aspects of customer value – the value that customers place on a particular level of reliability and the cost to them of having this level of reliability provided.

Distributors face choices about how to design different network components (such as substations and feeders), and how they restore supply after an interruption. These choices affect both network costs and the likely time to restore power after an interruption. It is the combination of these choices and the probability of an interruption that affects the level of reliability or expected unserved energy.

We propose to model the costs and benefits of operating the distribution network and options for restoring power after interruption. We propose to consider the impact of new technologies being trialled by the distributors (such as stand-alone power systems) and demand-side

46 This can be expressed in MWh and/or minutes

47 Within the electricity market, consistent with the cost-benefit framework adopted in the NER for the RIT-D.

solutions. We will then evaluate the costs and expected unserved energy for each option, and determine which choices lead to the lowest social cost for different parts of the network. We propose basing the recommended standard on the level of reliability that delivers the lowest social cost.

The corresponding level of expected unserved energy could be used to calculate an allowance for expected unserved energy in MWh, total minutes per annum or converted to a allowance in minutes per customer (similar to SAIDI). Looking at the expected frequency of interruptions, we could also convert expected unserved energy to an allowance in terms of the number of interruptions per customer (similar to SAIFI).

We will also need to consider the impact of DER and how this affects the calculation of expected unserved energy, as well as any other additional measures of reliability that need to be developed.

IPART seeks comments on the following:

9 Do you agree with our proposed approach to estimating the efficient level of reliability and basing the standard on the level that delivers the lowest social cost?

## 5.2 Estimating unserved energy across the network

A distribution network is made up of a complex series of components designed to deliver electricity to customers. Typically the distribution network consists of both meshed (usually two or more paths for the electricity to flow between substations) and radial components (a single path over which electricity flows). Subtransmission substations and zone substations are connected by a series of lines or feeders. The analysis of the efficient level of reliability can be done most effectively by selecting different parts of the network – such as a substation or feeder - and calculating the efficient level of unserved energy for each part. In order to do this, we need to decide which parts of the network to examine—or in other words, how granular our view of the network must be.

In our 2016 review of transmission network reliability standards, we used each of the bulk supply points of TransGrid as our network components. However, distribution networks typically contain both meshed and radial components with a large number of combinations of substations and feeders.

Our preliminary view is that we would treat each area, subtransmission substation and zone substation as a separate network component. We would try to group the feeders into a smaller number of categories with similar properties – such as type (CBD, urban, rural), length and capacity - and find the least cost set of choices for a representative feeder of each type. We welcome stakeholders' views on how to calculate expected unserved energy across the distributors' networks (for example areas, substations and/or feeders).

IPART seeks comments on the following:

10 How should we estimate expected unserved energy across distributors' networks (for example by area, substation and/or feeders)?

## 5.3 The inputs we need and how we would estimate them

For each part of the network, our approach seeks to identify the level of reliability that minimises the sum of the cost of expected unserved energy plus the direct costs (capital and operating) of providing that level of reliability. In order to do this analysis we require the following:

- the cost of expected unserved energy, which is a result of:
  - the value customers place on reliability (VCR)
  - the probability of asset failures
  - the duration of outages and restoration profile
  - profile of demand at each location
  - number and capacity of transformers and feeders and/or non-network options
- the direct costs (operating and capital costs) of providing different levels of reliability, and
- a discount rate and asset lives to convert capital costs to an annuity.

Our proposed approach to these inputs is discussed below.

### 5.3.1 The values customers place on reliability

The value that customers place on reliability (known as VCR) is expressed as a dollar value per kWh of energy not delivered. This value is multiplied by the expected amount of unserved energy to obtain a customer value that is compared with the direct cost of providing reliability.

Our terms of reference require us to have regard to the most recent VCRs published by the AER. The AER has separately identified VCRs for standard outages (up to twelve hours' duration) for residential customers in different climate zones, as well as business customers in different segments (agriculture, commercial, industrial) as shown in Table 5.1. It also published estimates for very large business customers that are directly connected to the network.

**Table 5.1 AER residential VCR values ($2019)**

| Residential customer segment | Aggregate residential VCR ($kWh) |
|---|---|
| Northern Territory | 18.31 |
| Climate Zone 1 - Regional | 23.95 |
| Climate Zone 2 - CBD and Suburban | 22.95 |
| Climate Zone 2 - Regional | 25.56 |
| Climate Zone 3+4 - Regional | 26.47 |
| Climate Zone 5 - CBD and Suburban NSW | 29.27 |
| Climate Zone 5 - CBD and Suburban SA | 33.23 |
| Climate Zone 5 - Regional | 24.57 |
| Climate Zone 6 - CBD and Suburban | 21.25 |
| Climate Zone 6 - Regional | 21.77 |
| Climate Zone 7 - CBD and Suburban | 21.39 |
| Climate Zone 7 - Regional | 16.96 |

**Source:** *AER - Values of Customer Reliability Review - Appendix F - Final report - December 2019*, Available from https://www.aer.gov.au/networks-pipelines/guidelines-schemes-models-reviews/values-of-customer-reliability/final-decision

We propose using the AER's standard VCR values in our analysis of the efficient level of reliability. Consistent with the approach we used in our 2016 review of transmission reliability, we propose estimating a VCR for each part of the network that we analyse, weighted by customer type. We understand that this is consistent with the approach used by distributors in planning and preparing RIT-D investment plans.

The AER will publish VCR values for widespread and long duration outages in early 2020. We consider that these values are likely to be more applicable to customer service guarantee payments which relate to longer duration outages. We will consider these estimates when reviewing the level of the current $80 customer service guarantee payments.

### 5.3.2 The probability and duration of outages

The approach calculates expected unserved energy by considering the:

- failure rate for each asset type (transformers, overhead cables and underground cables)
- load at risk – the load supplied from a bulk supply point or substation, which is at risk of being interrupted if an asset fails, after allowing for available backup capability, but before repair of the asset that has failed
- restoration time – the time to restore the network or implement a non-network solution, using back-up capability (which depends on switching arrangements), and
- repair time – the time to restore or repair failed assets. The failure rate of each asset depends on the type of asset and its age.

There is a great deal of historical information available about the probability, causes, duration and numbers of customers affected by interruptions for all three of the NSW distributors. This information is publicly available through the AER's Regulatory Information Notice documents. We propose to rely on this information as well as seek the views of the distributors, other experts and stakeholders on any emerging trends that may need to be considered. We will also need to consider the impact of using life cycle average failure rates or condition based failure rates (see Box 5.1 for further information).

**Box 5.1 Life cycle average failure rates vs conditions based failure rates**

When modelling unserved energy, the failure rates for different assets can be based either on the actual age and/or condition of the assets or on an average over the life cycle of the assets. When undertaking cost-benefit analysis for network investments, businesses would generally use the actual age/condition of the assets rather than a life-cycle average. This allows for businesses to best capture the costs and benefits of undertaking the investment.

In our 2016 review of transmission reliability standards we used life-cycle average failure rates to estimate the expected unserved energy in the final standards. These standard were expressed as planning standards which required Transgrid to plan, design and build its network to meet the expected levels of uncertainty rather than meet observed levels of performance.

We also need to consider how to account for different types of failures – catastrophic and non-catastrophic. While catastrophic failures require replacement of an assets, non-catastrophic failures can be repaired. This repair time also needs to be included when calculating unserved energy.

### 5.3.3 Demand at each location

Demand at each location is needed to calculate the load which is at risk of being interrupted if an asset fails, after allowing for available backup capability, but before repair of the asset that has failed.

A great deal of historical information is available about demand at each substation for all three of the NSW distributors. In most cases this includes detailed load duration curve data.

We propose using a 50% Probability of Exceedance (POE) demand to calculate the reliability standards. The actual maximum demand in any year is sensitive to factors such as the extent and time of the maximum or minimum temperature. POE demand is a generalised approach to defining the probability of exceedance of electricity maximum demand, where the maximum demand is expressed based on the probability it would be met or exceeded. i.e. a 50% POE maximum demand implies there is a 50% probability it would be met or exceeded.[48]

We propose using information available through the AER's Regulatory Information Notice documents as well as seeking the views of stakeholders on any emerging trends that may need to be considered.

We will also need to consider the impact of non-network solutions as well as DER on how we model demand. As noted in Chapters 2 and 4, these options are changing the way electricity flows across the network and demand at the substation and feeder level.

48 AEMO, Generation and Load, Available from: https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/data-nem/market-management-system-mms-data/generation-and-load , Accessed 22 February 2020.

### 5.3.4 The cost of providing reliability

We would seek information on the efficient costs for asset units, including transformers, feeders, switchgear and other necessary equipment based on information provided by the distributors to the AER as part of their pricing proposals. To the extent possible we would develop unit cost information for feeders and costs for the most common transformer types. Other relevant costs would involve restoration activities, and repair crews.

We would also look to develop estimates for non-network solutions that are currently being trialled by distributors (for example solar cells, batteries).

### 5.3.5 Discount rate

A discount rate and expected asset life are required to convert capital costs into annuity values. We propose using a discount rate based on the Weighted Average Cost of Capital (WACC) for the distribution networks. This approach uses assumptions that are specific to the risk profile of the distributors. We will use information from the distributors on the expected asset lives for different types of assets.

### 5.3.6 Sensitivity testing

We intend to construct a model that finds the lowest social cost across a range of operator choices about network design and operation. The results of such a model will be sensitive to certain input choices, such as unit costs, the VCR, asset failure rates, discount rates, etc. We propose performing extensive sensitivity testing to understand how our selection of input values within uncertain ranges may affect the results.

IPART seeks comments on the following:

11 Do you agree with our proposed approach to estimating the following inputs:

- the cost of expected unserved energy, which is a result of:
  - the value customers place on reliability (VCR)
  - the probability of asset failures
  - the duration of outages and restoration profile
  - profile of demand at each location
  - number and capacity of transformers and feeders and/or non-network options
- the direct costs (operating and capital costs) of providing different levels of reliability, and
- a discount rate and asset lives to convert capital costs to an annuity.

# 6 Recommending changes to the standards

The third and final step in our proposed approach to this review is to recommend changes to the reliability standards to the NSW Government.

This chapter outlines our proposed approach to recommending changes to the standards including interactions between the standards and national incentives, when any new standards should take effect, how often standards should be reviewed, who is best placed to conduct future reviews, and the appropriate compliance and monitoring framework for reliability standards.

## 6.1 Interactions between reliability standards and national incentives

As noted in Chapter 2, the AER determines the revenue that distributors need to meet their reliability obligations as well as providing incentives for the distributors to maintain and improve reliability using STPIS. Following the outcome of our economic assessment in step 2, we will consider the role of reliability standards and how they interact with schemes such as STPIS to ensure that there are appropriate incentives in place and minimise any duplication between the NSW standards and the national regulatory framework.

For example, if we found that the efficient levels of overall reliability measured using SAIDI and SAIFI are similar to the levels in STPIS, it may not be necessary to include overall reliability standard measures in the licences. Such an approach would duplicate incentives already provided through STPIS. However, STPIS does not currently provide an incentive to provide reliability at an individual feeder level. One option would be for us to recommend maintaining individual feeder standards in the licences. Alternatively we could recommend changes that remove these from the standard and recommend changes to STPIS to include incentives around overall levels of reliability as well as individual feeder reliability.

## 6.2 Amended licence conditions from 1 July 2024

Under the terms of reference for this review, we are to recommend reliability standards to the NSW Government. Our recommendations would also include a commencement date for any revised reliability standards. If the NSW Government accepts our recommendations, the distributors' licences will be amended.

We propose that any change to the reliability standards apply from 1 July 2024 as this timing aligns with the beginning of the next regulatory control period for the distributors and means that the distributors and the AER can take any revised reliability requirements into account at the next regulated revenue review. The distributors would know of any changes to reliability standards well in advance of those changes coming into effect. This gives the distributors an opportunity to engage and consult with their customers on what the changes might mean for services and prices, to inform their next regulated revenue submission to the AER.

## 6.3 How often standards should be reviewed

Under the Australian Energy Market Commission (AEMC)'s proposed framework for distribution reliability,[49] reliability standards would be determined every five years, nine months prior to the due date for the submission of a distributor's regulatory proposal to the AER.

We agree that reliability standards should be reviewed periodically, for a number of reasons:

- The modelling work we are proposing to undertake involves a range of data that may be updated, or for which better estimates or data sources may become available. This could include the estimates of VCR for different customer groups or locations, asset degradation schedules, or capital costs.
- Distributors will have an incentive to develop better data sources, given that these data are now used to establish reliability standards. This includes data on new technologies, which are likely to have an impact on the type and cost of non-network options that can provide reliability.
- The characteristics of distribution networks and customers' preferences may change over time.

The appropriate timeframe for reviewing standards may also depend on how different, or how far away, any new standards are from current standards. In our 2016 review of transmission reliability standards we applied an economic approach to setting reliability standards for the first time. As a result, we adopted a conservative approach in making our recommendations, so as not to introduce a significant change to the level of reliability required. As part of this review, we recommended 5-yearly reviews of the standards.

Our preliminary view is that distribution reliability standards should be reviewed every five years, to align with each regulatory control period. This will result in consistency between reliability reviews and revenue reviews, allowing any changes in standards (and therefore licence conditions) to be factored into revenue determinations.

Some of the potential options for providing reliability (particularly non-network solutions, such as improved technology) may also enable new options and/or reduce the cost of others. Some may depend on the forecast maximum demand and load profile in a particular part of the network, which can change over time.

We will consider whether the licence should include the flexibility for distributors to provide different levels of reliability from the standards in certain circumstances.[50] The distributors would need to demonstrate that any proposed alternative in these circumstances provides a lower social cost than the levels specified in the standard.

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49 AEMC, *Review of the national framework for distribution reliability*, *Final report*, September 2013.

50 For example, where a new technology arises that changes the balance between the cost of providing reliability and the value to customers and leads to a different optimal level of expected of unserved energy.

## 6.4 Frequency of reporting against reliability standards

Under the current licences, distributors are required to report quarterly to IPART on their performance against reliability standards. Performance must be independently audited by 30 September each year, for the preceding financial year.

We impose a number of reporting requirements on distributors in our role as licence compliance regulator. The information we collect through reporting allows us to:

- Determine whether distributors are meeting statutory obligations.
- Identify immediate risks and trends that signify emerging issues across the industry.
- Ensure the maintenance of employment conditions for employees of the leased distributors.

Reporting can be quarterly, annual, or in some cases, soon after a particular event or non-compliance occurs. The amount of information we collect varies depending on the area of regulation and, in the case of a non-compliance, the severity of that non-compliance.

We are subsequently required to report to the Minister for Energy and Environment by 31 October each year on licence compliance by distributors. These annual compliance reports are publicly released after being laid in Parliament.

We recognise that reporting obligations impose costs on distributors. If the benefits of a particular reporting obligation exceed these costs then this can be justified. However, reporting obligations that are poorly designed or implemented can impose unnecessary and excessive costs.

We note that we currently require TransGrid to report its performance against the transmission reliability standard annually.[51] We also require currently annual reporting against the performance standards in the NSW public water utilities' operating licences.[52]

While monitoring compliance with distribution network reliability standards is clearly necessary, we are considering whether quarterly reporting is the appropriate requirement going forward. Under our compliance and enforcement policy, we take a risk-based approach where we determine compliance requirements. We will consider the appropriate compliance framework for distribution network reliability standards as part of this review. If we find there is a case for changing the current reporting requirements, we will make a recommendation to NSW Government to allow for this change.

IPART seeks comment on the following:

12 What role does including reliability standards in licences play and do you agree that the standards should minimise any duplication of incentives between the NSW distributor licences and national regulatory framework?

51 IPART, *Electricity networks reporting manual – Transmission reliability standard – Annual reporting and additional information requirements*, March 2019, pp 2-3.

52 For example see IPART, *Sydney Water Reporting Manual - Operating Licence 2019-2023*, November 2019, p 22.

13 What is the appropriate compliance framework for monitoring performance against distribution network reliability standards? Should IPART have the flexibility to determine the frequency of reporting, in response to performance?

# A Terms of reference

I, Gladys Berejiklian, Premier of New South Wales, under section 12A of the *Independent Pricing and Regulatory Tribunal Act 1992*, refer to the Independent Pricing and Regulatory Tribunal (IPART) for investigation and report the following matter.

IPART is to provide a report to the Premier and the Minister for Energy and Utilities recommending:

1. any changes to electricity distribution reliability standards for the NSW distribution network businesses that could deliver bill savings to NSW electricity customers; and

2. any other measures that could be imposed on or implemented by the NSW distribution network businesses within the current regulatory framework that would be likely to reduce network prices and are consistent with the National Electricity Objective.

In making recommendations as to electricity distribution reliability standards, IPART is to apply an economic assessment to evaluate how efficient network capital and operating costs would vary with different levels of reliability, and then compare the level of expected capital and operating expenditure against the value that customers place on reliability.

In undertaking the review, IPART is to have regard to:

1. the objective of the New South Wales Government to improve electricity affordability while maintaining a reliable and secure network;
2. the potential impact on customer bills, assuming current regulatory arrangements, from:
    a) any change in the distribution network reliability standards;
    b) any other measures that would reduce network prices and are in the long term interests of customers;
3. the value customers place on having a reliable and secure network including the AER's VCR estimates to be published by 31 December 2019 and any other published values;
4. changes that would assist the NSW distribution networks to evolve and take advantage of new technologies that may offer more cost-effective solutions than traditional network investment (such as a stand-alone power systems);
5. the differences in the costs and benefits of delivering reliable network services to different networks and different parts of the network, including CBD, rural, and regional areas;
6. the NSW distribution network businesses' safety and security obligations;
7. a stable regulatory environment;
8. consistency with national incentives and obligations with respect to distribution reliability;
9. the AER's regulatory determinations for the 2019-24 regulatory period;

10. the relevant recommendations of the 2018 State Infrastructure Strategy and the Australian Competition and Consumer Commission's Retail Electricity Price Inquiry and reports which outline the pressures and experiences felt by NSW consumers such as Turning off the Lights: The Cost of Living in NSW by the NSW Council of Social Services and Close to the Edge by PIAC.

IPART is to undertake public consultation for the purposes of its investigation.

IPART is to release a draft report for consultation within 6 months of the publication of the AER's final VCRs and release a final report within four months of the draft report.

The Hon Gladys Berejiklian MP
Premier

Dated at Sydney 26/2/19

# B Current reliability standards

Copies of the reliability standards are available from IPART's website *Licence Conditions and Regulatory Instruments*, Available from:

https://www.ipart.nsw.gov.au/Home/Industries/Energy/Energy-Networks-Safety-Reliability-and-Compliance/Electricity-networks/Licence-conditions-and-regulatory-instruments.

**Network overall reliability standards**

**SAIDI standards (minutes per customer)**

| Feeder Type | Ausgrid | Endeavour Energy | Essential Energy |
|---|---|---|---|
| CBD Sydney | 45 | N/A | N/A |
| Urban | 80 | 80 | 125 |
| Short - rural | 300 | 300 | 300 |
| Long - rural | 700 | N/A | 700 |

**SAIFI standards (number per customer)**

| Feeder type | Ausgrid | Endeavour Energy | Essential Energy |
|---|---|---|---|
| CBD Sydney | 0.3 | N/A | N/A |
| Urban | 1.2 | 1.2 | 1.8 |
| Short - rural | 3.2 | 2.8 | 3.0 |
| Long - rural | 6 | N/A | 4.5 |

**Individual Feeder standards**

**SAIDI standards (minutes per customer)**

| Feeder Type | Ausgrid | Endeavour Energy | Essential Energy |
|---|---|---|---|
| CBD Sydney | 100 | N/A | N/A |
| Urban | 350 | 350 | 400 |
| Short - rural | 1000 | 1000 | 1000 |
| Long - rural | 1400 | 1400 | 1400 |

**SAIFI standards (number per customer)**

| Feeder type | Ausgrid | Endeavour Energy | Essential Energy |
|---|---|---|---|
| CBD Sydney | 1.4 | N/A | N/A |
| Urban | 4 | 4 | 6 |
| Short - rural | 8 | 8 | 8 |
| Long - rural | 10 | 10 | 10 |

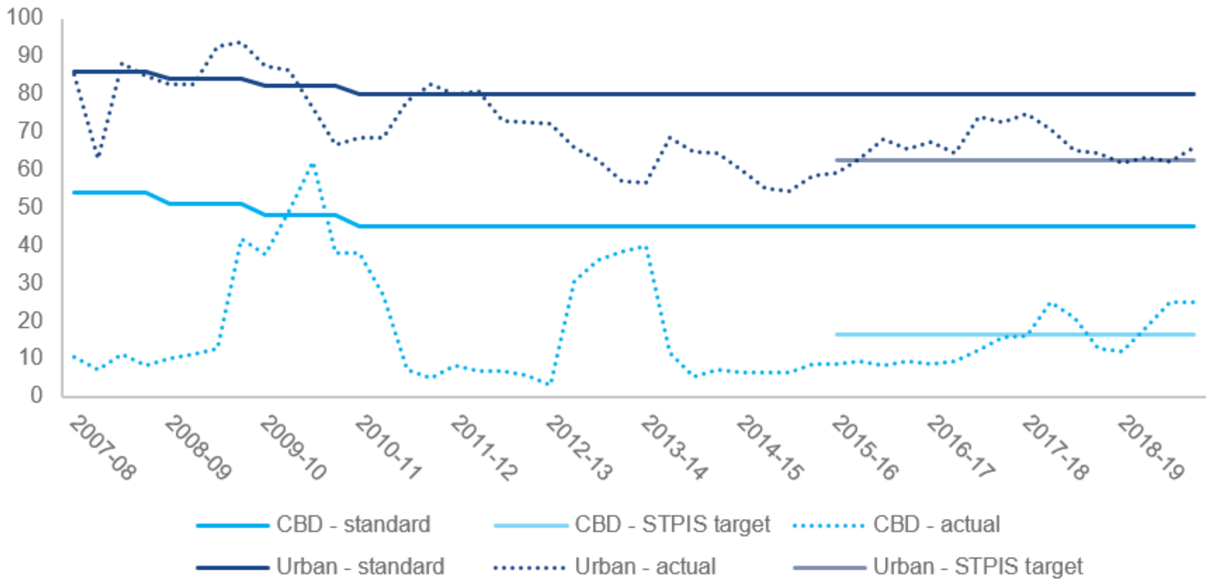
**Customer service standards (all distributors)**

| Type of area in which the customer's premises is located | Interruption duration standard (hours) | Interruption frequency standard |
|---|---|---|
| Metropolitan | 12 | 4 interruptions of greater than or equal to 4 hours |
| Non-metropolitan | 18 | 4 interruptions of greater than or equal to 4 hours |

# C Distributors' historical performance against the standards

## C.1 Ausgrid

**Figure C.1 Ausgrid – Overall SAIDI performance CBD and urban 2007-08 to 2018-19**




**Data source:** IPART analysis of distributor data.

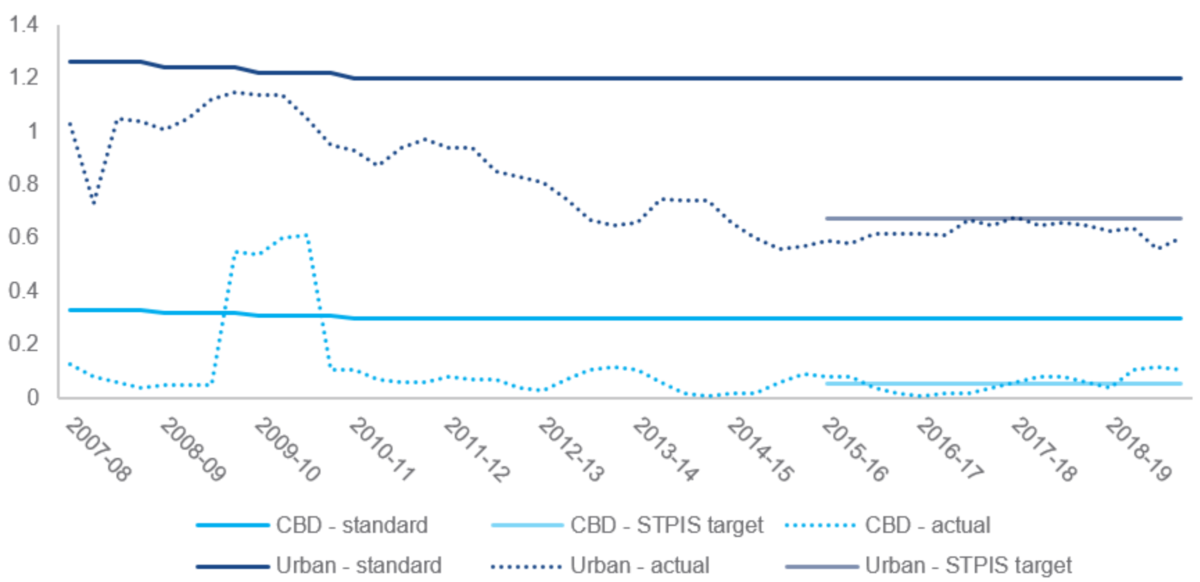
**Note:** Financial incentives for STPIS were introduced from 2015-16.

## Figure C.2 Augrid – Overall SAIDI performance short-rural and long-rural 2007-08 to 2018-19


**Data source: :** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

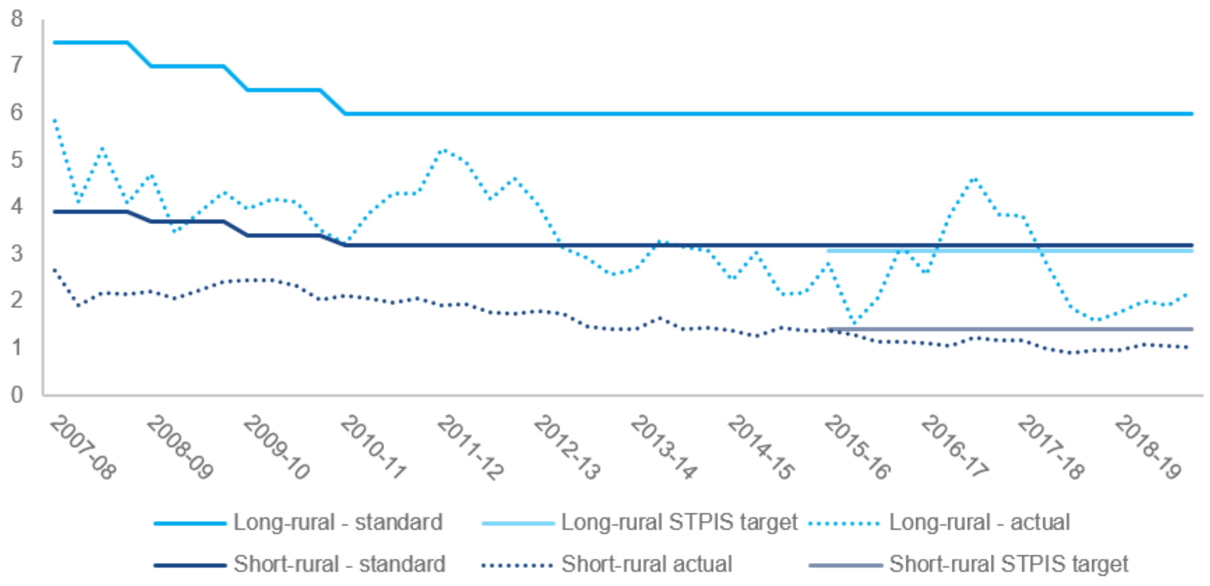
## Figure C.3 Ausgrid – Overall SAIFI performance CBD and urban 2007-08- 2018-19




**Data source: :** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

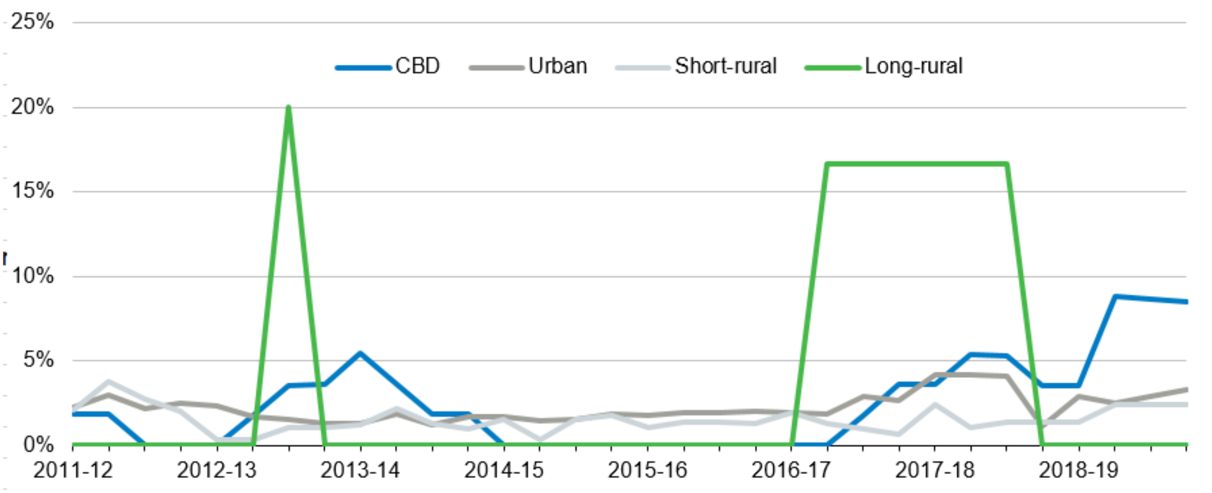
## Figure C.4 Ausgrid – Overall SAIFI performance short rural and long-rural 2007-08-2018-19




**Data source: :** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

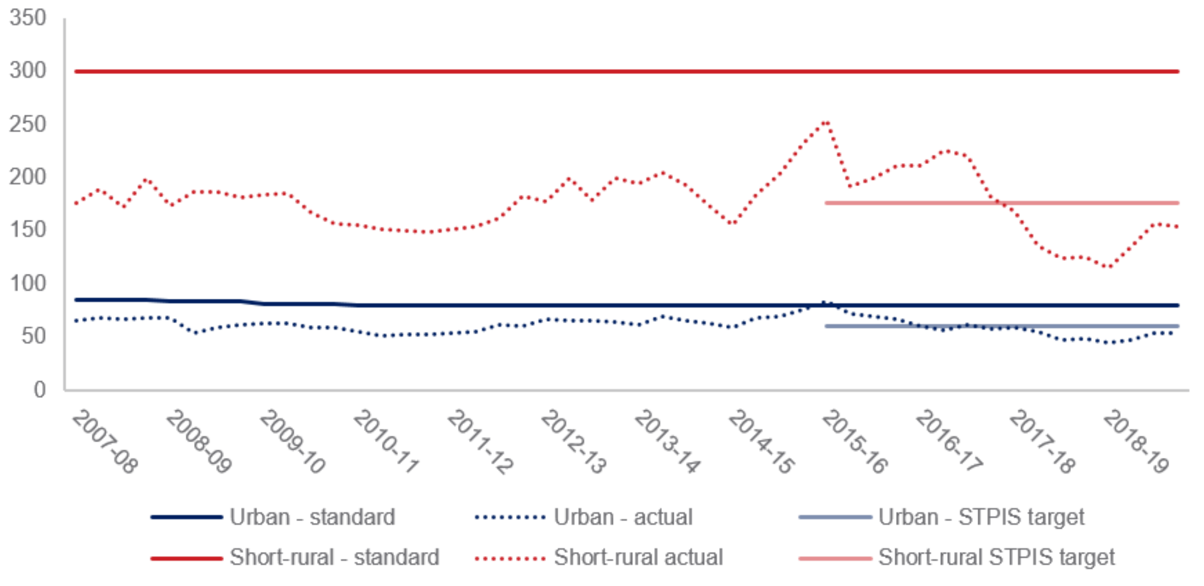
## Figure C.5 Ausgrid - Percentage of feeders above individual feeder standards 2011-12 to 2018-19




**Data source:** IPART analysis of distributor data.

## C.2 Endeavour Energy

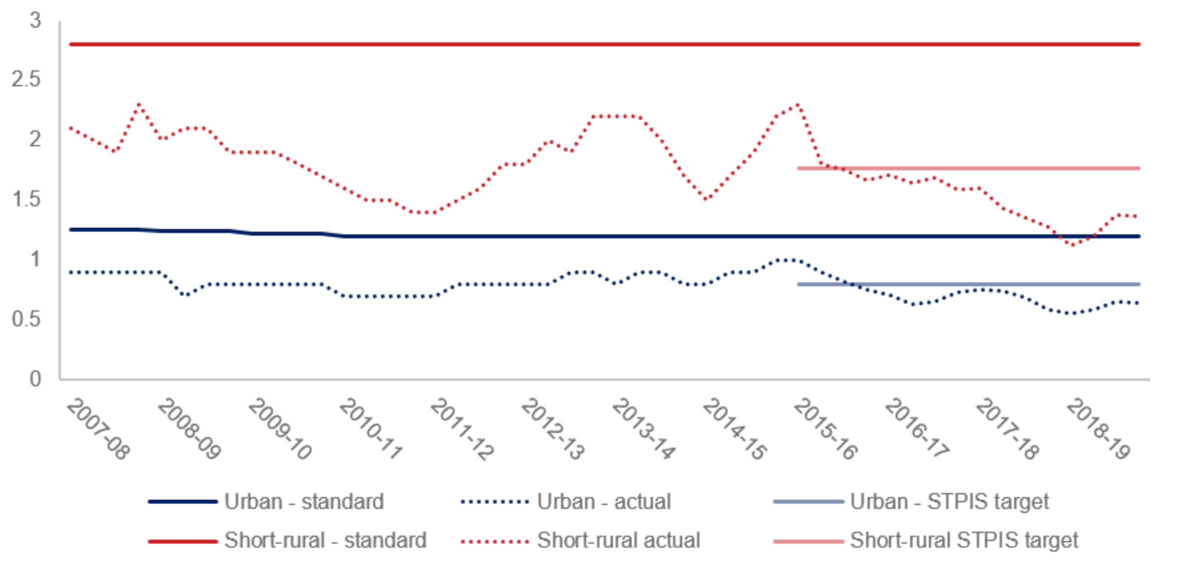
**Figure C.6 Endeavour Energy Overall SAIDI performance urban and short-rural 2007-08 to 2018-19**




**Data source:** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

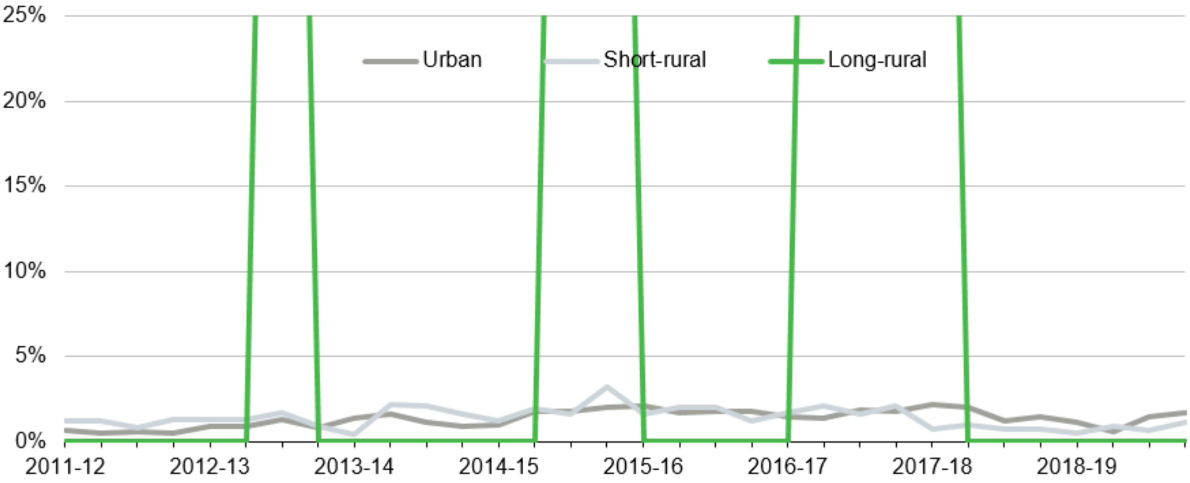
**Figure C.7 Endeavour Energy Overall SAIFI performance urban and short-rural 2006-07 to 2018-19**




**Data source:** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

**Figure C.8 Endeavour Energy percentage of feeders above individual feeder standards**

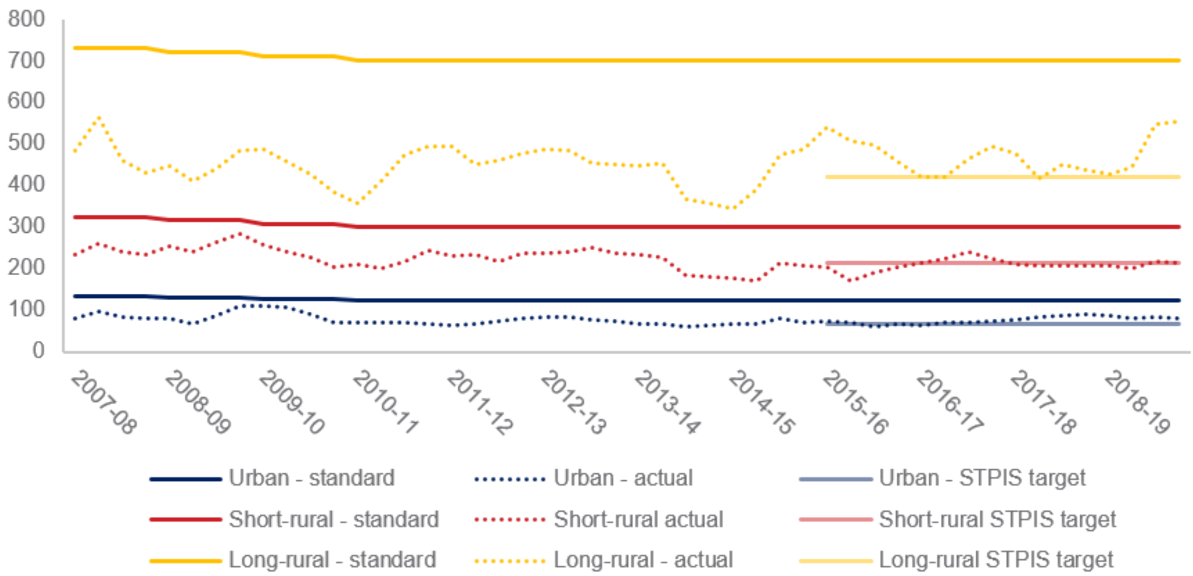



**Note:** Endeavour only has one long-rural feeder so result is either 0% or 100%.

**Data source:** IPART analysis of distributor data.

## C.3 Essential Energy

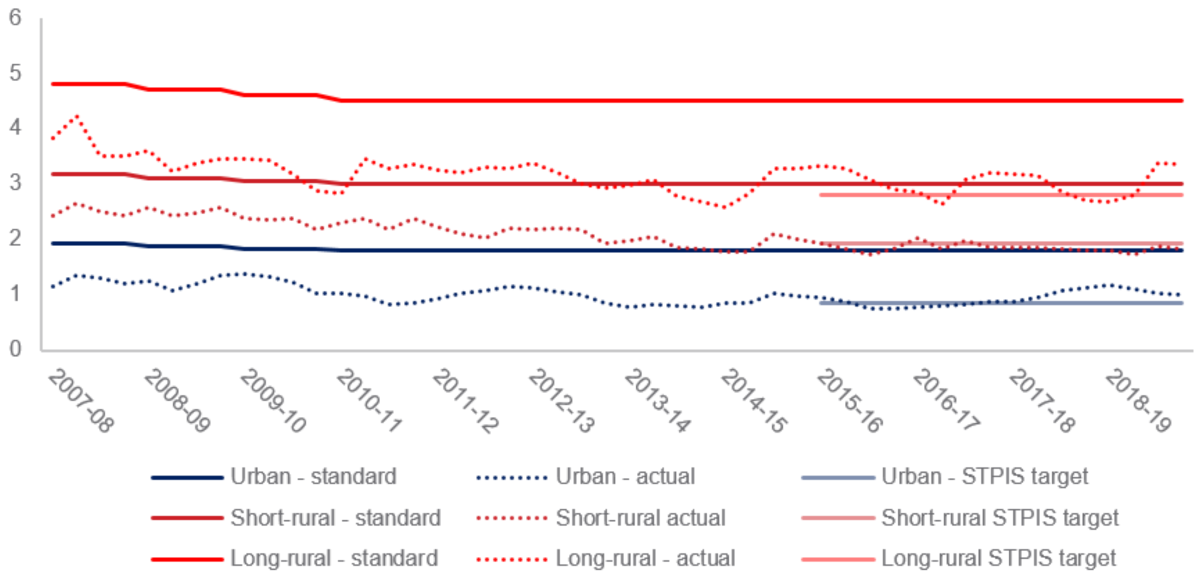
**Figure C.9 Essential Energy Overall SAIDI performance 2007-08 to 2018-19**




**Data source:** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

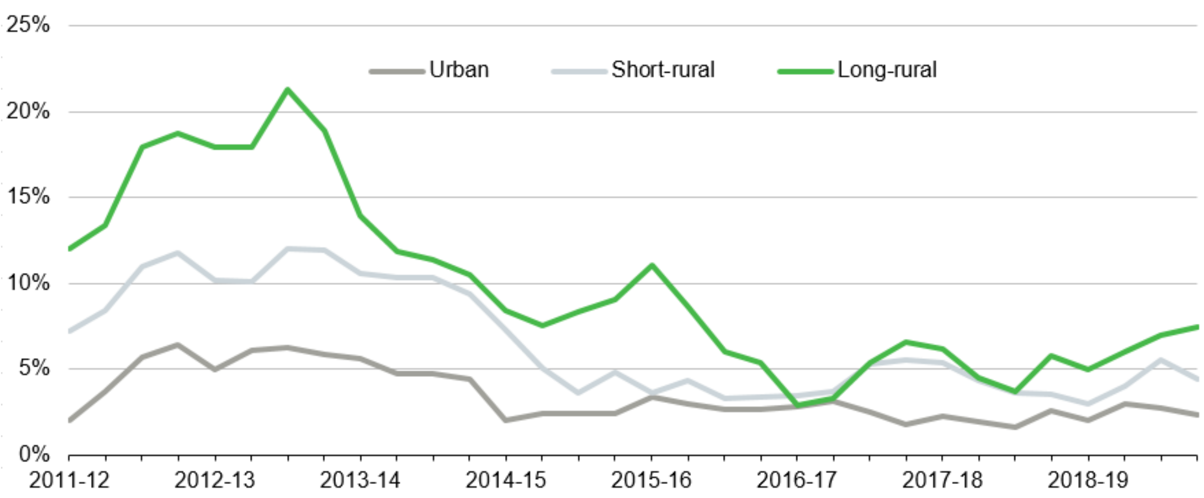
## Figure C.10 Essential Energy Overall SAIDI performance 2007-08 to 2018-19




**Data source:** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.

## Figure C.11 Essential Energy percentage of feeders above individual feeder standards




**Data source:** IPART analysis of distributor data.

**Note:** Financial incentives for STPIS were introduced from 2015-16.