IPART

Independent Pricing and Regulatory Tribunal
New South Wales

Transmission reliability standard compliance

From 1 July 2018

Issues Paper
Energy

June 2017

ISBN 978-1-76049-086-7

The Tribunal members for this review are:

Dr Peter J Boxall AO, Chair

Mr Ed Willett

Ms Deborah Cope

Inquiries regarding this document should be directed to a staff member:

Alex Oeser (02) 9290 8434

Andrew Harman (02) 9290 8428

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 7 July 2017

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:

Energy Networks Regulatory Unit
Independent Pricing and Regulatory Tribunal
PO Box K35
Haymarket Post Shop NSW 1240

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 on the previous page.

We may choose not to publish a submission—for example, if it contains confidential or commercially sensitive information. If your submission contains information that you do not wish to be publicly disclosed, please indicate this clearly at the time of making the submission. IPART will then make every effort to protect that information, but it could be disclosed under the *Government Information (Public Access) Act 2009* (NSW) or the *Independent Pricing and Regulatory Tribunal Act 1992* (NSW), or where otherwise required by law.

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

Contents

1 Introduction

IPART monitors compliance with safety and reliability obligations placed on electricity network operators in NSW. We also monitor compliance with licence conditions for gas and electricity networks. The Independent Pricing and Regulatory Tribunal (IPART) is reviewing the approach to assessing compliance with the reliability standards for electricity transmission in NSW. In November 2016, we made recommendations to the Minister for Industry, Resources and Energy setting out a new standard for the Transmission Network Service Provider (TNSP) – TransGrid.[1] On 1 June the Minister adopted our recommended reliability standard. We are commencing consultation on our proposed approach to assessing compliance.

The standard requires TransGrid to ensure that the transmission system is designed such that, for each bulk supply point,[2] the system:

- achieves the required level of redundancy (that is, it specifies the number of back-up arrangements that must be in place to support continued supply of electricity in the event that part of the transmission network fails), and
- does not exceed the specified allowance for expected unserved energy (that is, an expected amount of energy that cannot be supplied, taking into account the probability of supply outages attributable to credible contingency events, expected outage duration, and forecast load)

The standard does not prescribe how TransGrid must meet it. Instead it explicitly provides for TransGrid to determine the combination of network and non-network solutions it uses to meet the standard.

In both our Final Report and Final Supplementary report, we noted that we would undertake a further review including public consultation on the approach for assessing compliance in 2017. This paper explains the review, outlines how we propose to approach it, the issues we will consider and our preliminary views on these issues. The reliability standard is provided in Attachment A.

1.1 What is IPART reviewing?

The standard is a planning standard. We are undertaking consultation with TransGrid and other stakeholders on our approach to assessing compliance with the standard. In assessing compliance with the standard, we propose to review whether TransGrid has designed the transmission system for each bulk supply point to achieve the level of redundancy and does not exceed the allowance for expected unserved energy.

1 IPART, Electricity transmission reliability standards - Energy –Supplementary Final Report, November 2016.

2 A bulk supply point is defined as a location where supply is provided to DNSPs or directly connected customers. Generally, the locations are the busbar(s) at TransGrid's substations but sometimes the locations are where connections are made to TransGrid's transmission lines or cables (including "tee" connections).

The allowance for expected unserved energy in the standard is based on both the probability of asset failures occurring and the impact of those failures on supply given the demand at each bulk supply point. As a result, to assess compliance with the reliability standard, we would require TransGrid to provide a range of information, for example life cycle equipment failure rates, load profiles and maximum demand.

The standard also includes a new requirement for TransGrid to provide additional information to allow us to identify any changes to its asset management strategy or risk profile. This information may signal changes to reliability for customers as well as providing useful input to the next review of reliability standards.

This review will consult on the approach we propose to use to assess compliance, the frequency and timing of compliance assessments, and which inputs would be used by IPART to assess compliance.

1.2 What is IPART's compliance role?

We are undertaking this review of compliance as IPART is the safety and reliability regulator for the NSW electricity networks. Condition 3(a) of TransGrid's transmission licence requires that it must ensure that it and all other network operators of its transmission system comply with any reliability and performance standards issued by the Minister.

IPART has a number of powers for gathering information to monitor whether TransGrid complies with the standards. They include the following:

- Condition 15 of its Licence requires TransGrid to furnish such information as the Tribunal may determine, to enable the Tribunal to ascertain whether or not the Licence Holder is complying with the Licence conditions.
- IPART has also published a Reporting Manual that outlines the reporting requirements for all electricity network operators (including TransGrid) to provide IPART with sufficient information to exercise its regulatory functions. It is a licence condition that TransGrid complies with a Reporting Manual issued by IPART.
- Clause 7 of the reliability standard requires TransGrid to comply with any request notified to it by IPART for information that IPART reasonably considers to be necessary or convenient for monitoring TransGrid's compliance with the standard.

As part of this review we are consulting with stakeholders on both our proposed compliance method and whether stakeholders consider it is necessary to require TransGrid to use our proposed method when submitting its compliance report. In the event this is necessary we propose that either IPART or the Minister would approve the manner in which annual expected unserved energy is calculated.

We propose to produce a set of reporting obligations to be included in IPART's Electricity Networks Reporting Manual and Audit Guidelines.[3] We propose to use this information to assess TransGrid compliance with the reliability standard.

1.3 How can stakeholders provide input to the review?

For this review, we will conduct a public consultation process and our own research and analysis. This Issues Paper is the first step in our public consultation.

This review continues extensive work that was undertaken by IPART during 2015 and 2016 to determine the recommended reliability standard. As a result of this work, we have been able to draw on our experience and develop a preliminary view on the approach to assessing compliance. We are seeking comment on this approach and the issues raised in this paper.

We will also consult with key stakeholders such as TransGrid, in particular on our proposed method to estimate expected unserved energy including the proposed information we require TransGrid to provide.

We invite all interested stakeholders to make submissions in response to the paper by 7 July 2017. Details on how to make a submission is provided on page iii at the front of the paper.

We will also release a Draft Report and draft changes to the Reporting Manual and Audit Guidelines that outline our draft decisions and the analysis that supports them, and invite further submissions. We will consider all submissions in making our final decisions on how we propose to assess compliance by 30 September 2017.

Table 1.1 provides an indicative timetable for the review. We will update this timetable on our website as the review progresses.

Table 1.1 Indicative timetable for this review

Milestone	Indicative date
Issues Paper released	June 2017
Submissions on this paper due	7 July 2017
Draft Report released	Early August 2017
Submissions on this report due	Early September 2017
Final Report released	End September 2017

3 Electricity network operators (ENO) – such as TransGrid - continue to have the prime responsibility for safety and reliability in relation to their network, and discharge this responsibility through the implementation of their safety management systems and compliance with reliability standards. IPART's role is to hold ENOs accountable by developing an effective risk based compliance and enforcement framework. The Electricity Networks Reporting Manual outlines the reporting requirements for ENOs to provide IPART with sufficient information to exercise its regulatory functions. For more information see: https://www.ipart.nsw.gov.au/files/sharedassets/website/shared-files/energy-network-regulation-administrative-energy-licensing-website-documents/reporting-manual-electricity-network-reporting-manual-december-2016.pdf

1.4 How is this paper structured?

The rest of this Issues Paper provides more information on the review, our proposed analytical approach, and the key issues we will need to consider:

- Chapter 2 outlines our proposed approach for assessing compliance including the timing of TransGrid's reporting and the use of audits.
- Chapter 3 provides further information on how we propose to assess compliance with the level of redundancy and expected unserved energy allowances.
- Chapter 4 discusses additional information that we propose TransGrid provides us on its asset risk profiles.

1.5 List of issues for stakeholder comment

Throughout this paper, we have identified the issues on which we particularly seek stakeholder comment. We have also set out our preliminary views on several of these issues. 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, a full list of the issues we seek comment on is provided below:

10 Do you support TransGrid being required to report annually to IPART on its health index, probability of failure and event consequence for all of its major asset classes – overhead lines, underground cables and transformers? 18

2 Overview of our proposed approach to assessing compliance

The reliability standard is a planning standard, which mean that TransGrid must design the transmission system to achieve the requirements set out in the standard. The standard introduces the concept of probabilistic analysis and positive expected unserved energy into TransGrid's decision making processes. It also makes explicit provision for the standard to be met using non-network solutions.

This chapter sets out our preliminary views on the key steps in our proposed approach to assessing compliance, including the frequency of reporting and the use of audits.

2.1 We propose TransGrid report annually on compliance with the Reliability Standard

Our proposed approach would require TransGrid to submit an annual compliance report for the 12 months to 30 June by 31 August or another date specified by the Tribunal. TransGrid's annual compliance report would provide the following:

1. An assurance that TransGrid has designed the transmission system to achieve the level of redundancy specified in the standard for each bulk supply point. We propose this would be accompanied by network/circuit diagrams. (see Section 3.1 for further details).
2. An assurance that TransGrid has designed the transmission system such that the annual expected unserved energy in respect of each bulk supply point does not exceed the allowance for expected unserved energy specified in the standard. We propose this would be accompanied by a compliance spreadsheet setting out the formula and inputs that TransGrid has used to estimate annual expected unserved energy.
3. Information on asset faults and TransGrid's asset risk profile in a format agreed with IPART. (see Chapter 4 for further details).

Where TransGrid is unable to provide assurance that the transmission system is designed to achieve compliance with the reliability standard we propose that TransGrid provide details of why that assurance cannot be provided and details of actions (and timeframes) TransGrid proposes so that they can provide assurance.

The reliability standard also provides that TransGrid can request IPART's approval to provide some flexibility around the redundancy or expected unserved energy allowance at specific BSPs. TransGrid would be required to develop and submit a plan regarding measures to alter the reliability capacity of a particular BSP(s) where the plan if implemented, would be likely to provide a greater net-benefit than would be provided by TransGrid complying with the standard. In assessing any such applications we would review the proposal to ensure that it would not materially reduce the level of reliability

provided at any bulk supply point compared with the redundancy category and unserved energy values specified in the standard. We would assess any such proposal submitted by TransGrid on a case-by-case basis.

2.2 We propose TransGrid obtain an independent audit of compliance

In addition to the proposed requirement for TransGrid to submit an annual compliance report we also propose to require TransGrid to engage a suitably qualified auditor to independently assess compliance with the standard. IPART would approve the suitability of the auditor and the scope of works.

We propose that the annual audit would sample sufficient bulk supply points covering a range of redundancy requirements (N, N-1 and N-2) and location types (suburban, regional and remote locations). The information provided should be sufficient for the auditor to provide an opinion.

Independent audits are an important part of IPART's electricity network compliance framework. We propose that the scope of the proposed independent audit focus on:

- Whether the transmission system has been designed to achieve the level of redundancy specified in the standards. To do this, we would expect that the auditor would confirm that the necessary assets and non-network solutions are/were operated in a manner consistent with network/circuit diagrams outlined in section 2.1 above.
- Whether TransGrid has network management strategies or non-network solutions in place to achieve the restoration and repair times that it used as inputs to the estimates of expected unserved energy at each BSP.

TransGrid will be required to provide an independent audit report to IPART by a date that will be specified by IPART in the Audit Guidelines[4]. The auditor needs to be approved by IPART but TransGrid would commission the audit.

2.3 We will report on compliance annually to the Minister for Energy and Utilities

Each year, we are required to prepare and forward to the Minister a report on the networks' compliance performance during the 12 months ending on 30 June in that year. Our report is due to the Minister by 31 October in that year. The Minister must lay the report or cause it to be laid before both Houses of Parliament as soon as practicable after receiving the report.

We propose that we would report on compliance with the reliability standard as part of IPART's annual reporting to the Minister for Energy and Utilities.

Table 2.1 summarises our proposed approach and reporting calendar.

[4] IPART, *Electricity Network Audit Guidelines* June 2016.

Table 2.1 Summary of proposed approach and reporting calendar

Topic	Proposed requirement
Frequency of reporting	Annual
Reporting period –	previous financial year
TransGrid report and spreadsheet due to IPART	Date to be specified in the Reporting Manual[5]
TransGrid required to provide an independent audit report?	Date to be specified in the Audit Guidelines[6]

IPART seeks comments on the following

1 Do you agree with our proposed approach to assessing compliance each year?

[5] IPART, *Electricity Networks Reporting Manual* November 2016.
[6] IPART, *Electricity Networks Audit Guidelines* June 2016.

3 Assessing TransGrid's compliance with the reliability standard

This chapter outlines our proposed approach to assessing TransGrid's compliance with the level of redundancy and the allowance for annual expected unserved energy.

3.1 How will we assess compliance with the required level of redundancy?

The standard requires TransGrid to ensure that the transmission system is designed such that for each bulk supply point it achieves the required level of redundancy.[7]

Our preliminary view is that TransGrid would be required to confirm each year that the transmission system has been designed to achieve the level of redundancy set out in the standard. In the first year, TransGrid would need to provide network/circuit diagrams that demonstrate the required levels of redundancy.

As noted in Chapter 2, IPART proposes that an independent auditor be engaged to assist with assessing compliance. In assessing compliance, we propose that the auditor would review whether TransGrid has the necessary assets and non-network solutions to ensure that the transmission system is designed such that for each bulk supply point it achieves the required level of redundancy.

IPART seeks comments on the following

2 Do you agree with our proposed approach (confirmation by TransGrid and review by an independent auditor) to assessing compliance with the required level of redundancy?

3.2 How will we assess compliance with the allowance for annual EUE?

The allowances for expected annual unserved energy are based on both the probability of an asset being unavailable and the impact of this unavailability on supply, given the demand at each bulk supply point and back-up arrangements. To assess compliance with the standard it would be necessary to obtain current data on the transmission system and agree on a methodology for estimating expected unserved energy.

7 The level of redundancy specifies the number of back-up arrangements that must be in place to support continued supply of electricity in the event that part of the transmission network fails. Redundancy is typically defined using the N-x expression. Starting from the 'Normal' network operating configuration, the N-x expression specifies the number (x) of system elements that can be out of service without causing load curtailment, system instability, thermal overloading, or cascading outages. With the value of x commonly set as one, and less often at zero (no redundancy) or two (two levels of redundancy), the N-x expression is easily applied to set the broad expectations of reliability at a connection point. The x value is applied as the required level of redundancy in the network, which can be achieved by either network or non-network solutions.

3.2.1 Our proposed method to estimate annual expected unserved energy

To assess whether TransGrid has designed the transmission system such that the annual expected unserved energy allowance for each bulk supply point does not exceed the allowance in the standard we need to estimate the annual expected unserved energy for the relevant compliance year.

Boxes 3.1 and 3.2 provide an overview of how we propose to estimate the annual expected unserved energy. Our proposed method is consistent with the approach we used to recommend the allowances for expected unserved energy.

Box 3.1 Estimating annual EUE

At each BSP, the minutes of expected unserved energy would be the MWh of expected unserved energy per year multiplied by 60 (to get MW minutes) divided by the average annual demand at that BSP expressed in MW:

(1) EUE (min) = EUE (MWh) * 60 / avg demand (MW)

To simplify the following equations use the notation “tx” to denote transformer. The term “FR” is the failure rate: the expected average number of failures per year per transformer or line. For lines, this rate will depend on the length. The term “TTR” is time to restore a failed asset into service, which might involve replacement.

The MWh of expected unserved energy per year is the sum of EUE across four different asset failure scenarios:

1. A single transformer fails
2. A single line fails
3. A period of time in which two transformers at the same BSP are out of service
4. A period of time in which two lines at the same BSP are out of service.

Dual failure scenarios will not be applicable to BSPs where there is only one transformer or one line. The single transformer failure scenario will not be applicable to BSPs that do not have any transformers. In those cases, the relevant terms in the sum below will be zero.

(2) EUE (MWh) = EUE (1 tx fails) + EUE (2 tx fail) + EUE (1 line fails) + EUE (2 lines fail)

The four terms in equation (2) can be evaluated using equations (3) – (6):

(3) EUE (1 line fails) = L * FR 1st line * TTR 1st line

(4) EUE (2 lines fail) = M * FR 1st line * FR 2nd line * (TTR 2nd line)2 /8760

(5) EUE (1 tx fails) = N * FR 1st tx * TTR 1st tx

(6) EUE (2 tx fail) = O * FR 1st tx * FR 2nd tx * (TTR 2nd tx)2 /8760

The number 8760 = 24 * 365, which is the number of hours in a typical year.

The variables L, M, N, and O each represent the average MW of demand that would fail to be served if the failure mode in question applied for the entire year.

(7) L = peak demand (MW) * F(single line failure)

(8) M = peak demand (MW) * F(double line failure)

(9) N = peak demand (MW) * F(single tx failure)

(10) O = peak demand (MW) * F(double tx failure)

The function F(*) represents the fraction of the year for which demand exceeds the maximum that could be supplied under the specified failure condition. During that part of the year, supply would be interrupted if the failure condition applied. The function is estimated through a look-up to a logistic curve expressing the Load Duration information for the BSP. The input to the look-up is based on the maximum feasible supply when the failure condition applies.

Box 3.2 Estimating annual EUE for grouped BSPs

The reliability standard sets an expected unserved energy allowance for some individual BSPs as if they were a group. For example, Canberra and Williamsdale 132 kV substations are treated as though they are a single BSP. The five Inner Sydney BSPs: Beaconsfield, Haymarket, Rookwood Rd, Sydney North and Sydney South are also grouped together.

The group EUE (min) is calculated as follows:

(11) Group EUE (min) = sum [EUE (MWh_b)] * 60 / sum [MD_b * LF_b]

The sums are over all BSPs in the group. The subscript "b" refers to the summation index—one value per BSP. MD is the annual maximum demand in MW, and LF is the load factor (average demand/maximum demand) for each BSP

There is likely to be more than one way to estimate annual expected unserved energy. We consider it is important that a consistent method be used by both IPART and TransGrid to assess compliance. We are consulting with stakeholders on both our proposed compliance method and whether stakeholders consider it is necessary to require TransGrid to use our proposed method when submitting its compliance report. In the event this is necessary we propose that either IPART or the Minister would approve the manner in which annual expected unserved energy is calculated. IPART has similar powers in its role as compliance regulator under the *Water Industry Competition Act 2006*. For example we could propose that in the reliability standard the definition of expected unserved energy be replaced with the following:

> ***Annual expected unserved energy***, in respect of a bulk supply point, means the number resulting from the application of the *annual expected unserved energy method* for a financial year, in respect of that bulk supply point
>
> ***Annual expected unserved energy method*** means the document of that title approved from time to time and published on the Tribunal's website

IPART seeks comments on the following

3 Do you agree with our proposed method of estimating annual expected unserved energy at each bulk supply point as outlined in Box 3.1 and Box 3.2?

4 Do you consider it necessary to propose that either IPART or the Minister for Energy and Utilities approves the method to calculate annual expected unserved energy?

3.2.2 Compliance information TransGrid would be required to provide

To assess compliance with the reliability standard, we propose that TransGrid provide us with the following information for the relevant financial year:

BSP-specific data

- Maximum (peak) demand (MW)
- annual load duration curve
- length of lines feeding the BSP (km)
- proportion of lines that are overhead or underground by feeder, and

- maximum feasible supply (MW) under each of the four failure modes

Asset-specific data on life cycle average annual failure rates:

- per transformer
- per km of overhead line, and
- per km of underground cable

BSP and asset-specific data

- time to restore the first transformer that fails (hrs)
- time to restore the second transformer that fails (hrs)
- time to restore the first line that fails (hrs), and
- time to restore the second line that fails (hrs)

Maximum or peak demand (MW)

It is our preliminary view that in assessing compliance with the standard we require TransGrid to provide maximum demand for the 12 month compliance period.

The standard is expressed in minutes of unserved energy at average demand, and not in energy units, such as MWh. This means that when a higher level of maximum demand applies, the level of average demand increases roughly in proportion. While the unserved energy in MWh will increase, this level of energy will correspond to roughly the same number of minutes at the higher level of average demand. The relationships between maximum demand, average demand and unserved energy are not strictly linear, so the number of minutes of unserved energy will not be exactly the same at all levels of maximum demand. However, the allowance for annual expected unserved energy in the standard is expressed in minutes, rather than energy units. In our review to recommend the reliability standard we did undertake sensitivity testing for changes in maximum demand (at 70% and 130% of the base case values) This sensitive testing indicated that the level of expected unserved energy is relatively insensitive to maximum demand[8].

BSP specific data -asset configuration and sizing

We propose that TransGrid should provide IPART with updated information based on the actual configuration at each BSP. TransGrid plans its network based on the actual number and size of the assets and contracted non network solutions.

IPART seeks comments on the following

5 Do you agree that we should require TransGrid to provide bulk supply point specific data (maximum demand, load duration curve, line length and type) in order for IPART to assess compliance with the expected unserved energy allowance?

6 Do you agree that IPART should base its compliance assessment on maximum demand for that 12 month compliance period

[8] IPART, Electricity transmission reliability standards, Final Report September 2016 and Final supplementary Report November 2016

Asset-specific data on life cycle average annual failure rates:

It is important that the set of risks to be incorporated into our assessment of compliance with the standards reflect the same set of risks that were used to determine the allowance for expected unserved energy. If the set of risks is broader than what was included in recommending the standard, TransGrid may find it difficult to meet the standards without significant additional investment in reliability. This would not be efficient and would not be driven by the value customers place on reliability. On the other hand if the set of risks used to assess compliance is narrower than what was included, TransGrid may find it too easy to meet the standards and not invest when there would be value in doing so.

We consider that in assessing compliance we would need to consider a set of situations consistent with those used to recommend the expected unserved energy allowances. We propose that we would assess the probability and impact of the following situations:

- system normal
- single transformer failure
- single line failure
- double transformer failure, and
- double line failure

We note that in practice there are three possible causes of asset unavailability:

- unavailability due to breakdown failure
- unavailability due to corrective maintenance[9], and
- unavailability due to damage by third parties

Our preliminary view is when assessing compliance we would only consider the probability and impact of asset unavailability due to breakdown failures. This would ensure consistency between the set of risks included in recommending the standard and the compliance process.

When recommending the allowances for expected unserved energy, IPART included only asset unavailability due to breakdown as:

- Expected unserved energy should not arise from corrective maintenance activities that are prudently undertaken. Corrective maintenance activity can be undertaken at a time of the network provider's choosing. A prudent network provider would choose these maintenance times to minimise the likelihood of the loss of supply—for example by doing maintenance during periods of low demand. A network provider may also have non network contracts in place to assist with minimising the likelihood of the loss of supply during corrective maintenance activity.

9 This category can include unavailability to facilitate capital works/upgrades

- Service interruptions due to damage by third parties are outside the network provider's control. While expected unserved energy may arise from third party activity, it should not count against the network provider's expected unserved energy allowance under the reliability standard. We note however that network providers still have a responsibility to prudently manage and minimise risk from third party damage.

Failure rates

Our preliminary view is life-cycle average failure rates should be used in the compliance assessment, not failure rates based on current asset condition. This would ensure consistency with the way the standards were derived. Our proposed failure rates are presented in Table 3.1.

Table 3.1 Asset failure frequency rates

Asset type	Failure frequency
Transformers (catastrophic failures per year per transformer)	0.00557
Transformers (non-catastrophic failures per year per transformer)	0.17
Overhead lines (failures per year per 100km)	0.2901
Underground cables (failures per year per 100km)	0.00595

Data source: IPART based on TransGrid historic performance data and Ausgrid underground failure rates provided by TransGrid**.**

A catastrophic transformer failure is one that requires replacement of the unit. A non-catastrophic transformer failure can be rectified without replacing the unit.

To be consistent with the way the standards were derived, life-cycle average failure rates should be used in the compliance assessment, not failure rates based on current asset condition. Using condition based failure rates would have unintended consequences – for example, either requiring TransGrid to bring forward asset replacement when that would not be efficient, or allowing TransGrid to meet the standards too easily where assets are relatively young.

If TransGrid adopts non-network solutions as a means of meeting the reliability standards, we would need to consider what failure rates should be used for assessing compliance. We would consider these on a case by case basis.

IPART seeks comments on the following

7 Do you agree that when assessing compliance with the annual expected unserved energy allowance we would only consider the probability and impact of asset unavailability due to breakdown failures?

8 Do you agree that in assessing compliance IPART should use the asset failure rates shown in Table 3.1?

BSP and asset-specific data

In assessing compliance with the standard we would need to consider both the probability and impact of different asset failures, including the load that may be put at risk and the expected duration of any outages. Our preliminary view is that in assessing compliance we

would use TransGrid's estimates of the time to restore transformers and lines at each bulk supply point.

Estimating time to restore the service provided by a failed asset requires analysis of the network operator's specific contingency plans for switching to alternative circuits, repairing or replacing malfunctioning units and any non-network solutions available.

When recommending the allowances for annual expected unserved energy, we used planning criteria for restoration and repair durations based on advice from TransGrid and advice from our consultant and consulted on these as part of our draft and final reports.[10] We also noted that it was not possible to consider all types of solutions that could be available over the 2018 regulatory period. Some of the potential options for providing reliability, particularly non-network solutions, are not able to be considered in advance of when an investment decision is needed.[11] Others depend on the forecast maximum demand and load profile at each bulk supply point, which changes over time.

For network solutions, we propose to require an independent audit of the restoration and repair times for each bulk supply point. For non-network solution, our preliminary view is that TransGrid would be required to provide evidence of the third-party agreements that are in place to deliver them. Once these have been confirmed, we would require TransGrid to provide an annual statement that the agreements remain in place and have not changed.

IPART seeks comments on the following

9 Do you agree that in assessing compliance with the annual expected unserved energy allowance we would use TransGrid's estimates of the time to restore transformers and lines at each bulk supply point?

3.2.3 Flexibility around redundancy and annual expected unserved energy

To provide some flexibility there is provision in the standards for TransGrid to submit a proposal to IPART for a different level of redundancy and/or annual expected unserved energy for approval. The standards set out the process that must be followed and the analysis that TransGrid would need to provide in support of any such proposal.

Such a plan may not materially reduce the level of reliability provided at any bulk supply point compared with the redundancy category and annual expected unserved energy values specified in the standard. Further information is contained in the standard set out in Attachment A.

We propose to assess any such proposal submitted by TransGrid on a case-by-case basis.

10 For further information see Appendix D of IPART's Final Supplementary Report.

11 Non-network solutions are alternatives to traditional transmission assets, such as lines and transformers, which can be used to address supply constraints. They include demand side management (eg, load curtailment arrangements or local generation).

4 Information on TransGrid's asset risk profile

In our 2016 review we recommended that TransGrid provide additional information relevant to its asset replacement decisions that would allow us to identify any changes to its asset replacement strategy or risk profile. This information may signal reducing reliability for customers and also provide useful input to the next review of reliability standards.

Our preliminary view is that TransGrid would need to provide information on failure rates and asset risk profiles for its major asset classes annually. The sections below outline the type of information that we would expect TransGrid to provide each year.

4.1 Failure rates

We propose that TransGrid would be required to provide information on failure rates as part of its annual compliance report. Any changes in this information over time may provide one potential signal of reducing reliability for customers. It should provide this for each of its major asset classes – that is, transformers, overhead lines and underground cables. This information would also provide useful input to the next review of reliability standards.

As discussed in Chapter 3, our preliminary view is that compliance would be assessed using life-cycle average failure rates based on historical averages from TransGrid. However, these historical averages only provide a good estimate of the life cycle failure rates for the network where TransGrid does not make significant changes to its asset replacement strategy or risk profile. A policy change that allows assets to stay in service longer or their condition to deteriorate would, over time, raise the life cycle failure rate above what we have used to set the expected unserved energy allowances.

We also note that failure rates may not provide a complete picture of potential changes in reliability. Transmission networks tend to have a low number of outages, which means that focusing on failure rates may provide a false view of their reliability. There may be no outward signs that there is a major vulnerability in a transmission network until reliability is badly affected. Given this, we are also proposing the TransGrid provide further information on the risk profiles of its assets.

4.2 Asset risk profiles

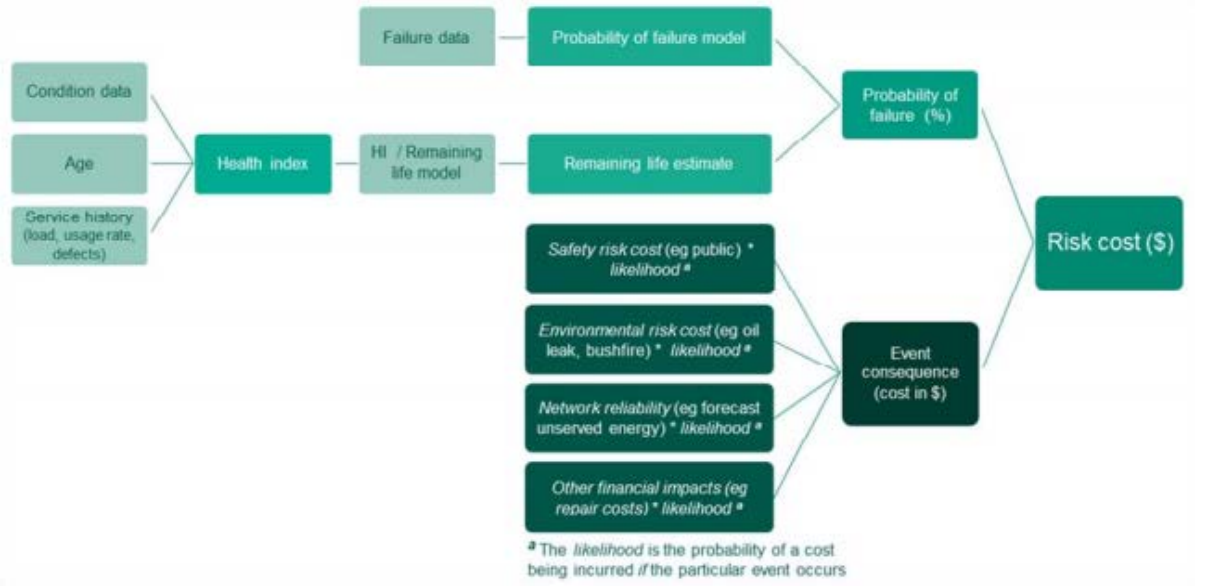
Asset risk profiles provide a framework for collating information and tracking changes in network reliability over time. They typically incorporate both the probability and consequence of different events on the transmission network.

In its submission to the AER, TransGrid notes that it has improved its asset management strategy and risk framework and implemented new asset monitoring and replacement tools.[12] These tools combine asset health (or the probability of failure) and criticality (the

12 TransGrid Revenue Proposal 2018-19 – 2022-23, p 65

consequence of failure and the probability that the consequence eventuates) to quantify risk and provide information on which assets needs to be prioritised.[13] Figure 4.1 provides an overview of TransGrid's risk cost framework.

Figure 4.1 TransGrid's risk cost framework



Data source: TransGrid Revenue Proposal 2018-19 – 2022-23, p 79

Our preliminary view is that TransGrid should be required to report annually to IPART on the health index, probability of failure and event consequence for all of its major asset classes – overhead lines, underground cables and transformers.

IPART seeks comments on the following

10 Do you support TransGrid being required to report annually to IPART on its health index, probability of failure and event consequence for all of its major asset classes – overhead lines, underground cables and transformers?

13 TransGrid Revenue Proposal 2018-19 – 2022-23, p 56

A The reliability standards

1. Status of this standard

(a) This standard is a reliability and performance standard issued by the *Minister* for the purposes of clause 3(a) of the *Licence*.

(b) This standard may be cited as the *Transmission Reliability and Performance Standard 2016 No. 1*.

2. Interpretation

(a) In this standard, where the terms below are italicised they have the corresponding meanings set out below.

Expected unserved energy means the expected amount of energy that cannot be supplied, taking into account the probability and expected impact (including expected outage duration and forecast load) of the following:

(i) failure of a single *system element*;

(ii) double transformer failure, or failure of equivalent *system elements*; and

(iii) double line failure, or failure of equivalent *system elements*.

Inner Sydney means the inner metropolitan transmission system, which is that part of the *transmission system* constituted by:

(i) cables 41 and 42;

(ii) the 330/132kV substations at Rookwood Road, Beaconsfield, Haymarket, Sydney North and Sydney South;

(iii) any future associated 330kV cables and 330/132kV substations; and

(iv) any of Ausgrid's 132k transmission network that links any of the above.

Level of redundancy means:

(i) for category 1 bulk supply points, a supply interruption may occur following the outage of a single *system element*;

(ii) for category 2 bulk supply points, a non-zero amount of load must be supplied following the outage of a single *system element*; and

(iii) for category 3 bulk supply points, a non-zero amount of load must be supplied following the outage of a single *system element*. In addition, for *Inner Sydney*, a

non-zero amount of load must be supplied following the simultaneous outage of a single 330 kV cable and any 132 kV feeder or 330/132 kV transformer.

Licence means the Transmission Operator's Licence under the *Electricity Supply Act 1995* granted to NSW Electricity Networks Operations Pty Limited (ACN 609 169 959) as trustee for the NSW Electricity Networks Operations Trust dated 7 December 2015, or a licence that replaces it.

Licence Holder has the same meaning as under the *Licence*.

Minister has the same meaning as under the *Licence*.

RIT-T means the *Regulatory investment test for transmission and application guidelines 2010* published by the Australian Energy Regulator, or any replacement of that document from time to time.

System element means:

(i) a transmission circuit (a line or a cable);

(ii) a transformer;

(iii) a component of physical infrastructure other than a transmission circuit or transformer; or

(iv) network support arrangements, backup supply capability, or other measure that provides supply capacity.

Transmission system has the same meaning as under the *Licence*.

Tribunal has the same meaning as under the *Electricity Supply Act 1995*.

(b) Headings and notes which appear in this standard are intend as an aide to usage only, and do not form part of this standard.

(c) References to clauses in this standard are references to clauses of this standard, unless this standard expressly provides otherwise.

3. Requirement to design for a specified *level of redundancy* for each bulk supply point

Subject to clause 5(a) below, the *Licence Holder* must ensure that the *transmission system* is designed such that, for each bulk supply point listed in the table in clause 8, the *transmission system* achieves the *level of redundancy* category specified for that bulk supply point in the table in clause 8.

4. Requirement to design for a level of *expected unserved energy* for each bulk supply point

Subject to clause 6(a) below, the *Licence Holder* must ensure that the *transmission system* is designed such that the annual *expected unserved energy* in respect of a bulk supply point listed in the table in clause 8 does not exceed the allowance for *expected unserved energy* specified for that bulk supply point in the table in clause 8.

5. Flexibility in planning for the level of redundancy

(a) The *Licence Holder* is not required to comply with clause 3 above in respect of a bulk supply point listed in the table in clause 8 provided that:

(i) the *Licence Holder* has developed and submitted to the *Tribunal* a plan regarding measures for altering the reliability of the supply capacity of the bulk supply point;

(ii) that plan provides a greater net-benefit, using the cost-benefit methodology defined in the *RIT-T*, than the net-benefit of complying with clause 3 above; and

(iii) the *Tribunal* has advised the *Licence Holder* in writing that it is satisfied that the plan submitted under clause 5(a)(i) above would, if implemented, be likely to provide a greater net-benefit than would be provided by the *Licence Holder* complying with clause 3 above in relation to the bulk supply point.

(b) The *Licence Holder* must implement the plan within a time specified by the *Tribunal* to the *Licence Holder*, and such implementation must be to the reasonable satisfaction of the *Tribunal*.

(c) For the avoidance of any doubt:

(i) the *Licence Holder* may submit, from time to time, a proposed replacement for a plan referred to in clause 5(a); and

(ii) clause 5(a) applies to such a plan in the same way that it would apply to the first plan submitted under that clause in relation to a bulk supply point.

(d) Where the *Tribunal* has expressed satisfaction in writing under clause 5(a)(iii) about a plan that relates to a bulk supply point or bulk supply points listed in the table in clause 8, the *Licence Holder* may advise the *Tribunal* in writing that it has elected not to implement the plan. If the *Licence Holder* so advises the *Tribunal* of such an election:

(i) the *Licence Holder* is not required to implement the plan in question, despite clause 5(b);

(ii) despite clause 5(a), the *Licence Holder* must comply with clause 3 in respect of the bulk supply point or bulk supply points to which the plan in question relates; and

(iii) the *Licence Holder's* election not to implement the plan may not be reversed, unless the *Tribunal* provides its written consent for the reversal.

6. Flexibility in planning for the level of *expected unserved energy*

(a) The *Licence Holder* is not required to comply with clause 4 above in respect of a bulk supply point listed in the table in clause 8 provided that:

(i) the *Licence Holder* has developed and submitted to the *Tribunal* a plan regarding measures for altering the reliability of the supply capacity of the bulk supply point;

(ii) that plan provides a greater net-benefit, using the cost-benefit methodology defined in the *RIT-T*, than the net-benefit of complying with clause 4 above; and

(iii) the *Tribunal* has advised the *Licence Holder* in writing that it is satisfied that the plan submitted under clause 6(a)(i) above would, if implemented:

(A) be likely to provide a greater net-benefit than would be provided by the *Licence Holder* complying with clause 4 above in relation to the bulk supply point; and

(B) not result in a material reduction in the level of *expected unserved energy* at any bulk supply point.

(b) The *Licence Holder* must implement the plan within a time specified by the *Tribunal* to the *Licence Holder*, and such implementation must be to the reasonable satisfaction of the *Tribunal*.

(c) For the avoidance of any doubt:

(i) the *Licence Holder* may submit, from time to time, a proposed replacement for a plan referred to in clause 6(a); and

(ii) clause 6(a) applies to such a plan in the same way that it would apply to the first plan submitted under that clause in relation to a bulk supply point.

(d) Where the *Tribunal* has expressed satisfaction in writing under clause 6(a)(iii) about a plan that relates to a bulk supply point or bulk supply points listed in the table in clause 8, the *Licence Holder* may advise the *Tribunal* in writing that it has elected not to implement the plan. If the *Licence Holder* so advises the *Tribunal* of such an election:

(i) the *Licence Holder* is not required to implement the plan in question, despite clause 6(b);

(ii) despite clause 6(a), the *Licence Holder* must comply with clause 4 in respect of the bulk supply point or bulk supply points to which the plan in question relates; and

(iii) the *Licence Holder's* election not to implement the plan may not be reversed, unless the *Tribunal* provides its written consent for the reversal.

7. Requirement to provide information to the *Tribunal*

(a) The *Licence Holder* must comply with any request notified to the *Licence Holder* by the *Tribunal* for information that the *Tribunal* reasonably considers to be necessary or convenient for the *Tribunal* in monitoring the *Licence Holder's* compliance with this standard.

(b) The *Licence Holder* must comply with a request under clause 7(a) within a reasonable timeframe notified to the *Licence Holder* by the *Tribunal*.

(c) If reasonably requested to do so by the *Tribunal*, the *Licence Holder* must commission an audit of its compliance with this standard (or specified aspects of this standard). Such an audit must be conducted:

(i) by an auditor approved by the *Tribunal* in writing;

(ii) at the expense of the *Licence Holder*; and

(iii) such that a report on the audit by the auditor is provided to the *Tribunal* within a reasonable timeframe notified to the *Licence Holder* by the *Tribunal*.

(d) At least 90 days before entering into any contract for the construction of a new bulk supply point intended to form part of the *transmission* system (or within a different timeframe proposed by the *Licence Holder* and agreed to in writing by the *Tribunal*), the *Licence Holder* must submit a proposal regarding the new bulk supply point to the *Tribunal*. The proposal must:

(i) propose a *level of redundancy* category that this standard should specify for the new bulk supply point;

(ii) propose a level of *expected unserved energy* that this standard should specify for the new bulk supply point; and

(iii) set out reasons justifying the *level of redundancy* category and level of *expected unserved energy* proposed.

8. Table of values

	Redundancy category	Unserved energy allowance, maximum minutes per year at average demand
1. Inner Sydney		
Beaconsfield West 132 kV	3	0.6[a]
Haymarket 132 kV	3	
Rookwood Road 132 kV	3	
Sydney North 132 kV	3	
Sydney South 132 kV	3	
2.Other bulk supply points		
Albury 132 kV	2	14
ANM 132 kV	2	6
Armidale 66 kV	2	7
Beryl 66 kV	2	5
Boambee South 132 kV	2	18
Canberra 132 kV and Williamsdale 132 kV	2	3
Coffs Harbour 66 kV	2	10
Coleambally 132 kV	2	32
Cooma 66 kV	2	28
Cooma 132 kV	2	11
Cowra 66 kV	2	25
Dapto 132 kV	2	4
Darlington Point 132 kV	2	4
Deniliquin 66 kV	2	19
Finley 66 kV	2	12
Forbes 66 kV	2	19
Gadara (132 kV & 11 kV)	2	13
Glen Innes 66 kV	2	43
Griffith 33 kV	2	12
Gunnedah 66 kV	2	19
Holroyd 132 kV	2	24
Ingleburn 66 kV	2	5
Inverell 66 kV	2	40
Kempsey 33 kV	2	24
Koolkhan 66 kV	2	19
Liddell 330 kV	2	2
Lismore 132 kV	2	4
Liverpool 132 kV	2	5
Macarthur 132 kV and 66 kV	2	3
Macksville 132 kV	2	23

	Redundancy category	Unserved energy allowance, maximum minutes per year at average demand
Manildra 132 kV	2	6
Moree 66 kV	2	5
Mount Piper 66 kV	2	19
Munmorah 132 kV	2	20
Murrumburrah 66 kV	2	19
Muswellbrook 132 kV	2	3
Nambucca 66 kV	2	65
Narrabri 66 kV	2	5
Newcastle 132 kV	2	2
Orange North 132 kV / Orange 132 kV and 66 kV	2	7
Panorama 66 kV	2	5
Parkes 132 kV	2	9
Parkes 66 kV	2	51
Port Macquarie 33 kV	2	14
Queanbeyan 66 kV	2	4
Raleigh 132 kV	2	32
Regentville 132 kV	2	13
Stroud 132 kV	2	21
Sydney East 132 kV	2	2
Sydney West 132 kV	2	1
Tamworth 66 kV	2	4
Taree 66 kV and 33 kV	2	15
Tenterfield 22 kV	2	79
Tomago 132 Note 3	2	13
Tomago 330 kV	2	14
Tuggerah 132 kV	2	13
Tumut 66 kV	2	13
Vales Pt 132 kV	2	3
Vineyard 132 kV	2	1
Wagga 66 kV	2	33
Wagga North 132 kV	2	5
Wallerawang 132 kV	2	26
Wallerawang 66 kV	2	31
Waratah West 132 kV	2	3
Wellington 132 kV	2	6
Yanco 33 kV	2	41
Balranald 22 kV	1	115
Broken Hill 22 kV and Broken Hill 220 kV	1	10
Casino 132 kV	1	7

	Redundancy category	Unserved energy allowance, maximum minutes per year at average demand
Dorrigo 132 kV	1	41
Hawks Nest 132 kV	1	42
Herons Creek	1	17
Ilford 132 kV	1	14
Marulan 132 kV	1	10
Molong 66 kV	1	46
Morven 132 kV	1	33
Mudgee 132 kV	1	14
Munyang 33 kV	1	14
Murrumbateman 132 kV	1	49
Snowy Adit 132 kV	1	52
Wagga North 66 kV	1	42
Wellington Town	1	21
Yass 66 kV	1	22

a Applies across all the Inner Sydney bulk supply points listed.