



ENERGY SECURITY BOARD
National Energy Guarantee
TECHNICAL WORKING PAPER

Forecasting the Reliability Requirement

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Executive Summary

Forecasting methodology and accountability

AEMO will be required to:

- Ensure that forecasts in the Electricity Statement of Opportunities (ESOO) are prepared against AER best practice guidelines and assessed as quality forecasts.
- Make sufficient information available so that ESOO forecasts are reproducible (or close to), by an independent forecaster or reviewer.
- Make available further information to support the published USE forecasts to provide further context to stakeholders.
- Report on forecast performance and publish at least on an annual basis.

Consult with stakeholders

Forecasting will be generally subject to a more formalised consultation process, which is itself developed through the Rules consultation procedures and published as Guidelines, to include:

- Best practice requirements on the forecasting methodology.
- Defining performance metrics, including back-casting as part of the performance monitoring.
- During development of the forecasts leading up to the ESOO publication, and then after the ESOO has been published, to review the forecasting process and results.
- The continuous improvement program.

Defining and calculating a material reliability gap

Regulatory requirements will specify:

- A reliability gap is calculated consistent with the current reliability standard, which is expressed as weighted average estimate of expected USE.
- MW estimates of the reliability gap must be published as supplementary information.
- A gap must be published with more granularity as to scale, timing and duration, accounting for and communicating forecast uncertainty.
- That the assessment of materiality must be against objective measures of materiality with some structured discretion to accommodate changing market conditions.
- That AEMO must publish a guideline, as part of the annual ESOO development consultation process, outlining how it will determine materiality.
- How and when should a 'material' gap be communicated to market participants?
- The treatment of regional interconnection.

The independent entity

The AER as the independent entity will determine whether a request from AEMO to trigger the reliability obligation should be approved.

The AER will be expected to access external advice and enhance its in-house technical capabilities to perform this function effectively. The AEMC Reliability Panel and procurement of external review services may complement AER in-house capability.

1 Introduction

On 20 April 2018, the Energy Security Board (ESB) presented the COAG Energy Council with a high-level design proposal for the National Energy Guarantee (the Guarantee). The COAG Energy Council agreed that the ESB progress the detailed design of the Guarantee for determination by the Council at its August 2018 meeting.

As part of the development process, the ESB convened Technical Working Groups to advise on certain detailed design elements of the Guarantee. The Technical Working Groups were comprised of a broad range of stakeholders with relevant expertise from more than 30 organisations.

This paper provides additional detail and context to the [Draft Detailed Design Consultation Paper](#). Interested parties are encouraged to lodge a submission to the consultation by **13 July 2018** for consideration by the ESB prior to the publication of the final design of the Guarantee.

There are three areas covered in this Forecasting paper:

Forecasting methodology and accountability (section 3)

Accurate forecasts about the balance of demand and supply over time, and the extent of any reliability gap, will be fundamental to the ongoing success of the Guarantee. The forecasting methodology should provide a transparent, well understood and stable framework for retailers and large customers to predict the scale and scope of their potential obligations well in advance, along with the potential cost of non-compliance.

Section 3 outlines the way in which the ESB proposal to use the ESOO as the basis for the forecasts and updates at each stage of the reliability requirement for the Guarantee can be more transparent and accountable. This framework will require that rules about transparency and stakeholder consultation are implemented as part of the package.

Defining and calculating the reliability gap (section 4)

Section 4 of this paper outlines options and preferred approaches for the following issues:

- how a reliability gap is defined
- how the materiality of an identified reliability gap is determined and communicated, and
- how interconnection between regions is accounted for.

Addressing these issues will be fundamental to the operation of the reliability obligation. Liable entities need robust and timely information regarding the nature and duration of the reliability gap to weigh up the costs and benefits of investment in new supply and/or accelerating wholesale contracting activities to manage their liability under the reliability obligation.

Independent review to trigger the reliability obligation (section 5) – the governance arrangements for the independent review of a request from AEMO to trigger the reliability obligation.

The objective of the independent entity's assessment is to provide confidence to stakeholders that the information and processes informing any decision to trigger the reliability obligation is

robust given concerns about relying on forecasts to determine the required level of capacity in the market.

Section 5 of this paper proposes arrangements for the independent review of the decision by AEMO to trigger the reliability obligation, and deals with:

- the role of the independent entity
- that the AER act as the independent entity, and
- AER's process to assess and decide on a request from AEMO to trigger the reliability obligation.

2 Overview of High-Level Design

The Guarantee is intended to contribute to system reliability by incentivising and facilitating adequate investment in dispatchable capacity (including demand response). Partly, this will be achieved through best practice forecasting of the demand-supply balance, with market participants incentivised to close any forecast 'supply gap' deemed inconsistent with the reliability standard.

In addition to being underpinned by robust and reliable forecasts, it is important that the methodology for defining and calculating the reliability gap is fit for purpose and transparent – as it may affect system reliability, system costs and the distribution of those costs.

The ESB has agreed the following design elements relating to forecasting for the reliability requirement of the Guarantee:

Forecasting methodology and accountability

- Using the ESOO, AEMO will forecast whether the reliability standard is likely to be met (or not) in any NEM region over a 10-year outlook period. If the forecast is that the reliability standard will not be met, AEMO will identify the size of any 'gap' in supply/demand response.
- These forecasts will also detail the pipeline of potential generation projects over the forecast period, along with the progress of their development.
- In developing the forecasts, AEMO will be required to publish and consult on its forecasting process through a more formal consultation process (set out in published guidelines).
- An appropriate accountability framework will be introduced to support and improve the development of these forecasts which will include rules pertaining to transparency and stakeholder consultation.
- The intention of the Guarantee is to remain aligned to the Reliability Standard whilst ensuring there are adequate resources available to meet peak (as opposed to average) demand.

Determining and calculating the reliability gap

The identification of a reliability gap will signal to the market the additional generation or demand response required over the period in question.

If AEMO has identified a reliability gap in its ESOO forecast 3 years out from the period in which the gap is forecast, it will need to form a view on whether the gap is sufficiently 'material' to trigger the reliability obligation of the Guarantee. If it is, AEMO will be required to submit a request to an independent entity to trigger the reliability obligation on liable entities.

The basis for this assessment is required to be clearly defined and transparently communicated to support liable entities to predict their potential liability and to close the gap as efficiently as possible. The level of prescription provided in the Rules will ultimately determine the trade-off between predictability and flexibility to accommodate changing market circumstances.

The reliability obligation is intended to incentivise liable entities through contracting and investment in resources to support the reliability of the power system. If a reliability gap is identified through the ESOO forecast then liable entities are placed on notice that until the gap closes they may be required to demonstrate future compliance.

Independent entity triggers the reliability obligation

- If AEMO identifies a 'material' reliability gap three years out (T-3), AEMO will be required to submit a request to an 'independent entity' to trigger the reliability obligation on liable entities.
- If the independent entity confirms AEMO's assessment, liable entities will need to assess their likely share of system peak demand and secure sufficient 'qualifying contracts' to cover this.
- If a material reliability gap persists (or emerges) one year out (T-1), the AER will activate the requirement for retailers to provide details of qualifying contracts. Concurrently, AEMO will commence the function of Procurer of Last Resort.

3 Forecasting methodology and accountability

Section 3 outlines options and preferred approaches to address the detailed design issues considered by the Forecasting Technical Working Group relating to methodology and accountability.

3.1 Overview

Transparency and performance monitoring

AEMO will be required to:

- Ensure that forecasts in the ESOO are assessed as quality forecasts against AER best practice guidelines and consult with stakeholders on the forecast methodology.
- Make sufficient information available so that ESOO forecasts are reproducible (or close to), by an independent forecaster or reviewer.
- Consult with stakeholders on how best to present material on the AEMO website so that information is easily accessible and interpretable, and report back to stakeholders.
- Make available further information to support the published USE forecasts to provide further context to stakeholders.
- Consult with stakeholders on defining performance metrics and consider back-casting as part of the performance monitoring.
- Report on forecast performance and publish at least on an annual basis.

Stakeholder consultation

AEMO will be required to:

- Consult with stakeholders through a more formal consultation process (set out in published guidelines), both during development of the forecasts leading up to the ESOO publication, and then after the ESOO has been published to review the forecasting process and results.

Continuous improvement program – publication and consultation

- AEMO will be required to publish and consult on a proposed improvement program, and then report on it as part of the next ESOO.

3.2 Transparency and performance monitoring

The Guarantee is dependent on the use of well-regarded, robust and reliable forecasts. As a result, an appropriate accountability framework needs to be introduced that provides greater transparency of the assumptions and methodology used in the development of these forecasts.

3.2.1 Robust, high-quality forecasting

A key feature of the Guarantee is to ensure forecasts are fit-for-purpose and of a high quality. This starts with the forecasting methodology (data, analytic and modelling process), which needs

to be transparent, refined using input from market participants and other stakeholders, and meets basic, best practice forecasting criteria.

The AER's best practice demand forecasting criteria will be further developed to inform the development and maintenance of the ESOO methodology:

1. Accuracy and a non-biased approach – forecast accuracy and level of bias needs to be measured objectively and then information used to produce representative forecasts. This includes good quality data management and model selection.
2. Transparency and repeatability – forecasts should be easily understood and well documented and there should be access to clear documentation of assumptions and methodology including the use of judgement. If the forecasting process is repeated by another forecaster a similar result should be obtained.
3. Incorporation of key drivers – documented justification of key drivers used in the modelling process.
4. Use of consistent and most recent input information – compare input assumptions with publicly available sources.
5. Model validation and testing – models used as part of the forecasting process need to be validated and tested using relevant diagnostic and model accuracy tests.
6. A regular review – the forecasting process needs to be reviewed regularly to ensure input data, assumptions, and methodology are the most up-to-date and follow robust forecasting principles.

AEMO will be required to assess ESOO forecasts against AER best practice guidelines and consult with stakeholders on the forecast methodology.

3.2.2 Access to supporting material

The forecasts used to support the Guarantee are required to be repeatable (or close to) by an independent forecaster or reviewer. To achieve this a base level of data and information related to input assumptions and methodology needs to be publicly available on the AEMO website.¹

A wide spectrum of data and information is used to develop the ESOO forecasts. This includes information provided to AEMO on a confidential basis. Publicly available information on the AEMO website will be restricted to information of a non-confidential nature or published in an aggregate form.

The models and/or description used to underpin the ESOO forecasting process is also available. This includes the market model that underpins the ESOO supply forecasts, although this requires access to a PLEXOS licence to run the model and reproduce the results.

¹ Material is available at the link: <http://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting>

The Rules currently deal with the publication of forecast information as follows:

- Access to information supporting the ESOO: clause 3.13.3(q) provides that AEMO must publish an annual Statement of Opportunities covering generating capabilities, network capabilities and constraints, and operational and economic information.
- Access to demand forecast information: this is a key input into ESOO modelling. Section 49(2)(b) of the NEL provides that AEMO must make sufficient information publicly available as part of its national transmission planner function.

AEMO will also consult with stakeholders on how to best present material on AEMO's website so that information is more easily accessible and interpretable. AEMO will also be required to report back via publication of key recommendations and changes to the website and through the monthly Forecasting Reference Group in its expanded model as discussed in more detail at section 3.3 below.

3.2.3 Publication of additional supporting material

The Guarantee is based on using unserved energy (USE) forecasts reported in the ESOO to assess reliability in each region for the next ten years. Additional descriptive information is required to be made available to provide further context to support these USE forecasts. As outlined in section 4 below, suggestions include:

- likely time of occurrence of the shortfall, such as season and time of day
- duration of the expected shortfall, and
- indicative examples of conditions under which USE is occurring.

The ESOO is based on probabilistic modelling, which produces a range of stochastic outcomes, meaning it is only possible to provide *indicative* information related to these model simulated outcomes.

AEMO will be required to make available further information to support the published USE forecasts, as part of its ESOO publication. This provides context to liable entities to be able to make informed decisions as part of the Guarantee.

3.2.4 Monitoring and publication of regular forecast performance

To provide further confidence in the forecasts used in the Guarantee, forecast performance will be monitored and published at least on an annual basis by AEMO.

AEMO will be required to consult with industry on a set of performance metrics and information. Performance metrics need to consider a back-cast comparison of actuals against forecasts, of key input assumptions and outputs, in addition to commentary explaining the variability around this comparison.

The aim of the back-casting is to test the reasonableness of key input assumptions and key model outputs. The issue of reporting forecast accuracy when dealing with probabilistic (POE) forecasts is more complex and requires further work when monitoring the performance of peak demand forecasts. AEMO will be required to engage with industry on the development of these metrics.

The performance monitoring system will also be used to help inform and provide justification for a continuous improvement program that AEMO will be required to implement. This is discussed further in section 6.

The Rules had not required AEMO to publish information on forecast performance. However, the AEMC recently made a rule change that requires AEMO's report on accuracy of its demand forecasts to be published on AEMO's websites, removing the requirement for the Reliability Panel to publish them. The rule is effective 1 July 2018. See:

https://www.aemc.gov.au/sites/default/files/2018-06/Information%20sheet_0.pdf.

Preferred approach

AEMO will be required to:

- Ensure that ESOO forecasts are regarded as quality forecasts against a set of defined criteria and consult with industry on the forecast methodology.
- Make sufficient information available so that ESOO forecasts are reproducible (or close to) by an independent forecaster or reviewer.
- Consult with stakeholders on how best to present material on the AEMO website so that information is easily accessible and interpretable and report back to stakeholders.
- Make available further information to support the published USE forecasts to provide further context to stakeholders.
- Consult with stakeholders on defining performance metrics and consider back-casting as part of the performance monitoring.
- Report on forecast performance and publish at least on an annual basis.

3.3 Stakeholder consultation

The Guarantee is dependent on the use of well-regarded, robust and reliable forecasts. As a result, an appropriate accountability framework needs to be introduced that ensures consultation on the assumptions and methodology used in the development of these forecasts.

AEMO will be required to engage with stakeholders throughout the forecasting process. During the development of the forecasts, there will be discussion on the input assumptions, methodology and judgements made. Stakeholders will require access to adequate detail (except confidential information) to be able to assess appropriateness of assumptions and methodology.

To achieve this, AEMO will be required to develop a more formal consultation process with published Guidelines. The Guidelines themselves should be developed using the Rules consultation procedures. This will allow stakeholders to provide input into the forecasting process, with AEMO required to address publicly how the input has been included/or not in the forecasting process.

In addition, it will be a requirement that after publication of the ESOO (by 31 August every year) AEMO will be required to engage with stakeholders to discuss and review the forecasting

process. Additionally, there should be opportunity to provide suggestions for improvements into the process, as outlined in section 3.4 below.

It is proposed that this engagement will occur through an enhanced and expanded model of the Forecasting Reference Group (FRG) which meets monthly. This is currently the forum where AEMO discusses its forecasting program of work and covers methodology and input assumptions and a presentation of draft forecasts. This regular engagement is intended to offer industry, government and consumer groups the opportunity to work collaboratively to improve current forecasting processes. The role of the FRG will be formalised and participation opened to a broader group of interested stakeholders. The independent entity would attend FRG meetings, to be updated with AEMO's analysis and test assumptions and methodology before the forecasts are publicly released.

Preferred approach

AEMO will be required to:

- Consult with stakeholders through a more formal consultation process (with published guidelines and an expanded Forecasting Reference Group) during development of the forecasts leading up to the ESOO publication and then after the ESOO has been published to review the forecasting process and results.

3.4 Continuous improvement program – publication and consultation

To increase transparency of the forecasting process, AEMO will be required to publish and consult on an annual improvement program to ensure that assumptions and modelling approaches are tested and transparent. The improvement program will be informed by the performance monitoring discussed in section 3.2.4 above. Updates would need to be completed before the publication of the next ESOO.

The improvement program will be made available to interested stakeholders and would consist of a list of proposed improvements, estimated impact to forecast performance, with deliverable dates. A summary will be published as part of the next ESOO. The program will capture improvements covering data and information, input assumptions and changes to methodology and processes.

Key focus areas may include battery charging/discharging profiles, incorporation of demand response, and improvements in survey collection mechanisms to reduce burden on participants.

Preferred approach

- AEMO will be required to publish and consult on an annual improvement program and then report on it as part of the next ESOO.

4 Defining and calculating the reliability gap

Section 4 outlines options and preferred approaches for defining a reliability gap, including:

- how the materiality of an identified reliability gap is determined and communicated, and
- how interconnection between regions is accounted for.

Addressing these issues will be fundamental to the operation of the reliability obligation. Liable entities need robust and timely information regarding the nature and duration of the reliability gap to weigh up the costs and benefits of investment in new supply and/or accelerating wholesale contracting activities to manage their liability under the reliability obligation.

4.1 Overview

Defining the reliability gap

- How the reliability gap is expressed:
 - The reliability gap will be calculated in a way that is consistent with the current reliability standard, which is expressed as weighted average estimate of expected unserved energy (USE).
 - Estimates of the reliability gap in MW would be published as supplementary information, with the translation subject to the same consultation and scrutiny as AEMO's other Electricity Statement of Opportunities (ESOO) forecasts.
- How a reliability gap is temporally defined:
 - The scale and duration of a forecast reliability gap would be determined and communicated on both an annual and seasonal basis.
- Other contextual information to be published:
 - AEMO publish ancillary information including on the key drivers of forecast supply/demand; the likelihood of (any) shortfall per region; how these risks were expected to change over time; and the likely magnitude and duration of shortfall events.
- Accounting for and communicating forecast uncertainty:
 - Supplementary information to expected USE would be published, with a focus on sensitivity analysis that supports an understanding of the probability and impacts of changes in assumptions.

Determining that a reliability gap is 'material'

- Should the assessment be based on prescriptive criteria, or assessed against guiding principles? Or a mixture of both?

- Rules would be drafted to establish a set of clear criteria to be factored in by AEMO, and by the independent entity responsible for approving its recommendations, in determining whether a reliability gap is 'material'.
- Principles would capture the costs and benefits of triggering obligations, taking into account the commercial incentives for the market to close any forecast reliability gap.
- Criteria would include the scale, duration and sensitivity to change of the forecast reliability gap.

How and when a 'material' gap is communicated to market participants

- A materiality framework should incorporate a requirement for AEMO to undertake a 6-monthly ESOO update following a decision to trigger the obligation, with little advance 'notice', at year T-3; that is, where there is a significant change in ESOO outcomes from year to year.

The treatment of regional interconnection

- Assessment of the materiality of an identified reliability gap will reflect inter-regional transfer capability between regions.

4.2 Defining the reliability gap

4.2.1 How should the gap be tangibly expressed?

The intended outcome of the reliability obligation is to incentivise retailers and large customers to support, through their contracting, investment in resources to maintain reliability of the NEM.

The reliability standard currently specifies that the level of expected unserved energy (USE) should not exceed 0.002 per cent of consumption per region in any financial year. It represents an acceptable trade-off between reliability and cost i.e. where the cost of additional capacity is equivalent to the avoided cost of load shedding. The standard is operationalised in the NEM reliability settings – market price cap and floor, cumulative price threshold and administered price cap – to drive economically efficient market investment outcomes consistent with this trade off.

The ESOO publishes expected USE forecasts to assess reliability in each region over a ten-year outlook. As expected USE is consistent with the framing of the reliability standard, it is proposed that this expected USE by region and year continue to form the backbone of reliability assessment under the Guarantee.

The identification of a reliability gap expressed as USE will signal to the market the additional MWh of generation output or demand response required over the period in question. But it may not fully support the information needs of the market and the independent entity responsible for approving any recommendation from AEMO to trigger the reliability requirement under the Guarantee:

- A minimum level of megawatts (MW) capacity is required to address point in time peaks in demand (or system stress events driven by supply variability events i.e. a system may

generate adequate amounts to meet net demand in a year but inadequate capacity to meet peak demand.

- Should the reliability obligation be triggered at year T-3 and the gap persists at year T-1, liable entities will need to be contracted (see the *Technical Working Paper on Qualifying Contracts*) for the MW capacity required to meet their share of the one in two-year demand forecast. Those contracts must be in place at year T-1, and cover the time period the gap is expected to occur. Penalties for not meeting this contractual requirement will be linked to the MW that AEMO procures through the Procurer of Last Resort (see the *Technical Working Paper on Compliance and Penalties for the Reliability Requirement*). Liable entities will thus want as early an indication of the scale and nature of their potential liability to minimise costs of compliance.

The Guarantee is intended to incentivise market participants to enter into long-term contracts to address any forecast reliability shortfall ahead of a reliability obligation being triggered and the Procurer of Last Resort safety net mechanism being called upon. The ESB considers that translating the gap between the reliability standard and expected USE into the MW of capacity reserves needed to reduce USE to an acceptable level, would aid market participants in assessing the magnitude of new generation or demand response required to avoid the Procurer of Last Resort safety net being exercised. It is also the basis for compliance.

As in all its forecasts, the translation of one to the other will be an exercise in expertise and informed judgment. To ensure transparency and accountability, AEMO's methodology for estimating a MW gap would be subject to the same consultation and scrutiny as other aspects of its ESOO forecasts (see section 3).

Other contextual information that would be useful to market participants including on the characteristics and distribution of expected USE is discussed below.

Preferred approach

- The reliability gap will be calculated consistent with the current reliability standard, which is expressed as weighted average estimate of expected USE.
- MW estimates of the reliability gap will be published as supplementary information, with the translation subject to the same consultation and scrutiny as AEMO's other ESOO forecasts.

4.2.2 How should a reliability gap be temporally defined?

Annual USE would not be expected to be distributed evenly across a year. Key factors that might alter the seasonal USE pattern include the effects of weather on supply and demand, and anticipated closures or new build.

Currently AEMO publishes expected USE in the ESOO on an annual basis. Continuing this practice would provide a (relatively) simple and well-understood metric. But more granular temporal definition would also have some advantages. For example, more granular definition may:

- Allow the reliability obligation to be triggered in relation to a shorter period of time (say just for summer rather than for a year), providing the basis for a ‘lighter touch’ contractual obligation at year T-1.
- Better enable market participants to target the most efficient sources of supply or demand response to the timing of expected gap.

ESOO modelling provides an hourly break down of USE, supporting detailed reporting where required, noting that the amount of data prepared is very large. This level of granularity is not relevant to long term investment decisions i.e. most USE is seasonal – over summer heat wave conditions – with the precise timing of tight supply and demand highly sensitive to changes in real time to weather conditions among other factors. But it would assist liable entities to better predict their potential contracting obligation at year T-1, leading to more efficient investment outcomes.

The ESB’s preferred approach is that the Guarantee be supported by more granular expected USE.

As outlined in section 3 of this paper, the Guarantee would require AEMO, in developing each ES00, to publish its inputs, assumptions and underlying methodology in a manner that supports its forecasts being reproduced by third parties. AEMO would consult with stakeholders on how best to present this information to ensure it is accessible and interpretable. Information published would include the following:

- likely time of occurrence of the shortfall, such as season and time of day
- duration of the expected shortfall, and
- indicative examples of conditions under which USE is occurring.

The expected USE would be translated into a MW reserve figure that accounts for the duration of the USE, and in particular, if it is time-limited to (for example) a single summer, or projected to persist over multiple years.

Preferred approach

- As part of its ES00 forecast, AEMO will publish the scale, timing and duration of any forecast reliability gap.

4.3 Determining that a reliability gap is ‘material’

4.3.1 The assessment will be based on objective criteria with some structured discretion

Once AEMO has identified a reliability gap in its ES00 forecast, it will need to form a view on whether the gap is sufficiently ‘material’ to trigger the reliability obligation of the Guarantee.

The basis for the assessment of materiality must be clearly defined and transparently communicated to support liable entities to predict their potential liability and to close the gap as efficiently as possible. Determining whether a reliability gap is ‘material’ requires a balance between certainty and predictability together with flexibility to accommodate changing market

conditions. This can be achieved by the use of objective criteria such as a percentage of maximum demand in a region persisting for a given period of time.

For example, 'hard-wiring' into the Rules the period over which expected USE is allowed to persist above the reliability standard before triggering the reliability obligation would provide a clear and predictable basis for liable entities to determine well in advance (taking into account their own and AEMO's forecasts) whether the reliability obligation is likely to be triggered. Similarly, mandating and transparently communicating how uncertainty in input assumptions are factored into the materiality assessment would assist liable entities to manage the risks of forecasting error, within their individual risk tolerance limits.

But hard-wiring in these factors would 'lock out' consideration of technology and other market developments impacting on the ability and incentives for the market to close the gap without regulatory intervention. This could result in inefficient investment and/or contracting costs being passed on to consumers.

The ESB's preference is to implement a transparent framework to allow AEMO (and the independent entity) to determine the materiality of a reliability gap with a strong emphasis on certainty and predictability, but allowing for some flexibility to accommodate changing market conditions. The Rules framework will specify:

- The timing of the materiality assessment.
- The objective measures of materiality which apply to the materiality assessment.
- A requirement that AEMO must publish a guideline, as part of the annual ES00 development consultation process, outlining how it will determine materiality.
- How a material gap, and decision to trigger the reliability obligation, is communicated to market participants.

Preferred approach

The Rules framework for determining whether a reliability gap is material will specify:

- The timing of the materiality assessment.
- The objective measures of materiality which apply to the materiality assessment.
- A requirement that AEMO must publish a guideline, as part of the annual ES00 development consultation process, outlining how it will determine materiality.
- How a material gap, and decision to trigger the reliability obligation, is communicated to market participants.

4.3.2 What principles and criteria are relevant to an assessment of materiality?

Key qualitative considerations in determining what is sufficiently 'material' to trigger the reliability obligation may include, by way of example:

- The commercial incentives - taking into account forecasting, technology and economic uncertainties - for market participants to 'close' the gap in the absence of a regulatory obligation.
- The risks posed to reliability should the forecast gap increase over time but insufficient 'build time' be available to bring the required additional capacity into the market at an efficient cost.
- Whether the gap is time-limited or persistent and relatively insensitive to forecast error.

For example, lead times for bringing new dispatchable capacity into the market vary by technology but range from around 12 months (or less) for batteries and demand response to up to 36 months for gas turbines. The Guarantee should encourage efficient investment in the technologies needed by the system but avoid incentivising capital outlays which run a high risk of being stranded due to forecasting error.

Reflecting these considerations, criteria would need to include, but not necessarily be limited to:

- the scale of the forecast gap
- the duration of the forecast gap, and
- the level of uncertainty around forecast outcomes.

The following provides practical example of how the 'materiality' assessment might operate:

- AEMO's ESOO neutral demand forecast identifies expected USE in Victoria in 2022 of 0.0021. The USE expectation is estimated from multiple simulations which saw USE on 10 days over the summer period. The expected USE is reduced to 0.0015 in the subsequent 2 years of forecasts and does not persist in the outlook beyond this.
- AEMO translates the forecast USE expectation into an estimation of the MW of additional capacity needed to bring USE below 0.002. It publishes this estimate, along with a suite of supplementary information including: the range of outcomes or 'uncertainty band' around the USE and MW estimates; the expected USE and MW requirement outcomes from different forecasting scenarios (e.g. low and high demand); qualitative information discussing the sensitivity of expected USE and MW outcomes to practical changes in the market (e.g. loss/unavailability of a major power station, acceleration of projects in its supply pipeline etc.); the estimated cost of addressing the gap through the RERT and direction powers.
- AEMO concludes, having regard to the principles and criteria specified in the Rules, that the gap is sufficiently material to warrant triggering the reliability obligation. It makes a recommendation to the independent body to this effect.
- The independent body considers AEMO's recommendation, reviews the rationale and underlying assumptions informing AEMO's assessment, having regard to the principles and criteria set out in the NER, and makes a decision.

Preferred approach

- The Rules establish the criteria to be taken into account by AEMO, (along with the independent entity in approving its recommendations), in determining whether a reliability gap is 'material'.
- Principles would capture the costs and benefits of triggering obligations, taking into account the commercial incentives for the market to close any forecast reliability gap.
- Criteria would include the scale, duration and sensitivity to change of the forecast reliability gap.

4.3.3 How and when a 'material' gap is communicated to market participants

Currently, AEMO publishes regional reliability forecasts over a 10-year outlook in the ESOO and Medium Term Projected Assessment of System Adequacy (MT PASA) on a weekly basis to a daily resolution, covering a 2-year period. MT PASA provides a weekly assessment of system reliability, including provision of information on demand, supply and network conditions for the purpose of helping participants plan outages as well as providing information to AEMO as to when to intervene (e.g. procure the RERT). Consequently, the MT PASA tends to change as participants put placeholders for outages in the outlook and then firm these up nearer the time, taking account of their own plans and the overall position.

Under the Guarantee the reliability obligation would be triggered by an ESOO forecast but liable entities may want to monitor changes to the outlook in between ESOO forecasts. For example, expected USE in a given year can change significantly as a result of new entry or exits of generation and/or revised load forecasts, such that there is little 'warning' that the reliability obligation is set to trigger. Liable entities will want to be able to predict, with some confidence, whether the obligation will be triggered, along with the 'firmness' of the forecast gap that feeds into that trigger (and thus sets an expectation regarding the scale of resources which AEMO may procure through the Procurer of Last Resort Function (see the *Technical Working Paper on Procurer of Last Resort*) in the absence of a market response).

Improved and more transparent forecasting processes (see section 3) – including greater certainty around the timing of major power station closures and visibility regarding the pipeline of new capacity – should help reduce variability in annual ESOO outcomes.

Building on these improvements, and to build market confidence in the 'firmness' of any material gap identified, the ESB considers that the materiality framework should incorporate a requirement for AEMO to undertake a 6 monthly ESOO update following a decision to trigger the obligation, with little advance 'notice', at year T-3; that is, where there is a significant change in ESOO outcomes from year to year.

Preferred approach

- Materiality framework should incorporate a requirement for AEMO to undertake a 6 monthly ESOO update following a decision to trigger the obligation, with little advance

'notice', at year T-3; that is, where there is a significant change in ESOO outcomes from year to year.

4.4 What is the appropriate treatment of regional interconnection?

Here the key question is whether the materiality assessment should factor in inter-regional transfer capability.

When a shortfall occurs in a given region, it can either be managed as an independent system or through interregional transfers across interconnectors. Presently, the ESOO forecast modelling process accounts for flows across regional interconnectors and allocates capacity into regions to cover a shortfall. Some examples include:

- If a region has spare capacity and a neighbouring region has an identified shortfall, the modelling process will use all available capacity on the interconnector.
- If two regions both experience a shortfall at the same time, the modelling simulations will assume a flow level across the interconnector that minimises transmission losses, while taking into account constraints which may force flows in a particular direction. This could result in USE in one region or both regions.

Similarly, when assessing the materiality of an identified reliability gap, a region can either be considered independently or according to its ability to share resources with adjacent regions.

There are two options which could be adopted in this assessment:

1. Confine the assessment of the USE/capacity requirement to a single region, or
2. Base the assessment of the USE/capacity requirement on sourcing electricity from adjacent regions across the interconnectors, noting the potential constraints on interconnector flows.

The first approach would reduce the ability to leverage the sharing of resources across regions and would risk a potential overestimate of the capacity required to avoid a breach of the reliability standard. But it would also avoid the potential for a USE issue to be transferred from one region to another (depending on the capacity buffer available in the region within acceptable USE limits) and imposing a regulatory obligation on retailers which have not 'caused' the problem.

The ESB's preference is to implement the second approach. This more accurately reflects the ESOO modelling simulation process, the reserve sharing capability between regions which occurs in practice, and the fact that all customers in the NEM benefit (for example, through increased competition and lower price outcomes) from interconnection.

Preferred approach

- Assessment of the materiality of an identified reliability gap will reflect inter-regional transfer capability between regions.

5 Independent review to trigger the reliability obligation

Section 5 outlines the governance arrangements for the independent review of the ESOO forecasts that influences the Guarantee. It discusses the functions of an independent entity role, and the process used to assess and decide when to trigger the reliability obligation.

5.1 Overview

The role of the independent entity is to determine whether a request from AEMO to trigger the reliability obligation should be approved, based on all information available. The aim is to provide an independent check on triggering a reliability obligation linked to a forecasting process. This:

- ensures that the decision to trigger the reliability obligation is justified, based on the information available
- enhances accountability for AEMO in its forecasting functions and in calculating a reliability gap, and
- supports good governance that delivers reliability and affordability outcomes.

The ESB is also proposing to extend the consultation and quality control arrangements for the development of the ESOO and in turn, support AEMO's assessment about any reliability gap. In addition to the independent review of the trigger, these checks and balances on the forecasting processes will help build confidence in the reliability obligation.

An independent review of AEMO's recommendation to trigger the reliability obligation must be:

- undertaken by an entity with the technical capability and expertise to assess the forecasting modelling and reliability gap assessment
- carried out in an independent, transparent and timely way, and
- exercised within clearly defined statutory powers and according to principles of good governance.

The AER is the preferred body to perform the independent entity functions. The functions are consistent with its existing energy market regulation role. The AER has resourcing and governance advantages over other options, including the AEMC Reliability Panel, but will need to develop technical expertise.

The AER will be expected to access external advice and enhance its in-house technical capabilities to perform this function effectively. The AEMC Reliability Panel and procurement of external review services may complement AER in-house capability.

Statutory powers for the AER to perform this function will be established in the NEL.

5.2 The role of the independent entity

The role of the independent entity is to provide a check on a request by AEMO to trigger the reliability obligation. If approval is given, the reliability obligation is triggered. The aim of having an independent check for this decision is to:

- ensure that the decision to trigger the reliability obligation is justified, based on the information available
- enhance AEMO's accountability in its forecasting functions and in calculating a reliability gap
- give stakeholders confidence in a regulatory obligation linked to a forecasting process, and
- support good governance and deliver reliable and affordable energy.

The framework to deliver these objectives needs to reflect design requirements for the independent entity that were discussed with the Technical Working Group.

- Technical capability – building on the transparency and accountability changes to forecasting methodologies and processes of AEMO, the independent entity must have the technical capability to check AEMO's assessment as to whether there is a material reliability gap:
 - technical matters – definitions, assumptions, forecast modelling and gap assessment, and
 - the processes followed to ensure transparent and accountable decision making.
- Flexibility – the choice of the independent entity should accommodate expected ongoing periods with little or no signs of material reliability gaps that require only a minimal role, as well as periods of potential demand for complex analysis and timely decision making.
- Independence – the independent entity must be impartial and not affected by the outcome of the decision. The independent entity can neither benefit from the decision nor be potentially be disadvantaged by the outcome.
- Authority – the independent entity must have clear and express powers to trigger the reliability obligation.

To ensure a robust decision-making mechanism, the framework design will also need to achieve a balance between allowing the transparency needed to give confidence to the market, and maintaining a simple and efficient process that avoids duplicating AEMO's processes and not adding value.

There are various models for this independent review function, including: conducting ongoing parallel monitoring; full merit assessment of AEMO's decision making; or reviewing AEMO information based on enhanced transparency of the ESOO processes.

Preferred approach

Noting the objectives of the role of the independent entity and the need for a timely and effective decision-making process by the independent entity, the preferred approach is for the independent entity to:

- Confirm or refuse to confirm that AEMO's request to trigger the reliability obligation three years out (T-3), including that the identification of a material reliability gap is reasonable and adequate based on the available information.
- Participate in consultative stages of the development of forecasting methodologies and processes of AEMO.
- If a material reliability gap persists one year out, the AER will activate the requirement for liable entities to provide details of qualifying contracts. Concurrently, AEMO will commence procurement of resources to address the remaining gap.

Any ongoing oversight by the independent entity would be based on a 'light touch' approach, with the independent entity having the flexibility to ramp-up the assessment and review of AEMO analysis if a potential material reliability gap emerges.

5.3 The independent entity

The Technical Working Group discussed the merits of different bodies fulfilling the role of the independent entity, including two options that were considered but ruled-out:

- The ESB, given its limited term role and non-statutory nature.
- A new body, given the significant establishment and ongoing costs.

The Technical Working Group also considered the structures and capabilities in existing bodies such as the AEMC Reliability Panel (Reliability Panel) and the AER.

5.3.1 The Reliability Panel

Technical Working Group members acknowledged that the Reliability Panel has access to relevant technical capabilities. The Panel brings both expertise and wide industry perspective in carrying out its current roles under the Rules.

However, a key aspect in deciding the appropriate entity for the role is the need to ensure independence from both AEMO as the entity requesting that the reliability obligation be triggered, as well as liable entities and other market participants who may be affected by the decision. It was noted the Reliability Panel is constituted to include members who would be liable entities under a reliability obligation as well as AEMO.

5.3.2 The AER

Technical Working Group members acknowledged the alignment of the independent entity function with the existing energy market regulation remit of the AER. While the AER has significant energy market regulation capabilities, it would need to develop in-house technical capabilities and potentially procure external services to perform the forecasting and reliability gap analysis review. It does however have the resourcing to get this support and manage the process. The AER would also need to manage its roles as both the independent entity assessing a decision to trigger the reliability obligation and its potential role as the entity responsible for compliance and penalties.

The potential for AER to seek expert advice from the Reliability Panel on particular matters was also acknowledged by the Technical Working Group, including in relation to calculating a material reliability gap, interpreting measures against a Reliability Standard, or conducting reliability gap analysis.

Noting that both the Reliability Panel and the AER have considerable capabilities that could be utilised in performing the independent entity function, the recommendation is that AER is the preferred body because of the governance and resourcing advantages.

Preferred approach

- The AER will be assigned the role as the independent entity tasked with determining whether to accept a recommendation from AEMO to trigger the reliability obligation.
- The AER will develop and secure the technical capabilities to fulfil this function.
- Express statutory powers will be given to enable the AER to perform this function.

5.4 AER's process to trigger the reliability obligation

For the AER to make a timely and effective determination of AEMO's request to trigger the reliability obligation, the AER would utilise its existing monitoring and compliance functions as the energy regulator to continuously engage with AEMO as it is carrying out the forecasting process, and be alert to stakeholder views and compliance issues.

To implement the preferred 'light touch' approach, the AER may develop appropriate procedural check points with AEMO. This may include annual checks on AEMO's adherence to Consultation Procedures, regular forecast performance monitoring and reporting on definitions and measures used, assumptions, modelling and analytical approaches to estimating reliability gaps.

The AER's own assessment process, as the independent entity, should also be formalised and published via a guideline to give stakeholders confidence in the reliability obligation and any decision to trigger. The guideline would outline issues the AER will consider in its review, including:

- Adherence by AEMO to any applicable consultation requirements in developing its recommendation.

- The appropriateness of forecasting methods and assumptions in estimating a reliability gap, and the criteria used by AEMO in its assessment of whether an estimated reliability gap against the reliability standard is material.
- Indicative timing for the AER to publicly report its decision.

The AER's determination will need to be timely to provide sufficient certainty for the industry. It is therefore important that the AER's decision is not unduly delayed.

A review of the arrangements for the AER as the independent entity and its performance (together with the integral work of the AEMO in developing a reliability requirement or Procurer of Last Resort trigger recommendation) could be built-into the framework.

Preferred approach

- The AER as the independent entity should follow a transparent and efficient process, set out in a guideline, to give stakeholders confidence that the decision to trigger the reliability obligation is justified.

A Abbreviations and defined terms

AEMC or Commission	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
COAG	Council of Australian Governments
ESB	Energy Security Board
ESOO	Electricity Statement of Opportunities
FRG	Forecasting Reference Group
Guarantee	National Energy Guarantee
MT PASA	Medium Term Projected Assessment of System Adequacy
MW	Megawatt
MWh	Megawatt-hour
NEL	National Electricity Law
NEM	National Electricity Market
POE	Probability of exceedance
RERT	Reliability and Emergency Reserve Trader
Rules	National Electricity Rules
USE	Unserviced energy

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