16 August 2013

Level 9
99 Gawler Place
Adelaide SA 5000
Postal Address:
GPO Box 2010
Adelaide SA 5001
T 1300 858 724
F 08 8410 8545

Mr John Pierce
Chairman
Australian Energy Market Commission
PO Box A2449
Sydney South NSW 1235

By online submission

Dear John

RE: Consultation Paper on Review of the National Framework for transmission and distribution reliability

AEMO welcomes the opportunity to provide feedback to the AEMC's Consultation Paper on the National Framework for transmission and distribution reliability.

AEMO continues to support the policy that all network investment should deliver a level of reliability that most effectively balances the costs of investment with the benefits of reliable supply to customers. Changes to the planning framework which promote efficient outcomes for customers are critical in the current context and essential to meet the National Electricity Objective (NEO).

AEMO believes the Commission have not made a clear case about the advantages that deterministically expressed reliability standards for the transmission framework will achieve. Given the current economic outlook of lower demand growth and uncertainty, it is important that reliability standards encourage the most efficient form of investments at the optimal time and do not provide businesses with an allowance for network investments which may not be required. Deterministically expressed standards still signal to network businesses that they should build assets to meet a specific reliability level at a particular time rather than focusing on the efficiency of services to meet reliability levels desired by customers.

AEMO would also like to provide feedback to the supplementary submission made by Grid Australia on the AEMC's Issues Paper on the Commission's review of the national framework for transmission reliability. AEMO believes that Grid Australia have misinterpreted some of the information included in the report prepared by Nuttall Consulting for AEMO which we would like to clarify, see Attachment 1. AEMO would also like to raise some critical points in relation to Grid Australia's supplementary submission which are outlined below in Section 2.

If you have any questions regarding any aspects of this submission please do not hesitate to contact Reena Kwong (03) 9609 8492.

Yours sincerely

Murray Chapman
Acting Executive General Manager
Corporate Development

1. AEMO's Response to the Consultation Paper on the review of the national framework for transmission and distribution reliability

1.1. Expression of transmission reliability standards

The consultation paper proposes an N-X expression of transmission reliability standards on grounds that it is difficult to develop outputs based standards in transmission due to the limited number of supply interruptions on transmission networks.[1]

AEMO notes that the SCER's terms of reference require the AEMC to build on the findings of previous reviews. Accordingly, the consultation paper reprises the final position of the AEMC's previous review of transmission reliability standards, which was completed in 2010. In 2010 the AEMC recommended a model known as the economic-redundancy approach, where an economic assessment is used to set input-based redundancy standards (such as N-X standards). Since then, however, there have been a number of fundamental changes in market conditions which mean that the AEMC's previous decision is out of date.

Among these is AEMO's Economic Assessment which clearly highlights how the current standards lead to economically inefficient outcomes. That outcomes, methods and assumptions are clear and transparent and demonstrate what can be applied across the NEM.

Further, the declining forecasts in energy and peak demand suggest that any previous positions need to be reconsidered in the light of changing market conditions.

1.1.1. Limitations of N-X standards

AEMO has serious concerns about the application of N-X standards in the current market environment. This type of standard:

- Is ill suited to an environment of uncertain demand,
- Creates a presumption in favour of network solutions, and
- Does not provide customers with any information on the level of reliability they receive.

N-X standards are ill suited to today's environment of uncertain demand. There may be a case for building assets in excess of current requirements when it is likely that assets will be required in the future. However, if the additional demand does not eventuate then the additional assets associated with a redundancy standard will become stranded, with the effect that customers are obliged to pay for assets that are never used.

Lower demand growth will not only delay the need for investment, it may also change the efficient form of investment. It is therefore particularly important that reliability standards are expressed in a manner that allows for technology-neutral investment solutions to be considered.

As N-X standards are expressed in terms of a level of redundancy of network infrastructure, it creates a presumption in favour of network solutions over non-network alternatives. It will be more straightforward for a TNSP to demonstrate that a network investment meets an N-X standard than to demonstrate that a non-network solution meets an N-X standard. Given

[1] AEMC, Review of the national frameworks for transmission and distribution reliability, Consultation paper, 12 July 2013, pg 2.

recent work to promote demand side participation, the proposal for N-X standards seems regressive.

Mandating the use of deterministically expressed reliability standards in a dynamic environment of increasing customer participation inevitably increases the risk of stranding assets or over-investment. Reliability standards must therefore allow for the increasing trend of customer decision-making relating to their electricity supply, which ranges from building design and installation of energy efficient appliances through to energy consumption behaviours based on electricity price[2].

Some jurisdictions have sought to reduce the bias towards network options by adopting more flexible N-X standards. For instance, the South Australian standards specify different deadlines for how long the network may depart from an N or N-1 standard, depending on the criticality of the connection point.[3] This approach gives the transmission network flexibility to consider non-network options for meeting their reliability standards, such as entering into network support arrangements with demand management providers.

This approach is clearly preferable to an inflexible N-X standard insofar as it reduces bias against non-network options. However, it also undermines the key purported benefit of deterministic standards, namely, their clarity and simplicity. Given that it is necessary to make N-X standards complex in order to reduce their bias, the case in favour of keeping them is dubious.

Further, while they may be easy for an engineer to understand, N-X standards are not clear or simple from a customer's perspective. Customers care about the level of reliability that they receive, not what assets are built. If reliability standards are expressed in terms of network engineering concepts, it will be more difficult for customers to make a meaningful contribution to the debate on the appropriate level of reliability standards.

1.1.2. Alternatives to N-X standards

There are other ways to express transmission reliability standards which avoid these problems. There is scope to develop outputs based measures of transmission reliability which could ultimately be used to reward transmission networks for providing services to customers rather than for building assets.

While outputs measures that are appropriate for transmission are different to the output measures that are appropriate for distribution, this does not make it necessary to revert to a redundancy standard. AEMO's submission to the transmission reliability issues paper attached a report by Nuttall Consulting which sets out options for transmission reliability measures.[4]

Consistent with the recommendation of the Nuttall Report, we support further development of standards based on expected energy not served (EENS). This approach would give TNSPs flexibility to meet the required level of reliability in the most efficient manner. This measure can also be expressed in a way that makes it easy for customers to understand the level of reliability they can expect to receive in return for a given level of expenditure.

---

[2] Including the installation of 2 GW of solar PV to date.
[3] ESCOSA, Electricity Transmission Code, Section 2.
[4] Nuttall Consulting, Electricity Transmission Reliability Measures Review of options and concept design – A report to AEMO, 24 May 2013.

1.1.3. National standard reference template for transmission

The consultation paper suggests that standard setters would be able to choose from a range of other parameters to complement the N-X standards, as set out in a national reference standard template for transmission.[5] The AEMC has proposed that AEMO is responsible for developing the standard template for transmission.

AEMO welcomes this potential role, which we consider to be closely aligned with our field of expertise and complementary to our National Transmission Planner role. However, we consider that standard setters should be able to choose a set of reliability parameters which does not include N-X standards.

1.2. Process for setting reliability targets and standards

AEMO recognises that the process set out in consultation paper represents a significant improvement on the status quo in some jurisdictions. In particular, we support:

- a process to develop robust estimates of the value of customer reliability (VCR),
- an economic assessment of reliability scenarios, taking into account the value that customers place on a reliable electricity supply
- measures to involve customers in the standard-setting process, and
- a transparent process which requires decision makers to provide reasons for their decision.

However, we do not support an economic redundancy approach. It locks in high cost assets for no discernible reliability improvement and is incapable of responding to the changing and dynamic nature of the market.

As set out in previous submissions[6], we support an economic approach to reliability planning. An economic assessment should be undertaken for each project rather than fixing economically derived standards over a regulatory control period. Fixed input standards are likely to lead to inefficient investment decisions and result in TNSPs being incapable of responding to changes in the market.

We do not accept the criticism that an economic (or probabilistic) approach to reliability is less transparent or more complex that an economic-redundancy approach. We ask that the AEMC detail those concerns so that they can be addressed in the future.

The "economic" part of an economic-redundancy approach involves undertaking the same economic assessment, using the same assumptions, that is used to apply an economic approach. However, under an economic-redundancy approach, the results of the economic assessment are subsumed into inflexible redundancy standards.

In effect, the main change relates to the timing of the complex economic assessments. Under an economic-redundancy approach, the complex economic assessments are carried out as part of a high level standard setting process which is less well placed to conduct a robust and thorough review. As a result, an economic redundancy approach is less likely to

[5] AEMC, Review of the national frameworks for transmission and distribution reliability, Consultation paper, 12 July 2013, pg 29.
[6] AEMO, Response to AEMC Issues Paper on Review of the National Framework for transmission reliability, 22 May 2013, AEMO, Response to Productivity Commission Issues Paper on Electricity Network regulation, 21 May 2012.

give rise to efficient standards that reflect the value that customers place on a reliable electricity supply.

1.3. Updating standards within the regulatory control period

It is particularly important in a low growth scenario that the framework ensures only efficient network proceeds. AEMO welcomes Grid Australia's recognition of the need for more efficient investment with the proposal to test investments against economic cost benefit principles prior to making the final investment decision. However we note that a special mechanism for updating standards would not be required if TNSPs were subject to economic reliability standards, since the cost benefit assessment would be built into the standard.

The AEMC's consultation paper proposes that NSPs should be able to apply to the relevant standard setter for an update to their reliability standards during the regulatory control period where there has been a material change in circumstances. We agree that the reliability arrangements should not lock in out of date standards, and that NSPs should base their investment decisions on the latest available information. We also agree that NSPs' allowed revenues should adjust in accordance with their reliability obligations.

However, we believe that there is scope to improve the effectiveness of the proposed adjustment mechanism. A TNSP or DNSP with reliability standards that have been set too high is unlikely to voluntarily request a review of their standard if the result is to reduce their allowed revenues via a negative cost pass through event.

The AEMC proposes that the standard setter could also initiate a change in reliability standards. If there is to be a realistic chance that material changes are to be identified, this entails ongoing involvement of the standard setter throughout the regulatory period. The update mechanism would involve significant additional administrative cost, and still provides less flexibility than an economic approach to standard setting.

AEMO supports expanded use of the contingent projects mechanism for transmission augmentation expenditures which are above the RIT-T threshold as this approach removes the risk and uncertainty of setting the revenue base businesses receive above what may actually be required. The alternative is to try to reflect uncertain investments within the ex ante forecasts, which is problematic when applied to a lumpy transmission augmentation program.

For instance, in the recent Electranet revenue determination, the AER dealt with the uncertainty by setting capex allowances based the capex attributable to each project, adjusted to reflect the probability of the project occurring during the regulatory control period.[7] For example, a $100 million project which has a 40 per cent chance of proceeding receives an allowance of $40 million. Given that transmission augmentation programs involve a small number of large projects, this approach is highly unlikely to result in allowed revenues that are aligned with the TNSP's costs. Further, TNSPs may be unwilling to pursue an augmentation if they have only been partially funded for the associated costs.

In contrast, if major transmission augmentation capex is dealt with as a contingent project, allowed revenues can adjust in accordance with efficient investment requirements. This approach will ensure that the risk of customers unnecessarily incurring costs due to demand being lower than forecast will be minimised and TNSPs will not face incentives to underinvest if demand and other augmentation drivers are higher than expected.

[7] AER Draft decision, ElectraNet 2013–14 to 2017–18, pg 243.

AEMO recognises that this approach represents a shift away from traditional ex ante incentive regulation. Our proposal only applies to a sub-set of transmission capex for which setting ex ante forecasts is particularly problematic, especially in an environment of uncertain demand.

2. AEMO's Response to the Grid Australia supplementary submission on the Issues paper

2.1. Uncertainty associated with the cost benefit analysis

Grid Australia have claimed that the cost benefit analysis is "subject to considerable uncertainty, both in terms of estimating the VCR and the probability and duration of an outage"[8].

As the Commission and Grid Australia are aware, AEMO has commenced its review of the VCR in which our Directions Paper[9] has outlined the approach to calculating a range of VCRs that cater for uncertainty. This will involve consideration of the following attributes:

- Range of outage duration
- Outage time of day (peak or non-peak)
- Severity of outage (localised or widespread)

AEMO believes this is a considerable step forward to the current approach of calculating VCRs and provides more confidence that the appropriate VCR can be applied for its intended use. AEMO will not specify which VCR should be used for a particular purpose, be it for network regulation or planning purposes, however we intend to publish values that deliver enough transparency on the calculation method of VCRs to allow for their appropriate application.

Relating to uncertainty surrounding the probability of an outage occurring, AEMO believes that within the industry, there is much expert knowledge and engineering experience, particularly within the transmission network service providers (TNSPs) themselves to be able to determine probabilities of outage rates of their equipment. Given that there is sufficient historical data to assist in the development of outage rates which TNSPs possess, as well as information available from AEMO market systems to calculate outage rates based on certain inputs, AEMO does not consider that there would be considerable uncertainty surrounding these values. AEMO is willing to work with the TNSPs to determine probabilities of outages. The availability of this type of data would improve transparency of assets across the NEM therefore providing an opportunity for more robust benchmarking to be undertaken by the AER, particularly for their service target performance incentive scheme (STPIS) for the revenue reset process.

AEMO would further like to point out that the model proposed by Grid Australia incorporates some level of uncertainty. Under this model, an ex-ante allowance is provided to the businesses with some uncertainty that the project will proceed. As the time of the augmentation need draws closer, a cost-benefit analysis is still going to be applied to determine a revised need date or if the project is needed at all. AEMO is under the

[8] Page 1, Grid Australia submission
[9] Available on AEMO's website http://www.aemo.com.au/Consultations/National-Electricity-Market/Open/Value-of-Customer-Reliability-Directions-Paper

assumption that this cost benefit analysis will be the same as AEMO's model, with the same assumptions on VCR and outage probabilities, and therefore is not convinced that this model is superior to the model proposed by AEMO.

2.2. The probabilistic approach is mechanistic and excludes engineering judgement

Grid Australia have claimed that "Probabilistic planning inappropriately encourages a mechanistic approach to reliability setting…By the same token, it discourages the exercise of engineering judgement, and thereby runs the risk of exposing customers to extreme outage events"[10].

AEMO does not accept that this is the case, nor does it believe that customers should be funding TNSPs for building assets based on historic 'rules of thumb'.

AEMO fails to understand how reliability standards expressed by an N-X approach, which means another asset is required to be built if that standard is breached, requires any engineering judgement.

AEMO is of the view that any form of planning requires sound engineering judgement when developing outage rates and probabilities of failure of equipment. It also encourages innovation through the need to consider all types of options (both network and non-network options) to relieve the constraint, not the asset option.

2.3. High impact low probability (HILP) events

Grid Australia have stated that the probabilistic approach would not consider HILP events.

This is incorrect.

AEMO recognises that this is an area for further work and is currently considering how these can be incorporated into current planning methods. We also note that such considerations are not inherently incorporated into redundancy standards either.

As noted previously our approach to developing VCRs includes consideration of a range of outage durations as well as the severity of the outage, that is whether it is a localised or widespread outage. The specific assessment of vulnerabilities in the network to high impact, low probability events can then be undertaken in an economic framework taking into account appropriate VCRs. We consider that this is consistent with an economic approach to planning and means that the need for additional measures to cater for HILP events is not required.

2.4. Transparency, compliance and accountability

Grid Australia have claimed that "performance against standards expressed deterministically are also readily auditable"[11].

AEMO remains convinced that the proposed reliability measure using an expected energy not served (EENS) to measure performance is just as 'auditable'. The EENS is a specific value of energy not served in MWh and the reliability standard will be breached if the EENS at that connection point is greater than the maximum. Additionally, a full cost-benefit analysis is also auditable as a project assessed on this basis will only proceed if its benefits outweigh its cost.

[10] Page 2, Grid Australia submission
[11] Page 8, Grid Australia submission

Grid Australia have also implied that their model, which allows for "triggers for re-examination of the reliability standards…are readily auditable"[12].

AEMO agrees with the Commission and Grid Australia that transparency is an important aspect that reliability standards must incorporate. As such, AEMO is interested in the approach Grid Australia would undertake in defining all possible triggers for re-examination. Additionally, AEMO is not convinced that all triggers could be identified prior to the commencement of the application of the reliability standard. AEMO believes that triggers would be identified on a case-by-case basis, with some triggers arising under certain circumstances only, which would be difficult to define and therefore the transparency of their model would be compromised.

2.5. Efficiency and fit for purpose

Grid Australia have made reference to AEMO's example of the Dalrymple connection point and have suggested that this situation would be addressed by their proposed model, which accounts for changes in market conditions, through the inclusion of more granular features at each connection point along with the N-X redundancy standard. Grid Australia also state that their model allows for flexibility and that non-network options would be considered by deterministically expressed standards. However they have also noted that they do not understand "how a non-network option could be economically efficient if it does not address a network need".

AEMO still believes the model proposed by Grid Australia that specifies an N-X reliability standard, continues to lock in a specific network option regardless of the additional or more granular features. Although the EENS is breached, the option of relieving this constraint must be another asset of similar nature due to the expression of the standard which is a redundancy approach. Therefore AEMO is uncertain how non-network options could be considered to relieve a constraint at a particular connection point if all that is required is to build another similar network asset.

Additionally, network businesses are not incentivised to actively seek non-network options to relieve network constraints through the current framework. Past examples, including the original Mid North Coast proposal[13] have demonstrated that such options are rarely thoroughly investigated during the process.

2.6. Setting the ex-ante revenue allowance

Grid Australia's supplementary submission has stated that their approach would "engage with customers immediately prior to the revenue setting process in relation to the level of reliability that's expected at each connection point" and that AEMO's model "discourages meaningful discussions with the customers on the reliability trade-off…"[14].

Once again AEMO refers to our work on the VCR review. This process provides for improved customer engagement so that more robust values can be determined and therefore AEMO fails to understand Grid Australia's comment that our model discourages meaningful

[12] Page 8, Grid Australia submission
[13] TransGrid website: http://transgrid.com.au/projects/projects/stroud-taree/Documents/Final%20report%20%20-%20Development%20of%20Electricity%20Supply%20to%20the%20Lower%20Mid%20North%20Coast.pdf
[14] Page 11 Grid Australia submission

discussions. The VCR values produced by AEMO will also continue to be updated regularly as more specific customer information and data becomes readily available (for example ANZSIC business codes being collected by the ABS) and will therefore ensure continual engagement with customers and the industry.

Nuttall Consulting
ABN: 40 109 825 863
18 Atkins Avenue
Glen Iris, VIC 3146, Australia
Mobile +61 (0)434 390 623

16 August 2013

Reena Kwong
Acting Group Manager
Regulatory Policy Development
AEMO
GPO Box 2008
Melbourne VIC 3001

(provided via email)

Dear Reena

With regard to your request for Nuttall Consulting to review a submission made by Grid Australia to the AEMC's review of a nationally consistent transmission reliability framework, please find below the findings of this review.

Background

AEMO has requested that Nuttall Consulting provides a response to a submission made by Grid Australia (GA) to the AEMC's review of a nationally consistent transmission reliability framework (the AEMC review). The GA submission of concern specifically discusses a Nuttall Consulting report (the report) that proposed the reporting of a transmission reliability measure, which is based upon the calculation of the expected energy not supplied (EENS) at each connection point. This report was attached to a submission that AEMO made to the same AEMC review (the AEMO submission).

This letter is provided in response to this AEMO request. At the outset, it is important to note that the GA submission includes some views on points made in the AEMO submission that do not concern the report. This letter only addresses matters that specifically relate to comments in the GA submission on the report.

Overview of my review of the GA submission

The broad thrust of the GA submission appears to be a view that EENS is not a particularly meaningful measure of reliability because it does not allow for the more catastrophic high-impact-low-probability events (HILP events)[1] and is not suited to benchmarking. Therefore, reporting it may misinform stakeholders and be too much effort to prepare for any benefits it would provide.

I do not believe that GA has provided any significant evidence in its submission to support these conclusions. In fact, as I will discuss in more detail below, in drawing these conclusions, GA appears

[1] These events were referred to as low frequency high consequence events in the report, but HILP events will be used here as that is the terminology being used by the AEMC.

to have misunderstood the scope of Nuttall Consulting review, draws inferences from the report that where never intended, and at times, misrepresents statements made in the report. Importantly, much of GA's concern with reporting EENS seems to be about weakly-related arguments associated with its aversion to probabilistic planning and benchmarking.

Therefore, it is important that I clarify the following:

- **reporting the EENS measure does not necessitate a probabilistic planning approach**

  Firstly, reporting EENS measures ***does not*** lock in the need for probabilistic planning as may be assumed from a reading of the GA submission. I believe it is just as useful for monitoring reliability performance under the n-x type framework that the AEMC and GA favour. In fact, if anything, I believe it may be even more worthwhile to monitor this measure if such a regime is adopted, as it appears to be the only meaningful ***output-based measure*** that can provide some information to customers, regulators and other stakeholders that is relevant to the capacity-planning decisions of TNSPs. This seems very important given that, as far as I am are aware, it was largely concerns associated with capacity-related deterministic reliability standards that was driving the need for a consistent reliability framework in the first place.

- **the EENS measure will not allow for all catastrophic events, but this limitation does not mean it will misinform stakeholders – assuming it is appropriately explained**

  Secondly – I have no disagreement with GA that there may be some limits in what outage events are captured by the EENS measure. As discussed in the report, it uses a simulated approach to allow for HILP events. And yes, due to the very low probability of some of these types of event, their probability and consequence may not be known with accuracy or even allowed for in the measure.

  But for the framework currently proposed by the AEMC to work then that is exactly the same problem faced by the standard setter, who will also have to try to allow for these types of events in defining economically efficient n-x standards.

  For customers to have any confidence in this new regime – and for its to achieve its original purpose of ensuring economic efficiency in determining reliability - the setter will need to perform some form of quantitative economic analysis to test the n-x type standards and determine the appropriate parameters of such a standard. How is it to do this? Presumably, it will have to determine the *expected* reliability effects of the standard on the relevant connection points. These reliability effects will need to be defined as an output-type measure of reliability if a value metric, such as the customer value of reliability (VCR), is used to transform the reliability measure to its economic value. And to determine this reliability measure in a way that it will have any use for transmission capacity planning, it will need to allow for some HILP events. Presumably, this quantitative analysis will use a similar simulated approach as discussed in the report. Consequently, the same problems and limitations exist for the setter.

  Furthermore, I am not in disagreement with GA that some judgement may be given to the setter to cater for unknown or unmodellable events. But surely to achieve the transparency

that the framework is meant to provide, the setter will be required to set out its assumption on this. If all parties are comfortable that it is possible for the setter to make judgments on the "unmodellable" amount of reliability[2] then surely customers (and regulators) are no more misinformed by being reported the EENS measure, in light of these stated assumptions, than they will be misinformed by the reliability they should expect from the standards that apply to each transmission connection point.

On this point, it is worth noting that in Nuttall Consulting's opinion, if this judgement is so great that it swamps the quantitative economic analysis that the setter will perform then what will this new framework ultimately achieve? Therefore, it seems that either judgment will dominate and economic efficiency will never be defined with any meaningful rational definition or the judgment will be low and reported EENS will have meaningful information content for stakeholders, provided it is appropriately explained and qualified.

- **the EENS measure facilitates benchmarking – it is not a benchmark**

  Thirdly – I am not in disagreement with GA that EENS on its own is not a helpful benchmark. But the report was evaluating measures against how well they would **facilitate** benchmarking and comparative analysis. Not whether or not they could be used as a benchmark.

  I still believe that the EENS measure is a good measure of "service quality" for productivity benchmarking studies. For example, it is difficult to see how a compliance measure to an n-x standard can be used directly in such analysis. And measures of actual reliability at any transmission connection point may be too volatile for this use.

  Possibly, more importantly, EENS is a good measure on its own for comparative analysis of reliability between connection points and jurisdictions. This type of analysis is not used to set benchmarks *per se*, but it is very useful to identify matters that may need further investigation. That is not to say that there is anything *wrong* with the measure of reliability if it compares unfavourably. But something that is driving it may not be understood or allowed for.

- **the EENS measure should not be too onerous to calculate at each connection point**

  Finally – I agree with GA that deterministic standard are still used in many jurisdictions. And, possibly in the 90's, it was correct that it would be time-consuming to calculate EENS in a routine way. And, as such, it may have been more marginal that the effort to report such a measure was not worth the benefit.

  But since that time, the technical literature has abounded with discussions around EENS and examples of its use to make planning decisions – both capacity and life-cycle asset management. Moreover, I would expect that most contemporary transmission businesses will already have, are be in the process of sourcing, the systems and skills necessary to

[2] Presumably, the setter will be required to clearly show the anticipated reliability as the sum of the "modelled" reliability (i.e. an EENS type measure) plus the setter's estimate of the amount that it cannot explicitly determine.

integrate this type of reliability analysis into their decision-making processes – even if they are subject to deterministic standards.

In fact, to cater for this requirement, most commercially-available power system software now has special-purpose reliability modules to aid in this type of analysis. Clearly, the commercial entities producing this software would not expend the considerable cost into developing these tools if they thought that most transmission businesses thought the analysis was not worthwhile and provided no meaningful information. For example, PSS®E, owned by Siemens, is one of the most widely used, if not the most widely used, power system analysis tools for electricity transmission planning and operation. To quote an example provided in the sales material for PSS®E:

> "A transmission company wants to find the impact of using un-served energy indices in planning its system. However, there is not much experience with this type of analysis, and there is a concern that data preparation could be onerous. Solution: The probabilistic reliability assessment feature of PSS®E provides a simple process for obtaining un-served energy indices."[3]

Even setting these mitigating developments aside, the report noted that the **incremental** effort to the prepare the measures for each connection point may be low because 1) there is a significant overlap of the matters that need to be resolved and defined to report EENS and to set standards, 2) the work is an extension of national planning work already undertaken annual by AEMO, and 3) much of the additional effort will be required to "start up" the measurement process and will not be repeated each subsequent year.

Given my concerns, I believe that great care should be taken in drawing any conclusion from GA's explanation and reasoning of matters that it relates directly back to the report. Instead, views of the merits or otherwise of the position in the report should be judged from the discussion provided in that report.

Notwithstanding these concerns, I have tried to clarify in this letter the specific matters that are raised in the GA submission. These broadly concern the following contentions raised in the GA submission:

- EENS does not allow for catastrophic failures, and so, does not allow for the full extent of HILP events
- EENS is not an appropriate or meaningful benchmark
- EENS benchmarking will not drive TNSP performance improvement
- EENS cannot be used to benchmark between TNSPs and DNSPs
- EENS benchmarking in other regulatory processes is misguided
- it is too great an effort to prepare measures of EENS at connection points.

[3] Siemens website, PSS®E Transmission Reliability Assessment brochure (pdf file)

EENS and HILP events

The first concern of GA is that the EENS measure (and probabilistic planning) do not account for the more catastrophic HILP events[4]. To support this view, the GA submission quotes a paragraph in my report that states that the calculation of EENS uses information on the frequency and extent of network outages, and so, can be made to inherently allow for HILP events.

Importantly, it goes on to quote another paragraph in my report where I state that "(t)he asset outage probabilities and outage durations are essential inputs to calculating the EENS measure. ***Ideally***, these should be based upon ***historical records*** of outage events" (emphasis added)[5].

From this, GA infers an otherwise unstated proposition of AEMO and, by association, Nuttall Consulting that we consider that the EENS measure will allow for ***all*** HILP events because it is derived from historical data. The GA submission then goes on to note that this is not the case as the required outage statistics derived from historical data are unlikely to contain information for catastrophic events and discusses some other examples of where this matter has been discussed previously (most notably during other work on determining VCRs).

I believe that GA's interpretation of my report is misleading. I do say that "ideally" the outage data should be based upon historical records, but I do not say that it "must". Although not clearly stated, I assumed that most readers would appreciate that this is not always possible. In these situations, data may need to be taken from other sources – or even expert judgement may be required at times.

To be clear on this point:

- I have no disagreement with the GA submission that historical data will be more suited to estimating statistics associated with a subset of HILP events. However, provided reasonable historical data is available, this should enable the modelling of the most significant single and double contingency events.
- Statistical modelling may be able to be used to infer the likelihood of some lower probability events. But, once again, I am in complete agreement with GA, this is unlikely to provide accurate estimates of the probabilities associated with catastrophic events, such as major cascading failures.
- However, in these situations, it is assumed that the standard setter would decide (or the framework would define):
    - what events would be material and can be modelled, and in turn, what approach and assumptions should be used
    - what events could be material, but cannot be modelled, and what, in its view, the scale of the unmodelled reliability would be and the circumstances that this may occur.

Importantly, as noted in the overview section above, whether or not a probabilistic approach or an "economically efficient" n-x approach is chosen, the standard setter will need to be consulting on these matters and making judgements on them.

[4] GA submission, pg. 2
[5] Nuttall Consulting report, pg. 38

Therefore, although some HILP events may not be allowed for in the reported EENS measure, the materiality of any unaccounted events should be able to be transparently explained, via the specifications within the framework or assumptions developed by the setter. Given this, it is difficult to see why there should be any more concern that stakeholders will misunderstanding an EENS measure than almost any other measure, metric, or data that TNSPs must report. All reported data needs some form of explanation and qualification. For example, it is difficult to see that the EENS measure would be any more prone to misunderstanding that the measures of actual transmission reliability presently reported (do stakeholders think these allow for all possible HILP events?).

On a related matter, it is also worth noting that the GA submission states that Nuttall Consulting's view is that the AEMC's proposed use of deterministically-expressed standards does not provide any weight to HILP events, quoting a section from my report.

Clearly, as discussed above, this is an incorrect interpretation of my report and my opinion. GA appears to have misunderstood that section of the report, which specifically related to whether or not a ***measure*** of compliance to such a standard provides any weight to HILP events.

As I specifically noted in this section[6], the standard may have been derived with some allowance for views on HILP events. However, a measure of compliance to the standard will not be weighted in any way by the range of HILP events that each specific connection point may be effected by.

For example, two transmission connection points may have the same standard and be loaded to the same level relative to the standard – as such, their measure of compliance will be equal. However, the probability or consequence of HILP events on each connection points will be different (this assumption should be valid for any real world situation). Therefore, the compliance measure has ***not*** provided any weighting to the effect of HILP events on the specific connection points in how it has been calculated. That should be a relatively uncontentious point provided it is properly understood.

Benchmarking – EENS is not a meaningful benchmark

GA agrees with Nuttall Consulting that output measures of ***actual*** year-by-year reliability at individual connection points are not appropriate, but it does not believe that EENS is a reasonable measure for benchmarking actual reliability.[7]

GA believes it is very difficult to infer meaningful information about transmission reliability by benchmarking EENS, and provides two similar arguments to support this view.

The first is:

- probabilistic planning means that customers must be exposed to some level of EENS in order for a some solution to be justified
- consequently, EENS on its own is not undesirable or inefficient – simply a decision signal to determine when an action should be taken

[6] Nuttall Consulting report, pg. 30
[7] GA submission, pg. 6

- therefore, a benchmark that shows EENS in one place is higher than in another, does not imply reliability is worse or inefficient in the former.

GA's second argument is:

- EENS only indicates the benefit side of efficiency, not the cost
- therefore, it provides an incomplete and potentially misleading assessment of whether a TNSP is proving an efficient level of reliability at a connection point.

I do not disagree with the factual correctness of GA's premises. However, I do not believe that it simply follows from these that *therefore* you cannot infer meaningful information from EENS. Furthermore, whether or not EENS can be used for benchmarking concerns how the benchmark is derived and used; I don't see how it simply follows from the arguments made that EENS has no role in benchmarking. Moreover, it certainly does not follow from these arguments that EENS has no role in comparative analysis. Importantly, the report was not a suggesting that EENS on its own would somehow be used to define a reliability benchmark e.g. a fixed reliability point that would suggest those below had an inefficient reliability level. The point being made was that EENS ***facilitates*** benchmarking and comparative analysis.

For example[8], one connection point having a greater level of EENS than another of equivalent size *does* imply it has poorer reliability in an absolute expected sense[9]. Yes, this on its own, does not say that that that extra level of unreliability is inefficient. I doubt that any stakeholder engaged in this process would not be aware of this; it is after all, the whole point of why the AEMC is tasked with developing an economically efficient approach to determine reliability at each connection point. To be clear, for any "real world" transmission network:

- each connection point will have a finite level of expected energy that will not be supplied i.e. it has to have some finite level of unreliability[10]
- the "true" economically efficient level of unreliability at every connection point will be different.

Nonetheless, it is difficult to see why such a measure of reliability - even if it only represents one component of the "efficiency story" - would not provide useful information to stakeholders or may mislead. Yes, for making economic decision, both sides need to be considered. But why is reporting this EENS measure any more misleading than reporting a connection point's VCR? They both only represent one component of the overall efficiency story.

And yes, on its own, it does not provide a direct measure of efficiency (what reliability measure would - should we therefore not report any?). Based upon Nuttall Consulting's experience of

[8] This example sets aside the unmodelled level of reliability discussed in the section above - or at least assumes it is either similar in scale between comparable connection points, insignificant in an expected sense, or the scale of this has been estimated.

[9] Obviously, for connection points of different scale, the absolute measure of EENS may not reflect differences in reliability on a per-customer basis. However, it is a relatively trivial exercise to index EENS to customer numbers or the energy demand for such scale comparisons.

[10] Noting that, in any year, the connection point may have perfect reliability i.e. actual energy not served will be zero. And some of the expected energy not served may not be modellable. Nonetheless, this finite level of unreliability, as a statistical *expectation*, still exists (we may just not be observing it).

assessing expenditure and reliability, it seems quite straightforward to see how such a measure would help to inform stakeholders about where there may be anomalies in reliability and planning decisions between connection points. This, at the very least, may suggest where further investigation may need to be made. That seems to be the cornerstone of much of what the AER is advocating in its approach to assessing expenditure i.e. having the information and tools necessary to target matters that it wants to investigate further. For example, assuming the n-x approach is chosen, reporting such a measure would very quickly identify connection points where:

- EENS is low, but capacity decision are being made; or
- EENS is high, but capacity decisions do not appear to be being made.

Nothing is to say that either of these situations is actually wrong, but reporting EENS will make it far more transparent where attention should be focused to understand the drivers of these effects.

Furthermore, some customers may want to make their own decisions, based upon measures of reliability at connection points and their own view of the value it has to them (e.g. of the best place to locate or whether or not to invest in backup supply). Without a measure such as EENS, it is not clear what the alternatives are for customers (or other stakeholders) to compare reliability under the n-x framework. For example, what meaningful comparison can a customer make of the expected performance it may receive from the following?

- a connection point with n-1 design, where the first 80% of the 50% PoE demand must be continual supplied, but the remaining 20% of the 50% PoE demand must be resupplied within 4 hours – and the standard is allowed to be exceeded for 1% of the time in each year
- another connection point with n-1 design, where 100% of the 50% PoE demand must be restored within 15 minutes
- and another connection point with n-1 design, where 100% of the 10% PoE demand must be able to be restored within 8 hours, but 50% of the 50% PoE demand must be continually supplied, 25% must be restored within 30 minutes and the remaining 25% must be able to be restored within 4 hours - and up to 300 MWhr of energy supplied can exceed the standard in any year.

All these options and many more seem to be possible based upon the AEMC's consultation paper. Maybe not all of these would be used in one jurisdiction, but certainly across jurisdictions something similar to this could eventuate as jurisdictional setters attempt to optimise the economic efficiency of the standards.

Consequently, I still believe that reporting an output-based measure, such as EENS, with appropriate caveats as to its limitations, should provide meaningful information to stakeholder. Whether or not it is misunderstood is simply about how it is presented and explained.

Benchmarking EENS will not drive performance improvement and enable comparisons between TNSP and DNSPs

GA does not believe that benchmarking EENS will drive performance improvement and enable comparisons between TNSPs and DNSPs.

To support this view, the GA submission refers to a section in the report that notes that the preferred reliability measure should provide consistency between transmission and distribution, and copies the following text from the report:

> "Although this review is focused on transmission, it would be preferable if reported reliability measures were consistent between transmission and distribution. This would reduce the effort of stakeholders to understand the measures, and make comparisons between sectors."[11]

The GA submission state that the "logical extension" of this report text is that TNSPs will be benchmarked against DNSPs and similar incentive schemes will be required[12].

I disagree with the logic and inferences made in GA's argument on this matter. The section of my report referred to by GA seems to be taken completely out of context from its place in the report in order to prosecute an unrelated argument about benchmarking, which, as I have already noted above, is not a correct interpretation of the position on this matter in the report.

The quoted text was made in a section of the report discussing the ***ideal*** characteristics of some – at that stage of the report, unidentified – reliability measure. These ideal characteristics were being introduced as criteria to judge possible measurement options against. They were ***not*** a listing of all the characteristics that I believed an EENS measure had, as could easily be assumed from the summary provided in the GA submission.

In this context, it does not seem unreasonable that it would be preferable that a measure would have some form of consistently in how the reliability of the supply of electricity to customers would be measured and reported for both TNSPs and DNSPs. Consistency between distribution and transmission frameworks was a preference stated by the AEMC in its issues paper[13]. As stated in this paper *"(a) consistent approach … will allow stakeholders to more easily understand the levels of reliability required of the networks, as well as the role of distribution and transmission networks in the overall level of reliability received by end use customers."*[14] In my view, it would be very surprising to think that customers may have a preference that a measure of the reliability of the supply they are provide by the electricity network was expressed in different ways depending on where it was being measured.

Obviously, that does not mean reliability itself should be the same in different places. And it is certainly incorrect to suggest that this is what Nuttall Consulting was implying in the context of a discussion on ideal characteristic of a reliability measure. That is almost too trivial a misrepresentation to warrant too much attention.

What Nuttall Consulting had in mind in defining that characteristic can best be shown by example. Setting aside the other ideal characteristics discussed in that section, what would be preferable for customers and many other stakeholders:

---

[11] Nuttall Consulting report, pg. 12
[12] GA submission, pg. 7
[13] AEMC, 2013, Review of the national framework for transmission reliability, Issues Paper, 28 March 2013, Sydney, pg. 11
[14] AEMC, 2013, Review of the national framework for transmission reliability, Issues Paper, 28 March 2013, Sydney, pg. 12

- similar measures, such as those based upon a unit of *customer energy not supplied* or *customer minutes not supplied*, which has some consistency in meaning whether it is measured and reported at a transmission connection point or at some location on the distribution network
- or the alternative, where distribution reliability is measured and reports as *customer minutes not supplied* and transmission reliability is measure and reports as some measure of *compliance to an n-x standard*?

All things being even, surely the former would be preferable by customers and other stakeholders. As also noted in the AEMC paper, consistency would aid joint planning between the TNSP and DNSPs, and measures of the distribution and transmission components of EENS would surely facilitate this.

On other matters raised by GA around this argument, due to this misapplication of the point Nuttall Consulting was making and the misunderstanding of the role EENS could play in benchmarking, these matters are not directly relevant to the point quoted from the report. Nonetheless, the following may be helpful in contextualising the EENS measure with the concerns of GA:

- *Relevance to a STPIS*. The focus of the EENS measure was for reporting reliability at connection points, not necessarily for setting targets of a STPIS. Nonetheless, a measure of EENS has some good properties for a future STPIS because this measure can be fairly readily transformed into an economic value, via a VCR. Therefore, as with the distribution STPIS, the economic link between the performance to the targets and adjustments to revenue is transparent. Furthermore, EENS will not be as sensitive to actual events, which, at the transmission level, may lead to volatile measurement of the actual reliability measure. Importantly, catastrophic HILP events would most likely be excluded from a STPIS anyhow, so the lack of modelling would not affect matters.
- *Statistical stability of the measure*. GA stated that current STPIS transmission measures are more statistically significant than EENS. I do not have the data to test that assertion. However, I would find it very surprising if this advantage was materially at the transmission connection point level, which was the purpose of the EENS measure in our report. In this regard, there may be averaging effects that improve the statistical significance of the current measures when they are calculated across the network (as typically occurs for a STPIS). But it would be surprising if the accuracy of such a measure at a connection point level could be shown to be similarly high. This seems to contradict the view held by most, including Nuttall Consulting, AEMC and GA, that there is too much volatility of actual year-by-year reliability at this level to make meaningful measures of reliability.
- *Role in benchmarking*. As discussed above, the GA submission discusses benchmarking reliability, as if reliability is the benchmark being determined. However, it is also important to appreciate that in a regulatory context, a reliability measure is typically required to normalise some other benchmark (i.e. an expenditure or productivity benchmark). It would appear to me that EENS would have better properties for this application than other alternatives. For example, how is this achieved for a measure that represented the level of compliance to an n-x type standard?

The proposed use of EENS benchmarks in regulatory processes is misguided

The GA submission states that "Nuttall Consulting's report **offers the following additional suggestions** for how the proposed EENS benchmarking may be used in other regulatory processes" (emphasis added)[15]. It then goes on to copy a part of the report text, as follows:

> "The AER or other stakeholders often need to assess the expenditure and investment needs of TNSPs in various regulatory documents, including revenue proposals, pass-through and contingent project applications, and annual planning reports. This assessment often involves the consideration of the factors driving changes to reliability. Therefore, the measures would add value to these processes if they provided some visibility of the network components and issues affecting reliability."[16]

Once again, I believe that this significantly misrepresents my position and the context of the quoted text. As in the above case, the statement quoted is copied from the section discussing the ideal characteristics of a reliability measure, under the heading *visibility of the drivers of reliability*. EENS as a measurement option had not even been introduced at that stage of the report.

That said, I am sure GA will consider this point is simply semantics as later in the report I do say that EENS had advantages in this regard. However, the actual text used as specifically relevant to EENS was as follows:

> "As the output measures make use of certain input measures, which can also be reported, the set of measures together can provide some insight into what specific matters may be driving unreliability or changes to reliability."[17]

Clearly, the ***actual suggestion*** being ***offered*** in the report is far less contentious than what GA has stated I was suggesting. In fact, in this context, it appears to me to be misleading to introduce my text as GA has done.

GA goes on to state that it "does not understand how the proposed benchmarking of expected unserved energy would have any bearing on the matters listed by Nuttall Consulting"[18]. Its inability to understand this matter is far more obvious given the paragraph it had just quoted was not directly related to either benchmarking or EENS.

Importantly, Nuttall Consulting still maintains that reporting the suite of measures, based around EENS, that are set out in Section 5.2 of the report can be useful in understanding why one capacity option may be more suited (i.e. economically efficient) than another to address unreliability. For example, information on outage frequencies and duration can inform whether an option to improve the frequency of asset outages or reduce restoration times may be better.

[15] GA submission, pg. 7
[16] Nuttall Consulting report, pg. 12
[17] Nuttall Consulting report, pg. 12
[18] GA submission, pg 7

It is also quite concerning to here that GA believes all information reporting is currently fit for purpose and it not aware of any issues that need to be addressed[19]. This view seems to be counter to views by other stakeholder that appear to be driving the many changes occurring in the industry, such as some aspects of the nationally consistent reliability framework and the AER's better regulation reform program.

It is also worth stating that my view expressed here is based upon my experience of reviewing projects and programs for regulatory purposes for over 10 years. This has covered reviews of all NEM TNSPs and most NEM DNSPs. Any business that has been subject to one of these reviews would know that the information typically published, even if fully in accordance with existing reporting requirements, is seldom sufficient on its own - the review normally requires other information. Importantly, information provided in annual planning reports typically provides little more than general guidance on why capacity planning decisions are being made. Even detailed reviews of regulatory test applications typically require additional information to be provided.

Interestingly, I believe reporting information of the type proposed in the report may well help the analysis and explanation of differences between TNSPs and connection point reliability to stakeholders, and the potential benefits of this may outweigh any risks on TNSPs that it may be misapplied or misunderstood. Maybe the spectre of benchmarking transmission means that GA is missing opportunities that could help its members explain reliability, their capacity decisions, and the factors driving differences between jurisdictions.

Setting the ex ante allowance

GA disagrees with AEMO's position that it is not significantly more complex to apply probabilistic planning than to operate with the economic redundancy regime. GA notes that AEMO accepts there will be more steps to apply this process, but question how this view can be then reconciled with a position that it will not result in more effort[20].

To support this view, GA quotes part of the report, which lists the following matters that will need to be defined within the framework:

- "the outage events to be modelled
- the preparation of outage probability models
- the applicable network ratings
- assigning EENS to connection points
- customer demand assumptions
- generation dispatch assumptions
- network and generation development assumptions
- load transfers and restoration assumptions
- circumstances where the standard methodology and assumption can be changed for preparing the measures."[21]

[19] GA submission, pg. 7
[20] GA submission, pg. 11
[21] Nuttall Consulting report, pg. 37

The GA submission then goes on to quote another section of the report, where I stated that preparing the EENS measure will require more effort on the part of TNSPs or AEMO. The GA submission follows this by stating that "the discussion in the Nuttall Consulting report illustrates **very clearly the likely additional effort that will be required** to implement AEMO's proposal for the use of EENS forecasts as a form of reliability measure"[22] (emphasis added).

Similar to many of my concerns expressed above, this appears to be a very selective copy of statements from my report to prosecute GA's argument. I do not disagree that extra effort will be required; I make this quite clear in my report.

However, my report also provides additional discussion on this matter and, importantly, states that "the actual incremental effort may be able to be minimised by the careful design of standardised models and assumptions. As such, the cost of this increased effort may well be much lower than the overall benefits of reporting these measures"[23].

In coming to this view, I note in my report the following three mitigating factors:

- The matters quoted by GA and dot pointed above, will most likely need to be decided upon to enable the reliability and economic analysis necessary to periodically test and set the n-x type standards preferred by AEMC. As such, we are only interested in *incremental* effort above this here.
- Furthermore, AEMO already performs a process through its national planner role that measures EENS in places. This could be extended to enable connection point measure to be made – reducing the overall incremental effort further.
- Also, much of the effort is probably "start-up" effort, and so, the ongoing measurement effort may be much lower.

Clearly, GA considers there to be no benefit in reporting this measure, and so, the above may be moot points in its opinion. However, as discussed in the report, but largely left unchallenged by the GA submission, I have considered other transmission reliability measurement alternatives and not found any to be more suitable as a measure of reliability that can inform transmission capacity-planning decisions. To take an alternative view would require a more complete critique of the evaluation provided in the report, which is not contained in the GA submission.

Closing

I trust you will find this review helpful. Please do not hesitate to contact me if you require any further clarifications.

Yours sincerely

Brian Nuttall
Director

[22] GA submission, pg. 11
[23] Nuttall Consulting report, pg. 29