

20 March 2019

Audrey Zibelman
Chief Executive Officer
Australian Energy Market Operator
Level 22, 530 Collins Street
Melbourne VIC 3000

Via email: forecasting.planning@aemo.com.au

Dear Ms Zibelman,

RE 2019 Forecasting and Planning Consultation Paper

TasNetworks welcomes the opportunity to make a submission to the Australian Energy Market Operator (**AEMO**) on the 2019 Forecasting and Planning Consultation Paper (**the Consultation Paper**).

As the Transmission Network Service Provider (**TNSP**), Distribution Network Service Provider (**DNSP**) and jurisdictional planner in Tasmania, TasNetworks is focused on delivering safe and reliable electricity network services while achieving the lowest sustainable prices for Tasmanian customers. This requires the prudent, safe and efficient management and development of the Tasmanian power system.

TasNetworks is assessing the feasibility of Marinus Link, a second Bass Strait interconnector between Victoria and Tasmania. In this regard, TasNetworks supports AEMO's efforts to improve forecasting and planning assumptions and methodologies. These are critical elements to the National Energy Market (**NEM**), Electricity Statement of Opportunities (**ESOO**) and the Integrated System Plan (**ISP**). TasNetworks has engaged and contributed to this process through the Executive Joint Planning Committee, Joint Planning Committee and the Forecasting Working Group. Overall, TasNetworks is supportive of the approach to most issues that AEMO has proposed in the Consultation Paper.

TasNetworks supports Energy Networks Australia's (**ENA**) submission and would like to make several further comments with a particular focus on Tasmanian issues that are also relevant to the wider NEM. The key points in this submission are:

- Given other work underway to ensure an "actionable" ISP, the scenarios or sensitivities chosen to represent the future states of the NEM must be able to be used by TNSPs within the Regulatory Investment Test for Transmission (**RIT-T**) framework. Should this not be the

case, a perverse outcome could potentially result, whereby major augmentations recommended by the ISP may not pass the RIT-T. Inclusion of additional sensitivities may be a way to circumvent this outcome.

- The potential for the reduction of power system inertia and fault level (also known as “system strength”), as large synchronous generating units are replaced by variable renewable generation, has been widely acknowledged and witnessed. In this respect, TasNetworks encourages AEMO to modify its detailed long term (**DLT**) model to include some representation of minimum fault levels and inertia requirements which will lead to capturing the appropriate mitigation cost in the optimisation process.
- TasNetworks considers priority should be given to understanding the longer term impact of climate change on hydro inflows, wind speed and solar irradiation. Long term average changes in these weather variables will impact upon the effective capacity factors of renewable generation technologies. This has the potential to alter optimal economic outcomes as the NEM transitions to a renewables-based power system.

TasNetworks responses to individual questions are provided below and we welcome the opportunity to discuss this submission further with you. Should you have any questions, please contact Tim Astley, Team Leader NEM Strategy and Compliance, via email (tim.astley@tasnetworks.com.au) or by phone on (03) 6271 6151.

Yours sincerely,



Chantal Hopwood
Leader Regulation

Q1. How could AEMO further improve stakeholder engagement and confidence in the results of the 2019-20 ISP and 2019 ESOO?

General comments

TasNetworks notes and supports the increased transparency with which AEMO is undertaking the 2019 ESOO and ISP. We appreciate that AEMO officers have spent time responding to TasNetworks' specific queries regarding technical material in the 2019 Input and Assumptions Workbook.

TasNetworks supports AEMO's intention to form a Customer Engagement Panel to represent customers' views in respect of forecasting and planning issues. We note that a number of industry related entities now include such customer representative panels. AEMO may wish to draw on the membership of such panels, or even dovetail with an existing established customer panel, rather than forming a new panel.

TasNetworks also supports AEMO's intention to publish and seek feedback on a draft ISP prior to the final publication of the 2019-20 ISP.

Stakeholder engagement for the purposes of developing forecasting input data and modelling methodology

It is essential that ISP and ESOO input data has been subject to an appropriate level of consultation and scrutiny during development. The industry-wide desire for an actionable ISP, which must by implication be highly robust, necessitates that ISP input data and modelling should not be subject to later dispute.

The input data (or subsets thereof) and model will be used by other parties undertaking electricity industry development modelling. This includes RIT-T modelling. The use of the data and model by other stakeholders is an economically efficient outcome, as the costs and effort expended by AEMO in developing the data set will be avoided by many other parties. Other stakeholders who choose to use AEMO's data set and model must have confidence that the data and model are accurate and will withstand scrutiny.

Given these factors, TasNetworks considers the level of consultation being undertaken by AEMO is:

- (i) appropriate at present; and
- (ii) should be seen as the norm in future, as further data and model improvement occurs.

TasNetworks notes that much of the ISP/ESOO input data requires specialist expertise to create and critique – indeed two industry experts may have contrary opinions – and the need for transparency in the data and model development process is paramount.

TasNetworks acknowledges that while it would be ideal to have all data sources and modelling methodologies fully documented, in practise this is not practical due to:

- the resource effort that would be required to fully document all data and methodologies; and
- some data items may be supplied to AEMO in commercial confidence.

We find AEMO's approach of dealing with specific queries concerning modelling methodology and data, i.e. on a one-on-one basis, to be generally acceptable. We suggest an enhancement to the existing informal one-on-one discussion process, whereby if such discussions reveal that published documentation about specific aspects of modelling or input data derivation is lacking, AEMO adopts the approach of publishing a short technical paper addressing the issue in question. A central repository of such papers on the forecasting and planning section of AEMO's website would a valuable information source.

Publication of Detailed Long-Term Model

TasNetworks has downloaded and examined the PLEXOS files for the DLT model, which AEMO made available on its web site following the publication of the 2018 ISP. We have found the ability to examine the actual model implementation was valuable to our understanding. We encourage AEMO to continue to make available the PLEXOS model files with future ISPs.

Q2. Do you agree that the proposed scenarios outlined in this section provide plausible and internally consistent future worlds for use in planning and forecasting publications? Do they provide sufficient stretch for forecasting and planning purposes? How could they be improved?

Internal consistency of scenarios versus stretch for planning purposes

TasNetworks agrees with the general concepts of the Fast Change, Neutral, and Slow Change scenarios. We do, however, have some concerns in relation to the internal consistency of the Fast Change scenario.

We understand the Fast Change scenario represents the combination of strong economic growth coupled with a concerted effort to decarbonise Australia's electricity sector. The scenario inputs have been chosen to drive a rapid transition to centralised variable renewables based generation. In the process, this will stress-test the capability of state transmission networks, interconnectors and centralised renewable generation development opportunities.

The proposed selection of variables for this scenario includes a deliberate choice of a lower proportion of Distributed Energy Resource (**DER**) uptake compared with other scenarios.

TasNetworks understands the reason for this, being a lower DER uptake rate will increase the requirement for centralised renewable generation, thus stretching the boundaries of transmission and interconnector limits and centralised renewable generation development requirements.

However, we are concerned that the low DER uptake assumption is inconsistent with considerable industry commentary highlighting increasing role of DER (which in this context includes demand side participation (**DSP**)) and customer engagement in the future electricity network. In particular, an inherent feature of strong economic growth is the increased scope for entrepreneurial activity. The possibility of start-up enterprises to capitalise on technological advances and relatively easy access to seed funding to deliver new DER products is arguably increased, rather than reduced under such conditions. While we recognise AEMO's reasons for taking a contrary position, TasNetworks considers it more plausible that the Fast Change scenario would include a higher proportion of DER than in the Neutral or Slow Change scenarios.

From the perspective of the ISP, as a study that explores future NEM development outcomes, this contradiction is not problematic. The difficulty arises in that such a scenario would be open to challenge if a TNSP was to include it in a RIT-T. It is TasNetworks view that, due to the internal inconsistency, such a scenario could not be used.

Given the industry wide desire to have an "actionable" ISP, it is essential that network development outcomes recommended in the ISP would be reasonably expected to pass a RIT-T. We acknowledge AEMO's reasons for formulating the Fast Change scenario as proposed, and we are not suggesting the scenario should be changed. We do, however, recommend that an additional sensitivity be conducted which includes the combined effects of strong economic growth, a desire to reduce emissions, and high DER uptake. This will be more informative from the perspective of a likely RIT-T outcome.

A similar argument can also be made in respect of the High DER scenario, in which inputs are chosen to drive a high DER uptake coupled with a low rate of large-scale renewable generation development. Again, TasNetworks acknowledges AEMO's reasons for choosing this scenario and we acknowledge it is informative, but we question whether the scenario could be used in a RIT-T.

Q3. What additional sensitivities should be explored in the 2019-20 ISP or 2019 ESOO, that could materially impact power system planning?

Fast Change (including DER)

As discussed above, TasNetworks considers it necessary to include a sensitivity which includes the combined effects of the input variables in the Fast Change scenario, with the inclusion of increased DER uptake.

Treatment of Snowy 2.0

TasNetworks' Marinus Link studies have indicated that the presence or absence of Snowy 2.0 will have a significant bearing on the future development of the NEM¹. At the time of writing it is not clear whether AEMO will include or exclude Snowy 2.0 in its core scenarios, although the 2019 Planning and Forecasting Consultation Paper asserts:

Larger and more detailed schemes, such as Snowy 2.0 or Battery of the Nation, will be considered in the modelling explicitly based on predetermined sensitivities to the core scenarios, if they do not meet AEMO's commitment criteria before modelling commences for the various forecasting and planning publications.

TasNetworks is uncertain whether "AEMO's commitment criteria" differ from the commitment criteria applicable to the RIT-T, being a *committed project* or an *anticipated project*². Should Snowy 2.0 meet the RIT-T definition of *anticipated project* by the time modelling commences, then the inclusion of this project in ISP core scenarios will be self-evident.

If Snowy 2.0 does not meet the requirements of an *anticipated project* but the project still appears plausible, then sensitivity studies with and without the presence of Snowy 2.0 should be undertaken to provide an informative view of NEM developments should either outcome eventuate.

National emissions reduction targets

TasNetworks acknowledges AEMO's intended approach in regards to emissions reduction targets which proposes that:

- A NEM-wide emissions reduction policy other than LRET will not be modelled; and
- Legislated state-based emissions reduction targets and DER policies will be included in the model.

AEMO's proposed approach is to examine emissions reduction as a model output, given the uncertainty that currently surrounds national emissions policy. We note the increased model detail, such as the inclusion of revenue sufficiency for large thermal plant, that should increase the accuracy of this approach to emissions modelling.

Although we understand the reasoning behind the proposed approach, we have a concern that the resulting emissions reduction is unknown until the model is actually run. There is a possibility that the emissions reduction may not meet either Australia's COP21 commitment (i.e. the Paris agreement, 26% emissions reduction on 2005 levels by 2030), nor a future more aggressive emissions reduction target.

TasNetworks requests that, when analysing the emissions outcomes of all scenarios and sensitivities, the emissions profiles be compared with the emissions reduction policy of the government of the day. Should the emissions reduction outcomes of a scenario not meet this policy, we request a sensitivity be modelled in which a mandated emissions profile is specified as a model input. The outcomes of such a sensitivity would then inform the public debate as to what additional costs and actions are necessary to achieve a particular emissions reduction profile.

¹ Project Marinus, *Initial Feasibility Report*, February 2019.

² Paragraphs 18 and 19 of the RIT-T define committed and anticipated projects

Increased time resolution in the DLT model

The 2018 ISP highlighted that storage technologies will play an increasing role in the transforming NEM. The value of storage technologies is in being able to absorb variable renewable energy at times of excess, and supply the market with stored energy at times of shortfall.

Inherent in any future market modelling is a trade-off (due to finite computing power) between the duration of a study and the number of time intervals per day that can be implemented. We understand AEMO currently implements eight load blocks per day.

A consequence of the need to have a limited number of load blocks is the averaging of both load and generation during a given time period corresponding to a load block. Peaks and troughs of load within a block may cancel each other out, the same applies for generation. Consequently, the modelled load and generation variability, and the value provided by storage, may appear to be lower in the model than in reality.

TasNetworks suggests that AEMO conducts an experimental run, in which the DLT model is used to simulate only half the number of study years, but with twice the number of load blocks (that is, the total computational power would be no different from the normal DLT run). The results of this could be compared with another iteration using the same number of study years but with the normal allocation of load blocks. Comparing results will provide an initial indication of whether the averaging inherent in the allocation of load blocks is having a significant impact on the value of storage in the future NEM.

Q4. Do the proposed inputs and assumptions provide a reasonable basis for assessing the value and direction of the future energy market transition? If not, please provide suggestions for improvement, particularly with regard to consumer embedded investments, large-scale generation technologies, and network and non-network options to support Australia's future energy system.

Social discount rate

AEMO proposes to use a Weighted Cost of Capital (**WACC**) of 6.25 per cent to derive annualised capital costs for market driven generation and regulated transmission investments, but a lower social discount rate of 4.0 per cent for the NPV assessment. This is in contrast to the 2018 ISP which used a social discount rate of 7.0 per cent and a WACC of 6.0 per cent.

ENA's submission discusses a possible outcome of the currently proposed approach, in which a development option recommended by the ISP may not pass the RIT-T. As previously identified in our response to Question 2, such ISP results may be informative but may be problematic when viewed in the context of an actionable ISP.

The dual-WACC approach represents a fundamental change to the NEM investment assessment framework and is therefore deserving of much broader analysis and consultation.

Modelling of consumer level DSP and DER

As currently proposed, DER and DSP are fixed inputs to the model for a given scenario. This differs from large scale generation and storage technologies, which will be allocated by the DLT model so as to optimise the cost of supply over the study period.

A potential improvement to the fixed-input approach to DER and DSP would be to either:

- (i) assign such resources an effective cost, thereby allowing the DLT model to allocate these resources, or
- (ii) vary the amounts of DER and DSP in response to prices faced by consumers (or a suitable proxy thereof).

Modelling of DER and DSP uptake is not an area of TasNetworks expertise, and we are unable to make a meaningful contribution to the development of such models. We also acknowledge that

consumer level investment decisions may be heavily influenced by non-economic factors, making the modelling of these resources all the more difficult. If taking approach (i) above, we envisage the cost assigned to consumer level DER and DSP resources would need to be modified from the true anticipated cost to account for non-economic factors in consumer investment decisions.

We are supportive of increased consideration of DER in the continuing GenCost project, as discussed on page 63 of the Consultation Paper.

Our response to Question 2 identifies the need for a sensitivity study that has increased amounts of DER in an essentially Fast Change scenario. Assuming the fixed-input approach to DER and DSP, it may be necessary to develop forecast trajectories for these variables that are part-way between the currently proposed trajectories, for use in such a sensitivity.

Q5. Do you have any other feedback on AEMO's proposed inputs and assumptions?

Long term climate change impacts on renewable generation input data

TasNetworks supports AEMO's proposed approach of using rolling reference years instead of a single reference year for the purposes of input data for hydro, wind and solar plant, and its correlation with peak demand.

The rolling reference years approach makes an inherent assumption that past weather patterns will be indicative of future weather patterns – an assumption that is increasingly uncertain in light of climate change. TasNetworks considers that attention should be given to including the long term impacts of climate change on hydro, wind and solar generation input data. Changes to long term averages of these inputs will change the effective capacity factors of the resulting generation, potentially altering the future generation mix.

We are aware that AEMO has commenced a joint project with the CSIRO and Bureau of Meteorology to derive improved climate and extreme weather information for the electricity sector. TasNetworks considers this should be a high priority area of work, given the impacts of climate change on input data are essentially unknown but may have a significant effect on study results.

Shadow connection points for marginal loss factors (MLFs) of future plant

On the MLF sheet of the 2019 Inputs and Assumptions Workbook, TasNetworks has observed some errors in the allocation of shadow MLFs for future generation connection point. In private correspondence we have pointed out specific issues relating to Tasmanian connection points. We will provide additional input as needed for AEMO to assign MLFs for Tasmanian REZs.

We suggest AEMO systematically review the allocation of shadow connection points for all NEM regions, as the inadvertent incorrect allocation of a MLF could have a material impact on study results.

Q6. Do you have specific feedback and data on:

- a. The list of candidate generation technologies for assessment?**
- b. The current and future generation technology costs assumed?**
- c. Generator fixed O&M costs, noting the inclusion of fixed costs associated with mines?**
- d. The appropriateness of AEMO's assumptions around various storage technologies?**
- e. The approach on generator retirements, including appropriate costs to convert existing CCGTs to OCGTs providing a peaking, rather than major energy production role?**

Storage costs

TasNetworks is supportive of AEMO's inclusion of pumped storage hydro costs as modelled by Entura. Noting that pumped storage costs and capacities can be highly location dependent, the increased detail with which pumped storage hydro is now represented in the cost database is a worthy improvement over the 2018 ISP assumptions.

Candidate generation technologies

TasNetworks notes that the technologies listed in the Build Costs table in the 2019 Input and Assumptions Workbook do not align with proposed candidate technologies in Table 7 of the Consultation Paper. In particular, Carbon Capture and Storage (CCS) technologies are included in 2019 Input and Assumptions Workbook, but are excluded from the proposed technology list Table 7. We also note that costs of synchronous condensers are not listed in the Workbook. We assume that AEMO intends to update the 2019 Inputs and Assumptions Workbook following the completion of this consultation process.

TasNetworks supports the omission of CCS technology, given this is not mature and representative cost data would be highly uncertain. We also support the omission of nuclear power as a candidate technology, given the moratorium on nuclear power development in Australia and our estimation that this technology would face very strong community opposition should it be proposed. As previously discussed, the need for an actionable ISP means results should be replicable in the RIT-T process, and it is uncertain whether nuclear generation would be permissible under the current RIT-T framework.

AEMO proposes to include Biomass (wood) as a candidate technology. TasNetworks notes that this is a mature technology, and at least one proposal for a wood-waste fuelled plant exists in the NEM. This suggests that wood fuelled biomass generation is a viable future technology option. However, determining a resource limit per region or REZ may prove highly problematic. TasNetworks suggests that biomass generation be excluded from the generation technologies, on the basis that its implementation is likely to be on an opportunistic basis as a by-product of other industries, rather than a technology that could be developed primarily for the purpose of electricity production.

Q7. For 2019 planning and forecasting activities, what, if any, material issues should be prioritised ahead of the issues proposed by AEMO?

TasNetworks generally agrees with the priority areas identified in Chapter 5 of the Consultation Paper.

Although the Consultation Paper acknowledges the need for increased understanding of climate change impacts, this is almost exclusively considered in terms of the power system's resilience to extreme weather events and High Impact Low Probability (HILP) events. That is, discussion of climate change tends to centre on the increasing likelihood of weather extremes.

Whilst not understating the importance of these considerations, TasNetworks considers that greater priority should be given to understanding the long term changes to "normal" climate, and how this will impact on the input energy available to renewable generation sources. This is discussed further in our response to Q5.

Q8. What other material HILP events should be considered in assessing resilience?

In addition to the HILP events identified in the Consultation Paper, the possibility of High Voltage Direct Current (HVDC) interconnector failure and a subsequent outage of several months' duration should be considered.

Q9. What mitigation options could be considered to increase grid resilience, and how should these options be evaluated? Is AEMO's proposed approach reasonable?

TasNetworks continues to develop its thinking with regard to increase grid resilience and mitigating the effects of HILP events. TasNetworks would be more than happy to share these insights with AEMO in the appropriate forum.

Q10. What other factors should be considered in the methodologies or proposed 2019 improvements to determine future inertia or system strength requirements?

The potential for decreasing system strength and inertia to impact on power system stability has been acknowledged. For example, fault level issues at Georgetown in Tasmania's North have increased, with existing constraint equations being, at times, inadequate for addressing system strength concerns. With the anticipated retirement of large synchronous generators, this situation could be expected to affect all NEM regions.

The detailed long term model, being an energy-only model (i.e. it does not model the contribution of ancillary services) will not inherently capture the impact of reducing fault level or inertia on dispatch outcomes. Considering Tasmanian outcomes, if either Marinus Link or significant wind development is forecast by the DLT model, it is entirely possible that the model could predict that Tasmania's demand could be sourced entirely from non-synchronous sources in some dispatch intervals if that was the economically efficient outcome. The laws of physics, however, mean this is outcome is not plausible.

We understand that AEMO feeds the outcomes of the DLT model to its short-term time sequential model to capture realistic dispatch behaviour. However, we are unaware of the details of the feedback process from the time-sequential model to DLT modelling or the number of iterations undertaken, nor whether every dispatch interval is considered in the time sequential model, nor how resource-intensive this iteration process is.

TasNetworks suggests that, rather than having no representation of inertia or fault level effects in the DLT model, some simplified representation of either fault level or inertia be introduced. For example, modelling inertia and system strength on a power station, power scheme, or Renewable Energy Zone (**REZ**) basis as opposed to an individual generating unit basis. Such a representation would not be perfect, however it would provide an initial attempt to ensure plainly implausible dispatch outcomes could not be predicted by the DLT model.

TasNetworks is currently attempting to formulate a simplified approximation of fault level and inertial impacts for its own modelling purposes. A prime consideration in our approach is to avoid increasing the number of variables in the model and we would be pleased to work cooperatively with AEMO on this.

We also note that GHD's Cost and Technical Parameters Review report includes costs for synchronous condensers, the mitigating technology likely to be employed to solve locational fault level issues or provide increased inertia.