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Our ref: E308248

Jodi Trigg

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Power and Water Corporation

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Dear Jodi

Review of submissions from Round 2 of the Generator Performance Standards (GPS) Stakeholder Consultations

As requested by Power and Water Corporation (PWC), Entura has reviewed stakeholder submissions made under Round 2 of the Northern Territory (NT) GPS Stakeholder Consultations with a view to determining whether any of the submissions would alter Entura's technical advice as presented in our report "NT Generator Performance Standards Code Review", Doc ID E308248, dated 20 June 2019.

We have reviewed the following submissions received via the PWC website:

- NT Solar Futures
- Tetris Energy
- Assure Energy
- Pro Analytics
- NT Airports
- Territory Generation
- Climate Action Darwin
- Energy Developments Pty Ltd (EDL) – Late submission

Plus three confidential submissions provided by PWC.

On the basis of this review, and a review of the scope of work and technical advice presented in our report, we confirm that our position as presented in that report is unchanged.

We offer the following commentary to expand on this position:

- Scope
    - A number of elements raised in the submissions are outside the scope of Entura's previous technical advice, and so these have no bearing on our position expressed in this letter. These include submissions in respect of:
        - Grandfathering conditions
        - Consultation processes
        - Definitions, drafting errors, cross referencing conflicts, documentation hierarchy
        - General or overarching statements about the renewable energy outcomes and alignment with policy.
- Forecasting accuracy
    - A number of submissions cite limitations in forecasting accuracy as a barrier to the proposed plant output forecasting requirements. Entura understands that these submissions relate to the accuracy of technologies to forecast solar PV output due solely on irradiance variation. Entura's baseline position in its report is that the proposed forecasting requirements can be met through the implementation of energy storage (thus providing sufficient backing for plant output forecasting), and as such are not reliant on irradiance forecasting.
    - Entura also recognised that irradiance forecasting may be available as an alternative to energy storage. In considering this alternative, we noted the need to forecast minimum production, not expected production (requiring a level of curtailment). The intent of Entura's statement was that plant output could be forecast in compliance with the requirements after taking into account the uncertainty in irradiance forecasting and adopting an acceptable risk position (for example, 90% probability of exceedance). Entura is aware that the confidence interval of prediction expands with the length of the forecast window and under partially cloudy conditions and that this may mean a relatively high self-imposed curtailment costs in early years, however, we expect irradiance forecasting accuracy will improve substantially over time and with more operational experience.
    - Some submissions include requests for forecasting requirements that are based on the current capability and accuracy of irradiance forecasting (i.e. shorter duration forecasts or allowing positive / negative variation within bounds of estimated production). Entura does not consider that these approaches would inherently meet the dispatch requirements driving the GPS changes (and again notes that limitations in one technology should not drive the standards, considering that other approaches such as storage are available).
    - For information, Entura has examined commercial supplier forecasting data from current operational sites in the NT. This data shows that current irradiance forecasting systems can forecast 5 minute interval production levels, up to 30 minutes ahead, such that the average actual production for the forecast interval meets the requirements of the forecasting provision (i.e. 90% of forecasts not exceeding actual capacity; remaining forecasts within 5% or 1 MW of actual capacity). As such, Entura's assessment

considered what storage provisions are required within a 5 minute interval prevent short duration (15s) dips in generation below the forecast level, and our findings are based on this assessment.

- For embedded generators coupled with load (including zero export systems)
    - Entura agree that there may theoretically be circumstances embedded generation systems coupled with load may have a zero export constraint and be prevented from meeting proposed forecasting requirements because of load variation. Considering the minimum generator size where the requirement applies, Entura consider it very unlikely that any new generators would connect under a zero export constraint.
- Generator classification
    - A number of submissions argued for the need to have different conditions for different generator types to suit their inherent capabilities. While not directly related to Entura's scope, Entura has considered the implication that some types of equipment need not be subject to forecasting or reactive power requirements. In this respect, Entura's view is that:
        - The forecasting requirements are likely to be sufficiently flexible for different generator requirements. As noted above, for solar PV plant, requirements can be achieved through coupling battery storage (or alternates) and as per our report, reactive power and frequency control requirements can also be met.
        - For other specialised equipment like synchronous condensers or flywheels, forecast energy would generally constant power consumption near zero and reactive power can be provided via the alternator, and thus can be accommodated under the requirements.
        - The forecasting, reactive power and frequency control requirements can be met by a range of generators providing different grid functions even if in some instances the forecasting requirements do not directly add value.
- Distributed generation and spatial smoothing of solar variations
    - A number of submissions argued spatial distribution of medium and small generators may have benefits including:
        - Greater spatial smoothing of total solar generation resulting in reduced forecasting requirements on individual generators and reduced total reserve capacity requirements.
        - Reduced risk of loss of reserve capacity from a fault on the Channel Island – Katherine interconnector (in particular).

      And that consequently this may favour a centralised approach.
    - While the specific benefits of spatially distributed generation are generally consistent with Entura's views expressed in our report, Entura has also recognised that there is currently potential for significant clustering of generation in the network, which may negate spatial smoothing benefits. This clustering would build in a reliability risk with relatively high frequency of occurrence (substantial change in total generation output due to cloud banks multiple times per year).

- Entura's report also noted the risk of locating ancillary services on radial feeders (e.g. Channel Island – Katherine interconnector) where a fault on that feeder may prevent access to these services.
- The impact of these factors will depend on network planning and siting of new projects.

- Costs
  - Several submissions challenge the notion that distributed storage with generation is least cost and argue that centralised storage will result in lower cost to customers. Some specifically challenge Entura's 'suggestion' that distributed storage with generation is least cost. Entura's view on this is:
    - Entura did not identify in its report that distributed storage would be the least cost solution (Entura has not conducted an economic analysis of the options), only that it was more likely to deliver a least cost solution considering the factors in its favour. Aside from the following two arguments, the submissions provide limited detail in support of their position, nor do they specifically address the points in favour of distributed storage with generation presented in Entura's report.
    - The first argument against distributed storage being least cost was the scarcity of DC coupled battery solutions in the Australian market. Entura agrees that this is currently the case (noting that there are still some suppliers), but our view is that this is not due to technical limitations but rather to a lack of current demand in the market driving these product offerings from suppliers. DC coupled solutions are more widely available in the international market and while there has typically been a short lag introducing new products in the Australian market, Entura do not consider their availability a major barrier to the proposed requirements. Further, as per our report , there are several other ways to meet the requirements than just DC coupled battery solutions.
    - The second argument was that centralised batteries can offer a range of other services such as fast frequency response (R-FCAS, C-FACS), reactive power provision, synthetic inertia, real and reactive fault contribution, voltage support, etc. However, in Entura's view, all of these services can also be provided by distributed storage, and in some instances such as voltage support and active power smoothing, distributed capacity may be more valuable than centralised capacity in improving network infrastructure utilisation (and delaying new investment).

Yours sincerely

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