Shell ENERGY

6 August 2024

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RE: Amendments to the Inertia Requirements Methodology

About Shell Energy in Australia

Shell Energy is Shell's renewables and energy solutions business in Australia, helping its customers to decarbonise and reduce their environmental footprint. Shell Energy delivers business energy solutions and innovation across a portfolio of electricity, gas, environmental products and energy productivity for commercial and industrial customers, while our residential energy retailing business Powershop, acquired in 2022, serves households and small business customers in Australia.

As the second largest electricity provider to commercial and industrial businesses in Australia[1], Shell Energy offers integrated solutions and market-leading[2] customer satisfaction, built on industry expertise and personalised relationships. The company's generation assets include 662 megawatts of gas-fired peaking power stations in Western Australia and Queensland, supporting the transition to renewables, and the 120 megawatt Gangarri solar energy development in Queensland. Shell Energy also operates the 60MW Riverina Storage System 1 in NSW. Shell Energy Australia Pty Ltd and its subsidiaries trade as Shell Energy, while Powershop Australia Pty Ltd trades as Powershop. Further information about Shell Energy and our operations can be found on our website here.

General Comments

Shell Energy believes there is merit in more clearly defining in the Inertia Requirements Methodology what is meant by inertia and inertia services and what are the goals of procuring inertia. We note that the goal of determining an inertia requirement is to enable system frequency control within determined limits. These limits include frequency excursion limits and rate of change of frequency (RoCoF) limits. We believe it is important to link these concepts explicitly because inertia is one of many services that can be used to control the system within the defined frequency limits. Other services include fast frequency control, System Integrity Protection Schemes (SIPS , and load shedding. It should also be recognised that increasing inertia can create risks to the system particularly if implemented without concurrent system-wide improvements in governor response, as high levels of inertia slow down the frequency response of the system, and increase the magnitude of frequency excursions which can put rotating plant and harmonic filters at risk.

Shell Energy supports further consultation on the identification of sub-networks where inertia services are to be procured by TNSPs. The Methodology does not provide sufficient clarity around the identification of the sub-networks and potential system islands. Without further detail it is difficult to gauge the suitability of any proposed methodology to control frequency in these sub-networks. There are some large radial sub-networks (eg Olympic Dam) where inertia would not be suitable for control in an islanding event as complete loss of

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[1] By load, based on Shell Energy analysis of publicly available data.

[2] Utility Market Intelligence (UMI) survey of large commercial and industrial electricity customers of major electricity retailers, including ERM Power (now known as Shell Energy) by independent research company NTF Group in 2011-2021.

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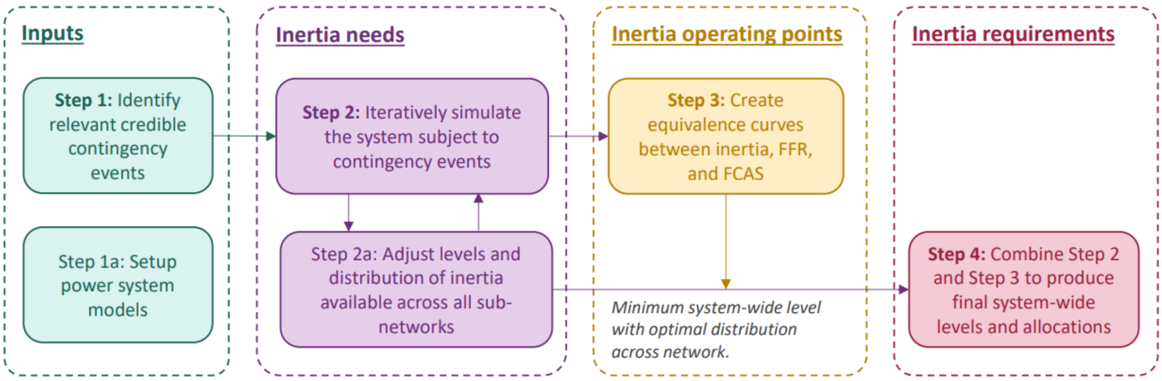
supply is the accepted outcome. Whilst this is an extreme example, the load and generation mix within any sub-network will play an important role in determining the most effective way to control frequency outcomes in the case of an islanding event.

When finalising the process and parameters for approving equipment (section 3.3.3 and 3.3.4), we encourage AEMO to consider the potential impact on system costs. As noted below, Shell Energy considers that the requirements methodology may limit access to inverter-based resources. This result could lead to additional costs to projects and consumers as it would necessitate installation of plant capable of providing physical inertia, such as synchronous condensers. We believe this would be a sub-optimal outcome as it may slow investment in inverter-based technologies, including renewables, adding further costs to consumers which is not in their long-term interests.

We have included responses to specific questions from the consultation document in the table below:

Question in Document	Shell Energy Response
3.1.2. Description of proposal	
Do you consider the proposed high-level methodology for determining the system-wide inertia levels and inertia sub-network allocations is appropriate?	Steps 1 and 2 in Figure 2 below are supported because this reflects long standing engineering practices. However, it is unclear what Step 2a would mean in practice. There is a high risk that the development of the system does not align with modelled requirements over the 10 year horizon which could lead to substantial levels of inefficient investment. Shell Energy supports explicitly modelling the contribution of each service to frequency control rather than the use of equivalence curves as identified in Step 3.

Figure 2 High level overview of assessment methodology for system-wide inertia levels



If not, what specific alternatives or additions might better address the NER requirement, and why?	Modelling of Fast Frequency Response, FCAS, and other services should be explicit. The use of equivalence curves could result in an incorrect understanding of the physical relationships between them which in turn risks serious engineering errors due to inadequate or flawed understanding of the system.

Are there any other issues relevant to the system-wide inertia level and inertia sub-network allocation methodology that AEMO ought to take into account?	Shell Energy notes that the location of inertia services could result in different frequency oscillation modes at a system-wide level, which should be taken into consideration. Beyond this, our view is that the location of an inertia service only needs to be considered to the degree that inertia in each separable island contains the correct amount and type of frequency control.
3.2.2. Description of proposal	
Do you consider the proposed factors for classifying sub-network islanding risk are appropriate?	Our view is that the proposal is very open-ended and risks excessive resources being applied to determining potential network islands. We consider further open consultation necessary as sub-network identification progresses to ensure that an appropriate methodology is applied and that the granularity of sub-networks is appropriate.
If not, what additional or alternative factors should also be included in this assessment, and why?	We suggest AEMO use a pragmatic approach based on identifying the weak cut sets of network edges, and the potential for high power flows across the branches to cause trips, separating the system into islands. Radial feeds to loads or generation should be removed from consideration. This process could benefit from further consultation with stakeholders.
3.3.3 and 3.3.4. Proposal for process and requirements to approve equipment	
Are the proposed parameters and requirements for a service to qualify as an inertia network service appropriate?	Shell Energy notes that the following listed requirement effectively rules out inverter-based resources as contributors to synthetic inertia provision since all electronic systems require measurements of the voltage waveform. We suggest reconsidering this requirement to ensure it is appropriate for inclusion of grid-forming inverter systems, and grid following systems where appropriate. *"Initiation of the synthetic inertial response must be inherent; that is, it should not require the calculation of frequency or RoCoF through measurements of the grid voltage waveform"* In Section 3.3.4: The first formula listed is incompletely defined and requires reference to the source CIGRE document. When we downloaded the referenced document to validate the formula it appeared not to contain the relevant formula.

	We would suggest the second formula be revised to conform with conventions to avoid confusion. E.g. ω should be $\Delta\omega$ when indicating a change in frequency etc.
Which of the approaches outlined for estimating the inertia level provided by non-synchronous equipment do you consider most appropriate, and why?	We consider that not enough information has been provided to make a determination between the approaches. All three cases presented, and others not listed, may be appropriate in different contexts.
Are there any alternative approaches to estimating the inertia level provided by non-synchronous equipment which AEMO should consider?	Explicitly modelling the response of the power system to a loss of load, generation or interconnector and considering the frequency control contribution of each type of service is an approach that we support.
Are there other issues relevant to the inertia service specification that AEMO should consider?	We recommend that services such as fast load modulation, load shedding, and generation curtailment in response to frequency excursions should be considered as they all have the ability to contribute to frequency control and system security.
3.4.2. Description of proposal	
Do you consider the proposed amendments appropriate for the calculation of secure inertia levels in each inertia sub-network?	The current level of detail around sub-network selection, location and resource mix is insufficient to make an informed determination regarding the appropriateness of the proposed amendments.
If not, what additional or alternative changes might better address the NER requirement, and why?	We consider that further consultation on identifying sub-networks is necessary to inform the methodology for calculating inertia requirements in each area.
Are there any other issues relevant to the secure inertia level requirements that AEMO ought to consider?	The transition of the grid to low or near zero (physical) inertia should be considered. The secure and reliable operation of the grid under the widest range of conditions is the goal rather than inertia levels alone.
3.5.2. Description of proposal	
Do you consider the proposed amendments appropriate for the calculation of satisfactory inertia levels in each inertia sub-network?	It is unclear how potential islands are going to be identified. It is also unclear how flows across interconnectors are expected to behave or be considered. We consider additional detail in these areas to be necessary.
If not, what additional or alternative changes might better address the NER requirement, and why?	See above
Are there any other issues relevant to the satisfactory inertia level requirements that AEMO ought to consider?	See above
3.6.3. Proposal for single-mass model tuning	

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Are the proposed future system conditions appropriate to consider as part of forward-looking inertia studies?	Our preference is for modelling to explicitly consider each type of service. Future system conditions should contain sufficient detail to enable examination of services individually by type. A sufficient range of future service mix outcomes should be considered to give confidence that service procurement will deliver the system security outcomes expected.
If not, what additions or alternatives should AEMO consider in forecasting inertia requirements?	We recommend close monitoring of the existing system to ensure that modelled outcomes align as closely as possible with real world outcomes. Model calibration based on real outcomes should be fundamental to the process.
3.7.2. Terminology updates – issue description and proposal	
Do stakeholders have any other concerns or additions to the proposed minor amendments introduced to maintain consistency with the broader changes in the Amending rule?	The proposed approaches to inertia procurement are focussed on only one parameter of a very complex and integrated system. While this is necessary, we do not believe it is the whole solution. A more wholistic approach would target the desired outcome, which is good frequency control across a wide range of circumstances to ensure system reliability and security. We note that good frequency control is not guaranteed by high amounts of inertia. Neither does it guarantee good system reliability. High amounts of inertia may cause higher power swings which makes line tripping on overload more likely. This leads to higher probability of islands forming during events which could cause cascading failures. These risks will be minimised through prudent analysis focused on the goal of frequency control and recognition that inertia is just one tool to address system security considerations.

Shell Energy looks forward to continuing to work with AEMO as development of the inertia procurement process progresses.

For further information or to discuss any questions regarding this submission, please contact Peter Wormald

Yours sincerely

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