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Australian Energy Market Operator

By email: PSMGReview@aemo.com.au

Dear Sir/Madam

Power System Model Guideline Issue Paper Consultation

Transgrid welcomes the opportunity to respond to the Australian Energy Market Operator's (AEMO) Power System Model Guideline (PSMG) Consultation Paper. As the jurisdictional planner, operator and manager of the transmission network in NSW and the ACT, we have an important role to play in the transition to a higher renewables penetration.

Transgrid is eager to assist AEMO in making practical, clear and reasonable updates to the PSMG to better maintain power system security and facilitate new plant connections. Transgrid is supportive of engaging in solving challenges for AEMO, NSPs and connecting customers which leads to smoother model management for the NEM. The benefits of which include reduced power system modelling challenges to entry for the significant volumes of asynchronous renewable and storage projects that need to connect during this energy transition.

Transgrid considers that:

1. Some parts of the PSMG need to be modified to be a better fit for today's needs of network modelling; and
2. Due to the recent modelling issues from inverter-based asynchronous generators and loads, some new aspects need to be added to PSMG.

Transgrid would like to provide the responses to the questions of the issues paper as follow. However, we acknowledge that some topics require further power system studies, and some are out of the Transgrid's area of oversight for planning and operating the network and will require attention of other organisations such as Distribution Network Service Providers (DNSP). Transgrid will take the opportunity to provide more detailed responses when the guideline is published for consultation.

Transgrid responses to the questions raised in the issues paper are outlined in the table below.

Questions	Description	Response
1	What is the threshold (if any) for deciding when to model a traditional large power system load in detail for power system simulations, be it megawatt-based, location-based or otherwise?	Transgrid proposes the same threshold as Generator automatic exemption's to be considered. The loads above 5 MW to be modelled unless no material impact from the load is observed by the Network Service Providers (NSP).

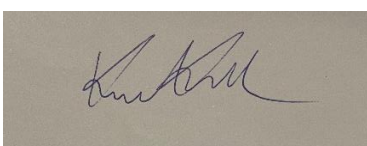
		<p>Transgrid notes that increasing the number of loads or converting the conventional load modelling could increase the complexity of the models and the simulation processing time and therefore these impacts need to be considered prior finalising the thresholds.</p>
2	<p>Is the IEEE or Composite and DER Load models suitable for these types of loads or is more detail required?</p>	<p>Transgrid believes that the proposed Composite load model, subject to further benchmarking would be acceptable for accurately representing loads in power system analysis. Transgrid believes that DNSPs may be in a better position to comment on this.</p>
3	<p>Are there any other types of large loads that have not been considered here?</p>	<p>Due to potential increase to the demand of Electric Vehicles (EV) in the future and their likely application for power system controls, Transgrid believes that PSMG should include guidance on incorporating EVs in load modelling.</p>
4	<p>Is the Composite and DER Load model sufficient to model data centres in RMS and EMT domains?</p>	<p>The proposed composite load model seems to have enough adaptivity to broadly reflect the data centres, but more measurements may be required to best use the proposed model.</p> <p>Transgrid also note that if one specific vendor is the dominant data centre load type, perhaps a vendor specific model can be a better representative.</p>
5	<p>What additional protection and control systems are expected to be required in the models?</p>	<p>Protections that impact ride through of load in the events of frequency or voltage disturbance need to be modelled. In this regard, the proper modelling of voltage-slip characteristic is very crucial for induction motors or RoCoF or power angle change for IBL.</p> <p>Transgrid also notes the importance of On-line Tap Changer (OLTC) and capacitor banks if they exist within the load.</p> <p>Control systems that may impact recovery from a disturbance also need to be considered. This can include behaviour of soft-starter or variable speed drives (VSD)/variable frequency drives (VFD).</p>
6	<p>What level of detail is required for IBL in RMS and EMT domains?</p>	<p>Transgrid suggests the following details to be considered:</p> <p>Dynamics of active and reactive power response in the event of voltage and frequency disturbances in both EMT and RMS.</p> <p>Transformers energisation, saturation curves and other impacting factors on inrush studies for EMT.</p>

		Filter bank switching logic and point-on-wave (POW) if exists.
7	What are the black start simulation model requirements for large power system loads (if any)?	Transgrid believes that correct load rating, transformer energisation (POW or pre-insertion resistor (PIR)) and saturation characteristics, large scale motor starting and its ride through capability, auxiliary reactive plants (if any) can be critical for the loads which participate in black start.
8	What level of R2 validation is appropriate for different types of load models?	<p>The key tests are the responses of the load to voltage disturbances such as system faults (under ongoing monitoring where possible), transformer tap changer or capacitor/reactor switching. The response to frequency change can only be limited to any system incident (if it happens during R2 or under ongoing monitoring).</p> <p>If the composite load model is going to be used for the modelling, the key part of the R2 should be regarding validating the proportion of the aggregated load indices so that the model can correctly represent the proportion of each sub-component. If there is opportunity to perform modelling on each component of composite load model (let's say motor type 1 first and then type 2, and so on), it would make fine tuning of the model parameters easier.</p> <p>In addition to R2 testing Transgrid sees the value of vendor specific HiL that are common in large loads such as data centres.</p>
9	What should the requirements for model provision in Section 7.4 be for IBL? Should it be identical to Generator data?	Transgrid believes that there are parts in section 7.4 that may not apply to load models or at least all load models. Transgrid will provide more details in the review of the actual guideline.
10	What components should be included in a new table in Appendix C for IBL? Are there any specific control systems, protection systems or other components that are specific for loads that will have material impact on power system simulations?	Composite load model components can be included in appendix C for IBL similar to the tables under C.4.1.
11	Are there any other issues relating to model requirements for large loads that AEMO has not considered?	Transgrid considers that further investigation should be undertaken for large industrial loads such as smelter and steel mills.
12	Are there any other methods that could guarantee that models remain usable for the life of the plant despite changes to simulation tools, versions,	Transgrid considers that availability of the source code is a key input to the long-term guarantee of model compatibility with different simulation tools and versions.

	or compiler toolchains that AEMO has not considered here?	There have to be ongoing coordination between site firmware changes and updating the source code.
13	Would there be any issues with developing a DLL to conform with a standardised explicit linking routine?	This is a reasonable approach; however, Transgrid believes that further discussions with vendors are required to address all the possible future scenarios.
14	Are there any issues with the proposals made under “Other matters”?	Transgrid supports to remove the references to RMS in the context of PLL or other functions. Transgrid also suggests PSMG to introduce methods for the validation of small signal models during commissioning of the plant.
15	Are there any additional required modifications to the Guidelines that AEMO has not considered here?	Some NSPs including Transgrid predominantly uses PowerFactory. PSMG should provide a clear statement that at the request of NSP, PowerFactory (or a nominated model) must be provided by the generator at the connection phase to represent the static and dynamic performance of the plant. Transgrid also proposes that each individual project provides a fully unencrypted SSAT model to assist with long term compatibility issues between different revisions and model platforms. Transgrid also see the necessity of PSMG stating the source code of the model to be also available to the NSPs and not only to AEMO. This should also apply to software platform other than PSSE such as PowerFactory and SSAT. Transgrid also propose the existing PSMG section 6.2 to be reconsidered in terms of accuracy criteria. There are multiple points in this section that may not fit the requirement of industry or at least require more clear wording.

We look forward to working with AEMO to further improvement of the Power System Model Guideline. If you require any further information or clarification, please feel free to contact Navid Aghanoori, System Analysis and Modelling Team Lead, at navid.aghanoori@transgrid.com.au.

Yours faithfully



Kasia Kulbacka

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