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Australian Energy Market Operator

By email: PSMGReview@aemo.com.au

Dear Sir/Madam

Power System Model Guideline Draft Consultation

Transgrid welcomes the opportunity to respond to the Australian Energy Market Operator’s (AEMO) Power System Model Guideline (PSMG). 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 renewable 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.
3. Transgrid also find it necessary to include the updates for the small signal modelling due to the evolving of the dynamic of the power system which were historically dominated by the synchronous machines.

Transgrid would like to provide the responses to different sections of the draft PSMG.

| Item No | Section | Page | Description |
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| 1 | 3.1 | 15 | Transgrid suggests the wording of this page where it states the “platform” to change to “the platform nominated by the NSP and AEMO”. This will assist the NSPs who heavily use modelling platform other than PSSE and PSCAD. |
| 2 | 1.3 | 15 | Transgrid recommends distinguishing between large signal and small signal block diagrams. As AEMO and NSPs are moving towards modelling asynchronous generators, it will be very useful |

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| | | | and necessary to receive an accurate linearised block diagram from OEM for small signal modelling. |
| 3 | 3.1 | 16 | If the statement “pre-commissioning model confirmation test report ²⁶ ” refers to pre-test simulation that are done prior to hold point testing, Transgrid suggests this item to be also added to AEMO’s published check list of R1 package for consistency. |
| 4 | 3.2 | 16 | Regarding the first paragraph of section 3.2, Transgrid recommends the following clarification: <ul style="list-style-type: none"> 1- Is this intended to imply that the proponent has a choice between the first and the second option or, the approach will be determined by NSP/AEMO? For example, if the load model cannot be modelled as IEEE ZIP or composite load model, can the proponent still provide load model using these standard models with some inaccuracies? 2- Is the composite load model referring to the AEMO library load model meaning that AEMO will make these models publicly available through data request? |
| 5 | 3.2 | 16 | Regarding the first paragraph of section 3.2, second sentence, should the “an NSP” change to “the connecting NSP”? |
| 6 | 3.4 | 17 | Does table 3, which describes the exemption criteria, mean all the connections above 5 MVA or below 5 MVA with SCR of less than 10, cannot be exempt? Transgrid believes adding some examples in the guideline for some generators with 1-4.9 MVA and SCR of 1-9.99 might be useful. |
| 7 | 4.0 | 17 | Can AEMO also refer to DMAT guideline in this section as there are some overlapping areas between the two guidelines? |
| 8 | 4.3.1 | 20 | Transgrid suggests adding some examples to clarify the term “Numerical Stability”. |
| 9 | 4.3.1 | 20 | Transgrid finds “at least five minutes” more appropriate than “up to five minutes” for the numerically stable performance of the model without disturbance. |
| 10 | 4.3.1 | 20 | With regards to the existence of a characteristic in the model where it does not have an equivalent in the actual plant, Transgrid suggests further notes or adding examples to this section may assist further in better understanding of this requirement. |
| 11 | 4.3.1 | 21 | Transgrid suggests the section that references to modelling to be initiated at any power down to 0 megawatts, to be changed to “any active power over the operating range of the plant”. |
| 12 | 4.3.1 | 21 | Transgrid suggests the reference to the available power from the fuel to change to available power from the energy source. |
| 13 | 4.3.5 | 24 | Where the guideline references to “When these preconfigured system conditions are beyond plant operational limits or otherwise not consistent with valid operating conditions for the plant, the model must warn the user by way of a message to the progress output device;”, Transgrid suggests that the guidelines include details of how the warning should be raised and the interpretation of it to be explained in the RUG. Currently, some models provide error with no explanations in the warning message or in the documentation. |

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| 14 | 4.3.5 | 24 | Park controller models should be required to be attached to the controlled bus/es and not a particular generator bus. This is to account for when generators are offline/disconnected which have those models connected to them. |
| 15 | 4.3.5 | 24 | Transgrid suggests the guideline include the requirement of temperature dependencies. |
| 16 | 4.3.5 | 24 | Transgrid highly recommends including a discussion on the requirement of spike mitigation implementation, the necessity of it under certain conditions and the acceptable methodologies. This will bring more consistencies that currently exist across the industry. |
| 17 | 4.3.5 | 25 | Transgrid recommends the inclusion of the requirement of OLTC dynamic modelling more clearly in this section as it can improve the initialisation of the models placing the tap changer in the correct position. |
| 18 | 4.3.5 | 25 | Transgrid recommends modelling the temperature dependencies in both RMS and EMT modelling platforms. This will remove the challenges during the commissioning, R2 model validation and ongoing compliance of the plant. |
| 19 | 4.3.6 | 25 | Transgrid recommends that the guideline provides the details of requirement regarding the average model versus full IGBT modelling and accuracy criteria for when these two modelling are claimed to be interchangeably used. |
| 20 | 4.3.12 | 31 | <p>Transgrid recommends excluding the RMS and EMT specific model versions.</p> <p>Perhaps other AEMO's guidelines or web-interfaces may be more suitable protocol for communicating this requirement.</p> |
| 21 | 4.5 | 34,16,46 | <p>Transgrid recommends where guidelines refer to Small-signal stability models submissions, it is noted that the submission must be in the platform nominated by the NSP. Transgrid is of the view that, any other format than SSAT model, will be extremely hard to maintain for a long period of generator's operation. If NSPs are requested by AEMO to provide SSAT model of every generator, and the NSPs must build the SSAT model from the block diagram, this will significantly increase the workload and as a result will significantly increase connection processing time. The other methods such as model identifications can be contradictory with small signal because it will not be known whether any limiter that has been reached. Additionally, it will be difficult to keep repeating the studies across many projects for different operating points. Therefore, having proper SSAT model by OEM knowing the linearities and non-linearities and maintaining over 30 years and updating it for 5.3.9 and S5.2.2 process, appears to be the most robust way moving forward.</p> <p>Additionally, if NSPs and AEMO are expecting the proponents to provide the small signal model, we have added small signal model submission in section 3.1 page 16 as well. Not listing them in that section, makes it unclear on whose responsibility it is to build the models.</p> |

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| 22 | 4.6 | 35 | Transgrid recommends this section makes reference to the 240-page CIGRE Technical Brochure 766, entitled "Network Modelling for Harmonic Studies". |
| 23 | 4.7.3 | 40 | <p>Transgrid recommends further clarifications to be provided regarding the below quoted statement on whether main grid-connected power transformers can be aggregated or not.</p> <p>To be able correctly capture the impact of the transformer on many aspects of power system modelling including power quality, static and dynamic performances, non-linear behaviour during saturation of the transformer on voltage and more, in normal operation as well as outages and contingencies, Transgrid suggests the transformers of the high voltage plant connecting directly to the transmission network to be explicitly modelled and not in an aggregated arrangement.</p> |
| 24 | 6.2.1 | 48 | <p>Transgrid seeks clarification on the requirements under section 6.2.1(b)(iii):</p> <p>1- It seems to refer to the comparison between measurement and simulated quantities, but instead it refers to phase angle between different quantities e.g. P and Q which does not necessarily mean any inaccuracy of the model.</p> <p>2- Additionally, with high bandwidth of inverter controllers, 5 Hz to be upper limit of this requirement seems very generous.</p> <p>3- "Damping with footnote 53" may need to either refer to adequately damped or at least "positively damped". However, again, undamped or damped, does not directly relate to model accuracy.</p> |
| 25 | 6.3.3 | 53 | Transgrid notes that one of the issues in the commissioning stage is that the tests noted in table 6 are often interpreted incorrectly with the tests requested to be undertaken and overlaid in Hold Point testing versus R2 model validation report. Therefore, Transgrid recommends an additional note clarifying that these are the minimum requirement would be helpful. |
| 26 | C.1.2 | 63 | Transgrid assumes that this statement applies to type 3 wind turbines, and for this we recommend to also include Grid Side Converter (GSC) quantities. |

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

D Thomson

Doug Thomson

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