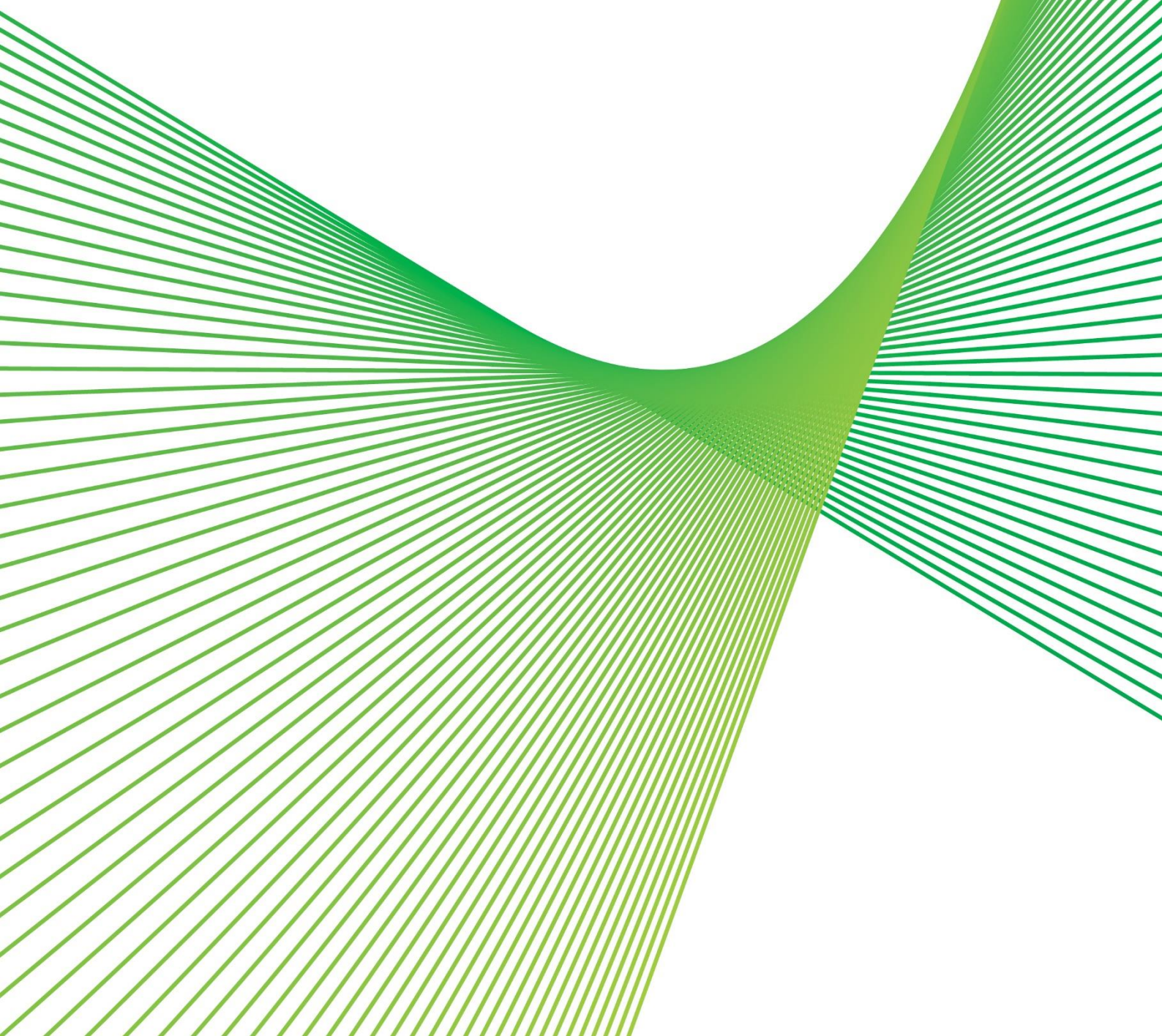![Transgrid logo]

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Technical performance and power system modelling requirements for a synchronous system security service

Supplementary to the 'meeting system strength requirements in NSW'
Project Assessment Draft Report (PADR)

Date of issue: 17 June 2024

Contents

1. Introduction and scope

This document specifies technical performance and power system modelling requirements for existing synchronous generators (Contractors) that are contracted (or proposing to contract) with Transgrid to provide system security services, including:

- System strength – fault current contribution;
- System strength – stable voltage waveform support; and
- Inertia.

Transgrid intends to negotiate a single network support agreement (NSA) to cover all system security services, e.g. a single NSA that covers both system strength and inertia.

Transgrid has developed this document based on best available knowledge and information and is now seeking industry engagement to help refine it. As such, this document should be considered in draft form, and we seek your feedback during our system strength PADR consultation period (closing 2 August 2024, contact systemstrength@transgrid.com.au).

2. Technical requirements for synchronous machines

2.1. Software and Hardware requirements

2.1.1. General Requirements

The generator must meet or exceed the agreed Generator Performance Standard throughout the term of the NSA.

Transgrid may also undertake Power System simulations using the models of the contracted generator at any time during the term of the NSA. These simulations are to ensure the effectiveness of the system security service at all times during the term of the NSA, under different conditions. Throughout the contract period, Transgrid may request a parameter change if further tuning of the control parameters is deemed necessary to address a system security issue in a specific part of the network. In such cases, both parties will work in good faith to implement the agreed changes, according to a process defined within the contract and NER requirements.

The following models must be compatible with the version of the wider network models that Transgrid and AEMO maintain and include the following modelling platforms:

1. PSSE 34.7 and the latest acceptable version by AEMO (Source code format to be Fortran base as requested by AEMO). It is anticipated that AEMO will migrate the existing models to a later version of PSSE in parallel to this RIT-T process. It is expected that if the Contractor submits any new or updated model, it is compatible with PSSE 34.7 and PSSE 36.

2. PSCAD V4.6 and PSCAD V5 compatible with Intel Fortran Compiler 2021 compliant with DMAT [2]. For the existing generators, it is expected that the models which are provided to Trangrid and AEMO are already compatible with these two platforms. If a compatibility issue to either of these platforms are observed, it is expected that the Contractor works with Transgrid in good faith to address the compatibility issue.

3. SSAT V20 and V22 compatible with Transgrid SSAT Submission Requirement [3].

a. For SSAT, models must be developed as per block diagrams.
b. Should the OEM have no experience with this software platform, Transgrid may assist the OEM developing this model.

4. PowerFactory V23

If the modelling package of the existing generator which has been previously submitted to Transgrid and AEMO, is still valid, no specific modelling action is required from the Contractors unless noted otherwise in this document.

It is also the Contractor's responsibility that the modelling and technical information of the generators either previously or newly provided to Transgrid always correctly reflect the actual performance of the generator. These performances include but are not limited to static, dynamic and protection behaviour of the generator. For any inaccuracy in the modelling representation, Contractors must work with Transgrid in good faith to address the observed issue.

If the Contractor intends to make any alteration to the generator which has a potential impact to the system security service, Contractor must consult with Transgrid prior to the change. These changes may include but are not limited to NER 5.3.9 or S5.2.2 alterations.

2.1.2. Compliance and Reporting Requirements

2.1.2.1. Compliance requirements

Should there be any outstanding non-compliance or non-conformance that may impact the performance of the generator regarding the system security services, the Contractor must include the non-compliances in the proposal and provide a rectification plan explaining how to address the non-compliance as per the NER, and subsequently seek to address it in good faith to Transgrid's, AEMO's and AER's satisfaction.

2.1.3. Technical Documentation and Power System Modelling

2.1.3.1. Testing of the required services procedure

Unless a new modelling package with a new performance is submitted to Transgrid from the generator involved in system security services and a new due diligence process is followed, the Contractor must warrant that all the existing performances observed in the R1, R2 (5.3.9 if relevant), remains compliant and unchanged.

2.1.4. Simulation Specifications and results

For all the new or updated models provided to Transgrid (e.g. as a part of system security services contract or otherwise), Contractors must comply with the following requirements:

1. The new or updated modelling package must follow the AEMO R1 submission checklist.

2. As a result of the modelling work, Transgrid may request a parameter change if further tuning of the control parameters is deemed necessary for more optimal and better system strength service. In such cases, both parties will work in good faith to implement the agreed changes, according to a process defined within the contract and NER requirements.

3. Any new model (or updated model) must go through due diligence process as well as reduced or full DMAT.

4. For any new or updated model, a new or updated Releasable User Guide must be submitted. RUG must be a standalone document without needing to refer to any other OEM document.

5. All new dynamic models must be benchmarked against other relevant valid dynamic models (e.g. PSCAD V5 and higher version of PSSE). The details of benchmarking studies and reports must be agreed with AEMO and Transgrid depending on the relevance.

6. If any new model such as SSAT, PSCAD V5 or PSSE 36 will be submitted, a mapping sheet of parameters between real implementation and the models must be submitted for RMS, EMT, Small Signal and real implementation.

7. The encryption of the new or updated models must follow [1-3] for any new model.

8. If not already, the RMS block diagram must be provided to Transgrid which will be used for modelling the generator in an internal small signal modelling platform for benchmarking purposes with SSAT. Block diagrams are to be submitted as an independent document and not a part of RUGs while RUGs include block diagram of the key components such as Excitation, PSS and Governor.

9. For any new or updated model, all the protection logics must be represented in both PSSE and PSCAD models that reflect the tripping thresholds of the generator in the event of relevant disturbance. This means, if Transgrid applies a disturbance on the grid, and the PSSE and PSCAD models newly or previously submitted by the Contractors indicates the ride through of this fault in stable manner, the generator must also ride through in reality.

    a. If there is any limitation in implementing certain protection function in any of the model, the limitation and plan to consider this function must be agreed with Transgrid.

10. If not previously done for the generator of system security services, the overload capacity of the generator must be communicated to Transgrid.

2.2. R2 Model Validation

Any system security services' generator or generator's performance standard change involving a 5.3.9 process that is ongoing in parallel to this RIT-T process, must complete R2 model validation process prior the commencement of the system security services.

The generator must be equipped with disturbance recorder (or a power quality meter) to show the performance of the generator during any power system event, for the first year of contract (either at the terminal of synchronous generator or POC). It is understood that all the existing generators already are equipped with this but if not, a new installation will be required. The data must have minimum 20 millisecond sampling and should include all standard power system quality quantities such as active power, reactive power, phase current and phase voltages both in RMS and instantaneous as well as phase-to-phase quantities, voltage and frequency.

3. Reference

1. AEMO's Power System Model Guideline
2. AEMO's Dynamic Model Acceptance Test
3. Transgrid SSAT Submission Requirement (request a copy if applicable)