AEMO
AUSTRALIAN ENERGY MARKET OPERATOR

Connection Application
Submission Review Checklist

June 2018

Network Development

To be used upon Connection Application submission in support of its completeness review.

Important notice

PURPOSE

This document has been prepared by AEMO in order to assist with the assessment of the Connection Application ***completeness***. It is not an exhaustive list of all requirements.

Until requirements of the Connection Application submission are satisfied, AEMO considers the application incomplete and the project to be in the Connection Enquiry phase.

DISCLAIMER

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VERSION CONTROL

Version	Date	By	Reviewed	Approved	Changes
# 1.0	27/06/2018	MG	MD	LR	

Contents

1. Documentation Completeness Checklist

The following documentation has been submitted as a minimum and may not necessarily provide a complete list of all technical details that are required:

	Requirement	Comment / file name / reference
☐	Proposed Generator Performance Standards (GPS) in the current AEMO template.	
☐	Connection studies report(s) detailing and demonstrating how the applicant intends to meet each of the performance standards.	
☐	PIA/FIA (Preliminary/Final Impact Assessment) as per ***System Strength Impact Assessment Guidelines***. If FIA is not applicable, evidence via PIA is provided to substantiate it.	
☐	Confirmation from the plant manufacturer of the minimum SCR and X/R ratio at which their plant can operate and at which PSS®E/PSCAD™ models are validated.	
☐	A complete set of PSS®E software simulation models (in .DLL and .obj/.lib in V34 format) representing the *generating system* that meet the ***Power System Model Guidelines*** and Modelling Requirements For synchronous systems, governor, excitation system power system stabiliser and limiter models will be required. For asynchronous systems Power Plant Controllers (PPC) must be modelled as a controller. PSS®E model files include (.sav, .raw, .dyr files) and sequence component data and connection numbers for Transformer vector group orientation. Generator impedance data must be consistent with the equipment data sheets and S5.2.8, and facilitate calculation of short-circuit currents (e.g using 'IEC' method)	

	Requirement	Comment / file name / reference
☐	PSS®E Model Acceptance Test Report as per Dynamic Model Acceptance Guideline.	
☐	Releasable User Guide (RUG) incorporating details on how to use all PSS®E simulation models including load flow setup of the generating system, generating system voltage control scheme details, model control modes , dynamic setup with details of the model's ICONs, CONs, STATEs and VARs. RUG is consistent with and meets the requirements of information in the ***Template for preparation of a Releasable User Guide*** **and** ***Power System Model Guidelines*****.** Refer to definition of Releasable User Guide in Chapter 10 of the NER.	
☐	A complete set of PSCAD™ software simulation models including user guides representing the *generating system* that meet ***Power System Model Guidelines*****.** The model shall also comply with Modelling Requirements. RUG is consistent with and meets the requirements of information in the ***Template for preparation of a Releasable User Guide*****.**	
☐	PSS®E / PSCAD™ *Generating System* model benchmarking report based on a SMIB case setup taking into consideration the lowest SCR condition at POC: ▪ Application of balanced 3 phase voltage disturbances for a range of retained voltage profiles, being 80%, 50%, 25% and 0% at the Point of Connection, is overlayed against the accuracy requirements for the applicable clearance times defined in the NER S5.1a.8. Signals taken into consideration for model accuracy overlays are Power, Voltage and Reactive Power at the Point of Connection of the *Generating System*.	
☐	Voltage Control Strategy document (and explanation of how the *generating system* meets S5.2.5.13 and S5.2.5.1, primary, secondary and tertiary control and equipment responses (switching logic where used) including examples for achieving Max and Min PF ranges).	

	Requirement	Comment / file name / reference
☐	Single line diagrams of the proposed: • Connection arrangement and *generating system* clearly showing the connection point including primary electrical SLD for all collector circuits showing switching arrangements for each generating unit. • Revenue meters and Power quality meters (can be provided once detailed design is complete) • Protection systems (can be provided once detailed design is complete) • Auxiliary supply arrangement • SCADA and communications SLD.	
☐	***Power System Design and Setting Data Sheet*** including all referenced documents within the datasheets (Schedule 5.5 of the NER) S- Standard D- Design R1 – Registered pre- connection R2 – Registered post- connection Note: Not applicable data sheets shall be "greyed" out and not removed from the ***Power System Design and Setting Data Sheet*** submission prior to AEMO reviewing and accepting it as "not applicable".	
☐	Generating system capability curve during steady state conditions and transients. Capability curve points in MS Excel format.	
☐	Protection and control scheme details including those required to be modelled to assess the impact of the proposed *generating system* connection. (Can be provided once detailed design is complete).	
☐	Model source code associated with all PSS®E user written simulation models. The source must be for the model as applied and used in the assessment of the GPS and its Releasable User Guide. It must meet FORTAN/FLX source requirements as in Modelling Requirements.	
☐	A set of functional block diagrams including all functions between feedback signals and *generating system* output. The parameters of each functional block including all settings, gains, time constants, delays,	

Requirement	Comment / file name / reference
deadbands and limits, as expected to be represented in standard Laplace block diagram. The characteristics of non-linear elements. The model functional block diagram illustrates all derivative states including derivative state variable names consistent with the block diagrams and the model settings/parameters.	

	Additional information required prior to Registration as per NER clause S5.2.4 – Provision of information	Comment / file name / reference
☐	Energy Conversion Model (required 3 months prior to registration).	
☐	Commissioning Plan (required 3 months prior to commissioning).	
☐	SCADA signal list (at least 3 months prior to registration).	

2. Information Consistency and Quality Check

	Requirement	Comment / file name / reference
☐	PSSE and PSCAD™ Models are consistent in the physical representation of the *Generating System.*	
☐	PSS®E and PSCAD™ Models are consistent with the ***Power System Design and Setting Data Sheet*** and the representation in the Generator Performance Standard – connection study report.	
☐	PSS®E and PSCAD™ Models – a map of parameters is provided including conversion process where applicable, consistent with the following items: ▪ Protection systems – over-voltage, over-frequency, under-voltage and under-frequency settings ▪ Any other limitations or protection systems that would otherwise limit accuracy of one of the models, e.g. Multiple LVRT capability and protection settings for overspeed or oscillatory protection ▪ Disturbance ride through logic and performance is consistent for the application of balanced disturbances, where models are consistent during and after the applied disturbance, e.g. look up tables, gains for active -reactive current injections, activation and/or deactivation thresholds for LVRT or HVRT etc.	
☐	Short Circuit (system strength impact) Assessment based on PSS®E OPDMS is consistent with the PIA (Preliminary Impact Assessment).	
☐	Single line diagrams align with the model representation of the *Generating System*.	

	Requirement	Comment / file name / reference
☐	Protection settings report does not over-rule any other requirement in the GPS (i.e. quality check to ensure that protection settings design (which may be undertaken at detailed design stage) does not impede any otherwise agreed GPS item or stated capability)	

3. Initial Model Check

	Requirement	Comment / file name / reference
☐	PSS®E model is provided as per ***Power System Model Guidelines*** and the PSS®E model version is consistent with Modelling Requirements. When the PSS®E model is opened and executed with PSS®E software version used by AEMO: ▪ The model does not result in unstable initialisation or initialisation that requires settling. ▪ The model does not result in initialisation or run time errors including non-convergence or suspect state errors. ▪ The model is dynamically stable for all possible ranges of system strength (short circuit ratio and X/R ratio) where the *generating system* would be in operation. ▪ The model allows active power, voltage, power factor, and reactive power reference change to be performed.	
☐	PSCAD™ model is provided as per ***Power System Model Guidelines*** and the PSCAD™ model version is consistent with Modelling Requirements When the PSCAD™ model is opened and executed: ▪ The model is dynamically stable for all possible ranges of system strength (short circuit ratio and X/R ratio) where the *generating system* would be in operation, and the model presented in the SMIB case is representative of the lowest SCR for the *generating system*. ▪ The model initialises and is able to remain stable at rated output and prior to application of any disturbance. ▪ The model is able to run through a balanced fault application in the SMIB case and achieve stable operating	

Requirement	Comment / file name / reference
condition upon removal of the fault/disturbance. ▪ The model is able to run through an unbalanced single phase and phase-to-phase-to-ground disturbance application in the SMIB case and achieve stable operating condition upon removal of the disturbance. ▪ The *generating system* (model) meets the requirements of the NER under the definition of **"*continuous uninterrupted operation*"** including "*responding so as to not exacerbate or prolong the disturbance*". ▪ The model allows active power, voltage, power factor, and reactive power reference change to be performed.	

4. PSCAD Study Guidance Checklist

PSCAD™ studies and verification of the PSS®E model accuracy of the *Generating System* representation and the plant capability to comply with the GPS must include:

	Requirement	Comment / file name / reference
☐	▪ Clause S5.2.5.3 to test the boundaries of frequency limitations and df/dt capability including frequency protection operation. ▪ Playback of frequency change performed and compared overlay of PSS®E and PSCAD™ responses against the accuracy requirements	
☐	▪ Clause S5.2.5.4 - to test the boundaries of the voltages in this clause including voltage protection operation. ▪ Playback of over-voltage curve defined in NER Figure S5.1a.1 and compared overlay of PSS®E and PSCAD™ responses against the accuracy requirements. ▪ Playback of under-voltage profile defined in S5.2.5.4 and compared overlay of PSS®E and PSCAD™ responses against the accuracy requirements.	
☐	▪ Clause S5.2.5.5 - to include balanced and unbalanced faults at various fault locations. ▪ In particular performances during the fault (such as reactive power injection capability) and post fault recovery (active power recovery and voltage recovery) have been investigated.	

	Requirement	Comment / file name / reference
	▪ Studies have been conducted in the network equivalent case as discussed with the NSP and AEMO. ▪ Fault locations and inclusion of any runback, trip schemes, where applicable have been considered and presented. ▪ For balanced system events, PSS®E and PSCAD™ responses are overlayed against the accuracy requirements. As a minimum one close up and one remote balanced event has been considered.	
☐	▪ Clause S5.2.5.8 – Studies to demonstrate capability to reduce power by ½ within 3 seconds on occurrence of frequency excursion (emulated via frequency playback). ▪ Fault locations and inclusion of any runback, trip schemes, where applicable have been considered and presented.	
☐	▪ Clause S5.2.5.11 – Studies to include injection of frequency disturbances to the *Generating System* which could be studied in a SMIB case.	
☐	▪ Clause S5.2.5.12 –Studies for this clause as applicable. ▪ Fault locations and inclusion of any runback, trip schemes, where applicable have been considered and presented.	
☐	▪ Clause S5.2.5.13 – Studies to include step responses in control setpoint and 5% voltage disturbance at the point of connection. ▪ Studies performed for voltage, power factor and/or reactive power controller where so used and agreed with the NSP/AEMO for the required operating system mode(s).	
☐	▪ Clause S5.2.5.14 – Studies to include curtailment of active power simulating a dispatch or runback instruction.	

Note:

- Signals taken into consideration for model accuracy overlays are (as a minimum) Power, Voltage and Reactive Power at the Point of Connection of the *Generating System*.
- Studies in Clauses S5.2.5.3, S5.2.5.8 and S5.2.5.11 may complement each other where so related.
- Assessment of clauses has been conducted in the network representative case as discussed with the NSP/ AEMO. The assessment of these clauses for the purpose of the PSCAD™ study and its PSS®E model overlays does not otherwise exempt from the compliance assessments to be carried out in the PSS®E models based on AEMO's OPDMS data.
- PSCAD™ studies demonstrating the effectiveness of any proposed system strength remediation schemes have been included.

END of DOCUMENT