Guideline for Preparation of a Releasable User Guide

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Important notice

Purpose and currency

AEMO has prepared this Guideline to provide information about the form and content of releasable user guides (**RUGs**), as at the date of publication, consistent with the requirements of the Power System Model Guidelines. The National Electricity Rules (**NER**) and the National Electricity Law (**Law**) prevail over this Guideline to the extent of any inconsistency.

Disclaimer

This Guideline:

- may be subsequently updated or amended;
- contains information which is provided for explanatory and guidance purposes only;
- does not constitute legal or business advice;
- should not be relied on as a substitute for obtaining detailed advice about the Law, the NER, or any other applicable laws, procedures or policies.

AEMO has made reasonable efforts to ensure the quality of the information in this Guideline, but cannot guarantee its accuracy or completeness.

Accordingly, to the maximum extent permitted by law, AEMO and its officers, employees and consultants involved in the preparation of this Guideline:

- make no representation or warranty, express or implied, as to the currency, accuracy, reliability or completeness of the explanatory information in this Guideline; and
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Abbreviations and Definitions

Terms that are defined in the NER have the same meanings when used in these Guidelines, regardless of whether they are italicised. The meaning of other terms and abbreviations are given in the table below.

Term	Definition
AVR	Automatic voltage regulator
BESS	Battery energy storage system
DYR	Dynamics Data File
EMT	Electromagnetic Transient
Generator	Includes a person who is required to register as a Generator under the NER in respect of a generating system for which a RUG must be provided.
kV	Kilovolt
Law	National Electricity Law
Model	Functional block diagram and model source code as per the definition of the RUG.
MVA	mega volt-ampere
MVAr	mega volt-ampere reactive
MW	Megawatt
NEM	National Electricity Market
NER	National Electricity Rules
NSP	Network Service Provider (includes a TNSP and, where a generating system is connected to a distribution network, a Distribution Network Service Provider)
OEL	Over-excitation limiter
PSCAD™/EMTDC™	Power System Computer Aided Design/Electromagnetic Transient with Direct Current
PSS	Power System Stabiliser
PSS®E	Power System Simulator for Engineering software
RMS	Root Mean Square
RUG	Releasable User Guide
STATCOM	Static synchronous compensator
SVC	Static VAR compensator
TNSP	Transmission Network Service Provider
UEL	Under-excitation limiter
Var	Volt-ampere reactive

Contents

Version release details

Version	Effective date	Summary of changes
2.0	3/6/2024	Updates to reflect National Electricity Amendment (Integrating energy storage systems into the NEM) Rule 2021.
1.0	1/7/2018	First release.

1. Introduction to Guideline

A Generator or an Integrated Resource Provider required to provide models under NER S5.5.7(b1)(1)(i) must provide separate RUGs for Root Means Square (**RMS**) and Electromagnetic Transient (**EMT**) models to AEMO and to the relevant Network Service Providers (**NSPs**) under clause S5.2.4(b) of the NER.

This Guideline has been prepared to assist Generators and Integrated Resource Providers in the development of a RUG in respect of their systems. A RUG is a document associated with a functional block diagram and model source code (combined, forming the **Model**). A RUG must contain sufficient information to enable a Registered Participant **without any prior knowledge of the plant** to use encrypted model source code provided under NER 3.13.3(l) to carry out power system studies for planning and operational purposes.

This Guideline explains how Generators and Integrated Resource Providers should prepare a RUG, including the information required, examples of information and, where relevant, the preferred form for the information (for example, tables or charts).

There may be other factors that impact the information to be provided in a RUG. Generators and Integrated Resource Providers are responsible to ensure they fulfil all relevant obligations in providing the RUG to AEMO, with reference to the versions of NER and AEMO's Power System Model Guidelines that are current at the time of submission.

This Guideline uses many terms that are defined in the NER. Failure to italicise those terms does not affect their meaning. There is a glossary for other terms and abbreviations at the end of this Guideline.

2. RUG Use

The model information provided in the RUG is typically used for power system studies such as:

- **Steady state (or 'load flow')** studies for the assessment of the power system within thermal limits, voltage control or voltage collapse limits and fault current limits. The model information must be the type of information suitable for a 'load flow' program, including a description of the location of the plant, sufficient to identify where to connect the plant in a load flow model of the power system, and any other connection point model information that may also be necessary.
- **Dynamic stability studies** for the assessment of performance of the power system, specific production units or generating systems/integrated resource systems. This assessment might include the assessment of transient stability limits, performance against performance or access standards (see Schedule 5.2 of the NER), impact on oscillatory stability of the power system or power system plant. Models must be written for specific software packages and are 'executable' models within those software packages. There might be one or more such models that are necessary to describe the plant fully.

A person carrying out power system studies might also need other information, such as the existence and performance of any special control schemes or protection schemes, or the commencement date of the plant's operation, if the plant is not yet in service. This information must also be provided and might be used for either the load flow or dynamic stability studies.

A user of the RUG is assumed to have a reasonable understanding and experience of the PSS®E and PSCAD™/EMTDC™ modelling environment in both load flow and dynamic studies. Registered Participants can also obtain load flow cases from AEMO or the Transmission Network Service Provider (**TNSP**) that includes the model referred to in a RUG.

3. Confidentiality

The RUG is intended to be used by other Registered Participants to assist them in carrying out power system studies for planning and operational purposes. Accordingly, the RUG, either in part or whole (or any document to which the RUG refers), may not be restricted from disclosure. AEMO is required under NER 3.13.3(l)(1) to provide the RUG to Registered Participants in an unaltered form.

Registered Participants who receive a RUG must treat it as confidential information as required by NER 3.13.3(l)(3) and NER 8.6.1.

4. RUG must be up to date

The separate RUGs for both RMS and EMT models is initially required to be submitted to AEMO by a Generator or Integrated Resource Provider at the time the Generator or Integrated Resource Provider makes an application to connect. It should be updated:

- As designs are finalised.
- Before any alteration to a generating system or integrated resource system.[1]
- When the Generator or Integrated Resource Provider becomes aware that the information is incomplete, inaccurate or out of date.[2]
- On request by AEMO, or the relevant NSP, where AEMO, or the relevant NSP, considers that the information is incomplete, inaccurate or out of date.[3]

5. RUG template

The rest of this Guideline provides a template for a Generator or Integrated Resource Provider to follow when preparing their RUG. This Guideline accounts for the minimum information required. However, AEMO cannot give any assurance that a RUG using this template will be accepted without revision. The Generator or Integrated Resource

[1] NER S5.2.4(b)(1) to (4) sets out the specific timing requirements (above).
[2] NER S5.2.4(d).
[3] NER S5.2.4(d).

Provider is responsible to ensure that all requirements are met, even with the use of this template.

The template specifies preferred formats for the required information. Where applicable, example tables are provided.

The template is generic and suitable for most connections. However, the template may require adaptation for particular circumstances. For example, some Generators or Integrated Resource Providers may find that:

- certain information fits better in a different section; or
- some parts of the template might not be applicable to all connections.
- The template and descriptions are not intended to limit the information provided by Generators or Integrated Resource Providers. Generators or Integrated Resource Providers:
- must fulfil the requirements of the NER; and
- may wish to include additional information where necessary or useful to help users of the RUG understand and apply the RUG.

All relevant information should be contained within the RUG itself. References to external documents should be limited to those required for validation purposes. Images embedded in documents must be of sufficient resolution to easily identify all components, parameters and values.

[Generating System/Integrated Resource System Name]

Releasable User Guide

This is a sample template that is designed for use in the creation of a Releasable User Guide (RUG) for a generating system or integrated resource system and needs to be read in conjunction with the Guideline document for Releasable User Guide and the Power System Model Guidelines

AEMO

AUSTRALIAN ENERGY MARKET OPERATOR

Version[4]

Version	Update	Date [dd/mm/yyyy]
1.0	Initial version provided with the application to connect	

[4] See paragraph 8 of the definition of releasable user guide.

Contents

Below is a suggested table of contents for the releasable user guide.

Suggested Table of Contents

Suggested list of Tables

Suggested list of Figures

1. Introduction

1.1. Broad description of generating system or integrated resource system

The introduction should contain a broad description of the generating system or integrated resource system, which can be provided by including and populating Table 1. Placeholders for detailed description of the plant and how it is modelled, including a diagram, are provided in section 2.

AEMO recognises that there are differences in the design and installation of plant technology, even for well-established technologies. Any Generator or Integrated Resource Provider preparing a RUG should not be limited to the types of information described in this template. Importantly, all information should be described well enough to allow any Registered Participant to use the model (unassisted) for the purposes provided in the NER.

All images and tables embedded in the RUG must be of sufficient resolution to easily identify all components, parameters and values.

Table 1 Broad description of the generating system or integrated resource system

Feature	Description
Type and configuration of system	E.g., consists of $X \times XX$ MW hydro / wind / etc turbines or similar.
Rated capacity (specify point)	
Geographical location	
Connection point	
Relevant Transmission or Distribution Network Service Providers for the connection	
Other relevant high-level information (add more rows)	E.g., other parties involved and unique aspects of the project.

1.2. Expected timeframes

The RUG is submitted with an application to connect. Accordingly, estimates for most of these timeframes should be provided, which will later be updated as each event occurs. The Generator or Integrated Resource Provider is expected to update Table 2 when the connection and commissioning dates are revised[5].

Table 2 Expected timeframes

The date on which each of the following will or has occurred[6]	Date [dd/mm/yyyy][7]
An application to connect is made under NER 5.3.4(a)	
A connection agreement is entered into under NER 5.3.7	
Connection	

[5] NER S5.2.4(d) requires updates to be provided after commissioning tests or other tests, when the Generator or Integrated Resource Provider becomes aware that the information is incomplete, inaccurate or out of date, or on request from AEMO or the NSP where either considers the information is incomplete, inaccurate or out of date.
[6] The items in this table reflect the content of paragraph 7 of the definition of RUG.
[7] If any event has occurred multiple times, please specify all dates and note updates.

The date on which each of the following will or has occurred[6]	Date [dd/mm/yyyy][7]
Commencement of commissioning	
Conclusion of commissioning	
The Generator/Integrated Resource Provider submits a proposal to alter a connected generating system/integrated resource system or a generating system/integrated resource system, for which performance standards have previously been accepted by AEMO, under clause 5.3.9[8]	
The Generator or Integrated Resource Provider is notified that the Network Service Provider and AEMO are satisfied with the proposed alterations to the plant under clause 5.3.10[9]	

Additional rows can be added to specify other relevant dates.

1.3. Assumptions

List any assumptions a user of the model would need to make in order to understand the model being provided that have been made in preparation of the RUG.

2. Plant and model overview

2.1. Connection to the NEM

Provide details of what the plant consists of and how it is to be connected into the NEM.

Figure 1 Placeholder for single line diagram of the system model.

This section should describe the information that a person carrying out studies would need to be able to model how the generating system or integrated resource system would perform after being connected to the network. This includes, for example:

- A single-line diagram for the model representation including the grid-level station configuration (Figure 1), connection point configuration and the NSP station configuration to the extent necessary to model the system in a load flow study, including relevant labels and with bus numbers that are consistent with any other bus numbers recorded in the document (for example in a DYR string).
- Details of where the system is connecting into the grid (e.g., connection point station, voltage level and bus, percentage or distance from the closest existing terminal stations on either side) including any configuration information as per the single-line diagram.
- A description of new transmission lines or distribution lines and elements being constructed to achieve connection to the network, including transformers and collector network.
- A description of any supportive reactive plant.
- Any differences between the diagram and the physical system including, for example, where components have been lumped and represented as a single unit in the model/diagram, or individual unit transformers.
- Any other necessary impedance or other relevant modelling information.

[8] Only relevant for an update where the system is being altered.
[9] Only relevant for an update where the system is being altered.

2.2. Detailed description of the generating system or integrated resource system

This section should provide a more detailed description of the system, including:

- The system's components, such as the production units, reticulation networks, transformers, park controllers and dynamic reactive support plant.
- The features of the system's design.
- How the system is coupled or decoupled from the grid.
- External conditions that may impact rating of the system (for example, ambient temperature).

2.3. Structure of the model

This section should provide a brief overview of the model, including:

- How the model may differ from the physical system or single line diagram provided.
- Modelling architecture (that is, the files provided and their relationship). For example, describe the components of the PSS®E / PSCAD model, and what role they play in modelling the system.
- Key modelling parameters, and how they account for the operating states of the power system.

Section 4 provides for detailed descriptions of the models, parameters, variations and how these are to be set to model the power system. This section is used to introduce Section 4 and should also explain how the schemes to be described in Section 3 fit into the model.

3. Detailed description of specific control schemes

Clause S5.2.4(c) of the NER requires information provided in the RUG to "encompass all control systems that respond to voltage or frequency disturbances on the power system".

The schemes that should be described in this section include:

- Voltage control.
- Frequency control.
- Power factor and/or reactive power control.
- Priority modes and controls.
- Protection schemes.

Description of the active power control of the plant including any different operating modes (e.g., active power raise or lower in response to frequency decreases and increases), droop settings and how to model those responses. All schemes applicable to the relevant generating system or integrated resource system should be described (the examples provided above are not exhaustive), including co-ordination schemes, such as runback schemes and trip schemes.

3.1. [Specific] Control Scheme

Each control scheme for the production unit or generating system/integrated resource system should be described. The description of each scheme should include:

- What the control scheme is targeting and whether it is the primary control mode.
- The basic philosophy of the scheme (sequential if applicable).
- Any relevant characteristics and how these vary, including:
  - Reference parameters
  - Trigger levels and resultant actions (e.g., switching of capacitor banks)
  - Deadbands.
- Any limitations of the control scheme.
- Functional block diagram(s) of the model that represent this control scheme in the PSS®E modelling environment (as per clause S5.2.4(b)(5) of the NER).

3.2. Protection schemes

Describe the protection systems relevant to load flow, dynamic simulation studies and power system security that are required to be included in power system studies.

For any production unit or generating system/integrated resource system, typical protection information includes settings for (but not limited to):

- Over- and under-voltage protection
- Over- and under-frequency protection
- Inter-trip or runback protection scheme
- Any other relevant protections (e.g. frequency rate of change protections).

If the system is synchronous, and the under-excitation limiter (**UEL**) and over-excitation limiter (**OEL**) actions will prevent the need for modelling under-excitation and over-excitation protection, these do not need to be included, but the RUG should indicate this omission and the reason for it. In all other cases, settings for these protection systems should be included. Similarly, if there are special (atypical) protection systems that are not required to be modelled explicitly, descriptions and settings of these special protection systems should be included. Additionally, if the plant will trip in response to receipt of an external control or trip signal, this must be captured here.

4. Modelling information[10]

Identify each model and the parameter values for each that is required to be used for the accurate simulation of the production unit or generating system/integrated resource system in detail.

[10] See paragraphs 1,2 3 and 5 of the definition of RUG.

- For RMS models, provide a table of all simulation model STATEs, VARs, CONS, ICONs, their values as implemented in the dynamic data files and a description of each function.
- For EMT models, provide a table of all user-definable settings and status code outputs for all plant within the generating system or integrated resource system, a range of acceptable values for each user-changeable variable and a description of each entry's function.

Generators or Integrated Resource Providers can rearrange this information, as long as all information is provided and adequately described and can be followed logically. Detailed tables and charts can be put into appendices if preferred.

For this item:

- 'Parameters' relate to the configuration data that the model uses (for example a gain or time constant or a physical characteristic, such as inertia). In providing the parameter, a short description or identifier for the parameter is required, as are the units and data format for that parameter.
- 'Values' relate to the numbers or other types of constants (e.g., integers or text) required by the model.

This information should be provided under the following subheadings:

- Plant capability
- Modelling parameters
- Load flow set-up
- PSS®E Dynamic set up (for a PSSE RUG)
- Control mode simulations
- Asymmetric fault simulations
- Other simulations
- Instructions for use of model source code

The model architecture should be described in Section 2 of the RUG. Section 4 should contain detailed explanations, with suggestions and examples of how this information should be used.

4.1. Plant capability

Describe the plant capability, its components, and how these are modelled (specify the base of all per unit parameters), including any limitations. Information should be provided in tabular or graphical form where possible. Separate sections could be used for each component. Not all components and models will be relevant to all units or systems; Generators and Integrated Resource Providers should include those that are relevant. The descriptions provided for each are as follows:

Production unit

- Rating information and nominal voltage information. Rating information should include nameplate rating (MVA) and active and reactive power limits. These limits should be in the form of a capability diagram (showing active power and reactive power limits over the range of operation of the plant), or a table including, for example:
  - plant MVA rating (i.e., single and aggregated production units)
  - rated active power (MW)
  - maximum and minimum active power (MW)
  - maximum loading (MW), minimum loading (MW)
  - limitations in term of maximum and minimum reactive power (MVAr) at various active power operating points (could be represented by a reactive capability diagram)
  - auxiliary load (MW and MVAr)
  - fault impedance information (positive and negative sequence – if in per unit, the per unit base as well)
  - direct and quadrature axis parameters and their values (including, for example, Ra, Xl, T'do, T"do, T'qo, T"qo, Xd, Xq, X'd, X'q, X"d, X"q)
  - any other parameters and their values, as required for the model (e.g., saturation information, inertia data, positive, negative and zero sequence impedance information for fault studies, etc.).

Figure 2 Placeholder for capability diagram

Transformer

- Transformer information for all the relevant transformers (high voltage to low voltage and other), such as:
  - impedances (incl. sequence data)
  - configuration (i.e., vector groups)
  - modes (e.g., offline or online tap changer)
  - grounding configuration and connection codes
  - tap ratio range
  - nominal tap ratio
  - MVA rating (i.e., single or aggregated units)
- For on-load tap changing transformer with automatic controls, the target voltage, or other control system settings and switching times.

Inverter

- Number of inverters

- Any output rating/de-rating depending on external factors (e.g., ambient temperature etc.)

Reticulation/cabling

- Reticulation information, such as the impedances (including all sequences [pos./neg./zero]) and rating
- Equivalent reticulation information if applicable

Other reactive components

One section per reactive component to describe its capability, including any capacitors, SVCs, STATCOMs:

- impedances
- configuration
- modes

4.2. Model parameters

Describe the models and parameters used to simulate the plant capability and operation for each of the components. Examples are provided below.

For each, the model type (depending on the software product used) should be described.

Wind Farm Models

- The turbine model (scaled to represent the aggregated output of the wind farm turbines[11], the parameters and their values. This should include all control systems and physical plant characteristics required for the model to represent the turbine(s) performance and behaviour.
- Control systems that are a part of the wind farm (farm level controls) that must be modelled to represent the performance of the system for power system studies (e.g. voltage or reactive power control systems for the wind farm, including power factor controls).
- The model aggregation methodology.

Solar Farm Models

- The panel model (scaled to represent the aggregated output of solar farm panels and inverters), the parameters and their values. This should include all control systems and physical plant characteristics required for the model to represent the solar farm performance and behaviour.
- Control systems that are a part of a solar farm (farm level controls) that must be modelled to represent that performance of the system for power system studies (e.g. voltage or reactive power control systems for the solar farm, including power factor controls).
- The model aggregation methodology.

[11] This is how, typically, wind farms are represented.

Battery Energy Storage System (BESS) Models

- The BESS model (scaled to represent the aggregated input/output of units and inverters), the parameters and their values. This should include all control systems and physical plant characteristics required for the model to represent the BESS performance and behaviour. This includes both directions of production and consumption of electricity (charging and discharging operations).
- Control systems that are a part of a BESS (system level controls) that must be modelled to represent that performance of the system for power system studies (e.g. voltage or reactive power control systems for the BESS, including power factor controls).
- The overall system control systems if the system is composed of various individual technologies in addition to the BESS.
- The model aggregation methodology.

Models of synchronous machine components

- The automatic voltage regulator (AVR) and exciter model
- The power system stabiliser model
- The governor and turbine models
- The excitation limiter models (UEL and OEL, and any other required limiter models)
- Any other control systems or plant models that are a part of the unit or system that must be modelled to represent that performance of that unit or system for power system studies.

4.3. Load flow set up

Describe the additional information necessary to model the production unit or generating system/integrated resource system in power system studies. Some of this information relates to the information being provided using the Power System Design and Setting Data Sheets[12]. This includes, for example:

- Detailed procedures on how to represent a settled steady state of plant in any studies or how to apply disturbances or setpoint changes.
- Any specific operational information that would be necessary for defining realistic load flow conditions (or initial conditions for dynamic stability studies), such as:
  - operational limitations;
  - any specific switching or configuration conditions (e.g. normally open circuit breakers, and the conditions under which they may be operated closed); and
  - any loading limitations. for example:

[12] https://aemo.com.au/energy-systems/electricity/national-electricity-market-nem/participate-in-the-market/network-connections/modelling-requirements

- a combined cycle gas/steam turbine plant is likely to have limitations on steam plant output depending on the loading of the gas turbine plant); or
- the reactive output or switched condition of reactive control plant (e.g. the voltage control strategy of dynamic reactive control plant in conjunction with capacitor bank operation).

Describe the required setup (i.e. any model parameter settings or specific configurations, and any specific requirements) to complete a load flow study, including:

- Steady state voltage control
- Example calculations in various modes
- Component parameters

Where possible, parameters should be described in tabulated or graphical form.

Any information about how the parameters might need to be varied to represent the performance or behaviour of the production unit or generating system/integrated resource system or any plant within the system should be included.[13] In particular, this is required where the performance is not explicitly demonstrated in the model[14]. Also provide information about how to vary the set-point of the model such as voltage/power factor set-point, active power set-point.

For a synchronous generating unit, for example, this should include:

- the unit loading level above which the power system stabiliser (PSS) is in operation (in some cases, the PSS is not in operation at low operating levels of the generation unit)
- if a governor model has non-linear characteristics that are not explicitly included in the model, the parameter value changes that are required to represent the plant's performance.

For wind farms, this would include information on how to vary the parameters if turbines are out of service.

Transformer setup for load flow

Table 3 Example tabulation of parameters for transformers

Parameter*	Value	Unit
Number of windings		Qty
Principal tap rated voltages		Qty
PSS®E winding connection code		N/A
Voltage set point		p.u.

*Only a sample of parameters provided

[13] Paragraph 2 of the definition of RUG.
[14] This information relates to the Model characteristics that are not necessary for typical power system studies, as required by the Power System Model Guidelines, or has been agreed with the relevant NSP and AEMO.

4.4. PSS®E Dynamic set up

Recommended ranges of the following dynamic simulation parameters should be stated, including:

- Numerical integration time step. Where models use an internal integration time step for some of its faster acting controllers this should be clearly highlighted.
- Tolerance for network solution.
- Acceleration factor for network solution.
- Frequency filter (filter time constant).

The files associated with devices, controllers and their dynamic models should be tabulated to allow a user to set up their PSS®E environment appropriately to complete studies, including constants, states and variables.

Table 4 Example tabulation of PSS®E Dynamic set up

Component	Description	Releasable Documentation	PSS®E Files required in Working Directory
E.g. Plant component E.g. Controller	Component and the file set up that relates to that component.	References to the documentation that contains the relevant file.	File name. List per PSS®E version if applicable.

Table 5 Example Dynamic Parameters

CON	Value	Description
E.g. J+1	3	Real power rating (MW)

ICON	Value	Description
E.g. I	3	Reactive control mode
I+1	475291	Bus number

VAR	Description
E.g. V+1	External reactive power reference

STATE	Description
E.g. K	Torsion angle
K+1	Torsion velocity

4.5. Control mode simulations

This section should describe:

- how the models relate to the control schemes described in section 3;
- how to use these models to simulate load flow and dynamic studies, including:
  - which models need to be used in conjunction (or not) with other models to simulate the control settings; and

- how these models and associated modes may be selected and varied through use of PSS®E parameters;

- how external parameters can be simulated (for example, wind variation);
- how limitations of the control schemes are modelled; and
- any limitations of the models themselves.

Again, where possible, these should be tabulated.

Table 6 Example tabulation of parameters set up for particular mode

Parameter	Value for mode 1	Value for mode 2	Value for mode 3
Parameter x	1	0	0.5
Parameter y	0	1	0.5

4.6. Asymmetric fault simulations

Recommendations for how to model any possible modes for faults should be described in this section, and the circumstances in which they arise.

4.7. Additional modelling information

Additional sections should be added, as required, to describe any additional specific parameter requirements to simulate modes or schemes to allow for modelling of the plant.

4.8. Instructions for use of model source code[15]

Describe the executable model[16] with sufficient information to allow the user to run it. Some models require special instructions and this section should describe those instructions and provide any other information for the user. Typically, for example, standard PSS®E models and some PSS®E user-written models do not require special instructions – if this is the case, advice to this effect would be useful. This should be related to the model architecture described in section 2.3.

4.9. Model limitations

Generators/Integrated Resource Providers must include a detailed description of the following for each component of the generating system/integrated resource system:

- Dynamic simulation run duration limitations for which the model accuracy is proven.
- Circumstances in which the model's dynamic simulation performance and accuracy is limited.
- Model limitations due to system strength (e.g. SCR and X/R validity ranges).[17]

[15] Paragraph 3 of the definition of RUG.
[16] For example, if the software product is PSS®E, this will be the object code version of the Model (e.g. "xmodel.obj").
[17] Generators/Integrated Resource Providers must provide documentation of the minimum design value of the weighted SCR at the unit HV terminals for asynchronous technologies, HVDC links and dynamic reactive support plant.

4.10. PSCAD™/EMTDC™ model name and version

Identify each model, name and version that is required to be used for the PSCAD™/EMTDC™ simulation of the production unit or generating system/integrated resource system.

4.11. PSCAD™/EMTDC™ dynamic set up and settable parameters

Describe the models and parameters used to simulate the plant capability and operation for each of the components. The files associated with devices, controllers and their dynamic models should be tabulated to allow a user to set up their PSCAD™/EMTDC™ environment appropriately to complete studies, including constants, states and variables.

The documentation must specify the range of time steps for which the model response is valid, and the duration of model initialisation.

5. References

References to external documentation should be limited to provide validation or additional, non-critical information only. All model source code and parameters, and instructions to use these should be contained within this template.

Any reference material should be provided to AEMO with the RUG.

Appendices

These are the appendices that could be added to provide further details on the information contained in the RUG. Any specific code or strings should be included as appendices.

Appendix A – Model parameters and values description

This is a placeholder for detailed tables and charts referenced in section 4. It is up to the Generator/Integrated Resource Provider how they wish to provide this information.

Provide a description of all parameters used in the model, or in the model source code, including those in strings and scripting.[18] This appendix should be used to describe any outstanding parameters.

Appendix B – DYR settings string

The DYR string allows for the dynamic modelling of the unit or system. All parameters in the DYR string should have been described in section 4.4 of this template. If any are outstanding, please place definitions in Appendix A.

Appendix C – Site specific scripting

Any additional scripts that allow for the model to be used in PSS®E, including that used to automate the execution of a sequence of activities that are specific to the system can be included and, if so, should be described as to their operation.

[18] Paragraphs 1 and 2 of the definition of RUG.

Appendix D – PSS®E snapshot of load flow

A single line diagram of the model in PSS®E with load flows should be included for reference.

Figure 3 Placeholder for PPS®E snapshot of load flow