



GRANT PUD INTERCONNECTION DATA REQUIREMENTS AND VALIDATION

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Rev. 01

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Preface

This document has been prepared as accurately as possible to aid interconnection Requesters to understand and correctly comply with the data requirements which need to be supplied for the purposes of engineering analysis as necessary to interconnect to the Grant PUD Electric System. Requirements specified in this document are subject to change from time to time and without prior notice.

Guidelines in this document shall comply with applicable Washington State requirements (WAC or RCW) and NERC/WECC reliability Standards and guidelines. If a conflict arises over interpretation of any statement in this document, the applicable official authority having jurisdiction shall take precedence. Additionally, if a guideline specified in this document is in conflict with an officially executed Interconnection Agreement or other contract between the Requester and Grant PUD, the Interconnection Agreement or other contract shall take precedence.

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1. General Requirements

1-A. NERC Data Requirements

In order to interconnect to Grant PUD's electrical transmission system, generation owners must comply with applicable NERC MOD and FAC standards.

*For the purposes of this document, bulk energy storage systems "BESS", must also comply with the same standards as required by generation, as they can equally affect the system when connected.

The standards include but are not limited to:

1. **MOD-032-2 (Data for Power System Modeling and Analysis):**
 - a. Requires Generator Owners (GO) to supply steady-state, dynamic, and short-circuit modeling data to their Transmission Planner (TP) and Planning Coordinator (PC).
2. **MOD-026-2 (Verification and Validation of Models for Generation Resources and Dynamic Reactive Power Resources):**
 - a. Mandates the verification and validation of excitation control systems, volt/var control functions, and governor/turbine control models against actual field or disturbance data (incorporating both positive-sequence and electromagnetic transient [EMT] requirements).
3. **MOD-025-2 (Verification and Data Reporting of Generator Real and Reactive Power Capability):**
 - a. Governs the submission and verification data for real (MW) and reactive (MVAR) power capabilities.
4. **FAC-001-4 (Facility Interconnection Requirements):**
 - a. Dictates that Transmission Owners (TO) and applicable GOs document and make available the technical connection criteria and data needed for a new generation facility.
5. **FAC-002-4 (Facility Interconnection Studies):**
 - a. Requires coordination and technical data sharing between the interconnecting entity and the Transmission Planner/Planning Coordinator to complete robust reliability impact studies.

1-B. Data Submission Requirements and Configuration

To comply with the requirements of Grant PUD, generator owners must comply with the following data requirements:

1. Network Modeling:

- a. For the power system “base case”, the complete system must be explicitly modeled at the main inverters and associated step-up transformers, up to the main high-voltage transformer (e.g. 115 kV, 230 kV) at the POI. No “netting” is allowed.
 - i. This includes the generation and internal auxiliary loads to be explicitly modeled as separate components.
- b. Generators are to have a defined P_{max} along with the associated reactive capability curve. This is not to exceed the requested interconnection injection value. In lieu of a curve, *max* and *min* reactive capability is acceptable
- c. Generator exciters are to regulate the high-side bus at the POI.
- d. Bus numbering is to be 1-99 only. The POI/Slack will begin at “1”.

2. Power Flow and Dynamics Alignment (positive sequence):

- a. The steady-state values (such as maximum real power, P_{max}) explicitly align with your dynamic turbine or inverter settings. For example, P_{max} in the power flow study cannot exceed the thermal capabilities programmed into the dynamic control model.
- b. Ensure plant controllers (when connecting more than one generation source – e.g. PV and BESS) are active and properly configured to include the controlled generators, the monitored bus and monitored branch (line or transformer) as necessary for coordination.

3. Dynamic Model Legitimacy (positive sequence):

- a. The models submitted must belong to the standard, approved list maintained by the WECC Modeling and Validation Subcommittee (MVWG). The submission of user-defined models (UDM) is not permitted.

4. EMT Modeling:

- a. There is an accurate network model.
- b. Plant-level controllers along with the inner control loops are represented.
- c. Capable of running time steps between 10-20 μs .
 - i. It should be self-initializing.
- d. Include documentation and a sample implementation test case. Test case models should be configured according to the site-specific real equipment configuration up to the point of interconnection.

1-B.1 Data Formats

To comply with the requirements for Grant PUD, the following formats shall be used, with the associated complete network model (where not otherwise specified):

1. Network Model (positive sequence)

- a. Text editable formats
 - i. PowerWorld: *.aux
 - ii. PSS/E: *.raw
 - iii. PSLF: *.epc
- b. PowerWorld binary (*.pwb)

2. Dynamic Data (positive sequence)

- i. PowerWorld: *.aux
- ii. PowerWorld binary which includes the dynamic models (*.pwb)
- iii. PSS/E: *.dyr
- iv. PSLF: *.dyd

3. Dynamic Data (3-phase EMT)

- a. PSCAD: *.psc,
 - i. Older versions: *.psc need to be updated

4. Short Circuit

- a. Aspen OneLiner: *.olr

2-B. Model Data Requirements, Validation and Testing

To comply with the requirements of Grant PUD, generator owners must comply with the following data requirements:

2-B.1 Network Model (positive sequence)

The following model checks will be performed:

- a. Impedance checking, voltage regulation and case convergence.
- b. Verify Bus numbering is 1-99 only with the POI/Slack at “1”.

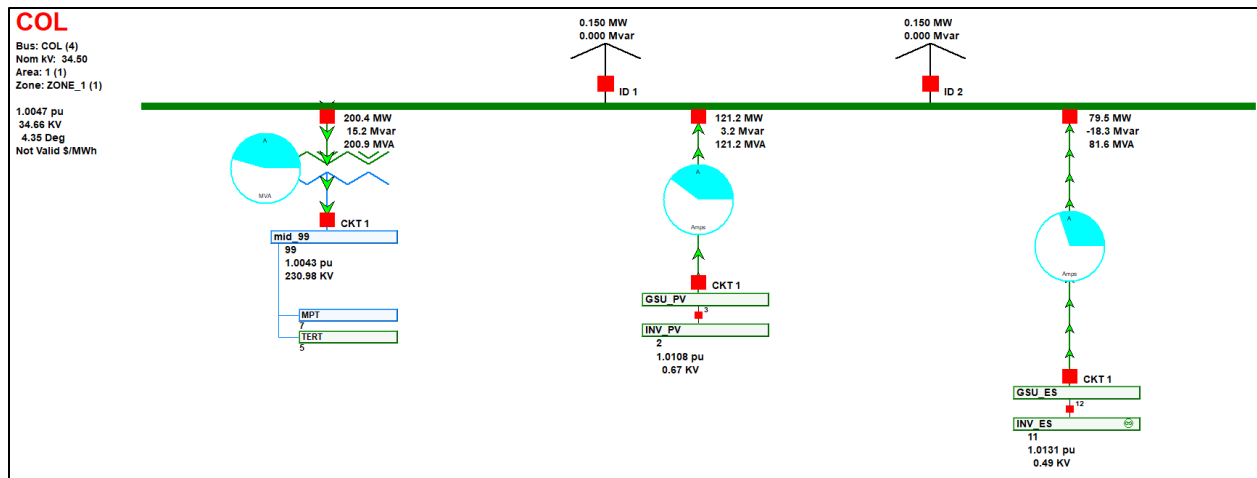


Figure 1: Example of Model (taken from PowerWorld)

2-B.2 Dynamic Data (positive sequence)

The following model checks will be performed:

1. Perform single-machine infinite-bus (SMIB) eigen analysis on the active models to verify no positive values or outliers which could result in instability.
2. Verify all time constants are within the necessary range for the $\frac{1}{4}$ cycle time step. If the models provided have identified corrections necessary, it will result in a failed dynamic model test.
3. Stay online for a 3-phase bolted fault at the POI, with self-clearing after 5 cycles.
4. Perform satisfactorily per the PRC-029-1 standard. A play-in test is performed to ensure that there is proper real and reactive response throughout a 20 second time-series analysis.

*These play-in values will provided as a separate excel sheet which will be made available at

<https://www.grantpud.org/transmission-information>

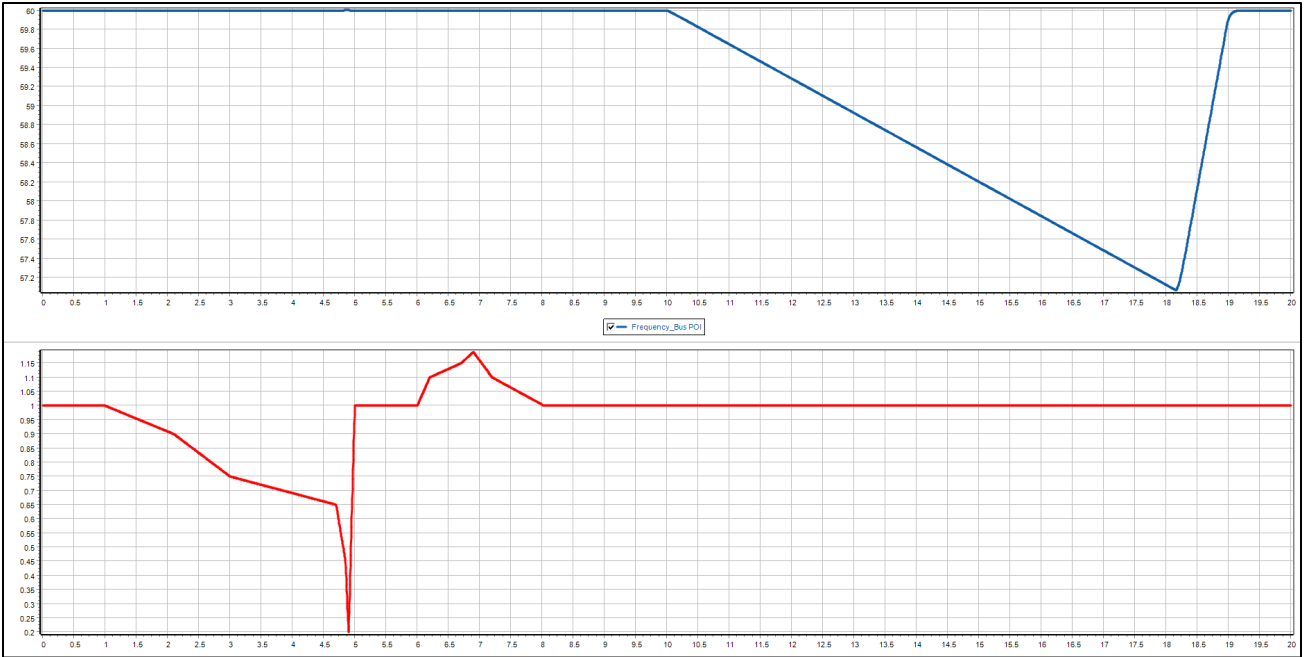


Figure 2: Plots of Frequency and Voltage Playin

Expected Frequency Response: There should be no notable change in real power output during the frequency excursion events.

Expected Voltage Response: There should be a proportional response to help maintain system voltage during events. Figure 3 is an example of a satisfactory plant MVAR as a function of system voltage at the POI.

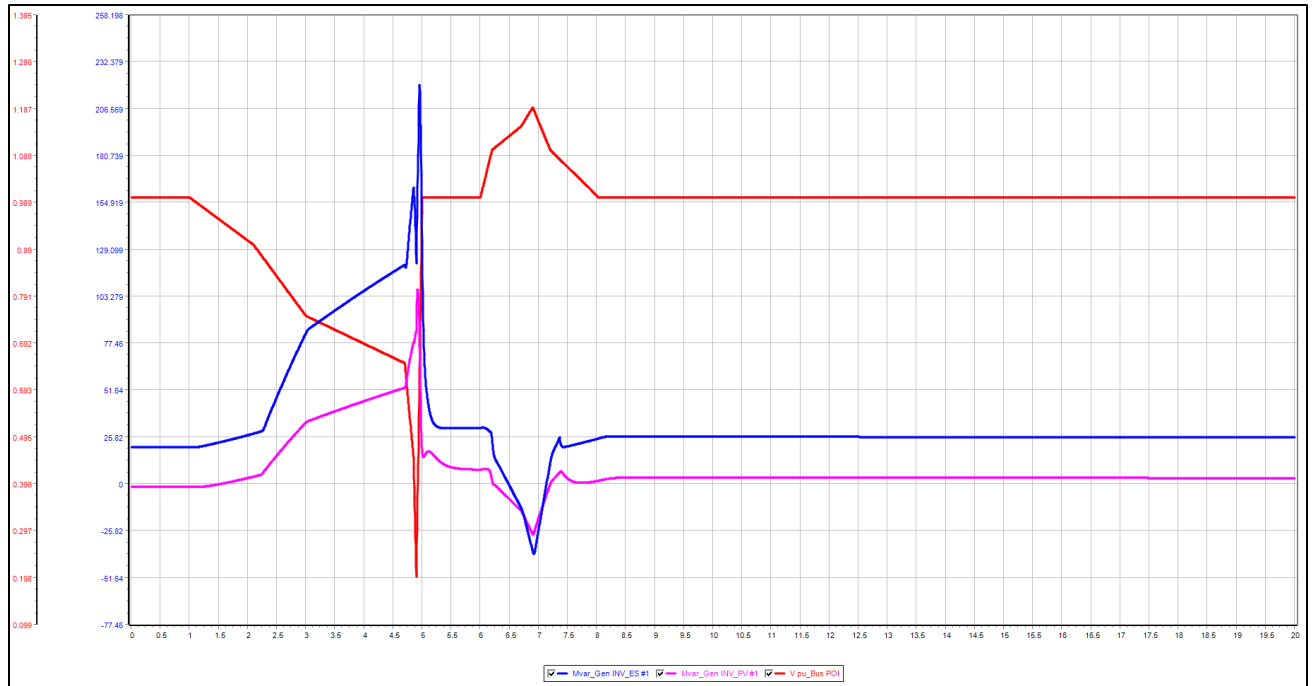


Figure 3: Plot of Expected Reactive Response During Test

2-B.3 Dynamic Model (3-phase EMT)

The following model checks will be performed

1. Single-phase to ground and three-phase faults.
2. Verify no unstable controller oscillations.

2-B.4 Short Circuit

The following model checks will be performed

1. Short circuit contributions for nearby three-phase bolted faults.