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⊘ **Xcel** Energy™	Public Service Company of Colorado	
Steady State, Dynamic and Short Circuit Modeling Data Requirements for PSCo's Planning Coordinator Area		**Version: 1.8**
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1.0   PURPOSE

This document establishes the steady-state, dynamic, and short circuit modeling data requirements and reporting procedures for Public Service Company of Colorado's planning area for the purpose of the WECC interconnection system model creation. This document also supports implementation of requirement 'R1' of the North American Electric Reliability Corporation (NERC) Reliability Standard MOD-032-1.

2.0   APPLICABILITY

This document applies to the Balancing Authority, Planning Coordinator, Transmission Planners, Generator Owner, Load Serving Entity, Resource Planners, Transmission Owner and Transmission Service Provider in PSCo's Planning Coordinator area.

3.0   APPROVERS

Name	Title
Connie Paoletti	Manager, Transmission Planning West

4.0   VERSION HISTORY

Date	Version Number	Change
3/13/15	1.0	New document
5/28/15	1.1	Minor changes
6/6/16	1.2	Annual Update
8/2/17	1.3	Annual Update
7/2/18	1.4	Annual Update
8/16/19	1.5	Annual Update
10/14/20	1.6	Annual Update & Minor changes
7/31/21	1.7	Annual Update
07/26/22	1.8	Annual Update

Procedure

1.   Introduction:

The NERC Reliability Standard MOD-032-1 requires each Planning Coordinator to establish consistent modeling data requirements and reporting procedures for the development of planning

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horizon cases necessary to support analysis of the reliability of the interconnected transmission system. Public Service Company of Colorado (PSCo) is a member of the WECC interconnection and submits steady state, dynamic and short circuit modeling data to WECC in order to support creation of the WECC system models. The WECC, through its Annual Study Program, compiles the Western Interconnection system models for use by its members.

This document establishes the steady state, dynamic and short circuit modeling data requirements and reporting procedures for PSCo Planning Coordinator (PC) area per requirement R1 of NERC Reliability Standard MOD-032-1.

2. **Applicability:**

   This document applies to the Balancing Authority, Planning Coordinator (PC), Transmission Planners, Generator Owner, Load Serving Entity, Resource Planner, Transmission Owner and Transmission Service Provider in PSCo's PC area.

3. **Planning Coordinator and Transmission Planner Responsibility:**

   PSCo's Planning Area includes all transmission facilities owned by PSCo, for which PSCo is the Transmission Planner (TP). PSCo is also the Transmission Planner for all Generator Owners interconnected to PSCo owned transmission facilities, and all Load Serving Entities for which PSCo provides Transmission Service. PSCo's planning area as TP is the same as its planning area as PC.

   PSCo is a Planning Authority/Planning Coordinator only for PSCo owned transmission facilities. The PSCo document "PSC-POL-Planning Authority Roles & Responsibilities.doc" describes PSCo's roles and responsibilities as a Planning Coordinator.

Steady State, Dynamic and Short Circuit Modeling Data Requirements and Reporting Procedures [MOD-032-1-R1]

PSCo is a member of the WECC interconnection. The System Review Subcommittee (SRS), formerly the System Data Work Group (SDWG), under the Reliability Assessment Committee (RAC) of WECC creates the interconnection wide models for steady-state, dynamic and short circuit data. The SRS also establishes modeling requirements for steady-state and dynamic models while the Short Circuit Modeling Working Group (SCMWG) establishes short-circuit requirements for models. These requirements are published by WECC in the WECC Data Preparation Manual (DPM), which is recommended to be followed by all members submitting data for the creation of interconnection models.

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Dynamic Modeling Data requirements are established in the "WECC Dynamic Modeling Procedure" and use models from the "Approved Dynamic Model Library". Unapproved models, (models not on the approved list) must go through the Model Validation Subcommittee (MVS) and follow the WECC Dynamic Modeling Procedure.

In order to support the creation of Western Interconnection cases as required by R4 of MOD-032-1, this document refers to the guidelines mentioned in the latest approved version of the WECC DPM for fulfilling the modeling data requirements for PSCo's planning area. This document also refers to MOD-032-1, Attachment-1 to the extent the requirements are applicable to PSCo's planning area modeling requirements. If updated versions of the above mentioned WECC documents that precede the date of this document are available, the WECC documents should be followed.

Steady State, Dynamic and Short Circuit Modeling Data Requirements [MOD-032-R1.1]:

WECC currently builds Interconnection-wide models for Steady State and Dynamic data only.

A. Steady State Modeling Data Requirements:

  (i) Bus (AC and DC): steady state bus modeling data should include nominal voltage, bus name, angle, unique bus number, area, zone, owner, bus type and voltage set point etc. In addition, the modeling data for Buses should meet the requirements stated in the WECC DPM. Bus number selection for new facilities must be coordinated with PSCo Data Submitter in order to avoid duplication.

  (ii) Aggregate Demand: Steady state data for modeling aggregate demand should include the load in-service status, real and reactive power, Load ID etc. In addition, the modeling data for demand should meet the requirements stated in the WECC DPM. Once a case request is received from WECC, PSCo will determine the appropriate load modeling percentage to be used for PSCo PC area.

  (iii)Generating Units: Steady State modeling data for Generators should include dispatch level, max and min real gross power limits, reactive power limits at the modeled max and min real power, regulating bus, MVA base, status, generator type etc. Additional steady state modeling requirements for generators can be found in the WECC DPM.

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Generator step up transformers should be modeled explicitly (not embedded in the generator model) and modeled using the transformer modeling requirements in section-vi below. Generation dispatch should be based on the WECC case description.

PSCo typically models wind at 21% of nameplate capacity and solar at 65% of name plate capacity in the power flow models unless the case description requests a different dispatch levels. When a case description models non-daylight hours, solar facilities will be modeled with 0% output.

If P_{GEN} is zero for any unit, it should be "statused out" unless the generator is a synchronous condenser or capable of providing reactive support without power generation. P_{GEN} of units must not exceed the P_{MAX} value and should be higher than the P_{MIN} value ($P_{MIN} \leq P_{GEN} \leq P_{MAX}$).

Station Service load should be modeled explicitly per the load modeling requirements under section-ii.

(iv) ***AC Transmission Line or Circuit:*** Steady state modeling of AC Transmission lines or circuits should include positive sequence R, X and B values, season specific normal and emergency ratings, status etc. Refer to the WECC DPM for additional steady state modeling requirements for AC Transmission Lines.

Summer normal and emergency ratings should be used for summer, spring and autumn cases. Winter normal and emergency ratings for facilities must be used for winter cases. All facility ratings must reflect the latest NERC Facilities Rating Standard (FAC-008) ratings.

For data submitted in PSSE, ratings 1 and 2 will be copied to the 3 and 4, 5 and 6, 7 and 8 respectively for the corresponding PSLF case being developed.

(v) ***DC Transmission System:*** DC transmission system model representation must follow the requirements of the WECC DPM.

(vi) ***Transformer:*** Transformers modeling should include transformer control type, controlled side (depending on transformer type), impedance (R, X, G, B), winding nominal voltages, tap ratios (voltage or phase angle), min and max tap positions, number of tap positions (for both

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ULTC and NLTC), normal and emergency ratings, status etc. Refer to the WECC DPM for additional steady state modeling requirements of Transformers.

Summer normal and emergency ratings should be used for summer, spring and autumn cases. Winter normal and emergency ratings for facilities should be used for winter cases. All ratings must reflect the latest NERC Facilities Rating Standard (FAC-008) ratings.

For data submitted in PSSE, ratings 1 and 2 will be copied to the 3 and 4, 5 and 6, 7 and 8 respectively for the corresponding PSLF case being developed.

(vii) Fixed Reactive Compensation: Shunt and series reactors and capacitors should be modeled with admittance value (B-actual), regulated voltage band limits, mode of operation, regulated bus, status etc. Additional requirements for modeling reactive compensation devices can be found in the WECC DPM.

(viii) Controlled Reactive Devices (including Static VAR Systems): Modeling of Static Var compensator devices must include reactive limits, voltage set point, fixed/switched shunt, status etc. Additional requirements for modeling Controlled Reactive devices including Static Var Systems can be found in the WECC DPM.

(ix) Area Interchange: PSCo coordinates and compiles the Area Interchange calculation for WECC designated Area 70. All long term firm contracts should be represented at the corresponding maximum contract capacities for the peak summer and winter cases.

For light load cases (heavy/light spring, heavy/light autumn, light summer and light winter) cases, the long term firm contracts for non-coal based generation should be dispatched at 35% of the contract capacities. For scenarios cases with targeted path flows, interchange schedules shall be changed to meet the path flow requirements. Other requirements for area interchange modeling can be found in the WECC DPM.

For operating cases, modeling realistic system conditions would take precedence over achieving targeted path flows if the targeted path flows seem to result in unreasonable load/gen representation.

B. Dynamic Modeling Data Requirements

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Only WECC approved dynamic models should be used. The list of WECC approved dynamic models can be found in the "WECC approved Dynamic Model Library". If the owner submits dynamic test data directly to WECC, a copy should be sent to PSCo.

The process for submitting Dynamic data to WECC is given in "WECC Generating Unit Model Validation Policy". For Generators where MOD26 and MOD27 data is submitted, the provided dynamic data will be used for MOD32 modeling purpose. Requirements for modeling Dynamic data are given in the WECC DPM.

(i) Generator: The generator dynamic data should include generator, excitation system, governor, Power system stabilizer etc. based on the type of generator. Requirements for generator dynamic data are stated in the WECC DPM.

A list of approved dynamic models to be used for conventional generator, Wind, Photovoltaic system, Static VAR systems, FACTS, DC system model are included in the "Approved Dynamic Model Library".

Generator data for future models can be based on data of similar models or design data. Once the generator goes in-service, the Generator Owner is required to provide the Generator model that represents the as-built model and its settings within 3 months of the Commercial Operation of the facility.

(ii) Load Data: Dynamic data for loads should be modeled per the requirements of the DPM. The Composite Load Model ID should be selected to represent the appropriate load type to the best of knowledge.

(iii) Under Frequency Load Shed (UFLS): UFLS data should be reported per the requirements of the WECC DPM, NERC standard PRC006 and NERC standard PRC024.

(iv) Under Voltage Load Shed (UVLS): UVLS data should be reported per the requirements of the WECC DPM, NERC standard PRC006 and NERC standard PRC24.

(v) Relay Modeling Data: Relay modeling data should be provided per the requirements stated in the WECC DPM.

C. Short Circuit Data Modeling Requirements:

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WECC currently does not build interconnection wide short circuit models, so PSCo does not have specific short circuit modeling data requirements. When requested by PSCo, short circuit data must be provided in the data format and requirements specified in the request letter.

Data Format [MOD-032-R1.2.1]

WECC cases are created in GE-PSLF software, so all steady state and dynamic modeling data will be compiled in GE-PSLF compatible .sav or .epc or .p and .dyd formats compatible with the latest version of PSLF approved for use by WECC.

As stated in the *Short Circuit Data Modeling requirements* section above, the data format for submitting short circuit data will be specified in the data request letter sent out by PSCo.

Level of Detail to Which Equipment Shall be Modeled [MOD-032-R1.2.2]:

The level of detail to which equipment shall be modeled should follow the requirements stated in the WECC DPM.

Case Types or Scenarios to be modeled [MOD-032-R1.2.3]:

The list of cases being built in any given year is published by SRS in the Base Case Compilation Schedule (BCCS). The BCCS lists the case name, corresponding case description (scenarios) and schedule for data submission for each WECC interconnection wide case. In addition, WECC staff also emails the case request letter before each case creation effort describing the case type (name), case description and schedule for data submission. Within five (5) days of receiving the WECC request letter, PSCo will re-send the WECC request letter to the data submitters (as defined in the WECC DPM). If you need to be added to the PSCo email list, please send a request using the contact information provided on the last page.

WECC currently does not build interconnection wide short circuit models, so short circuit data can be submitted upon request.

Schedule for Submission of data [MOD-032-R1.2.4]:

Generator Data Submission: The modeling parameters of any given generator are same in all WECC models, so Generator modeling data can be submitted once annually, in July. The data Submission shall include modeling data for new machines, or revised modeling data derived from Generator testing.

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If existing data in the WECC models has not changed, a written confirmation stating the validity of the existing modeling data shall be submitted.

Revised data from Generator testing can be submitted at any time of the year as it becomes available. The generation will be dispatched by PSCo per its dispatch practices stated in the generator section-A(iii) above.

Load Serving Entity Data Submission: Load Serving Entities for which PSCo is a TP should provide 10yr summer and winter load forecast data annually in February. PSCo will develop coincident peak load forecast from the submitted data, which will be modeled by PSCo in the WECC models.

Other data: PSCo follows the deadlines specified in the data request letter for the collection of Steady State and Dynamic Data required for the compilation of the WECC Base Case.

Specification for distribution or posting of Data [MOD-032-1-R1.3]:

This document will be updated annually before December and the latest copy will be posted on the PSCo OASIS website, at the following link:
https://www.rmao.com/public/wtpp/PSCO_Transmission_Planning_Docs.html.

Additional Modeling Requirements for Steady State and Dynamic data

Normally Open Facilities: All facilities should be represented in their normal operating conditions consistent with the year and season of the case being created. Transmission facilities and generation facilities that would be out of service for more than six (6) consecutive months should be modeled offline in the cases.

Planned Facilities: Steady state, dynamic and short circuit modeling data for future facilities should be submitted if the future facility is expected to be in-service by the time the case is expected to be released, or if the in-service date of the facility is before the year for which the case is being created. Requirements for modeling these planed facilities in steady-state, dynamic and short circuit models are given in the WECC DPM.

Future facilities that are in the preliminary planning stages, or for which in-service dates are uncertain, shall not be modeled in the WECC Interconnection-wide system models (per the Transmission Planner's judgment).

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Changes to Existing Facilities: Steady state, dynamic and short circuit modeling data changes to existing facilities should be submitted if the change is expected to be in-service by the time the case is expected to be released or the in-service date of the facility change is before the year for which the case is being created.

Load & Resource data: All WECC power flow case creation responses should include Load & Resource (L&R) data balance sheet. The L&R sheet should identify all interchanges, resource and load data and should balance loads and resources such that net is 0.

Back-to-Back DC Ties: Back-to-Back DC ties can be modeled as generators in the steady state power flow modeling data and netted in the dynamic modeling data. Requirements for modeling back-to-back DC ties are described in the WECC DPM.

Contact Information

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Links to WECC Documents

WECC DPM: WECC.org→Committees→RAC→SRS→Data Preparation Manual
2021: 2021 Data Preparation Manual.pdf (wecc.org)
2022: 2022 Data Preparation Manual.pdf (wecc.org)

WECC BCCS: WECC.org→Committees→RAC→SRS→Base Case Compilation Schedules
2021-22: 2022BCCS.pdf (wecc.org)
2022-23: 2023BCCS.pdf (wecc.org)

WECC Approved Dynamic Models: WECC.org→Committees→RAC→MVS→Approved Dynamic Model
Approved Dynamic Models May 2022.pdf (wecc.org)

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WECC Dynamic Modeling Specifications: WECC.org→Committees→RAC→MVS→Approved Model Specifications

-     For modeling specifications of Wind, Solar, Battery Energy Storage, Relays etc.