

# Transmission System Procedure



Public Service Company of Colorado

**Steady State, Dynamics and Short Circuit Modeling Data Requirements for PSCo's Planning Coordinator Area**

**Version: 1.3**

File Name: PSC-POL-Steady State-Dynamic-Short Circuit Data modeling requirements for PSCo PC Area.docx

**Page 1 of 8**

## 1.0 PURPOSE

This document establishes the steady-state, dynamics, and short circuit modeling data requirements and reporting procedures for Public Service Company of Colorado's planning area for the purpose of the Western Electricity Coordinating Council interconnection system model creation. This document also supports implementation of requirement R1 of the 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
Betty Mirzayi	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

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**Page 2 of 8**

### 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 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 Western Electricity Coordinating Council (WECC) interconnection and submits steady state, dynamics 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, dynamics 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, Dynamics and Short Circuit Modeling Data Requirements and Reporting Procedures [MOD-032-1-R1]**

PSCo is a member of the WECC interconnection. WECC's System Review Work Group (SRWG) is tasked with the creation of the system-wide models for the Western Interconnection. The SRWG has established steady state, dynamic and short-circuit modeling data requirements, which are reviewed and modified annually as needed. The WECC Steady State Modeling Data requirements are stated in the WECC DPM. The WECC Dynamics Modeling Data requirements are stated in the WECC DPM, WECC Dynamic Modeling Procedure and the Approved Dynamic Model Library. The WECC Short-circuit Modeling Data requirements are also stated in the WECC DPM. In order to support the creation of Western Interconnection cases as required in R4 of MOD-032-1, this document refers to the guidelines mentioned in the latest approved version of the WECC Data Preparation Manual (DPM) for fulfilling the modeling data requirements for PSCo's planning area. This document also includes the data listed in MOD-032-1, Attachment '1' to the extent they 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, Dynamics and Short Circuit Modeling Data Requirements [MOD-032-R1.1]:**

WECC currently builds Interconnection-wide models for Steady State and Dynamics data, but not for short-circuit data.

#### **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 numbers for new facilities should be coordinated with PSCo in order to avoid duplication.
- (ii) **Aggregate Demand:** Steady state data for modeling aggregate demand should include the load 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 must include dispatch level, real and reactive power limits, regulating bus, MVA base, status etc. Additional steady state modeling requirements for generators can be found in the WECC DPM. Generator step up transformers should be modeled exclusively (not embedded in the generator model) and

modeled using the transformer modeling requirements in item (vi) below. Generation dispatch should be based on the WECC case description. PSCo typically models wind at 21% of nameplate capacity and solar at 55% of name plate capacity in the power flow models unless the case description requests a different dispatch levels. If pgen is zero for any unit, it should be statused out unless the generator is a synchronous condenser. Pgen of units must not exceed the Pmax value and should be higher than the Pmin value.

- (iv) **AC Transmission Line or Circuit:** Steady state modeling of AC Transmission lines or circuits must 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 must be used for summer and autumn cases. Winter normal and emergency ratings for facilities must be used for winter and Spring 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 must be modeled with 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 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 and autumn cases. Winter normal and emergency ratings for facilities should be used for winter and spring 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):** Static Var compensator devices modeling data must include reactive limits, voltage set point, fixed/switched shunt (if applicable), 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 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 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 compromise system load/gen representation.

## B. Dynamics Modeling Data Requirements

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 Dynamics data to WECC is given in “WECC Generating Unit Model Validation Policy”. Requirements for modeling Dynamics 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. All approved dynamic models including wind, conventional generator, Photovoltaic system, Static VAR systems, FACTS, DC system model are included in the “Approved Dynamic Model Library”.
- (ii) **Load Data:** Dynamic data for loads should be modeled per the requirements of the DPM.
- (iii) **Under Frequency Load Shed (UFLS):** UFLS data should be reported per the requirements of the WECC DPM.
- (iv) **Under Voltage Load Shed (UVLS):** UVLS data should be reported per the requirements of the WECC DPM.
- (v) **Relay Modeling Data:** Relay modeling data will be included per the requirements stated in the WECC DPM

## C. Short Circuit Data Modeling Requirements:

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

**Data Format [MOD-032-R1.2.1]**

WECC cases are created in GE-PSLF software, so all steady state and dynamics modeling data will be compiled in GE-PSLF .sav or .raw or EPCL and dyd formats; in the PSLF version that is currently in use. 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 each equipment shall be modeled should follow the requirements stated in the WECC DPM.

For future facilities for which test data is not available, design data must be submitted. If design data is not available, approximate data that will adequately represent the generator can be used. The dynamic data should be in the WECC approved dynamic data models format.

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

WECC cases are compiled on an on-going basis through the year. The list of cases being built in any given year is published by SRWG in the Data Compilation Schedule (DCS). The DCS lists the case name, corresponding case description (scenarios) and schedule for data submission for each 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. WECC currently does not build interconnection wide short circuit models, so short circuit data can be submitted upon request. Within five (5) days of receiving the WECC request letter, PSCo will re-send the WECC request letter to the entities who submit data for each case (other than entities sending data annually). If you need to be added to the PSCo email list, please send a request at the contact information provided on the last page.

**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 shall be submitted once annually, in July. The data Submission shall include modeling data for new machines, revised modeling data derived from Generator testing; if the existing data in the WECC models has not changed, a written confirmation stating the validity of the existing modeling data shall be submitted. In addition, revised data from Generator testing can also be submitted at any time of the year as it becomes available. The generation will be dispatched by PSCo per its dispatch practices.

**Load Serving Entity Data Submission:** For Load Serving Entities whose data is modeled in the WECC models, summer and winter load forecast data for the future 10yrs shall be provided to PSCo annually in February. The corresponding coincident loads will be modeled by PSCo in the WECC models.

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**Page 7 of 8**

**Other data:** The tentative schedule for submitting steady state and dynamics data for WECC models is included in the WECC Base Case Compilation Schedule. PSCo will in turn assign new deadlines for data submission to PSCo for each of the WECC requests. This request letter will be sent out by PSCo within five (5) days of receiving the WECC request.

### **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 [http://www.rmao.com/public/wtpp/PSCO\\_Studies.html](http://www.rmao.com/public/wtpp/PSCO_Studies.html)

### **Additional Modeling Requirements for Steady State and Dynamics 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 out of service for more than six (6) consecutive months should be modeled offline in the cases.

**Planned Facilities:** Steady state, dynamics 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 the in-service date of the facility is before the year for which the case is being created. Future facilities which are in the preliminary planning stages or moving in-service dates can be omitted from the case creation efforts (per the Transmission Planners judgment). Requirements for modeling planning facilities in steady-state, dynamic and short circuit models are given in the WECC DPM.

**Load & Resource data:** All WECC power flow case creation responses should include Load & Resource (L&R) data balance sheet. The L&R sheet should show all interchanges, resource and load data and should show a balance between loads and resources.

**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 dynamics modeling data. Requirements for modeling back-to-back DC ties are described in the WECC DPM.

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**Page 8 of 8**

### Contact Information

*Sirisha Tanneeru*

Transmission Planning Engineer,

1800 Larimer St, 6<sup>th</sup> floor

Denver, Co - 80202

[Sirisha.tanneeru@xcelenergy.com](mailto:Sirisha.tanneeru@xcelenergy.com)

*Betty Mirzayi*

Manager, Transmission Planning West

1800 Larimer St, 6<sup>th</sup> floor

Denver, Co - 80202

[Betty.mirzayi@xcelenergy.com](mailto:Betty.mirzayi@xcelenergy.com)

### Links to WECC Documents

WECC DPM- [https://www.wecc.biz/Reliability/WECC\\_Data\\_Preparation\\_Manual.pdf](https://www.wecc.biz/Reliability/WECC_Data_Preparation_Manual.pdf)

WECC DCS - [www.wecc.biz/.../2014\\_Base\\_Case\\_Compilation\\_Schedule-R1.pdf](http://www.wecc.biz/.../2014_Base_Case_Compilation_Schedule-R1.pdf)

WECC Approved Dynamic Model Library - [www.wecc.biz/Reliability/WECC\\_Approved\\_Dynamic\\_Model\\_Library.pdf](http://www.wecc.biz/Reliability/WECC_Approved_Dynamic_Model_Library.pdf)

WECC Dynamic Modeling Procedure- [https://www.wecc.biz/Reliability/WECC\\_Dynamic\\_Modeling\\_Procedure.pdf](https://www.wecc.biz/Reliability/WECC_Dynamic_Modeling_Procedure.pdf)