BONNEVILLE POWER ADMINISTRATION

BPA MOD-032
DATA REQUIREMENTS
AND
REPORTING PROCEDURES

VERSION: 4.0 UPDATED: 5/18/2026

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Contents

1 Introduction

1.1 Overview

The Western Electricity Coordinating Council (WECC) develops a series of steady-state powerflow and dynamics simulation base case models, which are used by the Bonneville Power Administration (BPA) and its customers for performing planning, operations, and economic studies needed to fulfill various North American Electric Reliability Corporation (NERC) and Tariff compliance obligations.

This document incorporates data requests from multiple standards including MOD-032 to meet the above-mentioned obligations into a comprehensive Annual Data Exchange process, with the goal of reducing impact to entity resources.

Pursuant to Requirement 1 of MOD-032[1], BPA as a registered Planning Coordinator (PC) and its registered Transmission Planners (TP) have jointly established a set of common procedures for submitting data needed for developing the WECC interconnection Seasonal base case models. This process document will be posted and made available to the public anytime the document is updated, located on bpa.gov.

This document outlines the data reporting procedures needed to support the development of Seasonal base case models. These models must be made in compliance with requirements in MOD-032, as well as elements of FAC-008, MOD-025, MOD-026, MOD-031, PRC-024, TPL-007, TPL-008, and other standards as they become applicable (see also Section 5 Future Considerations). Moreover, these models must be compliant with any applicable requirements that may require data that realistically simulates steady-state and dynamic behavior of the transmission system for powerflow, dynamics, and Geomagnetically Induced Current (GIC) studies. Data requirements outlined in this document are intended to be consistent with NERC requirements.

BPA will request data required to accurately simulate the system in accordance with MOD-032, Att. 1. This includes data for all modeled equipment identified as Bulk Electric System (BES) and may include data for non-BES equipment when it is necessary to accurately model the performance and behavior of the BES. Applicable project data shall include anything that is currently or is expected to become BES, non-BES, or requested by the Planning Coordinator within the full planning horizon to support the WECC 20-year base case development (22 years from the date of receipt of data request).The PC is also responsible for submitting data for its area to the Electric Reliability Organization (ERO) or its designee per MOD-032 Requirement 4. This responsibility may be delegated to Area Coordinators as established by WECC. In the event BPA

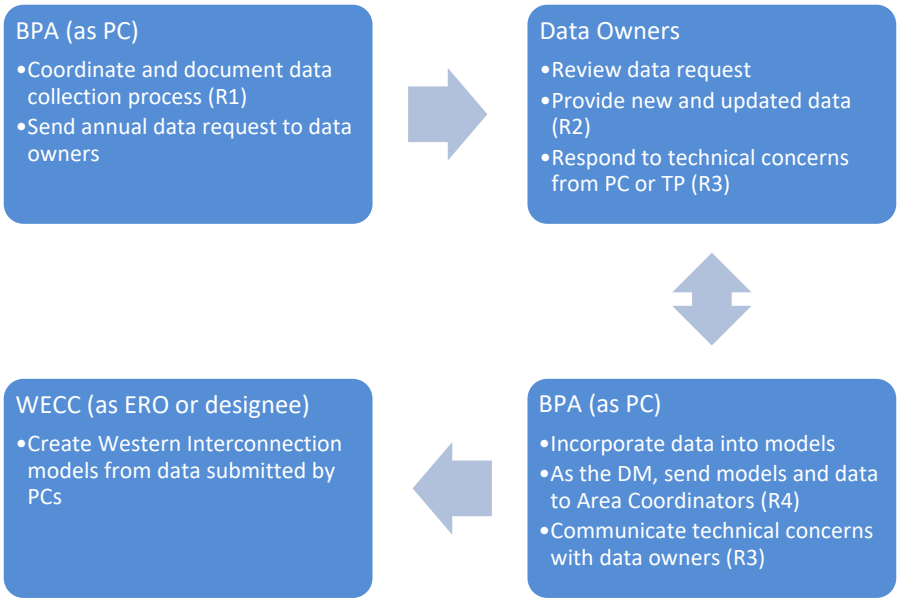
[1] http://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-032-1.pdf

delegates data submittal responsibilities to Area Coordinators, those Area Coordinators are to submit the data to WECC without alteration.

1.2 Data Submission Overview

Figure 1-1 provides a high-level overview of the data submission process outlined in MOD-032. Data requests will typically come from BPA's Customer Service Reliability Program (CSRP) team. When sending data, or otherwise communicating with BPA, please use CSRP's team mailbox: CSRP@bpa.gov

Figure 1-1: Generic MOD-032 Modeling Process Overview



Responsible entities (see Section 1.3) shall submit data to BPA as the PC on an annual basis (see Section 1.5). BPA as the Data Maintainer will submit received data to WECC via WPP (Area 40 Coordination).

BPA will provide a spreadsheet, or other mutually agreed upon format, requesting data by equipment type. Entities may elect to submit data in its own format provided their data submission satisfies all the data requested in the spreadsheet supplied by BPA. By submitting data, or by indicating that no data has changed, the responsible entity agrees that all data has been reviewed and verified, thus complying with the data request.

Data owners are required to submit facility rating information per FAC-008, GIC data per TPL-007, extreme weather data per TPL-008, dynamic testing schedule supporting MOD-026, and generation ride through capabilities per PRC-024. MOD-032 Attachment 1 lists the minimum data to be requested per the standard (see Section 6) and is summarized by responsible entities below. Sections 1.6 and 1.7 list additional data requested in BPA's PC area.

1.3 Responsible Entities

Pursuant to requirements in MOD-032, FAC-008, MOD-025, MOD-026, TPL-007, TPL-008, PRC-024, FERC Order 881, and BPA's LGIA, SGIA, NTMOA, BASA, TOP, and TP[2] customer agreements, data owners are responsible for providing the data necessary to model their assets per criteria outlined in this document. Data owners and their respective data submission responsibilities are stated below:

- Generator Owners (GO) are responsible for submitting modeling data for their existing and approved future generating facilities and associated relays (see Section 1.6). Also, see Section 3 regarding MOD-025/026, and PRC-024 data submittals.
- Transmission Owners (TO) are responsible for submitting modeling data for their existing and approved future transmission facilities (see Section 1.7).
- Entities that are only registered as a Balancing Authority (BA), Transmission Service Provider (TSP), or Resource Planner (RP) will be notified if any data is required.
- Distribution Providers (DP) are responsible for submitting load (and other applicable) data for their existing and approved future facilities (see section 2.1.3).
- Entities that have insufficient metering for load modeling purposes will also receive a data request; regardless of their registration status.

Entities that are not NERC registered will be notified if any data is required to model its system for reliability purposes.

BPA's Data Maintainer (DM) area is established by all data within BPA's PC area excluding such data from qualifying entities who have elected to not submit data to BPA as explained below.

Qualifying entities within BPA's PC area, excluding those which have a Transmission Operator (TOP) agreement with BPA, may elect to submit their data directly to an Area Coordinator instead of BPA as their PC. A qualifying entity is one that either has the ability to submit data directly to an Area Coordinator or submits to another PC or TP that can submit data to an Area Coordinator. If an entity chooses to not submit data to BPA, then they must notify CSRP@bpa.gov. In such cases, BPA will not be responsible for submitting their data to the associated Area Coordinators. In addition, such entities must ensure their data submission meets BPA's MOD-032 R1 reporting procedures and data requirements. If an entity would like to submit data themselves or to another entity as their Data Maintainer (see Section 1.3), they should notify BPA in writing at CSRP@bpa.gov.

[2] Large Generator Interconnection Agreement (LGIA), Small Generator Interconnection Agreement (SGIA), Network Transmission Memorandum of Agreement (NTMOA), Balancing Area Service Agreement (BASA), Transmission Operator Program (TOP), Transmission Planner (TP)

1.4 Typical Scenarios

For each annual WECC base case Compilation Schedule, BPA will submit data for a set of powerflow and dynamic cases as shown in Table 1-1. The typical scenarios developed could change from year to year based on WECC and member needs. At a minimum, scenarios needed for Transmission Planning and Operations and MOD-032 compliance will be included. Specific scenarios will be posted on the WECC SRS website annually for the upcoming year. General descriptions of the typical scenarios are provided below per the WECC base case Compilation Schedule:

- Winter Peak Load (HW) – the winter peak demand expected to be served.
- Winter Light Load (LW) – the winter demand expected to be served.
- Spring Peak Load (HSP) – the spring peak demand expected to be served.
- Summer Peak Load (HS) – the summer peak demand expected to be served.
- Summer Light Load (LS) – the summer demand expected to be served.
- Fall Light Load (LF) – the fall demand expected to be served.

See also section 5.1.2, Future Scenario Considerations, for upcoming potential related changes that may be worth consideration.

Table 1-1: Scenarios to be Developed

Description	Model Year	Heavy Winter	Heavy Spring	Heavy Summer	Light Fall
Near Term	1-2	X	X	X	X
Mid Term	5	X		X	
Long Term	9-10	X		X	
20-Year Term	20			X	

Example: Data Requests are sent in 2021. These data requests would be received in 2021, planning studies performed in 2022, and labeled as the 2023 System Assessment. Case scenarios would thus include a 2024-2025, 2028, and 2032-2033 case respectively.

1.5 Schedule

Data submissions to WECC, via Area Coordinators, will be compliant with MOD-032 R4, and will follow the data request schedule as outlined by the WECC SRS documentation. The WECC data request schedule can be found on the WECC SRS website under "base case Compilation Schedules."

For data within BPA's Data Maintainer area, BPA will send out data requests annually, or as needed with an expected data submission of 30 days after initial request. Registered entities are required to submit data per MOD-032 R1.2.4 at least every 13 months.

Dynamic data, including relay models and models for generators, will have an expected data submission of 60 days after initial request per PRC-024 R4 requirements.

1.6 Generator Owner

In coordination with their interconnected TO, the GO shall provide the necessary data to model their generating facilities (see Section 3.1 for relation to MOD-026 data submittals). At a minimum, the GO shall provide the data listed in Section 6 below. Table 1-2 provides a summary of the data required to be submitted by the GO. As PC, BPA may specify supplemental information to be provided by applicable GOs in addition to Table 1-2, and Section 6.

Data for existing and planned generators with executed interconnection agreements should be submitted. Actual dispatch will be determined based on study needs.

Table 1-2: Data to be submitted by the GO		
Steady-State	**Dynamics**	**Short Circuit**
Generator parameters PQ Capability Curves	Generator	For applicable Steady-State Items, provide:
Generator step-up (GSU) transformer data with tap setting and range	Excitation System	• Positive Sequence Data
Seasonal output capabilities	Turbine-Governor	• Negative Sequence Data
Station Service Load under normal conditions	Power System Stabilizer	• Zero Sequence Data
Reactive Power Compensation[3]	Protection Relays outlined in section 3.1.6	• Mutual Line Impedance Data
In-service status		
Wind/PV Collector System		
Regulated Bus		

1.7 Transmission Owner

The TO is responsible for providing the necessary data to model the items listed in Table 1-3, as well as Section 6 below. As PC, BPA may specify supplemental information to be provided by applicable TOs in addition to Table 1-3, and Section 6.

Table 1-3: Data to be submitted by the TO		
Steady-State	**Dynamics**	**Short Circuit**
System Topology	Static VAR Systems	For applicable Steady-State Items, provide:

[3] Additional reactive power support equipment (such as a switched shunt) used to maintain an acceptable power factor at the Point of Interconnection

Table 1-3: Data to be submitted by the TO		
Steady-State	**Dynamics**	**Short Circuit**
Buses	HVDC Facilities	• Positive Sequence Data
AC Transmission Lines	FACTS Devices	• Negative Sequence Data
HVDC transmission Facilities	Protection Relays	• Zero Sequence Data
Transformers with tap setting and range	Load Long ID	• Mutual Line Impedance Data
Limiting switchgear		
Reactive Power Compensation		
Static VAR Systems (SVS)		
Loads		
Regulated Bus for Voltage Control Devices		

1.8 Facility Ratings

Facility ratings (FAC-008) data will be requested annually or on an as-needed basis whereas MOD-032 is an annual process. FAC-008 and MOD-032 may be requested simultaneously to ensure consistency between the submittals. Responsible entities may submit ratings using its own report. This report should contain the fields in BPA's request, including seasonal ratings. The FAC-008 data submission must correspond to the ratings reflected in all study horizons and as provided in the MOD-032 data submission. Below is an itemized list of minimum requirements for a valid FAC-008 data submission.

Please provide:

- At least the two most limiting elements in each facility that are *owned* by the reporting entity.
- Normal and emergency ratings submitted in MVA for transformers and phase shifters, and Amps for all other equipment types.
- Emergency ratings duration shall reflect 30 minutes or longer, and all elements' emergency duration shall be included in the submission.
- A ratings methodology which supports the data owner's system, including:
    - Treatment of normal and emergency ratings.
    - Applicability of emergency ratings to the following study horizons: Planning, Operations Planning, and Real-Time.
    - Treatment of ring bus, breaker-and-half, double-breaker, or other configurations.
- Seasonal ratings data in support of WECC base case development, including:
    - Seasonal temperature assumptions for summer, winter, spring, and fall seasons.
    - Normal and emergency ratings for each season

    - Ratings that support the branch modeling data provided in the MOD-032 data submission.
- Ambient temperature ratings in support of reporting entity's ratings methodology and seasonal ratings data.
    - BPA's FAC-008 data requests include an ambient temperature range from -40°C to 55°C in 5-degree increments; this data is used to support BPA real-time operations. Data submissions that do not include higher temperature ratings should include guidance on how to treat equipment at these higher temperatures. Lower temperature fields that are not populated will be automatically populated with the next higher temperature rating value.
    - Seasonal temperature assumptions will be aligned with the corresponding ambient temperature's ratings such that rating values are within a 5% variance of each other.
- Other scenarios or information, as applicable to properly model ratings in the seasonal WECC base cases.

Criteria for requesting FAC-008 facility ratings data may include:

- Partial ownership of a shared facility with BPA.
- Ownership of a BES facility for which BPA is the registered TOP.
- Partial ownership of a shared facility with a BPA-registered TOP asset.
- Ownership of a facility as part of a customer agreement to lease, maintain, and operate BPA-owned equipment.

2 Steady State Model Development

2.1 Level of Detail

- If requested, each data owner is required to submit applicable data requested in the Annual Data Exchange template. Data requested in the template will be used by BPA for incorporation into the WECC Seasonal Powerflow Models. Examples of the data reflected in the template may include, but are not limited to, Transmission projects that are planned and funded or In-Service with the associated in-service date and retirement of facilities with the expected de-energization dates.
    - Data must be included that accurately depicts the system over the full planning horizon (~22 years from the data request).
- Generators with executed Generator Interconnection Agreements (GIA)[4] and associated network upgrades. At a minimum, all generators with a nameplate 10 MVA or larger or a facility with an aggregated nameplate 20 MVA or larger must be modeled in detail and are to be submitted by applicable entities.
- Bus/load/generation and devices profiles, which include:
    - Bus information: Nominal kV of the bus shall not be altered as it is set for each kV-class (500, 230, 115, etc.) when creating the powerflow base case.
    - Load type
    - Corresponding generation limits and levels (Mbase, Pmin, Pmax, Qmin, Qmax, and Pgen), and generator reactive capability curves (PQ Curves / D-Curves). All data submitted should also align to data submitted per the following NERC standards:
        - Mbase values will be requested from non-BES generators. All BES generators will submit Mbase values via dyd data submitted under MOD-026.
        - Pmin, Pmax, Qmin, Qmax values will be aligned to those submitted also under MOD-025. Pmax should also align with maximum generator capabilities as submitted under MOD-026.
            - *Pmax is the maximum steady-state real power output (MW), at unity power factor, given the current physical capabilities of the unit under the most opportune conditions in a given year. Also ignoring operational restrictions that may reduce the permissible power output. The rating must account for the physical capabilities of all equipment in the power train including generator derates, mechanical limitations, and any other physical limitations of the equipment.*

[4] https://www.bpa.gov/energy-and-services/transmission/tariff

- *The Pmax value found in the powerflow does not account for other limitations such as: generator step-up transformer limits, contractual limits, temporary/sub-seasonal de-rates, or other limits not directly associated with the physical capability of the generator to deliver power to the system. Only limits looking into the generator from the generator terminal bus should be reflected in Pmax.*
- *A valid Pmax must also be supported via data submitted under MOD-026 dynamic testing and the supplied generator capability curve.*

▪ Data for all PQ Curves will be provided to determine Qmin and Qmax values per PRC-019.

- Submitted data must be the actual data that aligns with the in-use operational settings and should be submitted as the corresponding Qmin and Qmax levels for various Power generation (Pgen) levels. The Pgen levels must include Pgen = 0, Pmax, and other data points to generate a reasonable and representative piece-wise linear capability curve for use in power system simulations.

o Settings on regulating equipment such as transformers, switched shunts, and HVDC data.

o Data needed to support Geomagnetic Disturbance (GMD) assessments including, but not limited to, substation grounding resistance, line DC impedance, transformer winding DC resistance, and transformer connection type.

- Updates and/or corrections to approved future generation and transmission projects.
- Any corrections that need to be made to existing system data modeling, including facility retirement updates.
- Any other information requested by BPA, as the PC, deemed necessary for modeling.

GOs will coordinate with their interconnected TO in order to ensure that their data is consistent with the TO-submitted topology. GOs may submit their data directly to BPA or work with their interconnected TO to submit the data to BPA on their behalf. If GOs have arranged with their interconnected TO to submit data on their behalf, this must be communicated in writing to BPA at CSRP@bpa.gov.

If the data has not changed since the last submission, responsible entities will have the option of indicating that the data has not changed.

The data submitted must be sufficient to perform reliability and economic studies on the Bulk Electric System (BES) as defined by NERC[5]. To that extent, relevant data associated with sub-BES facilities may also need to be provided.

[5] https://www.nerc.com/pa/Stand/2018 Bulk Electric System Definition Reference/2018_BES_Ref_Doc_Clean_08072018.pdf

2.1.1 Definitions

- Data Types
  - **Steady-State**: Required to represent the normal and continuous operation of the power system to include GIC data necessary to support the analysis of the power system during a Geomagnetic Disturbance (GMD) event.
  - **Dynamics**: Supports the time-domain analysis of power system stability.
  - **Short Circuit**: Positive, Negative, and Zero sequence data as well as any mutual line impedance data.

2.1.2 Project Modeling Criteria

Inclusion of projects in the base case models is shown in **Error! Reference source not found.**.

Table 2-1: Project Inclusion Criteria

Type & Status	Conceptual/Proposed/ Planned/Retirement	Designed/Funded/Construction/In Service/Corrections
Steady-State	NOT MODELED	MODELED
Dynamics		
Short Circuit		
GIC		
FAC-008		

- Project Statuses
  - **Conceptual**: Idea stage or vision plans.
  - **Proposed**: Projects that require additional review and are subject to change.
  - **Planned:** Projects that are in, or have completed, the planning process
  - **Designed:** Projects that have completed design, and there is intent to permit and construct the project with a high degree of certainty
  - **Funded/Construction**: Projects that have money allocated, and will be in, or are already in construction.
  - **In Service**: Facility is energized.
  - **Corrections**: Changes, error or actual, to be submitted in all future base cases.
  - **Retirement**: Equipment that will be permanently removed from service.

2.1.3 Loads

Entities that meet both of the following thresholds will submit loads directly via MOD-032.

- The entity has more than 30 modeled load busses of greater than 100kV with insufficient metering, and
- The entity has more than 80% of their modeled load busses of greater than 100kV with insufficient metering.

The term “insufficient metering” is any situation where the load at a bus cannot be directly resolved by meters. This happens when more than one modeled load must use the same meter

(or group of meters). In such cases, the entity shall supply a percentage distribution to properly allocate the aggregate load to the individual modeled loads.

Loads submitted directly under MOD-032 must meet the following requirements:

- Provide both the Real (MW) and Reactive (MVAR) net load at the modeled bus level as specified in the data request sheet,
- Specify the appropriate Load Long ID for the dynamics composite load model following the Load Long ID instructions (see also section 3.1.5),
- Provide the percent distribution for all loads that have insufficient metering,
- Provide monthly peak values going out at least 22 years in order to fulfill all time horizons,
- Include any committed load projects per modeling thresholds found in Section 2.1.2.

All other entities will submit loads via the LaRC (per MOD-031 described below) to BPA's Agency Load Forecasting group. Adherence to this will satisfy most of an entities MOD-032 load submission requirements. Entities are still required to provide the following information under MOD-032.

- Specify the appropriate Load Long ID for the dynamics composite load model following the Long Load ID instructions (see also section 3.1.5),
- Provide the percent distribution for all loads that have insufficient metering,

These load submissions must be in enough detail such that BPA's Agency Load Forecasting group can deliver to BPA's Transmission Grid Modeling group reasonable bus level load forecasts sufficient for WECC base case development.

These load submissions only provide real power forecasts for base case development. Therefore, the reactive power will be calculated using 0.95 as the power factor.

BPA is required to solicit load information from Customers annually (both BPA's NERC MOD-031 and OATT processes). BPA conducts this solicitation using the Load and Resource Consolidated Data Collection Tool (LaRC) and Customers are required to respond to the following sections:

- NERC MOD-031 Load Data
    - Box 1 - Hourly data for Historical Fiscal Year Period (MOD-031 - R1-1.3.1)
    - Box 2 - Historical Monthly Data (MOD-031 - R1-1.3.2)
    - Box 3 - Forecast Monthly Data (MOD-031 - R1-1.4)
    - Box 4 - Forecast Annual Data (MOD-031 - R1-1.4)

- NERC MOD-031 DSM (Demand-Side Management)
    - Box 5 - R1-1.5.3 How Demand Side Management is addressed in the forecasts of its Peak Demand and annual Net Energy for Load.
    - Box 6 - R1-1.5.4 How the controllable and dispatchable Demand Side Management forecast compares to the actual controllable and dispatchable Demand Side Management for the prior calendar year and, if applicable, how the assumptions and methods for future forecasts were adjusted.

- Box 7 - R1-1.3.4 & 1.4.5 Review the historical Demand Side Management and forecasts of Demand Side Management for 22 years into the future.

See also Section 5.1.2 Future Considerations, Loads, for upcoming potential related changes that may be worth consideration.

- OATT required submissions
  - Forecast Annually by Fiscal Year 22 years out for each POD (POD# and POD long name):
  - Summer Peak (MW)
  - Winter Peak (MW)
  - Energy (MWh)
  - Energy (GWh)
  - Balancing Authority in which the Forecast resides (i.e. BPAT or other)

In addition to including project-based loads in their submissions for Boxes 3 and 4, and on the OATT Load Information tab as applicable, BPA also requests that Customers distinctly provide project-based loads on the New and Possible Loads tab. These would be loads that they forecast in their service territory, including the following distinct information on each project-based load:

- Point of Delivery (POD)
- Bus number, name, and/or identifier
- Line-Load Interconnection Request (LLIR) No.
- Description
- Probability (%)
- MW amount of load forecast annually, for 22 years out.

BPA then determines if the 70% threshold for these loads is met to include them in the Agency Load Forecast.

2.1.4 Ratings

Ratings submitted under MOD-032 need to satisfy the following requirements:

- Ratings shall be provided in MVA.
  - Ratings should be submitted to the tenth's place, or first decimal (example 239.1 MVA).
- Ratings must be based off the nominal kV of the pertinent bus in the Powerflow base case.
- Ratings shall be determined based on the most limiting element for all equipment comprising a given branch in the model.
- Ratings shall align with data submitted under FAC-008.
  - MVA ratings calculated from Amps will be truncated, not rounded, to the first decimal. For example, if the limiting element for a 115kV facility is 2000 Amps, the truncated MVA calculated rating would be 398.37, whereas the rounded MVA rating would be 398.4 (from 398.37). The correct value to submit is 398.3.

Received Amps	MVA	Truncated Rating
2000 Amps	398.37	398.3

    - BPA will overwrite branch ratings to reflect the calculated truncated value as needed, based on submitted FAC-008 data.
- Entities should use their own facility rating methodology (if available) to correlate ambient temperatures to seasons for each equipment type.
- Ratings shall be given for each season below:
    - Summer Normal (Continuous)
    - Summer Emergency (30-minutes or longer)
    - Winter Normal (Continuous)
    - Winter Emergency (30-minutes or longer)
    - Spring Normal (Continuous) *
    - Spring Emergency (30-minutes or longer) *
    - Fall Normal (Continuous) *
    - Fall Emergency (30-minutes or longer) *

* Spring and Fall ratings are only required if an entity's ratings methodology supports their determination. Entities shall inform BPA of any seasonal assumptions. When an entity does not have Fall ratings, the Spring ratings will be used instead. When an entity does not have Spring and Fall seasonal ratings, the summer ratings will be used instead for both seasons.

2.1.5 Modeling of Wind Farms and PV Power Plants

- Wind and photovoltaic projects shall be represented with an equivalent generator(s), an equivalent pad-mount transformer, an equivalent collector system, a substation transformer between the collector system and the transmission bus, and a transmission line (if applicable).
- See also: WECC Wind Power Plant Powerflow Modeling Guide and PV Plant Powerflow Modeling Guide

3 Dynamics Model Development

3.1 Level of Detail

Dynamics simulations analyze the transient response of the power system following a disturbance. These simulations are in a timeframe of 0-20 seconds with a typical time step of ¼ cycles. As such, it is necessary to develop a model that sufficiently represents the automatic response of all active elements to a disturbance on the power system.

If requested, each responsible entity is required to submit the following model data:

- Dynamic models to represent approved future active elements such as, but not limited to, generators, Flexible Alternating Current Transmission System (FACTS) devices, or fast switching shunts.
- Updates to existing dynamic models.
- If the data has not changed since the last submission, indicate that the data has not changed in the attached data request spreadsheet.

Dynamics data submitted annually for MOD-032 is in addition to requirements in the BPA "GO Model Data Submission Process" document. Data will not be requested from responsible entities whose models for their generator type are still under development within WECC.

A separate request will be sent every 10 years per the BPA "GO Model Data Submission Process" document that requires testing and new data be submitted. All responsible entities must still adhere to all requirements and data collection procedures outlined in BPA's "GO Model Data Submission Process" document. BPA's "GO Model Data Submission Process" document is available on request by emailing CSRP@bpa.gov.

GOs are expected to submit directly to BPA unless they have arranged with the interconnecting TO to submit data on their behalf. If this arrangement is used, it must be communicated in writing to BPA at CSRP@bpa.gov.

See also section 5.1.3 Future Considerations, Generation, for upcoming potential related changes that may be worth consideration.

3.1.1 Synchronous Generators

At a minimum, all generators with a nameplate 10 MVA or larger, or a facility with an aggregated nameplate of 20 MVA or larger must be modeled. A detailed model of a generator must include:

- Generator Model
- Excitation System Model
    - May be omitted if unit is operated under manual excitation control
- Turbine-Governor Model

    - May be omitted if unit doesn't regulate frequency
- Power System Stabilizer Model *
- Reactive Line Drop Compensation Model *
- Over Excitation Limiter *
- Under Voltage Ride Through Relays *
- Under Frequency Ride Through Relays *

* May be omitted if device is not installed or not active

Generators with detailed modeling must use a dynamic model from the WECC Approved Dynamic Model Library found on the WECC MVS website. If a suitable model is not in the approved library, the responsible entity may request a model be added to the standard list by providing BPA with a technical justification for doing so. BPA will present the technical justification to the MVS for approval and inform the entity if the model has been accepted or not.

Several legacy models have been omitted from the WECC Approved Dynamic Model Library since they can be directly converted to newer dynamic models with minimal effort and without changes to simulation results. In instances where detailed dynamic modeling is unavailable, generic data may be used. Generators without detailed modeling will be netted.

3.1.2 Renewable Energy Facilities and Inverter-Based Resources

At a minimum, all generators with a nameplate 10 MVA or larger, or a facility with an aggregated nameplate of 20 MVA or larger must be modeled. A Renewable Energy Facility shall be modeled using equivalent generator representation as described in Solar PV Plant Modeling and Validation Guideline, WECC White Paper on Modeling Hybrid Power Plant, and WECC Wind Plant Power Flow Modeling Guide. Renewable Energy plants with detailed modeling must provide a generic dynamic model from the WECC Approved Dynamic Model Library (January 2026) found on the WECC MVS website.

*Please note that the REPC_B model is being phased out. Please use REPC_D going forward. The model will be fully retired 8/23/26

These models include the following:

- Renewable Energy Generator/Converter models
- Renewable Energy Electrical Controls models
- Renewable Energy Plant Controller models
- Mechanical Element Models for Wind Turbine Generator
    - Two-mass model of Wind Turbine Generator drive-train
    - Aero-dynamic model for Type 3 wind turbine generators
    - Pitch control system model
    - Torque control system model
- Protection Models
    - Low-/High- Voltage Ride-Through model

- Low-/High-Frequency Ride-Through model

3.1.3 Static VAR Compensators & Synchronous Condensers

Static VAR Compensators (SVC) and synchronous condensers are reactive power devices that can vary the amount of reactive power supplied or absorbed within the simulated timeframe (0-20 seconds). These devices must be modeled in sufficient detail in order to simulate its expected behavior.

3.1.4 HVDC

All high-voltage direct current (HVDC) transmission facilities must be represented with a sufficiently detailed model to simulate its expected behavior. For future HVDC transmission, facilities where exact design specifications are not known, generic HVDC models should be used.

3.1.5 Load

The dynamic behavior of load must be modeled in sufficient detail to meet NERC compliance obligations. Providing a specific dynamic load characteristic model or the load composition is acceptable.

The composition of the load shall be defined as referenced in WECC's MVS Load Long ID Instructions. Based on the composition of the load, an appropriate dynamic representation will be developed using models available in the PSLF dynamics library, likely a composite load model (CMPLDW).

Dynamics models for UVLS and UFLS are required when installed. Approved models can be found in the WECC Approved Dynamic Model Library found on the WECC MVS website.

3.1.6 Additional Protection Relays

Generic protection relays are applied during the simulation that scan for bus voltages, out-of-step conditions, and against generic protection zones for transmission lines. These generic protection relays only monitor system conditions.

Equipment-specific detailed protection relays may also be submitted at the discretion of the responsible entity; however, detailed protection relay models need to be submitted when:

- Voltage and frequency ride through capabilities of any generator when these relays are present.
- 3-phase over current relays are required when it is the primary form of protection.
- Other relay models are required by the WECC Approved Dynamic Model Implementation Schedule

3.2 Dynamics Data Checks

Once the dynamic models are created, a set of data checks to flag potential issues with the data submitted will be performed. In addition to the data checks, a sample set of disturbances are run

to assist in model review. Dynamics data checks are documented in the BPA "GO Model Data Submission Process" document for MOD-026.

4 Short-Circuit Model Development

4.1 Level of Detail

Short-circuit data is required for all generators, shunts, transformers, and lines that are required to be submitted in Sections 2 or 3.

MOD-032 requires that short-circuit data should be shared openly between applicable NERC functional entities. Applicable entities are responsible to submit all data consistent with the short-circuit requirements in Attachment 1.

For the customers belonging to the Transmission Planner Coordinated Functional Registration program, fulfillment of the short-circuit data collection portion of the Annual Data Exchange is described in the Transmission Planner Coordinated Functional Registration agreement. All other applicable entities will continue to follow the process identified below.

Applicable entities shall submit this data to BPA's SPC Technical Services Group (TEZP) annually starting in July and no later than the third week of November. Any modeling data submitted after this time will not be included in the following calendar year model.

The data should be provided in whatever native format the applicable entity uses to perform their short-circuit studies (ASPEN or CAPE). If a short-circuit software model is not available, the entity will work with TEZP to determine an acceptable format.

This data is shared with WECC as requested, as approved by applicable entities, and is not part of regular (MOD-032 R4) data submittals. WECC does not currently create interconnection-wide cases for the use of short-circuit analysis.

5 Future Considerations

5.1 Potential impacts to MOD-032 data requests and modeling

A variety of FERC and NERC standards are under development or being implemented, which may have significant impacts on future modeling, registration, and data reporting requirements for customers in BPA's Planning Coordinator area. Below is a summary of potential changes to consider monitoring for your own organization.

5.1.1 TPL-008: Extreme Weather conditions

Per NERC TPL-008 implementation, entities will be required to provide ratings and load forecast information for extreme winter and summer conditions. Current implementation dates are noted below.

- R1 Enforceable 4/1/2026
- R2-R6 Enforceable 4/1/2028
    - In support of base case creation (R3 & R4), BPA will request the data (ratings and loads) prior to these enforceable dates under the MOD-032 process, no later than the 2027 MOD-032 data request period.
    - Entities will need to develop and implement a methodology in order to provide:
        - monthly extreme peak load values (both Summer and Winter) going out at least 22 years
        - Ratings in support of selected benchmark events for Extreme Summer and Extreme Winter.
- R7-R11 Enforceable 4/1/2030
- See also section 1.4 Introductions, Typical Scenarios

5.1.2 MOD-032-2: Loads

- R1 Enforceable 4/1/2028
- R2-R4 Enforceable 4/1/2029, includes the following additional load data requirements:
    - Establish the ability to distinctly call out the aggregate amount (in MW) of Distributed Energy Resources (DER) embedded in the net load forecast.
    - Supply the amount (in MW) of Inverter Based Resources (IBR) connected to the load bus.
    - Distinctly separate out any Large Single Point Loads that are greater than 20MW (or per future NERC guidance), including the corresponding dynamic composite load model ID.
    - These new load data requirements will likely be submitted under MOD-031.
    - See also section 2.1.3 Steady State Model Development, Level of Detail, Loads.

5.1.3 MOD-026-2: Dynamics modeling data

- MOD-026-2 is effective beginning 4/1/2026, and will replace MOD-026-1 and MOD-027-1, which will be retired effective 3/31/2026. The effective dates for the requirements of the new NERC standard are listed below:
- R1 and R7 Enforceable 4/1/2027
- R2-R6 Enforceable 4/1/2029

5.1.4 Future Generation Considerations

- Per FERC Order 901 direction, entities may be required to register if they have Inverter-Based Resources (IBR) or Distributed Energy Resources (DER) greater than or equal to 20 MVA and interconnected at a voltage greater than or equal to 60kV ("Category 2"). This order will impact future MOD-025, MOD-026, and MOD-032 data submissions.
- See also section 3.0 Dynamics Model Development

6 MOD-032 - Attachment 1

The table below indicates the information that is required to effectively model the interconnected transmission system for the Operations Planning Horizon and Planning Horizons including FAC-008 and TPL-007 data. Data must be shareable on an interconnection-wide basis to support use in the Interconnection-wide cases. A Planning Coordinator may specify additional information that includes specific data required for each item in the table below. Each functional entity responsible for reporting the respective data in the table is identified by brackets "[functional entity]" adjacent to and following each data item. BPA additionally may request data from responsible entities as outlined in section 1.3. The data reported shall be as identified by the bus number, name, and/or identifier that is assigned in conjunction with the PC, TO, or TP.

steady-state *(Items marked with an asterisk indicate data that vary with system operating state or conditions. Those items may have different data provided for different modeling scenarios)*	**dynamics** *(If a user-written model(s) is submitted in place of a generic or library model, it must include the characteristics of the model, including block diagrams, values and names for all model parameters, and a list of all state variables)*	**short circuit**
1. Each bus [TO] a. nominal voltage b. area, zone and owner 2. Aggregate Demand[6] [LSE] a. real and reactive power* b. in-service status*	1. Generator [GO, RP (for future planned resources only)] 2. Excitation System [GO, RP(for future planned resources only)] 3. Governor [GO, RP(for future planned resources only)] 4. Power System Stabilizer [GO, RP(for future planned resources only)] 5. Demand [LSE] 6. Wind Turbine Data [GO] 7. Photovoltaic systems [GO] 8. Static Var Systems and FACTS [GO, TO, LSE]	1. Provide for all applicable elements in column "steady-state" [GO, RP, TO] a. Positive Sequence Data b. Negative Sequence Data c. Zero Sequence Data 2. Mutual Line Impedance Data [TO] 3. Other information requested by the Planning Coordinator or Transmission Planner necessary for modeling purposes. [BA, GO, LSE, TO, TSP]

[6] For purposes of this item, aggregate Demand is the Demand aggregated at each bus under item 1 that is identified by a Transmission Owner as a load serving bus. An LSE is responsible for providing this information, generally through coordination with the Transmission Owner.

3. Generating Units[7] [GO, RP (for future planned resources only)] a. real power capabilities - gross maximum and minimum values b. reactive power capabilities - maximum and minimum values at real power capabilities in 3a above c. station service auxiliary load for normal plant configuration (provide data in the same manner as that required for aggregate Demand under item 2, above). d. regulated bus* and voltage set point* (as typically provided by the TOP) e. machine MVA base f. generators step up transformer data (provide same data as that required for transformer under item 6, below) g. generator type (hydro, wind, fossil, solar, nuclear, etc.) h. in-service status* 4. AC Transmission Line or Circuit [TO] a. impedance parameters (positive sequence) b. susceptance (line charging) c. ratings (normal and emergency)* - per line and per facility d. in-service status* >200 kV - DC resistance 5. DC Transmission systems [TO] 6. Transformer (voltage and phase-shifting) [TO] a. nominal voltages of windings b. impedance(s) c. tap ratios (voltage or phase angle)* d. minimum and maximum tap position limits	9. DC system models [TO] Other information requested by the Planning Coordinator or Transmission Planner necessary for modeling purposes. [BA, GO, LSE, TO, TSP]	

[7] Including synchronous condensers and pumped storage.

e. number of tap positions (for both the ULTC and NLTC) f. regulated bus (for voltage regulating transformers)* g. ratings (normal and emergency)* - per line and per facility h. in-service status* i. >200 kV – Core Type j. >200 kV – AutoTransformer k. >200 kV – Winding connection type l. >200 kV – DC resistance m. >200 kV – Blocking devices 7. Reactive compensation (shunt capacitors and reactors) [TO] a. admittances (MVars) of each capacitor and reactor b. regulated voltage band limits* (if mode of operation not fixed) c. mode of operation (fixed, discrete, continuous, etc.) d. regulated bus* (if mode of operation not fixed) e. in-service status* f. >200 kV – Winding connection type 8. >200 kV – Shunt DC resistance Static Var Systems [TO] a. reactive limits b. voltage set point* c. fixed/switched shunt, if applicable d. in-service status* Other information requested by the Planning Coordinator or Transmission Planner necessary for modeling purposes. [BA, GO, LSE, TO, TSP] 9. Static Var Systems [TO] a. reactive limits b. voltage set point* c. fixed/switched shunt, if applicable d. in-service status*		

Other information requested by the Planning Coordinator or Transmission Planner necessary for modeling purposes. [BA, GO, LSE, TO, TSP]		

7 Version Control Block

Version	Date	By	Summary of Changes
1.0	6/30/2015	Ron Sporseen/TPCR	Initial Posting
1.1	1/25/2016	Ron Sporseen/TPCR	Update to section 1.3, responsible entities
1.2	4/15/2016	James Randall/TPMG	Various edits to sections 1.4, 1.5 & errata
1.3	4/19/2017	Various/TPMG & TPCR	Remove LSE and other various edits
1.4	11/9/2018	Various/TPMG	Added TPL-007 and FAC-008 data reporting requirements.
1.5	11/26/2019	James Randall/TPMG Lukas Boler/TPMG Tom Daufel/TPCR	Edited for consistency and included rating criteria between FAC-008 and MOD-032. Added PRC-024 language.
1.6	10/01/2020	Various/TPMG	Updated 1.8 FAC-008 due to change in internal process for data collection. Included other minor errata and language changes for consistency.
1.7	11/09/2021	Various/TPMG	Updated language to better clarify: data collection and submission process, required consistency between FAC-008 and MOD-032 submissions, Data Maintainer clarifications and TOP Customer requirements, planned vs. funded definitions, specifications for requested ratings, and other errata and language changes for consistency throughout the document.
1.8	8/12/2022	Various/TPMG	Updated 1.8 FAC-008 due to changes in internal process for data collection to align with ratings under MOD-032. Included other minor errata and language changes for consistency.
1.9	5/26/2023	Various/TPMG	Updated FAC-008 and steady state (and other) sections to reflect internal process changes for data collection to align with ratings under MOD-032. Included other minor errata and language changes for consistency.

2.0	8/1/2024	Various/TPMG	Consolidated references to facility ratings section, Updated Table 1-2 - 1.3, updated pmax definition, updated language to better clarify facility ratings criteria including seasonal and emergency ratings, updated Generator section (and others)to include dynamic modeling requirements and equipment. Updated links, included other minor errata and language changes for consistency
3.0	7/8/2025	TPMG	Added summary of data to be requested (section 1.1), added reference to DPs in multiple sections, added future considerations as section 5, updated Typical Scenarios (section 1.4)clarified project modeling thresholds (section 1.1, 2.1.2), clarified load submission requirements (section 2.1.3)
4.0	3/31/2026	TPMG	Consolidated section 1.9 with 1.1, 1.2, 1.3. Added Pmax definition. Updated NERC standards to include applicability and data needs per MOD-026-2, TPL-008-1, and MOD-032-2 across document. Other errata changes throughout document.