California Independent System Operator
&
Southern California Edison

Joint Transmission Planning Base Case Preparation Process

NERC Reliability Standard MOD-032-1

Version 1.8

December 9, 2024

INTENTIONALLY LEFT BLANK

Table of Contents

Appendices

INTENTIONALLY LEFT BLANK

1. Introduction

The purpose of the Transmission Planning Base Case Preparation Process (Process) is six-fold.

First, as required by NERC Reliability Standard MOD-032, Requirement R1, is for the California Independent System Operator (CAISO), as Planning Coordinator (PC), and Southern California Edison (SCE), as Transmission Planner (TP), to jointly develop steady-state, dynamics, and short circuit modeling data requirements and reporting procedures for the PC's planning area.

Second, this Process will demonstrate and help support how CAISO, SCE, and Participating Transmission Owners (PTO[1]), including: Resource Planners, Transmission Owners, Transmission Planners, and Transmission Service Providers meet MOD-032 and WECC's Data Preparation Manual (DPM) requirements. The CAISO is the PC and BA for PTOs and Transmission Planners located in area 24 of the WECC base cases, which includes, but not limited to: SCE, Metropolitan Water District (MWD), Valley Electric Association (VEA), GridLiance West (GLW), City of Anaheim, City of Azusa, City of Banning, City of Colton, City of Pasadena, City of Riverside, and City of Vernon. This process was developed in accordance with MOD-032, Requirement R1, to provide:

- Guidance to model the data listed in Attachment 1 of MOD-032.
- Specifications of the following items consistent with procedures for building the interconnection-wide case(s):
    - Data format,
    - Level of detail to which equipment shall be modeled,
    - Case types or scenarios to be modeled, and
    - A schedule for submission of data at least once every 13 calendar months.
- Specifications for distribution or posting of the data requirements and reporting procedures so that they are available to those entities responsible for providing the data.

Third, as required by MOD-032, Requirement R2, this process provides guidance to: each BA (including non-PTO entities in area 24 of the WECC base cases), Generator Owners, Load Serving Entities, Resource Planners, Transmission Owners, and Transmission Service Providers that shall provide steady-state, dynamics, and short circuit modeling data to its Transmission Planner(s) and Planning Coordinator(s) according to the data requirements and reporting procedures developed by its Planning Coordinator and Transmission Planner in Requirement R1.

[1] Per CAISO, a PTO is defined as a Transmission Owner that enters into a Transmission Control Agreement (TCA) with CAISO and places its transmission assets and Entitlements under CAISO's operational control in accordance with the agreement. For the latest "List of Participating Transmission Owners", refer to the CAISO's public website.

Fourth, as required by MOD-032, Requirement R3, upon receipt of written notification from its Planning Coordinator or Transmission Planner regarding technical concerns with the data submitted under Requirement R2, including the technical basis or reason for the technical concerns, each notified Balancing Authority, Generator Owner, Load Serving Entity, Resource Planner, Transmission Owner, or Transmission Service Provider shall respond to the notifying Planning Coordinator or Transmission Planner as follows:

- Provide either updated data or an explanation with a technical basis for maintaining the current data;
- Provide the response within 90 calendar days of receipt, unless a longer time period is agreed upon by the notifying Planning Coordinator or Transmission Planner.

Fifth, as required by MOD-032, Requirement R4, CAISO or its designee shall make available models for its planning area reflecting data provided to it under Requirement R2 to WECC (Electric Reliability Organization (ERO) designee) to support creation of the interconnection-wide case(s) that includes the CAISO's planning area (area 24 of the WECC base cases).

Sixth, this Process establishes consistency amongst various CAISO and SCE base cases to demonstrate compliance with NERC Standards that are applicable to Planning Coordinators and Transmission Planners and includes controls to ensure data accuracy and fidelity to base case objectives by use of checklists and formal reviews.

The CAISO shall make this Process available to all the PTOs and non-PTOs in area 24 of the WECC base cases by sending it via email and/or posting it on CAISO's public website.

2. SCE's Master Base Cases

2.1. Data Requirements

This section provides the data format and content requirements for development of SCE's master base cases. Refer to Appendix A, Data Preparation and Data Validation, and WECC's latest approved DPM for further detailed modeling requirements. PTOs and non-PTOs, including Generator Owner, Load Serving Entity, Resource Planner, Transmission Owner, or Transmission Service Provider shall provide their data to SCE and CAISO to be modeled into WECC's base cases in accordance with the WECC Base Case Compilation Schedule or revised schedule/dates as communicated by WECC. WECC will send request letters to PTOs and non-PTOs who are on WECC's System Review Subcommittee (SRS) distribution list, who shall provide their data as specified in data requirements listed below (consistent with the interconnection-wide process and in accordance with MOD-032). Refer to Appendix A and WECC's latest approved DPM for further details. This data will be incorporated into SCE's master base cases, which will be used by CAISO and SCE to develop additional base cases for their respective planning studies.

These requirements establish consistent system models amongst SCE, CAISO, and WECC. Appendix A and WECC's latest approved DPM address Steady-State, Dynamic, and Short Circuit Duty (SCD) data requirements.

If the SCD data format is from a program other than PSLF or PowerWorld, then this data shall be provided to SCE in the separate format (e.g., Aspen or Cape).

Upon request, SCE shall provide the SCD data within an agreed upon timeframe.

2.2. Steady-State Data

Steady-state data for transmission facilities shall include:

- Except for collector-based generation such as wind and solar, all Bulk Electric System elements, as presently defined by SCE, within SCE's system shall be represented in SCE base cases without equivalency.
- The facilities are expected to be in-service in the month and year represented by the case.
- Existing transmission facilities.
- CAISO approved transmission projects.
- If necessary, non-Bulk Electric System elements must follow the same submittal requirements for the Bulk Electric System elements.
    - Any equivalency of non-Bulk Electric System elements shall be modeled to yield similar results as a full representation in both static and dynamic analysis.
    - Non-Bulk Electric System generation shall, at a minimum include, but are not limited to:
        - Facilities with connected individual generation resources ≥ 10 MVA or aggregate generation resources ≥ 20MVA
        - Facilities with connected reactive resources ≥ 10 MVAR
        - The data requirements should be consistent with WECC's latest approved DPM and NERC Reliability Standard MOD-032. Refer to Appendix A and WECC's latest approved DPM for additional requirements.

2.3. Dynamic Data

To provide consistency in data submittals and help avoid potential software simulation problems, the guidelines of WECC's latest approved DPM and Appendix A shall be followed prior to each submittal. In all cases, dynamic data must match with steady-state data provided for each SCE base case (i.e., bus name and number, voltage, and MVA, must be the same for both steady-state and dynamic data).

2.4. Short Circuit Duty Data

Short circuit data is necessary to perform studies such as breaker duty evaluation and relay coordination. The necessary data includes, but not limited to:

- Positive sequence
- Negative sequence
- Zero sequence
- Mutual coupling line impedance
- Transformer winding connections

2.5. Generator Owner Procedures

Any Participating Generator Owner within area 24 of the WECC base cases shall provide modeling data in accordance with applicable NERC Reliability Standards, the WECC Data Preparation Manual, the WECC Generating Unit Model Validation Guideline, and the CAISO's Business Practice Manual for Transmission Planning Process[2] to SCE (basecase@sce.com) and the CAISO (gridmodelingdata@caiso.com) based on the periodicity in the NERC Reliability Standards (MODs 025, 026, & 027 & PRCs 19 & 24), WECC Generating Unit Model Validation Guideline, and Section 10 of BPM for Transmission Planning Process. Upon receipt of this data from Generator Owners and after usability is validated, these generating unit data will be included in SCE's master base cases and the base cases that are submitted to WECC and CAISO. SCE and CAISO will include the data in SCE's Annual Transmission Reliability Assessment and the CAISO transmission planning process base cases.

MOD-032 explicitly requires the submission of data at least once every 13 calendar months. Therefore, at minimum, modeling data shall be submitted by the end of each calendar year, but not to exceed 13 calendar months between each submission. For data that has not changed since the last submission, a written confirmation that the data has not changed is sufficient. As a reminder, section 25.5 of the CAISO Tariff requires notification to the CAISO and SCE at least 90 calendar days in advance of making modifications to generating facilities. Please refer to that section of the Tariff and the Generator Management BPM on the CAISO website for more details.

2.6. Base Case Schedule to Submit Data to WECC

SCE, PTOs, and non-PTOs located in area 24 of the WECC base cases will coordinate to develop a base case that represents each entity's system in a WECC full-loop base case which supports the creation of the interconnection-wide cases(s). Each PTO and non-PTO located in area 24 of the WECC base cases, including: Resource Planners, Transmission Owners, Transmission Planners, and Transmission Service Providers shall submit their data to SCE and CAISO in accordance with the WECC Base Case Compilation Schedule or revised schedule/dates as communicated by WECC; that is if changes are made to their base case models. Upon receipt from PTOs' and non-PTOs' data in area 24 of the WECC base cases in CAISO's planning area, SCE

[2] CAISO Business Practice Manual

will model the data and submit a full-loop base case to WECC that incorporates data from SCE, PTOs, and non-PTOs. These base cases will be submitted to WECC and the CAISO in accordance with the WECC Base Case Compilation Schedule or revised schedule/dates as communicated by WECC. When an issue of submittal timing warrants extending the deadline, SCE may modify the due dates, not to exceed 15 calendar days, by an agreed upon extension between WECC or CAISO.

3. Roles and Responsibilities

3.1. SCE's Master Base Case Development

SCE maintains two master base cases, a 1-year out and a 5-year out case. The master base cases are utilized to develop each WECC base case and SCE's Annual Transmission Reliability Assessment (ATRA) base cases. The master base cases are updated to reflect the latest system changes identified during the ATRA base case development. In addition, those base cases are validated on an annual basis for SCE owned facilities. This shall include, but not limited to:

- Latest transmission system topology
- Transmission line and transformer impedances
- Transmission line and transformer facility ratings
- Dynamic models
- Latest generation interconnection information

Refer to Appendix A "Data Requirements and Data Validation" for detailed data modeling requirements. These data requirements were extracted from the current WECC DPM. The tables in this appendix provide power flow and dynamic data requirements.

Table 1: Roles and Responsibilities for Entities/Assessments

Responsible Entities/Assessments	Roles
Regional Planning	Master base cases keepers. Develop and submit WECC base cases. Incorporate project files developed by Transmission Planners on an as needed basis.* Update master base cases for CAISO identified base case changes during the WECC base case review process.
Generation Interconnection Assessment	Develop Generation Interconnection base cases. Notify the master base case keeper of system changes identified by SCE or by the CAISO planners during the generation interconnection base case development and study process.
Reliability Assessment	Develop the ATRA base cases annually. Provide the ATRA base cases to the master base case keeper. Notify the master base case keeper of system changes identified by SCE or by the CAISO planners during the ATRA base case development and reliability study process.

* Project files for incorporating into the master base cases shall follow the requirements identified in Appendix A.

Table 2: Transmission Planning Modeling Assumptions

Base Case Models	Regional Planning	Reliability Assessment	Generation Interconnection Assessment	CAISO TPP
Generation	Model generation in-service, under construction, or on an as needed basis	Per CAISO TPP Study Plan Populate PMAX2 with NQC	Consistent with all applicable Interconnection Procedures	Per CAISO TPP Study Plan
Transmission Facilities	Including, but not limited to: Existing CAISO controlled Facilities CAISO approved transmission projects	Including, but not limited to: Existing CAISO controlled facilities CAISO approved transmission projects	Consistent with all applicable Interconnection Procedures	Per CAISO TPP Study Plan
Load Forecast	CEC 1-in-2 year load forecast	CEC Forecast 1-in-10 year load forecast for peak cases, off-peak cases vary Explicit additional achievable energy efficiency load models Demand Response (voluntary load shed)	Based on ATRA base case utilized as directed by CAISO	Per CAISO TPP Study Plan

Base Case Models	Regional Planning	Reliability Assessment	Generation Interconnection Assessment	CAISO TPP
Project Files	Future planned projects up to 10 years. Coordinate with responsible planners to obtain the latest files. Incorporate changes or projects into the appropriate WECC and master base case(s)	Upon the master base case keeper's request, provide updates on future projects and/or provide any corrections to the base cases	Update the Generation Project Data Depository on an ongoing basis every time updated data is provided by the Interconnection Customer (IR, MMA, preliminary Engineering, and Final Engineering, As-Built) for any future planned projects	Provide change files to CAISO as soon as possible

3.2. Regional Planning's Roles and Responsibilities

The master base case keeper will be responsible for preparing and submitting WECC base cases to WECC (ERO or its designee) and the CAISO. Each WECC base case will be developed from one of SCE's master base cases. Appendix B addresses the process for developing a WECC base case after a request is received from WECC. The master base case keeper will maintain the master base cases through ongoing coordination with the responsible planners to ensure that the latest modeling data for existing and future facilities are reflected in these master base cases. The master base case keeper will determine the inclusion of projects in the WECC base cases based on the project status, month, and year represented by the case.

3.3. Reliability Assessment Base Case Development Roles and Responsibilities

Planners that are responsible for the annual Reliability Assessment studies will:

a. Develop the annual ATRA base cases by using the master base cases to update approved WECC base cases. The final ATRA base cases will include up-to-date information of the existing facilities, future generation, and transmission projects per the study requirements as outlined in the study plan.

b. Monitor the progress of reliability-driven projects and provide the following to the master base case keeper:

   i. Updates or corrections to existing transmission facilities, and

   ii. Project files for newly approved transmission facilities. Transmission facilities include transmission lines, transformers, loads, reactive support devices (e.g.,

shunt capacitors and reactors, series capacitors, SVCs, SVDs, synchronous condensers, etc.), RASs, and other power system devices. Project files shall include simulation models with associated parameters (e.g., impedances, ratings, and susceptance), location, distance, and plan of service, and

iii. Confirmed review comments and change files developed as part of CAISO's TPP base case development work.

c. Review generator projects from the Generation Project Data Depository for status updates and determine which projects shall be included into the ATRA base cases. In addition, a list of ISO market resource identifiers for all ISO Participating Generators in the SCE service territory should be populated into the generator data Long ID field in the GE PSLF model data and maintained by SCE in coordination with CAISO.

On an as needed basis, the master base case keeper will request updates on reliability projects. Upon receipt of this request, the responsible project sponsor/planner will provide the updates in an EPC or EPCL format to the master base case keeper. The status of updates to transmission facilities will be maintained by the project sponsor/planner. Once the network upgrades are placed in service or approved by CAISO, the project sponsor/planner will provide project updates to the master base case keeper, if any, of the new transmission facilities' parameters including impedances, facility ratings, line distances, and locations.

3.4. Generation Interconnection Assessment Base Case Development Roles and Responsibilities

3.4.1. Generation Interconnection Base Cases

Generation base cases start from the ATRA base cases. Those base cases are modified to include transmission and generation facilities in accordance with the Generation Interconnection study process. Generation Interconnection base case assumptions are identified in the CAISO Generation Interconnection study plan.

During this modification, if a planner identifies a discrepancy in the technical parameters of existing or future facilities such as impedance, facility ratings, and transmission line topologies, the planner will submit an email change request to the master base case keeper at basecase@sce.com to address the discrepancy. The email change request should include all supporting evidence such as, but not limited to: EPCL, EPC, DYD files. If the change request is approved, the master base case(s) will be updated, and this update will be reflected in the future base case submittal to WECC and CAISO.

3.4.2. New Generation and Interconnection Facilities

Planners that are responsible for the Generation Interconnection Assessment will:

a. Update the progress of queued generation in the Generation Interconnection Project Data Depository and will notify the master base case keeper of the status of generation projects when requested. For example, generators in-service or under construction will be modeled in the base cases. Also, if generator projects are placed in-service in phases,

the generators will be modeled and can be dispatched with respect to the commercial operation date of each phase.

b. Be responsible for reviewing the initial design, final engineering, and As-Built data for the interconnection customer generating facilities, to be provided by the Interconnection Customer in accordance with executed interconnection agreements.

3.4.3. Network Upgrades or RAS for Interconnecting Generators

Planners that are responsible for the Generation Interconnection Assessment will:

a. Maintain the status updates of transmission facility upgrades. Post the changes on the Generator Interconnection Project Data Depository and notify the master base case keeper, upon request, of any changes to network upgrades, including upgrades that are placed in service. These upgrades include, if any, but not limited to: impedances, facility ratings, line distances, and locations.

b. Be responsible to inform the master base case keeper of any new or modification to Remedial Action Scheme (RAS) that are associated with generation projects and provide the RAS data in the WECC RAS File Format.

c. Update and maintain SCD data for new generation projects and associated transmission facilities until such upgrades are placed into service and As-Built information is provided. Any future changes to upgrades not driven by generation interconnection requests will be updated and maintained by the appropriate organization where the modification need is identified.

3.5. CAISO'S Base Case Development Roles and Responsibilities

Every year CAISO posts the CAISO Transmission Planning Process Study Plan developed along with the stakeholders. CAISO planners review the study plan with SCE and then initiate the Transmission Planning Process. The reliability assessment is performed on the bulk system and the local areas for the 10-year planning horizon to ensure that the performance of the system under the CAISO controlled grid will meet or exceed the applicable reliability standard performance requirements.

During the CAISO transmission plan base case development, the WECC power flow base cases are used as the starting point, and the portion of areas that will be studied in each WECC base case will be updated by the latest information provided by the PTOs. The SCE system modellings in the TPP base cases shall start from the latest ATRA base cases. The ATRA cases shall include up-to-date information of the existing facilities, future generation, and transmission projects for the next 10-year planning horizon in accordance with the Study Plan. After the updated topology has been incorporated, the load and resource modellings in the TPP base cases will be adjusted to represent the operational scenarios outlined in the Study Plan.

SCE will provide a list of renewable projects that are either under construction or recently went in-service to the CAISO planners. SCE will model and dispatch these renewable projects pursuant to the CAISO Study Plan. SCE will provide a list of all additional and/or retired generation, transmission, and other projects that will be modeled in the planning cases. The

California Public Utilities Commission (CPUC) provides the CAISO with the Renewable Portfolio Standard (RPS) portfolios to be used in the TPP annually. CAISO Planners will compare the SCE and CPUC list and identify the additional projects that needs to be modeled to meet the RPS requirements. CAISO Planners will provide to SCE the list of additional generation that needs to be modeled in the ATRA base case and a list of any new conventional generation resources, as per CAISO study plan, that needs to be modeled. SCE will model this additional RPS renewable generation and dispatch these renewable generators pursuant to the CAISO Study Plan. CAISO planners will also communicate this list of additional generation projects that need to be modeled in the applicable WECC base cases to meet the RPS requirements as specified in the WECC Base Case Request Letter.

The CEC will post 1-in-10 demand forecast and provide allocations to bus-bar locations. SCE will explicitly model the following: Additional Achievable Energy (AAEE) savings, Additional Achievable Fuel Substitution (AAFS) impacts, Additional Achievable Transportation Electrification (AATE) forecast, Behind the Meter PV (BTM-PV) installed capacity, and Demand Response (DR). SCE will update the ATRA base cases according to the ATRA Study Plan incorporating topology changes, CEC load forecast, CEC allocations, path flows, and CAISO new resources. SCE will develop DYD files, p1-p7 contingency files, A-bank load forecast tables and will provide this information to CAISO. SCE will ensure that the provided DYD files will have a stable response during a no disturbance run.

CAISO planners will review the provided information and communicate back any concerns identified in the base case to SCE via written comments. SCE will update its current ATRA and WECC master base cases, as needed, to address CAISO's written comments. Once the outstanding concerns are resolved, if any, CAISO will merge the San Diego Gas & Electric (SDG&E) base case with the SCE base case and will build the full loop base case as specified in the CAISO study plan. CAISO will work with SDG&E to obtain their TPP base case to be merged with SCE.

SCE will provide the bulk system and the local area base cases for the years in the study plan and CAISO planners will start the TPP study.

Requirement R6 of FAC-014-3 directs each transmission planning entity to use facility ratings and criteria that are not less limiting than those described in RC West's SOL methodology unless the entity provides a technical rationale to the entities identified in the standard. To that end, SCE as a TP shall ensure that the facility ratings it provides for its facilities to CAISO as a PC in the planning models are consistent with the facility ratings data they provide to their Transmission Operator and/or RC West per the RC's SOL Methodology and the facility ratings criteria in the ISO Planning Standards and/or the ISO TPP Study Plan. The applicable time duration for the facility ratings in the planning models can be found in the Transmission Register.

3.6. Base Case Submittals to WECC

SCE is responsible for submitting WECC base cases and review comments for area 24 to WECC and CAISO in accordance with the WECC Base Case Compilation Schedule or revised schedule/dates as communicated by WECC. When an issue of submittal timing warrants extending the deadline, SCE may modify the due dates, not to exceed 15 calendar days, by an agreed upon extension between WECC or the CAISO. SCE will provide the initial base cases to CAISO for review and comment. The CAISO will review SCE base case data and provide comments to SCE during the Base Case Review Process[3]. SCE will provide written response to the CAISO, using the case review sign-off sheet in Appendix D, confirming that the WECC Base Case has been updated to address CAISO's review comments or provide an explanation for maintaining the current data. SCE will provide base case data or review comments for area 24 to WECC and CAISO. In addition, SCE and CAISO will retain documentation records for a minimum of four years.

3.7. SCE and CAISO Responsibilities for Generator Data Validation

CAISO and SCE established a joint generator data review process to implement Section 10 of the CAISO BPM for TPP, which provides consistency in generator modelling data submissions from the Generator Owners and ensures the data be fully validated by SCE and CAISO. The purpose of this section is to specify roles and responsibilities for submitting generator data to WECC through its base case development process.

Once CAISO and SCE have validated the generator data and determined that the requirements are met by the Generator Owner, SCE will update the master base cases with the validated generator modeling data, if any changes are needed. However, if the only remaining data that has not been received or validated is the electromagnetic transient (EMT) model, then SCE will update the master base cases with the validated GE-PSLF power flow modeling data. If an update to the generator power flow and/or dynamic modeling data is required, the update will be submitted to WECC and CAISO in response to a WECC base case data request and/or submitted to WECC Gen Test (gentest@wecc.org).

CAISO and SCE will review the WECC base cases sent out for review to ensure the previously approved generator data is included in the base case and dynamics file. If additional changes to the generator data are required, they will be included in the review comments submitted to WECC and CAISO.

[3] The CAISO, in agreement with SCE, has developed a case review sign-off sheet for providing WECC Base Case Review comments to SCE (Appendix D)

4. Approvals

The Joint Transmission Planning Base Case Preparation Process, developed by the California Independent System Operator (CAISO) and Southern California Edison (SCE), identifies modeling data requirements and reporting procedures as specified in NERC Reliability Standard MOD-032-1 Requirement R1.

The parties signing this document agree to their individual and joint responsibilities for implementing modeling data requirements and reporting procedures in accordance with the Joint Transmission Planning Base Case Preparation Process.

Signed by:
Robert Sparks
F18DD60F4309448...

12/9/2024

Robert Sparks Date
California ISO, Sr. Manager, Regional Transmission-South

DocuSigned by:
Hayk Zargaryan
B130A6551742487...

12/9/2024

Hayk Zargaryan Date
SCE, Sr. Engineering Manager, Regional Planning

5. Revision History

Version No.	Description	Date
1.0	Initial Document	July 1, 2015
1.1	Minor edits for clarity and to ensure compliance obligations	July 1, 2016
1.2	Minor edits to ensure compliance obligations and to accommodate the WECC Anchor Data Set requirements	August 31, 2017
1.3	Edits to ensure compliance obligations under ISO TPP BPM section 10. Section. III updated to reflect changes to SCE's transmission planning group structure.	September 14, 2018
1.4	Appendix A updated to reflect changes in the 2020 WECC Data Preparation Manual. Changes to establish that VEA will submit data to SCE instead of NVE.	December 17, 2019
1.5	Section 3.8, and Appendix A updated to reflect changes in the Dynamic data and SCE and CAISO's responsibilities in reporting generator data to WECC	November 06, 2020
1.6	Section 3.8 to reflect changes in the dynamic data and EMT validation	December 23, 2020
1.7	Minor edits for clarity and Section 3.3 updated to include generator resource IDs	September 12, 2023
1.8	Section 3.5 updated to reflect Requirement R6 of FAC-014-3. Minor edits for clarity in Appendix B and removed Appendix E.	December 9, 2024

Appendix A:
DATA REQUIREMENTS AND DATA VALIDATION

The modeling requirements in Appendix A were extracted from the current WECC DPM. Where there are differences between Appendix A and the latest approved WECC DPM, the latest approved WECC DPM shall be followed with the exception of following:

- Generating facilities less than 10 MVA may be modeled explicitly or aggregated.
- Generating facilities connected to the WECC system below 60 kV may be modeled explicitly or aggregated.
- Aggregated generation capacity that is 20 MVA or larger and is connected to the WECC transmission system at 60 kV or higher, and is a collector–based generation facility, then steady-state data and dynamics data can be submitted for the generation facility as a single-unit generator model or multiple-unit generator model. (Wind and solar farms are an example of a collector-based generation facility.)
- Retired generators can either be removed from the base case or have their ID changed to "R*".

A. Base Case Preparation

- **AC and DC Buses**
  a. Buses usually represent all the equipment in a substation that is at the same voltage level and is connected together. If desired, multiple bus sections within a substation can be represented by separate buses connected by Connectors or AC Transmission Line models that can be opened or closed as needed. Buses may also represent a node on a transmission line such as a tapping point or change in ownership.
  b. Location of the bus will be identified by the combination of Area, Zone, and/or Owner fields. Optionally, the latitude and longitude fields can be submitted using decimal degrees with data entered not to exceed five decimal places. Additionally, latitude and longitude fields are required with the substation data in the "AC Substation" section.
  c. See Appendix A, Table 1: Data Requirements (Buses) for further modeling details.

- **Generators**
  a. Generators selected for Area Slack Control, including the system slack, shall meet the same technical requirements as selecting generators for automatic generation control (AGC) of a Balancing Authority Area. Generators selected for AGC typically have the following attributes:

i. Changes in MW output cause small changes in generator angle (suggested; dAngle/DP < 0.15 degrees/MW).
ii. Generation is dispatchable.
iii. Maximum MW output typically greater than 100 MW.
iv. Unit is expected to be in service for the time frame represented in the WECC base case.

b. Modeling of generators shall comply with the following:

i. If the individual generator unit capacity is 10 MVA or larger and the generator is connected to the WECC transmission system at 60 kV or higher, then submit steady-state data and dynamics data for each generator.

ii. If the aggregated generator unit capacity is 20 MVA or larger, the generators are connected to the WECC transmission system at 60 kV or higher, and is not a collector–based generation facility, then submit steady-state data and dynamics data for each generator. (Wind and solar farms are an example of a collector-based generation facility.)

iii. If the aggregated generation capacity is 20 MVA or larger, is connected to the WECC transmission system at 60 kV or higher, and is a collector–based generation facility, then steady-state data and dynamics data should be submitted for the aggregated generation capacity as a single-unit generator model.
iv. Modeling of Utility-Scale Distributed Energy Resources (U-DER) should comply with the following:
    1. Individual U-DER facilities with an aggregated generation capacity of 10 MVA or larger should be modeled explicitly at the low side of a transformer and include a dynamic model.
    2. Individual U-DER facilities with and aggregated generation capacity under 10 MVA should be included in a load model at the low side of the transformer. See “Data Requirements (Loads)” for modeling details and details on modeling Retail-Scale Distributed Energy Resources (R-DER).
v. Generating facilities without DYD data shall be netted in the DYD file and have their Non-Conforming Load Flag set appropriately. Steady-state and dynamic generator data shall be consistent. Steady-state and dynamic generator data shall be consistent.

c. Synchronous motors 10 MVA and larger shall be modeled as individual machines, using a generator model with negative Real Power output and constant Reactive Power (Q) output.
d. Induction motors shall be modeled as a load with the intent of using an induction motor model (MOTORW).
e. Synchronous condensers shall be modeled individually using a generator model.

f. Generator step-up transformers shall be modeled explicitly; therefore, they shall not be modeled using the internal generator step-up transformer feature of a generator model. All related parameters shall be set to the default values. See "Data Requirements (Transformers)".
g. Station service loads (ID = 'SS') shall be represented explicitly as separate loads on the generator bus. See "Data Requirements (Loads)."
h. Wind and photovoltaic plants shall be represented through an equivalent generator(s), equivalent low-voltage to intermediate-voltage transformer, equivalent collector system, and substation transformer between the collector system and the transmission bus. See the WECC Wind Power Plant Power Flow Modeling Guide and PV Plant Power Flow Modeling Guide.
i. Large industrial sites may include imbedded generation. Industrial aggregated generation capacity of 10 MVA and larger shall be represented in power flow instead of netting with the total load. If a generator is connected to the low side of the bulk-power delivery transformer, then the transformer must be represented in the power flow, and the generator and load must be connected to the low-voltage side of the transformer.
j. Generator maximum real power (Pmax) in power flow must be consistent with the turbine capabilities defined in the Master Dynamics File.
k. Generator data shall be extracted from generator test reports or data obtained from Generator Owners.
l. See Appendix A, Table 2: Data Requirements (Generation) for further modeling details.

- **Transmission Lines (AC)**

a. Series connected reactive devices modeled in AC Transmission Lines shall be explicitly modeled.
b. AC Transmission Line models connecting two areas, as defined by WECC, shall be maintained in the "Master Tie-Line File."
c. When breakers are explicitly represented in the model, they should be modeled as Breakers with the Connector Type field set to Breaker. See "Data Requirements (Connectors)" section.
d. AC transmission lines modeled with impedance below X = 0.00029 p.u. (the threshold impedance in PSLF) shall not be used to represent a closed loop (ring bus representation).
e. Normal and emergency thermal rating fields for the seasonal scenario described in the base case data request letter shall be populated for all AC Transmission Line models.
f. Line-connected transformers shall not be modeled using the internal line connected transformer feature of a transmission line model; all related parameters shall be set to the default values. See "Data Requirements (Transformers)."

g. Data for AC lines will consider the length of the line when calculating line parameters. For example, long lines will be modeled with impedances adjusted to account for the uniform distribution of the series impedance and shunt admittance along the length of the line.
h. Obtain the limiting component or facility ratings of a transmission line from the CAISO Transmission Registry.
i. If available, obtain transmission line impedances from the SCE's Line Impedance Database.
j. Appendix A, Table 3: Data Requirements (AC Transmission) for further modeling details.

- **Connectors**

a. Connectors should be considered as objects other than transmission lines, series capacitors, series reactors and transformers connecting two buses. Breakers can be modeled as Connectors.
b. MVA or Amp Ratings for Connectors are not required. The connected transmission line or transformer may include the connector rating if the connector is the most limiting element of the devices intended to be represented in the model.
c. See Appendix A, Table 4, Data Requirements (Connector) for modeling details.

- **Transformers**

a. Transformers with no Tap Changing Under Load (TCUL) or phase-shifting capability shall have the Tap Control Type field set to '1' and shall not have TCUL or phase-shifting data included in the cases. Conversion from the latest approved version of PSLF to other widely used programs may create model discrepancies with partial TCUL or phase-shifting data. Actual transformer equipment type shall be represented.
b. Transformer data may can be entered on either the transformer base (transformer winding MVA base and winding voltage base) or the system model base (100 MVA and system nominal voltage base). Impedance values and tap position values shall use a consistent unit base value for a given transformer.
c. Transformer models connecting two Areas, as defined by WECC, shall be represented in the "Master Tie-Line File."
d. Normal and Emergency thermal rating fields corresponding to the seasonal scenario described in the base case data request letter shall be populated for all Transformer models.
e. The Transformer Impedance Correction Table shall be maintained in the "Master Tie-Line File."
f. Obtain Transformer Thermal Facility Ratings from SCE SOB No. 33.
g. See Appendix A, Table 6, Data Requirements (Transformers).

- **Fixed Shunt Reactive Elements**

a. Fixed-shunt elements that are directly connected to a bus shall be represented as bus shuts.
b. Fixed-shunt elements that directly connect to and switch with a transmission line shall be represented as line shunts.
c. Fixed Line Shunt models connected to an AC Transmission Line model connecting two Areas as defined by WECC, shall be represented in the "Master Tie-Line File" if requested by the process detailed in the data submission request.
d. Fixed shunt reactive devices inside wind and solar projects must be modeled explicitly in power flow.
e. See Appendix A, Table 7, Data Requirements (Fixed Shunts)

- **Controlled Shunt Reactive Devices**

a. Controlled shunt reactive devices models should be used to represent the following devices explicitly in power flow:
    i. Mechanically switched shunt capacitors and reactors;
    ii. Static VAR Compensators;
    iii. STATCOMs; and/or
    iv. Thyristor-switched shunt capacitors and reactors.
b. Controlled shunt reactive devices inside wind and solar projects must be modeled explicitly in power flow.
c. The number of explicitly modeled shunts on a bus should be minimized to aid solving
d. See Appendix A, Table 8 Data Requirements (Controlled Shunts)

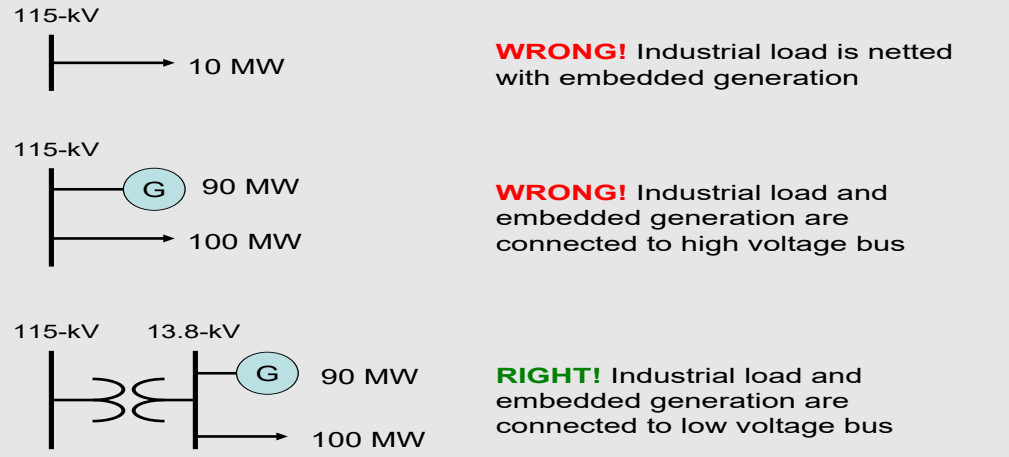
- **Loads General Requirements**

a. Use the CEC Load Forecast and distribute amongst SCE's A-Banks.
b. Real and reactive power for each load shall be provided.
c. Motors 10 MVA or larger shall be modeled as machines (see "Data Requirements (Generation)").
d. Station service at modeled generation facilities with station service load greater than or equal to 1 MW shall be modeled explicitly. Generator station service load models shall have their Load ID set to 'SS.'
e. A climate zone shall be provided for each load in accordance with the WECC MVS Load-Long ID Instructions (LID Instructions), either within the case data provided, or in a separate spreadsheet file. The PC shall select an appropriate Long ID that correctly represents the dynamic load characteristics and place it in the climate zone field.
f. Modeling of Distributed Energy Resources (DER) should comply with the following:

i. If data is available, all Retail Scale Distributed Energy Resources (R-DER) and only individual Utility-Scale Distributed Energy Resources (U-DER) with an aggregated output below 10 MVA should be modeled using the distributed generation fields in the load model.

ii. See "Data Requirements (Generation)" for details on modeling U-DER with an aggregated generation capacity of 10 MVA or larger.

g. Industrial loads and embedded generation not consistent with the R-DER modeling section shall be modeled on the low side of the transformer, as shown in the following figure:



- See Appendix A, Table 9, Data Requirements (Loads)

- **DC Transmission Lines**

a. Include (at a minimum) the following DC Transmission Line (overhead and underground) requirements: line parameters, Normal and Emergency Ratings, control parameters, rectifier data, and inverter data.
b. MW set-point of converter data shall be equal to or less than the DC Transmission Line Rating.
c. Appendix A, Table 5, Data Requirements (DC Transmission) for modeling details.

- **AC Substations**

a. Substations represent all the buses in a substation. These collections of buses are connected by transformers, bus sectionalizing breakers, switches, and/or short transmission lines.
b. See Appendix A, Table 10, Data Requirements (AC Substations)
c.

- **Dynamic Data**

Approved dynamic models conform to the WECC Dynamic Modeling Procedure. All dynamic models contained in the MDF shall be those approved by the MVS. If the model you want to use is not on the approved list, you must go through the MVS and follow the WECC Dynamic Modeling Procedure.

The following approach to dynamic data shall apply Interconnection-wide:

a. Generators and other dynamic devices shall be represented with approved dynamic data as recommended by the MVS to represent the designated dynamic equipment modeled in WECC base cases. The approved models can be found within the Approved Dynamic Model Library[4].
b. Estimated or typical manufacturer's dynamic data based on facilities of similar design and characteristics may be used to represent planned generators and other dynamic devices if specific design data cannot be obtained. MVS maintains the Typical Machine Data document. Specific dynamic design data shall be submitted per the WECC Steady-State and Dynamic Data Criterion.
c. Load Requirements
    i. A composite load model shall exist for each load modeled in the steady-state data.
    ii. Keep dynamic load data characteristics consistent with reported steady-state data.
d. Underfrequency Load Shedding
    i. Include under frequency load shedding records for all loads that have UFLS relays on the interconnected system.
    ii. The pickup frequency of each stage shall be lower than that of the previous stage. UFLS must comply with WECC-coordinated off-nominal requirements as specified in the WECC Off-Nominal Frequency Load-Shedding Plan document.
    iii. Pertinent load data must be included in the MDF. All UFLS data in the MDF must match bus, load, and/or branch identifiers in the cases.
    iv. The UFLS models must correspond to UFLS information provided to the WECC Underfrequency Load-Shedding Review Group in accordance with WECC Underfrequency Load-Shedding.
    v. To include data in Planning cases, submit the data with the case development and identify as planning data.
e. Undervoltage Load Shedding
    i. UVLS records must be included for all loads that have under-voltage relays on the interconnected system.

[4] MVS | Western Electricity Coordinating Council

ii. The pick-up and time-delay settings must be coordinated for each stage with the previous stage.
iii. Pertinent load data must be included in the MDF. All UVLS data in the MDF must match bus, load, an/or branch identifiers in the case.

f. Relays
i. Relay models as approved for use by the SRS must be included per the timeline and scope it establishes for primary relays. PCs are also strongly encouraged to submit all relevant backup relay modeling data.

- **SCD Data**

Short circuit data is necessary to perform a myriad of studies such as breaker duty evaluation and relay coordination. The necessary data includes the zero, positive, and negative sequence data of transmission lines but also includes but not limited to the generator characteristics and transformer winding connections.

1. Positive Sequence
2. Negative Sequence
3. Zero Sequence
4. Mutual Coupling Line Impedance
5. Transformer Winding Connections
6. Auxiliary transformers / equipment connected at the tertiary (i.e. grounding transformers, series reactors, etc.)

Data Requirements
AC AND DC
General requirements:

Table 1: Data Requirements (Buses)

Field	Description	Requirements
Number	Bus number	B1. Refer to Table 1b: Area, Zone and Bus Number Assignments B2. WECC staff shall provide DC Bus numbers.
Name	Bus name • Alphanumeric string containing 1 to 12 characters • At least one non-numeric character	B3. Bus names shall be unique within the same Base Voltage class.
Base Voltage	Nominal voltage class of Bus (kV)	
Bus Type	AC Bus type {0,1,2,-2} • 0 = swing bus (voltage magnitude and phase fixed) • 1 = load bus (unconstrained voltage angle and magnitude) • 2 = generator bus (voltage control [terminal or remote] within generator limits) • -2 = generator bus with unlimited reactive power limits • Other bus types may be used to indicate OFF status. • Bus type -4 and smaller is the accepted convention for deleted buses. DC Bus type {1,2} • 1 = for a rectifier • 2 = for an inverter	
DC System Number	DC system number (not required for AC Bus)	B4. WECC staff shall assign a DC system number for each DC system prior to model submission.

Field	Description	Requirements
Scheduled Voltage	Scheduled voltage (pu) • 5 decimals • Default: 1.00000	B5. If the Bus is regulated by a generator or other device, the scheduled voltage shall be specified in per unit with respect to the Base Voltage of the Bus. B6. If Bus is not regulated, the scheduled voltage is optional for information purposes only.
Vmax	Maximum pre-contingency System Operating Limit (SOL) voltage provided to applicable Reliability Coordinator (pu).	
Vmin	Minimum pre-contingency System Operating Limit (SOL) voltage provided to applicable Reliability Coordinator (pu).	
Area	Bus Area in which Bus is located	B7. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.
Zone	Bus Zone in which Bus is located	B8. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated range of Zones used by Area.
Owner	Owner Number	B9. Owner number shall be the Transmission Owner, Generator Owner, or PC (as established by a written agreement). B10. WECC staff shall assign Owner Number to required entities.
Substation	Substation in which Bus is assigned	B11. Buses relative to GIC analysis shall be assigned to a substation
Balancing Authority	Balancing Authority in which Bus I located	B12. All buses shall be assigned to a Balancing Authority Area.
Data Maintainer	Maintainer of model designation	B13. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.
Service	In or Out of Service Dates	

Table 2b: Area, Zone and Bus Number Assignments

Area No.	Zone Range	Area Name	Member System	Member System Bus Range
24	240 – 259	So Calif	SCE	24,000 – 24,999
	2400-2599			240,000 – 249,999
	940 – 959			94,000 – 95,999
	290-299			29,000 – 29,999
	9400-9599			290,000 – 299,999
	890-899		VEA, GLW	18,900-18,999
				189,000-189,999
			CDWR, MWD,	25,000 – 25,999
			Others	250,000 – 259,999

Data Requirements (Generation)
General requirements:

Table 2: Data Requirements (Generation)

Field	Description	Requirements	Measure
Bus Numbers	Number of the Bus to which the generator is attached. • See "Data Requirements (Buses)"		
Unit ID	Two -character Generator identifier		
Status	Generator status • 1 = in-service • 0 = out-of-service	G1. Out-of-service units shall have status set to zero. G2. Retired units shall be deleted rather than having status set to zero.	
Pgen	Real power output (gross MW)	G3. Pgen shall be at or within the unit Pmax and Pmin parameters for units that are in-service.	If Status = 1: Pmin ≤ Pgen ≤ Pmax
Qgen	Reactive power output (MVAr)		
Pmax	Maximum real power output (MW)	G4. Pmax shall reflect the maximum real power output of the unit, also known as 'gross' capability. G5. Pmax shall not be greater than the maximum capability of the unit represented by the governor model.	Pmax ≤ Governor Max
Pmin	Minimum real power output (MW)	G6. Pmin shall reflect the minimum real power output of the unit. G7. Pmin shall be less than or equal to Pmax	Pmin ≤ Pmax
Qmax	Maximum reactive power output (MVAr)	G8. Qmax shall reflect the appropriate maximum reactive power output of the unit.	

Field	Description	Requirements	Measure
Qmin	Minimum reactive power output (MVAr)	G9. Qmin shall reflect the appropriate minimum reactive power output of the unit. G10. Qmin shall be less than or equal to Qmax	Qmin ≤ Qmax
Q Alloc Factor	Reactive power regulating assignment factor • 0.0 – 1.0 • > 0.0 for AVR control • 0.0 for constant PF control or gen Status=0		
Q Table Flag	Reactive capability curve flag • 0 = do not use capability curve • 1 = use capability curve if it exists	G11. Q-Table data used for internal studies shall be included in WECC base case submittals. G12. PMax value shall exist on the Q Table if used.	
Base load Flag	Base load flag • 0 = non-base load unit (responds to low frequency with additional mechanical power) • 1 = base load unit (cannot respond to low frequency with additional mechanical power) • 2 = base load unit (cannot respond to low and high frequency with mechanical power)	G13. Base Load Flag Shall be consistent between steady-state and dynamics models	

Turbine Type	• 0 = unknown • 1 = steam turbine (except steam of combined cycle) • 2 = combined cycle steam part • 3 = steam cross-compound • 4 = combined cycle total unit (planned gens and details for separate model not available) • 5 = hydro • 6 = Internal Combustion Engine (diesel, piston, reciprocating) • 7 = diesel turbo charged • 11 = GT (single shaft, does not include turbine part) • 12 = aero derivative GT • 13 = single-shaft combined cycle • 14 = Synchronous condenser (no turbine) • 19 = Turbines used in a Binary Cycle (including geothermal) • 20 = type unknown wind turbine • 21 = type 1 wind turbine (onshore only) • 22 = type 2 wind turbine (onshore only) • 23 = type 3 wind turbine (onshore only) • 24 = type 4 wind turbine (onshore only) • 25 = wind turbine (offshore) • 29 = combined cycle combustion turbine part

Field	Description	Requirements	Measure
	• 31 = photovoltaic (unknown or mix) • 32 = photovoltaic (fixed) • 33 = photovoltaic (tracking) • 40 = DC tie (generators representing DC ties) • 41 = motor/pump • 42 = energy storage – battery • 43 = energy storage – flywheel • 44 = energy storage – other • 46 = energy storage – compressed air • 47 = energy storage – concentrated solar power • 48 = fuel cell • 51 = hydrokinetic, axial flow turbine • 52 = hydrokinetic – wave buoy • 53 = hydrokinetic – other • 54 = energy storage – reversible hydraulic turbine • 99 = other		

Primary & Secondary Fuel Type	• 0 = unknown • 10 = (ANT) Anthracite Coal • 11 = (BIT) Bituminous Coal • 12 = (LIG) Lignite Coal • 13 = (SGC) Coal-Derived Synthesis Gas • 14 = (SUB) Subbituminous Coal • 15 = (WC) Waste/Other Coal • 16 = (RC) Refined Coal • 20 = (DFO) Distillate Fuel Oil • 21 = (JF) Jet Fuel • 22 = (KER) Kerosene • 23 = (PC) Petroleum Coke • 24 = (PG) Gaseous Propane • 25 = (RFO) Residual Fuel Oil • 26 = (SGP) Synthesis Gas from Petroleum Coke • 27 = (WO) Waste/Other Oil • 30 = (BFG) Blast Furnace Gas • 31 = (NG) Natural Gas

- 32 = (OG) Other Gas
- 40 = (AB) Agricultural By-Products
- 41 = (MSW) Municipal Solid Waste
- 42 = (OBS) Other Biomass Solids
- 43 = (WDS) Wood/Wood Waste Solids
- 50 = (OBL) Other Biomass Liquids
- 51 = (SLW) Sludge Waste
- 52 = (BLQ) Black Liquor
- 53 = (WDL) Wood Waste Liquids excluding Black Liquor
- 60 = (LFG) Landfill Gas
- 61 = (OBG) Other Biomass Gas
- 70 = (SUN) Solar
- 71 = (WND) Wind
- 72 = (GEO) Geothermal
- 73 = (WAT) Water
- 80 = (NUC) Nuclear
- 81 = (PUR) Purchased Steam
- 82 = (WH) Waste Heat

Field	Description	Requirements	Measure
	• 83 = (TDF) Tire Derived Fuels • 84 = (MWH) Electricity use for Energy Storage • 85 = (OTH) Other		
Reg Bus	Bus with voltage controlled by this Generator	G14. Regulation of a remote Bus that does not represent actual system operation shall be avoided.	
Vsched	Generator scheduled voltage (pu)		
Area	Area in which generator is located	G15. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.	
Zone	Generator Zone in which located	G16. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated range of Zones used by Area.	
Base MVA	Generator base (MVA)	G17. Unit Base MVA shall be equal to the MVA Base parameter of the unit's Dynamic machine model.	Base MVA = Machine Base
Owner	Owner Number • Up to 8 owners allowed	G18. Owner Number shall be the Generator Owner. G19. WECC staff shall assign Owner Number to required entities.	
G tap	Tap ratio of generator step up transformer	G20. G tap shall be set to 1.	G tap = 1
R TR	Resistance of generator step up transformer	G21. R TR shall be set to 0.	R TR = 0
XTR	Reactance of generator step up transformer	G22. X TR shall be set to 0.	X TR = 0
R Sub transient	Sub transient resistance of generator		

Field	Description	Requirements	Measure
X Sub transient	Sub transient reactance of generator	G23. X Sub transient shall be equal to the sub transient reactance represented in the unit Dynamic machine model.	X Sub transient = Xdpp (or Ldpp)
Balancing Authority	Balancing Authority Area in which Generator is located		
Data Maintainer	Maintainer of model designation	G24. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.	
Service	In Service or Out of Service Dates		
Long ID	Resource long identifier LID	G25. Maintain and populate with a list of ISO market resource identifiers for Participating Generators	

Additional data for short circuit duty

Field	Description	Requirements	Measure
R0	Zero Sequence Resistance of generator		
X0	Zero Sequence Reactance of generator		
R-	Negative Sequence Resistance of generator		
X-	Negative Sequence Reactance of generator		
GND	Ground Connection • Solidly Grounded • Through Impedance		
R	Resistance of Grounding Circuit		
X	Reactance of Grounding Circuit		

AC Transmission Lines
General requirements:

Table 3: Data Requirements (AC Transmission)

Field	Description	Requirements	Measure
FROM Bus Number	Number of the bus to which the FROM end of the transmission line section is attached. • See "Data Requirements (Buses)"		
TO Bus Number	Number of the bus to which the TO end of the transmission line section is attached. • See "Data Requirements (Buses)"		
Circuit ID	Circuit identifier • Two-character circuit identifier	X1. AC Transmission Line modeling equivalent circuits shall have Circuit ID set to '99' or 'EQ.'	
Section Number	Section number (1-9 in ascending order beginning at FROM end)	X2. AC Transmission Line with multiple sections shall number the sections consecutively starting with '1.'	
Status	Branch status • 0 = out-of-service • 1 = in-service • 2 = bypass	X3. AC Transmission Line shall have the anticipated status of the line in the case.	
R	Branch section positive sequence resistance	X4. Resistance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Data Submitter.	

Field	Description	Requirements	Measure
X	Branch section positive sequence reactance	X5. Reactance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Data Submitter.	
B	Branch section positive sequence susceptance	X6. Susceptance used for modeling an AC Transmission Line shall conform to the modeling practices as deemed appropriate by the Data Submitter.	
Rating MVA 1	Summer Normal Branch Rating (MVA)	X7. Line rating required	Rating MVA 1 > 0
Rating MVA 2	Summer Emergency Branch Rating (MVA)	X8. Line rating required	Rating MVA 2 > 0
Rating MVA 3	Winter Normal Branch Rating (MVA)		
Rating MVA 4	Winter Emergency Branch Rating (MVA)		
Rating MVA 5	Fall Normal Branch Rating (MVA)		
Rating MVA 6	Fall Emergency Branch Rating (MVA)		
Rating MVA 7	Spring Normal Branch Rating (MVA)		
Rating MVA 8	Spring Emergency Branch Rating (MVA)		
From Loss Assign.	Loss factor (0.0 - 1.0) used to assign losses • 1.0 = 100% loss assigned to FROM end of AC Transmission Line • 0.0 = 100% loss assigned to "TO" end of AC Transmission Line		
Area	AC Transmission Line area location	X9. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.	

Field	Description	Requirements	Measure
Zone	Transmission Line zone location	X10. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated ranges of Zones used by Area.	
Ohms	Ohmic data flag • 0 = impedances in pu • 1 = impedances in ohms		
Owner	Owner Number (1 through 8)	X11. Owner number shall be the Transmission Owner of transmission facility and Generator Owner for lines within generation facility. X12. WECC staff shall assign Owner Number to required entities.	
Data Maintainer	Maintainer of model designation	X13. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.	
Service	In Service or Out of Service Dates		

Additional data for short circuit duty

Field	Description	Requirements	Measure
R-	Branch section negative sequence resistance		Usually the same as positive sequence
R0	Branch section zero sequence resistance		
X-	Branch section negative sequence reactance		Usually the same as positive sequence
X0	Branch section zero sequence reactance		
B-	Branch section negative sequence susceptance		Usually the same as positive sequence

Field	Description	Requirements	Measure
B0	Branch section zero sequence susceptance		
FROM Bus (1)	Number of the bus to which the FROM end of the transmission line section is attached which has mutual coupling with this line		
TO Bus (1)	Number of the bus to which the TO end of the transmission line section is attached which has mutual coupling with this line		
Circuit ID (1)	Circuit identifier that has mutual coupling with this line • Two-character circuit identifier		
M(1)	Zero Mutual Impedance between this line and (1) line		
FROM Bus (2-8)	Repeat for all other lines that have mutual coupling with this line		
FROM Bus (2-8)	Repeat for all other lines that have mutual coupling with this line		
Circuit ID (2-8)	Repeat for all other lines that have mutual coupling with this line		
M(2-8)	Repeat for all other lines that have mutual coupling with this line		

Connector
General requirements:

Table 4: Data Requirements (Connector)

Field	Description	Requirements	Measure
FROM BUS Number	Number of the bus to which the FROM end of the Connector is attached. See "Data Requirements (Buses)"		
TO BUS Number	Number of the bus to which the TO end of the Connector is attached. See "Data Requirements (Buses)"		
ID	Connector identifier Two-character identifier		
Status	Connector status • 0 = out-of-service • 1 = in-service 2 = bypass	B1. Connector shall have the anticipated status of the line in the case.	
Connector Type	Connector device type • Breaker • Load break disconnect • Disconnect • Fuse • Ground disconnect		
Allow Consolidation	Flag for allowing topology processing to consolidate the Connector within a "superbus" • YES NO		
Rating MVA 1	Summer Normal Connector Rating (MVA)		
Rating MVA 2	Summer Emergency Connector Rating (MVA)		
Rating MVA 3	Winter Normal Connector Rating (MVA)		
Rating MVA 4	Winter Emergency Connector Rating (MVA)		

Field	Description	Requirements	Measure
Rating MVA 5	Fall Normal Connector Rating (MVA)		
Rating MVA 6	Fall Emergency Connector Rating (MVA)		
Rating MVA 7	Spring Normal Connector Rating (MVA)		
Rating MVA 8	Spring Emergency Connector Rating (MVA)		
Data Maintainer	Maintainer of model designation	B2. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.	

DC Transmission Lines
General requirements:

Table 5: Data Requirements (DC Transmission)

Field	Description	Requirement	Measure
ifrom	DC 'FROM' bus number		
ito	DC 'TO' bus number		
ck[2]	DC line identifier		
projid	Project Identifier		
st	DC line status		
dcsys	DC system number		
area	Area number		
zone	Zone number		
r	DC line resistance		ohms
l	DC line inductance		henries
c	DC line capacitance		microfarad
rate[8]	DC current ratings		amps
aloss	DC line loss assignment factor		per unit
nown[8]	Owner number		
Balancing Authority	Balancing Authority Area in which DC bus & converter are located		
Data Maintainer	Maintainer of model designation	D1. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.	
Service	In Service or Out of Service Dates		

Transformers
General Requirements

Table 6: Data Requirements (Transformers)

Field	Description	Requirements	Measure
FROM Bus Number	Number of the bus to which the FROM end of the transformer is attached. • See "Data Requirements (Buses)"		
TO Bus Number	Number of the bus to which the "TO" end of the transformer is attached. • See "Data Requirements (Buses)"		
Circuit ID	Circuit identifier • Two-character circuit identifier	T1. Transformer modeling equivalent circuits shall have Circuit ID set to '99' or 'EQ.'	
Status	Transformer Status • 0 = out-of-service • 1 = in-service • 2 = secondary open • 3 = tertiary open • 4 = primary open	T2. Transformers shall have the anticipated status of the transformer in the case.	
Tap Control Type	Transformer type code • 1 or 11 = Fixed • 2 or 12 = TCUL • -2 or -12 TCUL Disabled • 4 or 14 = Phase-Shifting • -4 or -14 = Phase Shifting Disabled	T3. TCUL Disabled and Phase Shifting Disabled should be used to represent a temporary physical changed in transformer control or to address potential modeling issues	
Regulated Bus Number	Number of Bus whose voltage is regulated or "TO" bus number for phase-regulated transformer	T4. Regulation of a remote bus that does not represent actual system operation shall be avoided.	
Impedance Table Number	Impedance correction table number		
Tert Bus Number	Tertiary winding Bus number • See "Data Requirements (Buses)"		

Field	Description	Requirements	Measure
3wpt Bus Number	Internal '3-winding point' Bus number • See "Data Requirements (Buses)"	T5. This nus number shall be unique to the transformer and be consistent in all cases.	
Area	Transformer Area in which located	T6. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.	
Zone	Transformer Zone in which located	T7. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated ranges of Zones used by Area.	
FROM-TO Base MVA	Transformer MVA base (prim. to sec. for 3-wndg)		
FROM-Tert Base MVA	MVA base - prim. to tertiary for 3-wndg		
TO-Tert Base MVA	MVA base - tertiary. to sec. for 3-wndg		
R FROM-TO	Resistance primary to secondary		
X FROM-TO	Reactance primary to secondary		
R FROM-Tert	Resistance primary to tertiary		
X FROM-Tert	Reactance primary to tertiary		
R TO-Tert	Resistance secondary to tertiary		
X TO-Tert	Reactance secondary to tertiary		
FROM Winding Nom Volt	Primary winding nominal voltage (kV)		
TO Winding Nom Volt	Secondary winding nominal voltage (kV)		
Tert Winding Nom Volt	Tertiary winding nominal voltage (kV)		
FROM Fixed Tap	Primary winding fixed tap position (pu)		

Field	Description	Requirements	Measure
TO Fixed Tap	Secondary winding fixed tap position (pu)		
Tert Fixed Tap	Tertiary winding fixed tap position (pu)		
Variable V Tap or Variable Angle	TCUL tap position (primary winding) or phase angle position	T8. Variable V Tap or Variable Angle shall be at or within Max VAr Tap and Min VAr Tap for Transformers that are in-service.	Min VAr Tap ≤ V Tap ≤ Max VAr Tap
Step Size	TCUL (pu) or phase-shift (angle in deg) step	T9. Step Size shall reflect the capability of the transformer.	
FROM Angle	Primary winding phase angle (deg)		
TO Angle	Secondary winding phase angle (deg)		
Tertiary Angle	Tertiary winding phase angle (deg)		
G-Core Loss	Magnetizing conductance (pu)		
B Magnetizing	Magnetizing susceptance (pu)		
Rating 1	**Summer Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr)	T10. Transformer rating required	Rating MVA 1 > 0
Rating 2	**Summer Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr)	T11. Transformer rating required	Rating MVA 2 > 0
Rating 3	**Winter Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr)		
Rating 4	**Winter Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr)		
Rating 5	**Fall Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr)		

Field	Description	Requirements	Measure
Rating 6	**Fall Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr)		
Rating 7	**Spring Normal** Branch Rating (MVA) (primary winding for 3-winding xfmr)		
Rating 8	**Spring Emergency** Branch Rating (MVA) (primary winding for 3-winding xfmr)		
TO Winding Rating MVA 1	Ratings – secondary winding for 3-winding xfmr		
TO Winding Rating MVA 2	Ratings – secondary winding for 3-winding xfmr		
TO Winding Rating MVA 3	Ratings – secondary winding for 3-winding xfmr		
Tert Wind. Rating MVA 1	Ratings – tertiary winding for 3-winding xfmr		
Tert Wind. Rating MVA 2	Ratings – tertiary winding for 3-winding xfmr		
Tert Wind. Rating MVA 3	Ratings – tertiary winding for 3-winding xfmr		
FROM Loss Assign	Loss assignment factor (primary winding for 3-winding xfmr) (pu)		
TO Loss Assign	Loss assignment factor - secondary winding for 3-winding xfmr (pu)		
Tert Loss Assign	Loss assignment factor – tertiary winding for 3-winding xfmr (pu)		
Max Var. Tap	Maximum TCUL ratio (pu or deg)	T12. Max Var. Tap shall be greater than Min Var. Tap.	
Min Var. Tap	Minimum TCUL ratio (pu or deg)		

Field	Description	Requirements	Measure
Max Cont V or MW	Maximum voltage (power) at controlled bus (pu or MW)	T13. Max Cont V shall be greater than Min Cont V.	
Min Cont V or MW	Minimum voltage (power) at controlled bus (pu or MW)		
Ohms	Ohmic data flag • 0 = impedances in pu • 1 = impedances in ohms		
Owner	Owner Number (1 through 8)	T14. Owner number shall be the Transmission Owner for transmission facility and Generator Owner for generator facility. T15. WECC staff shall assign Owner Number to required entities.	
Data Maintainer	Maintainer of model designation	T16. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.	
Service	In Service or Out of Service Dates		

Additional data for short circuit duty

Field	Description	Requirements	Measure
R0 FROM-TO	Zero Sequence Resistance primary to secondary		
X0 FROM-TO	Zero Sequence Reactance primary to secondary		
R0 FROM-Tert	Zero Sequence Resistance primary to tertiary		
X0 FROM-Tert	Zero Sequence Reactance primary to tertiary		
R0 TO-Tert	Zero Sequence Resistance secondary to tertiary		
X0 TO-Tert	Zero Sequence Reactance secondary to tertiary		

Field	Description	Requirements	Measure
FROM Bus Connection	Connection can be the following: • Wye • Wye:Auto • Delta:Open • Delta:Close • Delta tested as Wye • Zig-Zag		
TO Bus Connection	Connection can be the following: • Wye • Wye:Auto • Delta:Open • Delta:Close • Delta tested as Wye • Zig-Zag		
TERT Bus Connection	Connection can be the following: • Wye • Wye:Auto • Delta:Open • Delta:Close • Delta tested as Wye • Zig-Zag		

Fixed Shunt Reactive Elements
General Requirements

Table 7: Data Requirements (Fixed Shunts)

Field	Description	Requirement
FROM Bus Number	Number of the Bus to which the FROM end of the transmission line on which the shunt is connected for line shunts, or number of the Bus at which shunt is connected for bus shunts. • See "Data Requirements (Buses)"	
TO Bus Number	Number of the Bus to which the TO end of the transmission line on which the shunt is connected, for line shunts, or 0 for bus shunts. • See "Data Requirements (Buses)"	
Shunt ID	Shunt identifier • Two-character shunt identifier	F1. Line shunt connected to the FROM end of the transmission line shall have Shunt ID starting with 'F.' F2. Line shunt connected to the TO end of the transmission line shall have Shunt ID starting with 'T.'
Circuit ID	AC Transmission Line circuit identifier for line shunts or blank for bus shunts • Two-character circuit identifier	
Section Number	Number of AC Transmission Line section to which shunt is connected if line shunt or '0' if bus shunt	
Shunt Status	Shunt status • 0 = out-of-service • 1 = in-service	F3. Fixed shunts shall have the anticipated status of the shunt in the case
Area	Fixed Shunt Area in which located	F4. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.
Zone	Fixed Shunt Zone in which located	F5. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated ranges of Zones used by Area.
G	Actual shunt conductance (pu)	

Field	Description	Requirement
B	Actual shunt susceptance (pu)	
Owner	Owner Number (1 – 4)	F6. Owner number shall be the Transmission Owner or Generator Owner. F7. WECC staff shall assign Owner Number to required entities.
Data Maintainer	Maintainer of model designation	F8. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.
Service	In Service or Out of Service Dates	

Controlled Shunt Reactive Devices
General Requirements

Table 8: Data Requirements (Controlled Shunts)

Field	Description	Requirement
Bus Number	Number of Bus at which device is connected • See "Data Requirements (Buses)"	
SVD ID	SVD identifier • Two-character identifier	
SVD Status	SVD status • 0 = out-of-service • 1 = in-service	S1. Controlled shunts shall have the anticipated status of the shunt in the case.
SVD Control Type	Device type • 0 = Fixed • 1 = Discrete • 2 = Continuous • 3 = All or Nothing • 4 = Discrete control using Voltage Dead Band • 5=WECC SVC • 6=WECC STATCOM • 7=WECC TSC/TSR	
Regulated Bus	Number of Bus regulated by this shunt • See "Data Requirements (Buses)"	S2. Regulation of a remote Bus that does not represent actual system operation shall be avoided.
Area	Controlled Shunt Area in which located	S3. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area.
Zone	Controlled Shunt Zone in which located	S4. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated ranges of Zones used by Area.
G Actual	Actual shunt conductance (pu)	
B Actual	Actual shunt susceptance (pu)	
B Min	Minimum susceptance of continuous element (pu)	

Field	Description	Requirement
B Max	Maximum susceptance of continuous element (pu)	
Voltage Dead Band	Voltage control bandwidth divided by two (pu) (types 3 & 4)	S5. Voltage Dead Band shall prevent regulated voltage from exceeding the Voltage Dead Band with a single Controlled Shunt step. S6. The minimum dead band shall be 0.02
B Step	Susceptance of each switched element in nth stage (pu) (types 1-4, 7)	S7. Step size shall reflect the capability of the controlled shunt
No. of Steps	Number of equal admittance steps in nth switched stage (types 1-4, 7)	S8. Number of steps shall reflect the capability of the controlled shunt
B Min	Minimum total susceptance for device (pu)	
B Max	Maximum total susceptance for device (pu) Maximum current for type 6 (pu)	
XC	Compensating (slope) reactance (pu) (types 5, 6, 7)	
B Min SH	Minimum B for switching shunts (pu) (types 5, 6, 7)	
B Max SH	Maximum B for switching shunts (pu) (types 5, 6, 7)	
STSB	Slow reset control on/off status (pu) (types 5, 6, 7)	
B Min SB	Minimum B for slow reset (pu) (pu) (types 5, 7)	
B Max SB	Maximum B for slow reset (pu) (pu) (types 5, 7)	
VRFMIN	Minimum Voltage reference for slow reset (pu) (types 5, 6, 7) Minimum Voltage reference for types 3 &4 if Voltage Dead Band <= 0	
VRFMAX	Maximum Voltage reference for slow reset (pu) (types 5, 6, 7) Maximum Voltage reference for types 3 &4 if Voltage Dead Band <= 0	

Field	Description	Requirement
dVdB	System dV/dB for slow reset (pu) (types 5, 6, 7)	
Ni	Number of steps in shunt	
Owner	Owner Number (1 through 4)	S9. Owner number shall be the Transmission Owner or Generator Owner. S10. WECC staff shall assign Owner Number to required entities.
Balancing Authority	Balancing Authority Area in which Shunt is located	
Data Maintainer	Maintainer of model designation	S11. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.
Service	In-Service or Out of Service Dates	

LOADS
General requirements:

Table 9: Data Requirements (Loads)

Field	Description	Requirement
Bus Number	Number of Bus at which load is connected • See "Data Requirements (Buses)"	
Load ID	Two-character identifier	L1. Load modeling generator station service shall have Load ID set to 'SS.' L2. Loads at the same Bus shall have unique Load ID.
Load Status	• 0 = load out-of-service • 1 = load in-service	L3. Load shall have the anticipated status of the load in the case.
Non-Conforming Flag	• 0 = load will change with scaling • 1 = load does not change with scaling	L4. Non-conforming Flag shall be set to '1' for loads which shall not be changed in load scaling operations of power flow software.
Area	Load Area in which located	L5. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated Area
Zone	Load Zone in which located	L6. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated ranges of Zones used by Area.
Const MVA P	Constant MVA real power load	
Const MVA Q	Constant MVA reactive power load	
Dist Status	• 0 = generator out-of-service • 1 = generator in-service	
Dist Gen P	Real Power output (MW)	
Dist Gen Q	Reactive power output (Mvar)	
Dist Gen P Max	Maximum Real Power output (MW)	
Const CUR P	Constant current real power load	L7. Const CUR P shall not be used.

Field	Description	Requirement
Const CUR Q	Constant current reactive power load	L8. Const CUR Q shall not be used.
Const Y P	Constant admittance real power load	L9. Const Y P shall not be used.
Const Y Q	Constant admittance reactive power load	L10. Const Y Q shall not be used.
Owner	Owner Number	L11. Owner number shall be the Transmission Owner for transmission loads, Generator Owner for station service, Distribution Service Provider for distribution loads. L12. WECC staff shall assign Owner Number to required entities.
Long ID	Climate zone and substation type identification	L13. Seven-character identifiers of the climate zone and load type – the first three characters represent the climate zone, followed by underscore, and three characters representing the substation/feeder load mix type. Details are included in the LID_Instructions and Composite Load Model Implementation documents.
Balancing Authority	Balancing Authority Area in which Load is located	
Data Maintainer	Maintainer of model designation	L14. Refer to Table 1b: Area, Zone and Bus Number Assignments for designated member system acronym.
Service	In-Service or Out of Service Dates	

AC Substations
General requirements:

Table 10: Data Requirements (AC Substations)

Field	Description	Requirement
Sub Number	Substation Number	Each substation shall have a unique number that matches one of the buses contained in the substation
Sub Name	Substation Name	Up to 12 characters with a unique name (substation name from the West-wide System Model (WSM) is recommended)
Sub Latitude	Geographic Latitude	Actual latitude data of the substation in decimal degrees
Sub Longitude	Geographic Longitude	Actual longitude data of the substation in decimal degrees

Area Interchange Schedules
General Requirements

1. Area Interchange schedules shall be coordinated between Areas to meet the objectives of the data request letter.
2. The sum of net Area Interchange Schedules for the interconnection-wide case shall be equal to zero.

Master Tie-Line File

The Master Tie-Line File (MTLF) contains:

- Master lists of owners and zones;
- Path definitions and ratings for paths in the ;
- Lists of lines and transformers which interconnect areas; and
- A placeholder for area-to-area transactions for the existing system.

Appendix B:
WECC BASE CASE PREPARATION

WECC compiles eleven base case scenarios (base cases), annually, to support compliance requirements for Transmission Operator, Transmission Planner, Planning Coordinator and other functional entities to meet WECC's requirements of MOD - 032 R1 and R2. The following provides a joint CAISO/SCE's process that helps to support compliance with these requirements and is consistent with the interconnection-wide process.

A. WECC Initial Base Case Compilation

1. WECC Data Request Letter is emailed to WECC Members
2. Begin sub-coordination process and confirm interchange schedules by the sub-coordination deadline
   a. Coordinate and obtain interchange schedules, pump loads, loads, and/or generation dispatch from the following entities and populate into the Load & Resources (L&R) Spreadsheet:

APS/SRP	PG&E
CDWR	NVE
IID	SDG&E
LADWP	VEA/GLW
MWD	WAPA

3. Download the WECC starting base case and associate materials (zip file) as required in the WECC Data Request Letter from the WECC website
4. Compare the WECC starting base case to the latest master base case and update Area 24 representation accordingly. If needed, include new projects (transmission, generation, etc.) based on the month and year represented by the WECC base case.
   a. Apply network model data change submitted by MWD, CDWR, VEA/GLW, and/or other entities within area 24 of the WECC base case.
      i. Additional changes to the master case after the comparison shall be applied to create the new master base case
5. Use the latest L&R Spreadsheet to populate generation, load, pump, interchange, and losses data in accordance with the WECC Base Case Data Request Letter
   a. Loads
      i. Determine load to be used based on base case scenario request and populate into the L&R Spreadsheet.
         1. Select 1-in-2 year Load Forecast year in accordance with the WECC Base Case Data Request Letter
         2. Adjust SCE Load to meet the base case scenario
         3. Coordinate MWD and CDWR's pump load forecast
            a. Populate the L&R Spreadsheet with MWD's pump load dispatch.
            b. Populate the L&R Spreadsheet with CDWR's pump load dispatch.
         4. Coordinate VEA/GLW's load forecast

        a. Populate the L&R Spreadsheet with VEA/GLW's load dispatch.
    b. Interchange
        i. Populate the L&R spreadsheet with the interchanges obtained from item 2.a. above
    c. Generation
        i. Dispatch generation within the L&R Spreadsheet to balance the Load, Interchange, Pump Loads and Losses
            1. Dispatch generation to balance loads and resources
                a. Ensure generators aux load is accounted for in the L&R Spreadsheet
            2. Coordinate MWD, CDWR, and VEA/GLW's generation dispatch
                a. Populate the L&R Spreadsheet with MWD's generation dispatch.
                b. Populate the L&R Spreadsheet with CDWR's generation dispatch.
                c. Populate the L&R Spreadsheet with VEA/GLW's generation dispatch.
6. Import the real power for loads, interchange schedule for Area 24, and generation dispatch into the updated WECC starting base.
7. Solve Base Case
    a. Determine the PSLF Calculated losses by going to PSLF "tabr" table and then click "Area" and search for Area 24
        i. Enter this MW Loss value into the L&R Spreadsheet
    b. Compare the Generator Swing Output (MW) from the updated WECC starting base case to L&R Spreadsheet. The swing generators' outputs shall match (+/- ~1 MW) in the base case and L&R Spreadsheet.
        i. If it does not match, perform the following:
            1. Compare the SOCALIF (Area 24) PLOAD and the load value in the L&R Spreadsheet
                a. If the load differs, make the necessary adjustment in either the solved base case or the L&R Spreadsheet
            2. Compare the SOCALIF (Area 24) INT_MW value and compare it to the L&R Spreadsheet
                a. If the Net interchange differs, make the necessary adjustment in the updated WECC starting base case or in the L&R Spreadsheet
8. Dynamic Data Check
    a. Obtain latest WECC Master Dynamic File (MDF), replacing the Area 24 section in the associated DYD file with the Area 24 section from the MDF, and read into the solved base case
        i. Check for any missing generator models in the dynamic data file when the MDF is loading
        ii. Initialize the base case with the dynamic data file
        iii. Resolve any errors that were identified on the screen
        iv. Run a non-disturbance transient stability analysis for 10 seconds.
            1. If it did not result in a flat line, determine the cause of not obtaining a flat line, for example but not limited to:
                a. Ensure that no Pgens exceed Pmaxs
                b. Ensure there are no overloads for SCE owned facilities

c. Check the models of the latest generators added to the MDF.
d. Check the spread of the generator angles and, if necessary, turn off any Non-SCE generators that have a large spread and re-run. A non-disturbance evaluation shall produce a flat line.

v. Ensure you close the channel file and base case (**DO NOT SAVE THIS BASE CASE**).

9. Power Flow Base Case Data Check:
   a. Re-open solved base case
   b. Solve the base case again and check for the following:
      i. SCE's Base Case Load Modeled with the appropriate WATT/VAR Ratio
      ii. 230 kV and 500 kV Substation voltages in Southern California Edison's area are within SOB No. 0017 ranges or appropriate ranges
      iii. Check for Area 24 errors (ie. Zone, owner, overloads)

Submit the following to WECC/CAISO

a. Solved power flow base case
b. L&R Spreadsheet
c. EPC files to update bface or iface tables
d. DYD files for missing dynamic models to be updated to the Master DYD file

B. WECC Final Base Case Review

1. Download the WECC base case for review and associate materials (zip file) from the WECC website
2. Repeat Step 9, above
3. Ensure the base case is consistent with the latest master base case. If necessary, update the review base case as needed.
4. If necessary, incorporate comments to the base case provided by MWD, CDWR, VEA/GLW, and/or other entities within area 24 of the WECC base case.
5. Ensure the base case meets the following:
   a. SOB-017 voltage and VAR requirements or within appropriate ranges
   b. Thermal loadings are not exceeding normal ratings identified in the CAISO Registry
   c. Iface/bface tables are correct
   d. Ensure a flat line is achieved with a non-disturbance run.
6. For WECC operating base case
   a. Provide GCC with the base case for their review
      i. If necessary, resolve GCC reviewer comments
7. If changes were made to the base case, create a change file
8. Submit the following to WECC and CAISO by the deadline
   a. If required, Signed approval forms
   b. If necessary, a change file (*.p)
   c. If necessary, EPC files to update bface or iface tables
   d. If necessary, DYD files for missing or updated dynamic models
9. Complete the WECC Base Case Development Check List in Appendix C.

C. SCE Base Case Retention Requirements

For each base case, the following shall be retained and provided as NERC compliance evidence:

1. WECC Base Case Data Request
2. Email correspondence or coordination with entities for interchanges, pump load forecast, and/or generation dispatch.
3. Email correspondence for an entity's system representation
4. Email confirmation of submitting base case/review comments to WECC and the CAISO.
5. Signed WECC Base Case Development Checklist

Appendix C:
WECC Base Case Development Checklist

Below are key actions and procedures that are critical to developing base cases accurately and on a timely basis. Please make sure that you follow this checklist and indicate that you have completed the critical tasks outlined below for each WECC base case for which you are responsible. An individual assigned by management shall review the base case and the completed checklist shall be signed by both the responsible planner and the reviewer.

WECC Base Case Study Year and Season:

Type of Case: ☐ Planning Case ☐ Operating Case
☐ Initial Compilation ☐ Review Case

Comments

Responsible Planner: _____ **Date:** _____

Reviewer: _____ **Date:** _____

Base Case Preparation Checklist – As Applicable

- ☐ The Data Request Letter or Review Request Letter has been received from WECC
- ☐ Review Comments have been received from the following:

  List:

- ☐ Equipment Characteristics, System Data, and Interchange Schedules for steady-state modeling have been provided to WECC where applicable:
  - ☐ Bus (Substation)
  - ☐ Generating Units
  - ☐ AC Transmission Lines or Circuits
  - ☐ DC Transmission Lines
  - ☐ Transformer (voltage and phase-shifting)
  - ☐ Reactive Compensation (shunt and series capacitors and reactors)
  - ☐ Interchange Schedules
- ☐ Equipment Characteristics and System Data for dynamic modeling have been provided to WECC
  - ☐ New or Refurbished Excitation Systems Data
  - ☐ Unit-Specific Dynamics Data for Generators and Synchronous Condensers
  - ☐ Device Specific Dynamics Data for dynamic devices such as SVC, HVDC, and FACTS devices
  - ☐ Dynamic Load Data

WECC Data Preparation Manual – As Applicable

☐ Bus Guidelines

☐ Avoid duplication of bus names within same kV class

☐ Bus names and numbers consistent from case to case

☐ Bus numbers within designated ranges: 24000-24999, 25000-25999, 29000-29999, 94000-95999, 240000-249999, 250000-259999, 290000-299999, 18900-18999, 189000-189999,

☐ Provide zone and owner numbers

☐ Generator Guidelines

☐ Minimize load netting, load netting shall be avoided.

☐ Pmax shall not be greater than the maximum capability of the governor (mwcap)

☐ Model single unit generators of 10 MVA or higher

☐ Model aggregate plant capacity of 20 MVA or higher connected via step-up transformer to 60-kV or higher

☐ Generator representation consistent between steady-state and dynamic data (i.e., Bus Number, Bus Name, Bus Id, Bus Voltage)

☐ Delete retired generators that have been demolished from steady-state and dynamic data

☐ Avoid remote regulation (more than one bus away)

☐ Set baseload flag to 2 for units unable to respond to low frequency with additional mechanical power

☐ Enter Operating Pmin data accurately

☐ Pgen must fall within or at Pmin and Pmax

☐ AC Line or Circuit Guidelines

☐ Avoid equivalent transmission systems. Equivalent branches must have a circuit ID of “eq” or “99”. If no line rating is available, use 9999 MVA.

☐ Model all transmission lines 115-kV and above except very low impedance lines (<0.00029)

☐ Exclude SCE lines not meeting Bulk Power System Definition

☐ Model any significant looped transmission less than 115-kV

☐ Model anticipated outages – operation base cases, obtain outage schedule from GCC

☐ Number line sections consecutively beginning with “1”

- ☐ Avoid bus ties and low impedance lines where possible (i.e., greater than or equal to 0.00029)
- ☐ Include appropriate facility ratings, including normal & emergency ratings (8 Ratings)

☐ Transformer Guidelines

- ☐ Model TCUL transformers as such only with complete TCUL data (Automatic; type 2)
- ☐ TCUL Transformer maximum tap must be greater than minimum tap
- ☐ Maximum phase shift angle must be greater than minimum phase shift angle (Type 4)
- ☐ For manual tap changing (Type 1), voltage shall not exceed SOB-017 Voltage requirements

☐ Load Model Guidelines

- ☐ Model Load level to reflect the conditions and season of the case
- ☐ Model generators less than 10 MVA as load with ID “nt” that are load netted.
- ☐ Represent loads at the same bus as being in the same area as the bus
- ☐ Model generator station service load explicitly with an ID of “SS”

☐ Fixed Reactive Device Guidelines

- ☐ Explicitly model all fixed shunt elements

☐ Switched Reactive Device Guidelines

- ☐ Explicitly model all switchable shunt elements

☐ Area Interchange Guidelines

- ☐ Coordinate all transactions between areas (LADWP, PG&E, SDG&E, AZ, WAPA, MWD, IID, and CDWR)
- ☐ The sum of all area interchanges must be zero

☐ Master Tie Line File Guidelines

- ☐ Tie-Lines or paths are up to date in the IFACE and BFACE tables
- ☐ Do not change area numbers that represent a WECC member area

☐ Generation Dynamic Model Guidelines

- ☐ Submit Power System Stabilizer Data for generators equipped with PSS

☐ Load Dynamic Model Guidelines

- ☐ Include default area or zone dynamic load characteristics

- ☐ 20% Induction Motor for loads >5 MW at load buses and >80 MW at generator buses

☐ Under Frequency Load Shedding Guidelines

- ☐ Include UFLS data that complies with WECC-coordinated off-nominal requirements

☐ Under Voltage Load Shedding Guidelines

- ☐ Include any UVLS records

☐ DC Lines, SVC, and D-VAR system Guidelines

- ☐ Model SVC systems to reflect actual performance

Additional Base Case Preparation Guidelines – As Applicable

Below are additional items SCE incorporates into WECC Base Cases as needed:

- ☐ CDWR Pump Load and Generation Forecast has been coordinated
- ☐ MWD Pump Load and Generation Forecast has been coordinated
- ☐ Incorporate comments received, if any, from City of Anaheim, Azusa, Banning, Colton, Riverside, Vernon, Pasadena, and VEA/GLW.
- ☐ Other Comments have been incorporated

List other Comments:

- ☐ All transmission projects approved by the ISO are modeled.
- ☐ All generation projects and related POS are modeled per DPM criteria for developing WECC base cases (Refer to Appendix A) or study scope as applicable.
- ☐ SCE Sub-Transmission Load Forecast is modeled for the Sub-Transmission system.
- ☐ The load is modeled with the appropriate WATT/VAR ratio.
- ☐ Slack bus generators are in generation mode and fall within their respective Pmin and Pmax values.
- ☐ All voltage profiles are at high-end operating levels and within limits
- ☐ The VAR flows between SCE and other utilities are within the SCE SOB 17 operating limits or within appropriate ranges.
- ☐ All thermal, voltage and stability results meet the appropriate performance standards (NERC/WECC/ISO/SCE criteria including SCE SOB 17).
- ☐ Items on Steadystate and Dynamics Dashboard have been corrected or prevented
- ☐ Owner and Zone numbers are not 0 or 1
- ☐ The dyd data file matches the power flow base case and a non-disturbance run results in a “Flat Line.”
- ☐ Signature Forms has been signed (if required by WECC) (Review Only)
- ☐ Grid Operations has reviewed the case (Review of Operating Case Only)

Checklist Deviations

Please provide details as to the cause of the deviation(s) and the resolution below

Appendix D:
CAISO sign-off sheet for WECC Base Case review

Case Name
POWER FLOW CASE
DATA COMMENT AND SYSTEM REVIEW

PROCEDURE FOR SUBMITTAL

1) **ISO to PTO** (current form)
2) PTO to AREA COORDINATOR
3) AREA COORDINATOR TO WECC TECHNICAL STAFF

DATA COMMENT

CAISO Planning Engineers have reviewed the WECC Base Case 'Case Name' for 'PTO name' area. Please find below the identified deficiencies and the recommended changes:

S.No	Deficiency	Recommended Change/s	PTO's comment
1			
2			
3			
4			
5			
6			

ISO Engineer Name: Name
Review being submitted for PTO: PTO name
Date: date