California Independent System Operator

&

Pacific Gas and Electric

Joint Transmission Planning Base Case Preparation Process

Final

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NERC Reliability Standard MOD-032-1

February 2024

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1 Introduction

1.1 Purpose

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

The first, as required by NERC Reliability Standard MOD-032, Requirement 1, is to provide a jointly developed process for California Independent System Operator's (CAISO) (as Planning Coordinator (PC) and Balancing Authority (BA)) and Pacific Gas and Electric's (PG&E) steady-state, dynamics, and short circuit modeling data requirements and reporting procedures for the PC planning area.

Second, this Process will demonstrate and help support how CAISO, PG&E, 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 requirements. The CAISO is the PC and BA for PTOs and certain Transmission Planners located in area 30 of the WECC base cases, which includes, but not limited to: PG&E, Trans Bay Cable (TBC), Western Area Power Administration (WAPA – with its Path 15 participation only), Hetch Hetchy Water and Power (HHWP) of the City and County of San Francisco (CCSF), California Department of water resources (CDWR) and Silicon Valley Power (SVP). This process was developed in accordance with MOD-032, Requirement 1, as follows:

- Provide guidance to model the data listed in Attachment 1 of MOD-032.
- Provide 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.
- Provide specifications for distribution or posting of the data requirements and reporting
- Provide procedures so that they are available to those entities responsible for providing the data.

Third, as required by MOD-032, Requirement 2, this process provides guidance to: each BA (including non-PTO entities in area 30 of the WECC base cases), Generator Owners, Load Serving Entities, Resource Planners, Transmission Owners, and Transmission Service Providers that 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.

[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 3, 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 4, 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 in area 30 of the WECC base cases).

Sixth, this Process establishes consistency amongst various CAISO and PG&E planning base cases utilized for compliance with NERC Standards 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 30 of the WECC base cases by sending it via email and/or posting it on CAISO's public website.

1.2 Transmission Planning Base Cases

PG&E's Transmission System Planning (TSP) department develops the following base cases to perform a variety of Transmission Planning studies.

- Annual Transmission Planning Base Cases
- WECC Base Cases
- Generation Interconnection Studies Base Cases
- Load Interconnection Studies Base Cases
- Bases Cases used for other Transmission Planning Studies

To maintain consistency, the approved Annual Transmission Planning Base Cases are used as the starting cases for each of the other base cases developed. The base cases are modified based upon the objective of the study and the study assumptions.

This document includes details of the assumptions used and the process followed for developing the Annual Transmission Planning Base Cases and a high level description of the assumptions used in the other cases.

2 Annual Transmission Planning Base Case Development Process

This section provides an overview of the Annual Transmission Planning Base Case Development Process. This process is completed on a yearly basis in order to keep the PG&E system model up-to-date and consistent with the changes that have occurred throughout the year. The Annual Transmission Planning Base Cases follow the CAISO TPP timeline and the assumptions included in the CAISO TPP Study Plan. These base cases are used to perform Transmission Grid Assessment and to develop the Transmission Expansion Plan.

This process is broken up into several rounds. Each round builds on the previous round in a chronological fashion. Details of each round are included in Section 2.3.

2.1 Team Roles and Responsibilities

The following PG&E groups: Regional Planning, System Planning, Interconnection Planning, and Substation and Transmission Line Asset Management are all actively involved in the Base Case Development Process.

Table 1 describes the high level roles and responsibilities of each PG&E group in the base case development process.

Additional supporting PG&E groups and other data owners involved are:

- Operations Engineering
- Asset Management/Strategy (T-Line and Substation)
- Distribution Planning
- Electric Generation Interconnection (EGI)
- California ISO
- Generation Owners (GO)
- Other Transmission Owner (TO) or Transmission Service Provider

Table 2 includes a list of base case inputs, the group responsible for providing the inputs, and the source of information used in developing the required inputs.

Table 1 Team Roles and Responsibilities

Team	Role and Responsibilities
Regional Planning (RP)	Develops Load Forecast Coordinates base case development Provides change files to model wholesale load interconnections Coordinates with CAISO and aids in development of assumptions to be used in the base case Develops non-full loop and full loop cases
Interconnection Planning (IP)	Provides models, status, and EDRO dates for future generators Provides change files to model retail load interconnection
System Planning (SP)	Provides change files for future capacity (CAISO approved) and maintenance projects; Provides change files to model conforming and non-conforming loads Provides change files to reflect generation retirement and generation dispatch assumptions per CAISO study plan Serves as PG&E area experts responsible for reviewing and approving any required changes in each of the eight PG&E areas
Substation and Transmission Line Asset Management	Provides as-built models for all (capacity, maintenance, load interconnection, and generation interconnection) transmission upgrades Provides EDRO dates for future transmission upgrades

Table 2 Transmission Planning Modeling Assumptions

Base Case Model Inputs	Responsibility	Source
Load		
Transmission Level Load Forecast	Regional Planning	Distribution Planning for distribution load forecast and System Planning for non-conforming Load, self gen, and station service loads
Distribution Load Forecast	Distribution Planning	
Transmission connected (non-Muni) load forecast	System Planning	300 kW Report
Future Wholesale Load Interconnection/Changes	Regional Planning	Load interconnection study
New Retail Load Interconnections or Increase of Existing Retail Load Interconnections	Interconnection Planning	Load interconnection study
Generation		
Models for future generators or generator going through re-powering studies and associated network upgrades	Interconnection Planning	Cluster Studies
PG&E Network Changes		
CAISO approved capacity projects - Future	System Planning	CAISO TPP studies
CAISO approved capacity projects - As Built	Transmission System Asset Development	As built design and equipment test reports
Maintenance Projects – Future	System Planning	
New Generator/New Load - As built	Substation and Transmission Line Asset Management	
Maintenance Projects - As Built	Substation and Transmission Line Asset Management	
Miscellaneous changes (actual switching representation, ratings update, etc.)	System Planning	Operations Engineering, TSAD, and others
Non PG&E Changes		
Network model for Municipal Utilities (Load Forecast, Generation Assumptions, Network changes, etc.)	Regional Planning	Municipal Utilities
Updates to existing Generator Models	Regional Planning	Generator Owner
Transmission Owner's models (e.g., Transbay Cable)	Regional Planning	Transmission Owner

2.2 Transmission Planning Modeling Assumptions and Responsibilities

PG&E's Transmission System model will comply with the requirements in WECC's Data Preparation Manual. This section provides additional information on what assumptions are made and to what level of detail is required for modeling the various aspects of the base cases created in this process.

2.2.1 *Transmission Project Modeling*

The existing system model will be based upon as-built design and equipment test reports. Future capacity projects in service dates are based on the AB970 report which is published in the first quarter of the year (e.g., Jan 2018 for the 2018 cycle base case). For these projects, models are based upon the approved scope from the project submittal provided to the CAISO. Project scope may be updated based upon more recent information provided by the Substation and Transmission Line Asset Management team. Change files for the projects will reflect the most up to date information available for both scope and in service date.

Future maintenance projects in service dates are based upon the latest information on the schedule of the maintenance projects. The maintenance projects that have a firm plan to be implemented and are either "under construction" or scheduled to be "under construction" will be modelled in the cases based upon the scope of work provided by Substation and Transmission Line Asset Management team.

2.2.2 *Generation*

a. Models

Existing generator models will reflect the latest models provided by the Generator Owner.

Future Generators will be modeled based upon project status tracking data from EGI using the latest generator models in cluster studies. Only projects that have a status of "in construction" will be modeled in future base cases. The exception to this will be based upon the RPS needs. If the "in construction" list of generation does not meet the RPS needs, additional generation will be modeled to meet these needs. This additional generation shall be based upon most likely to occur generation that is still moving forward. Typically an LGIA or PPA would be the next set of criteria for modeling based on RPS needs.

b. Dispatch

Generation dispatch for existing units will be based either on historical information (if available) or based upon NQC values. Future renewable generation dispatch will be based upon the CAISO TPP Study Plan for the given scenario.

2.2.3 *Demand*

The Load Forecast process documentation provides additional details. Summarized here is a high level description intended to help inform assumptions used in the Base Case process.

a. Distribution

The Distribution of loading for summer peak cases is based upon the Distribution Planning load forecast, extracted from the LoadSEER program model. LoadSEER is a load forecasting program that utilizes historical peak loading and transfer information to generate a standard multi-variable regression forecast which utilizes temperature and economic indicators to produce a 10 year forecast on each bank and feeder within the electric distribution system. The program also performs a 10 year geo-spatial customer class load forecast using historical consumption load and other geographical data to assign a scoring for the likelihood of receiving new load based on one of our 4 customer load classes (domestic, commercial, industrial and agricultural) to each 1 acre parcel in PG&E's service territory. Following the scoring of each parcel, the program then performs an allocation of load by customer class based on CEC mid-range system peak forecast by customer class. These two forecasts are used by the engineers to evaluate and produce their final bank and feeder level forecasts.

b. Aggregate Load Forecast

The aggregate system load forecast is based upon: system loading from the prior year, recorded temperatures, the Distribution Planning forecast from December 15, and the latest CEC forecast. The prior year's loading and temperature data inform the creation of a starting point that represents the adjusted loading that may have occurred if 1in10 temperatures were observed. From the starting point load growth is allocated based on the Distribution Planning forecast, scaled to conform to the CEC growth for each year.

c. Nonconforming Transmission Loads

i. Existing

Transmission level Nonconforming Load demand is set by using the previous 12 months' maximum recorded summer demand as available in the 300kW report.

ii. Future

Future Transmission Nonconforming loads are provided by regional planning and Interconnection Planning team. Loads will be modeled if they are completed the facility study phase and have indicated their desire to connect to the PG&E facility by signing the appropriate agreements.

d. Fuel Substitution (FS)

Fuel Substitution (FS) models will be based on data provided by the CEC bus level allocations. FS models will be represented as a load on the corresponding bus and will have an ID of "FS".

e. Transportation Electrification (TE)

Transportation Electrification (TE) models will be based on data provided by the CEC bus level allocations. TE models will be represented as a load on the corresponding bus and will have an ID of "TE".

2.2.4 *Outage Information*

Planned outages that are at least 6 months in duration will be modelled based upon the planned dates of outages using the outage information provided by Transmission Operations and CAISO.

2.2.5 *Firm Transmission Service and Interchange*

Known commitments for Firm Transmission Service and Interchange will be modelled based upon the information provided by the ISO.

2.2.6 *Distributed Energy Resource Model*

a. Energy Efficiency (EE)

Energy Efficiency (EE) models will be based on data provided by the CEC bus level allocations. EE models will be represented as a negative load on the corresponding bus and will have an ID of "EE".

b. Distributed Generation (DG)

Distributed energy resources (DER) should be modelled in steady-state and dynamic data per the WECC Solar Photovoltaic Power Plant Modeling and Validation Guideline either as an aggregated generator for in-front-of-the-meter distributed energy resources or as DG

component in the composite load model for self-generation including behind-the-meter solar PV by using the DG field on the PSLF load model the total nameplate capacity of the DG will be represented under PDGmax field, and the actual output will be based on the scenario.

For PG&E the total nameplate capacity is specified by the CEC, the allocation and location for projected DG is derived from the latest DRP filed with the CPUC as provided by Distribution Planning.

c. Demand Response (DR)

Demand Response is provided by internal demand response programs department, and consists of several program types. Each type can be modeled as a negative load initially out of service on their respective buses with ID of "D0", "D1", "D2", etc. corresponding to different programs. All such IDs (e.g. "D1") shall represent the same program across the system and may not correspond with a particular load on the bus, but instead serves as a bus level aggregate.

d. Storage

Storage will follow similar modeling practices as generation; it should be "under construction" or is needed to meet a mandate. Similar to generation the size of the storage may dictate whether it is modeled as a stand-alone generator type or is modeled as a negative stand-alone load, or is added as a DG component.

2.3 Annual Transmission Planning Base Case Development Process

Figure 1 summarizes the Annual Transmission Planning Base Case development process. The process is divided into four different rounds. A short description of each round is included in the following sections.

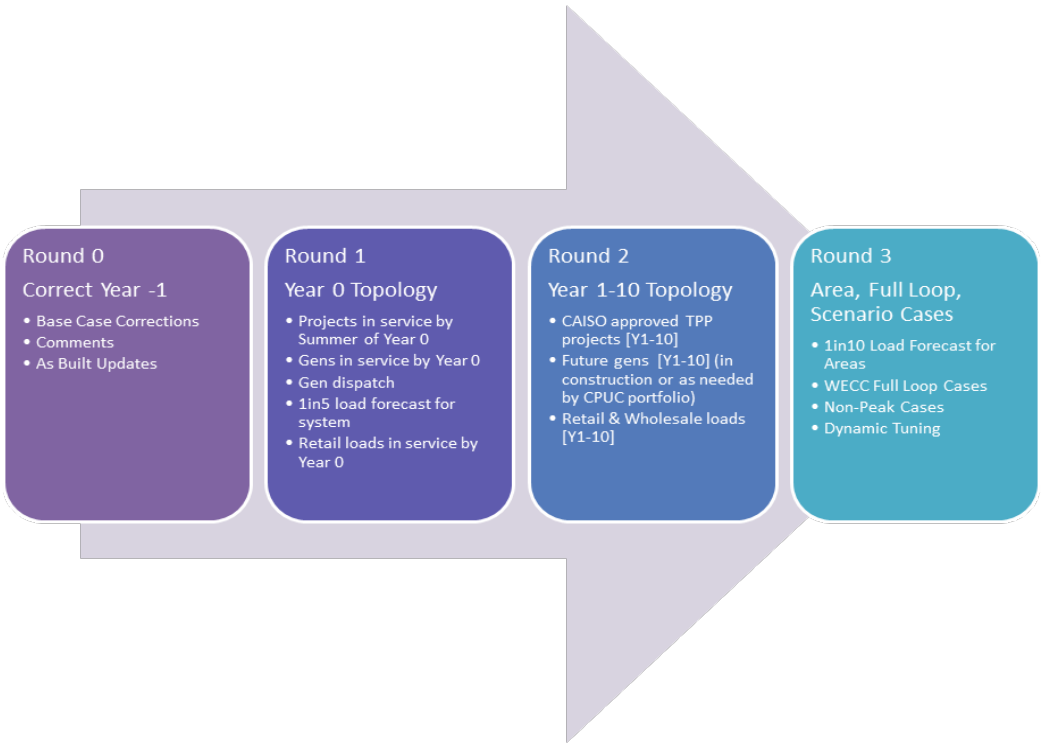

Figure 1: Annual Transmission Planning Base Case Development Process

2.3.1 *Timeline*

The timeline of the process begins in October and ends in May. Figure 2 below illustrates the approximate breakdown for the various Rounds.

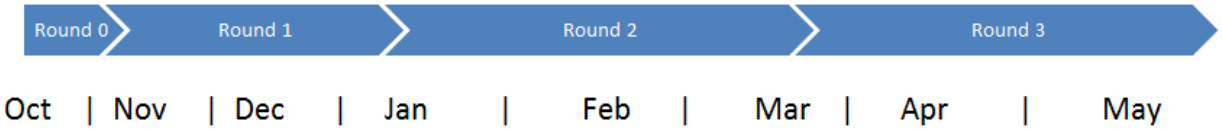

Figure 2: Approximate Timeline of the various Rounds

2.3.2 *Round 0: Updating the Current Year*

The goal of Round 0 is to update the starting base case from the previous Base Case cycle. This includes incorporation of comments received and ongoing changes prior to the kickoff of the new base case cycle. It is the responsibility of the Base Case lead to compile all of the changes and apply them to the starting case. After this has been done, the case is sent out for review for any additional comments/changes to be incorporated before moving on to Round 1. The end result is a case that roughly reflects the present-day topology.

2.3.3 *Round 1: Building the First Year*

The goal of Round 1 is to create the Year 0 case (e.g., for the 2015 cycle, a 2015 summer case is built). This case is built upon the output of Round 0. The additions to this case include any projects that will be in service by June 1 of the upcoming year. Projects may include Transmission capacity, generation, load interconnections, maintenance, or other topology changes. Further, gen dispatch, non-conforming loads, and the load forecast for system cases may be applied to this case.

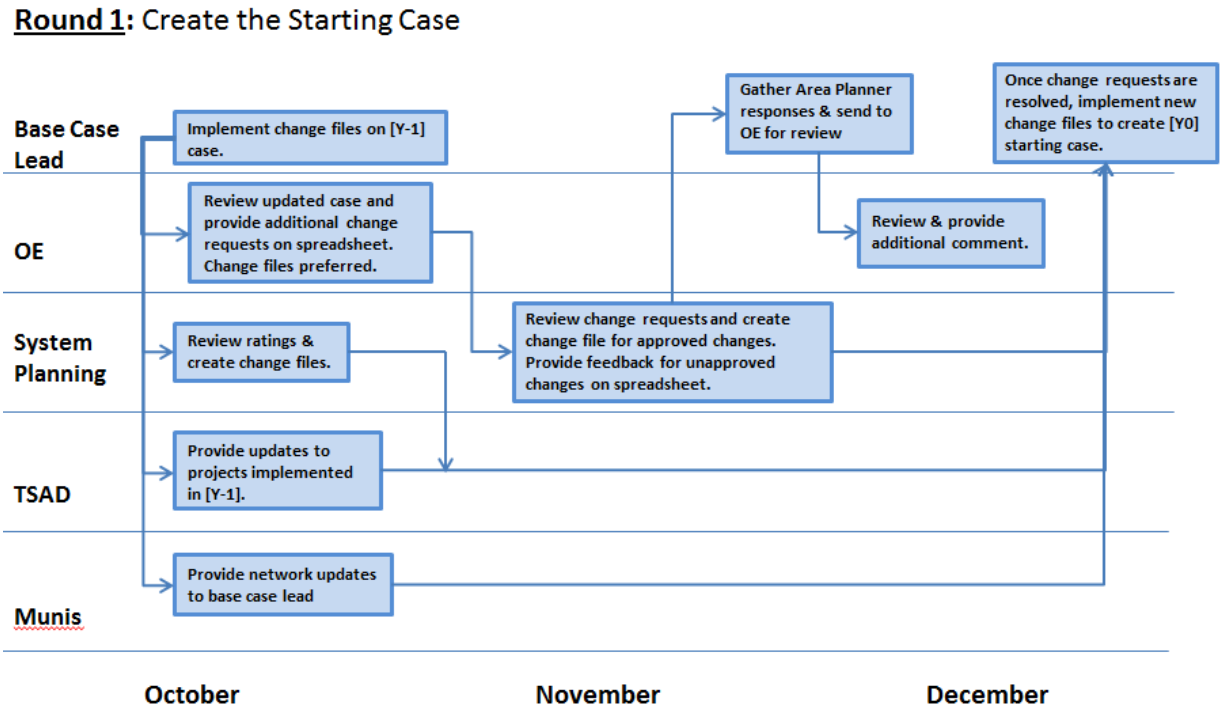

Figure 3: Round 1 Responsibility Process Map

2.3.4 *Round 2: Building the Next 10 Years*

The goal of Round 2 is to create the base topology for the next 10 years. Each case is built on top of the case from the year prior with the addition of projects implemented in the current year. Projects include CAISO approved TPP capacity projects, maintenance projects, generation, load interconnections, and other system changes. Round 2 may also include system load forecast and nonconforming loads. Figure 4 below provides a simple process diagram for this stage.

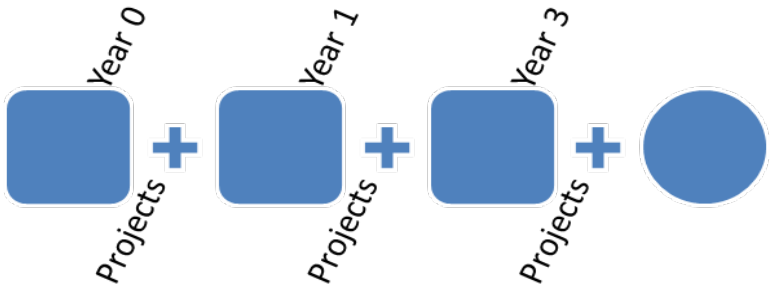

Figure 4: Round 2 Process

Round 2: Create the 10-year Summer Peak Cases. Establish topology.

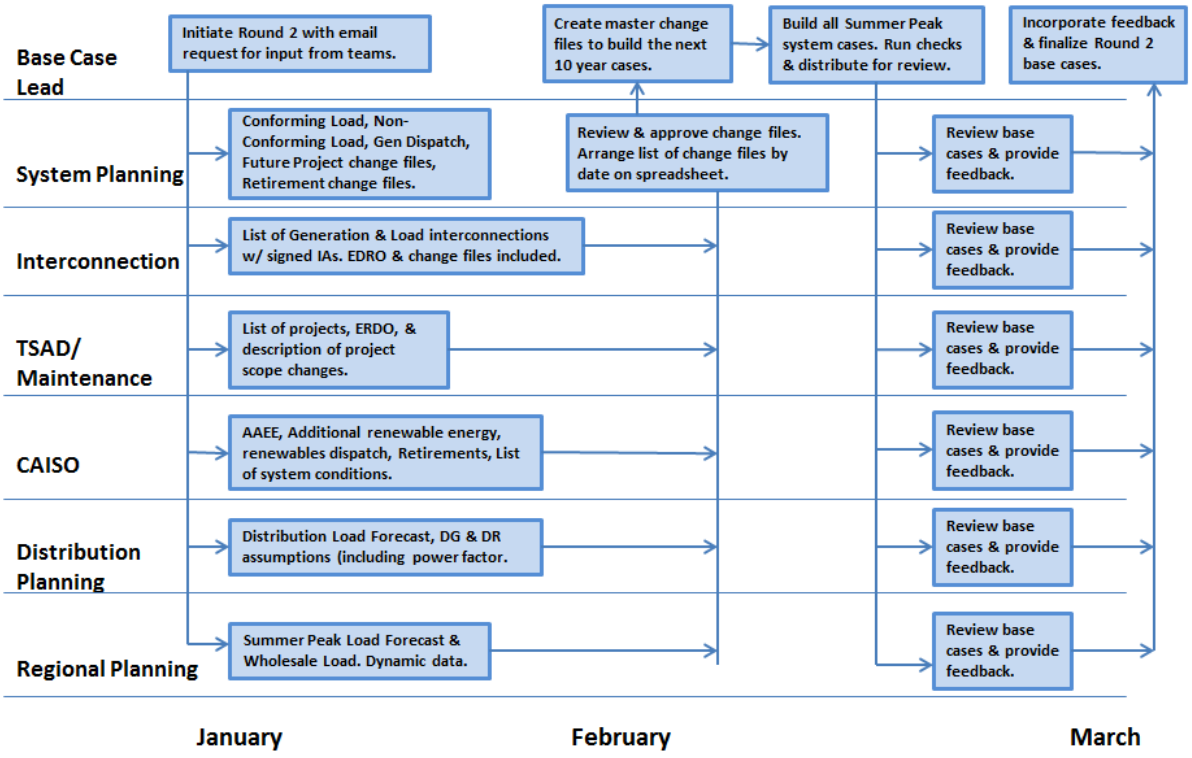

Figure 5: Round 2 Responsibility Process Map

2.3.5 *Round 3: Area Cases, Full Loop Cases, Non-Peak Cases*

Once the system topology Round 2 cases are completed various scenario cases can then be created. Area 1in10 peak cases are used for PG&E assessment purposes. Full Loop versions of the system 1in5 and area 1in10 cases are created for CAISO use, as well as for dynamic stability studies. Non-Peak cases are created to study system conditions aside from summer peak, that may still stress certain parts of the system in a way that summer peak does not. This may be

due to loading patterns, some areas peak other than summer during a heat wave, or may be due to other scenario and assumptions such as generation patterns, high hydro in spring, reduced peaker/thermal output in the evenings, and no solar after about 8pm for partial peak or shoulder peak cases. The sections below will add further detail to the process.

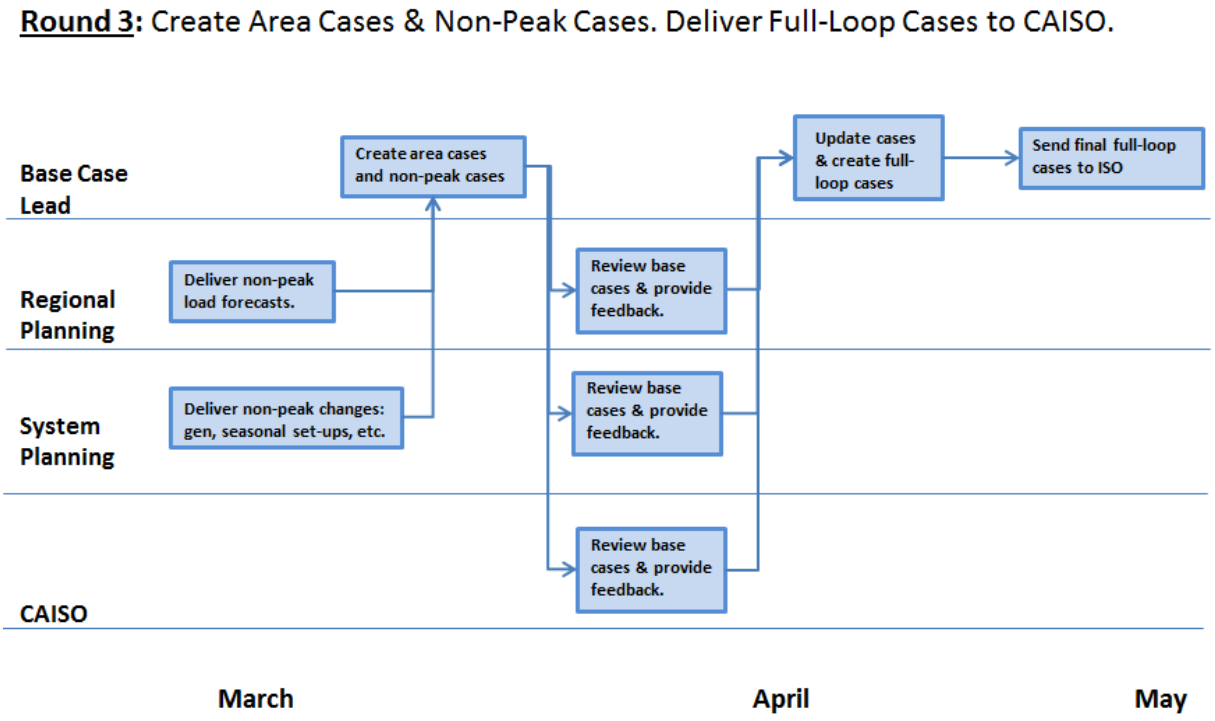

Figure 6: Round 3 Responsibility Process Map

2.3.6 *Area Cases*

Each area peak (1in10) case is built from the system peak (1in5) case for the same year. Thus a GRBA 2017 case is built from a system 2017 case. This ensures that the topology and other base assumptions are the same for the system peak case and all area cases for a given year. The changes for the area cases are load forecast assumptions and some generation dispatch, primarily to ensure the swing bus is balanced. Figure 7 below illustrates this process.

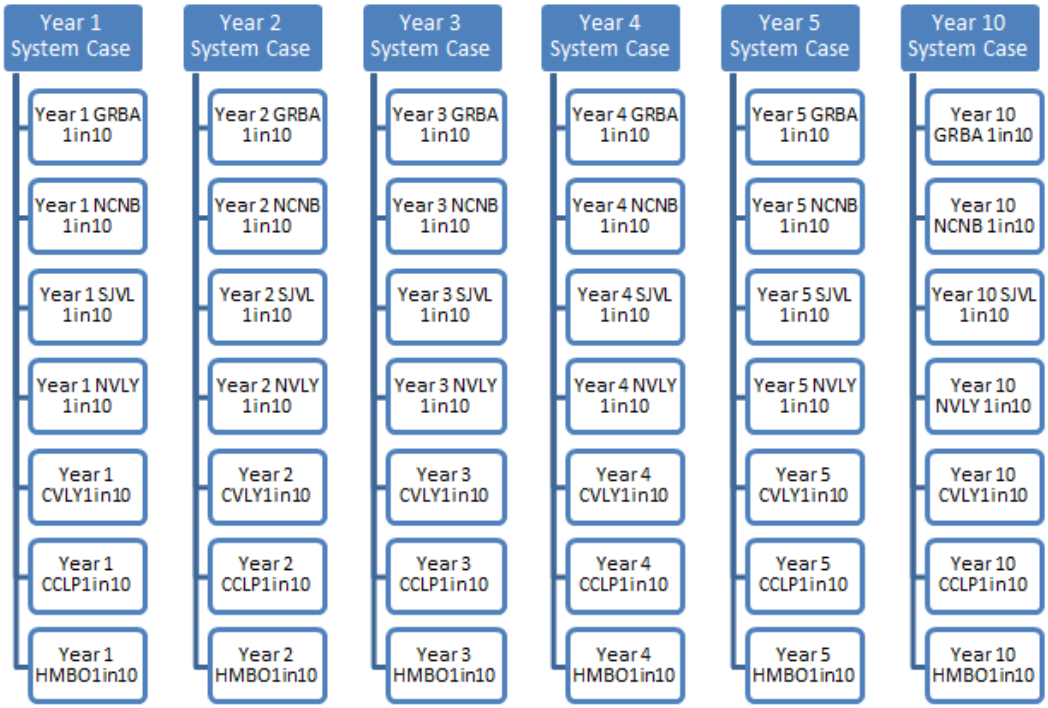

Figure 7: Area Case Creation from System Round 2 Cases

2.3.7 *Full Loop Cases*

Full loop version cases are created for CAISO use and for dynamic stability studies. These cases are created by inserting the updated topology model from Round 2 into a representative WECC case (based on CAISO TPP Study Plan). Figure 8 below illustrates this process. Full loop area cases are created from the full loop system case (after stitching) and made by scaling the loads and gens in the same fashion as done for the truncated area cases.

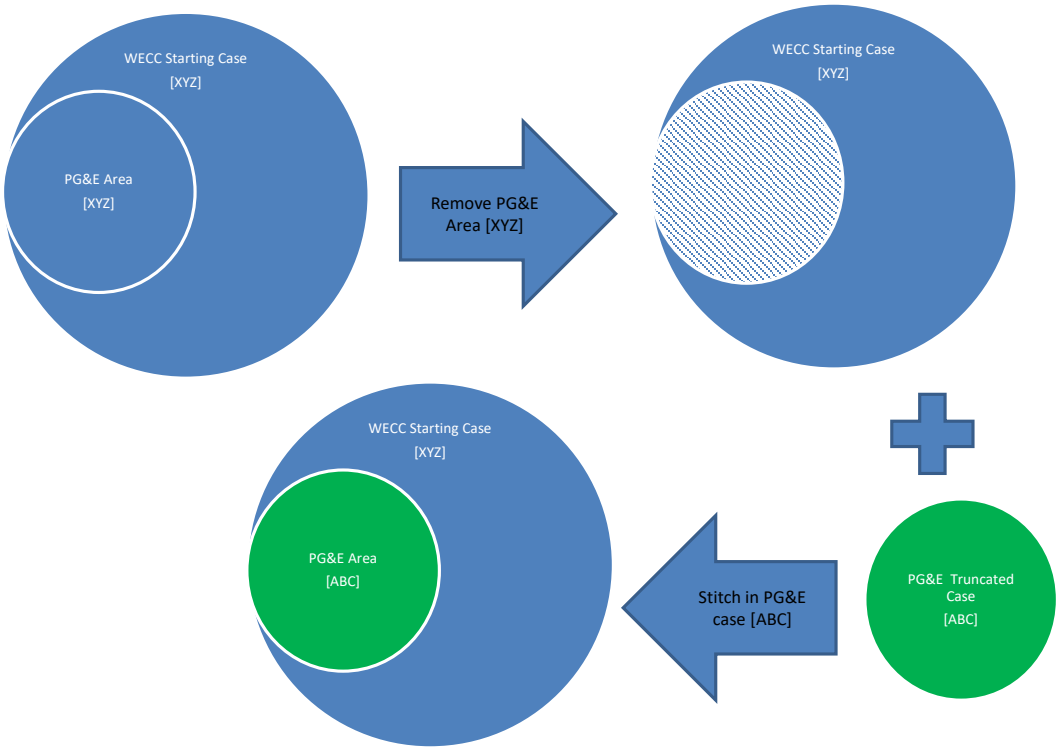

Figure 8: Full Loop Case Creation

2.4 Other Base Case

As discussed in Section 1.2 the approved Annual Transmission Planning Base Case is used as a starting case for the other base cases developed by TSP. The following table summarizes the changes made to the different cases.

Table 3 Assumptions for other Base Cases

Base Case Assumption	WECC Base Case	Load Interconnection Studies Base Case	Generation Interconnection Studies Base Case	Bases Case used for other Transmission Planning Studies
Starting Case	Annual Transmission Planning Base Case	Annual Transmission Planning Base Case	Annual Transmission Planning Base Case	Annual Transmission Planning Base Case
Generation	Changes per WECC annual Study Program	Generation dispatch assumption may change based upon the load interconnection study plan	Per the study plan	Generation dispatch assumption may change based upon the study plan
Transmission Facilities	No change	No change	Per the study plan	No change
Load Forecast	Per WECC annual Study Program	Use approved load forecast for peak cases. Forecast for non-peak cases will be based on approved seasonal forecast or historical loads.	Per the study plan	Use approved load forecast for peak cases. Forecast for non-peak cases will be based on approved seasonal forecast or historical loads.

Version History

Version	Change	By	Date
1.0	California ISO and Pacific Gas & Electric (PG&E) Joint Process Document for MOD-032-1 Requirement R1 Implementation and Compliance, initial version	Catalin Micsa and Anupama Pandey	6/29/2015
2.0	Update e-mail address; add Generator Owner Procedure; update the WECC Data Preparation Manual; add WECC Gen Unit Model Validation Procedure; add WECC Gen Facility Testing and Model Validation Requirements	Catalin Micsa and Wenjuan Zhang	6/29/2016
3.0	Update the Introduction section and distributed energy resource model; the WECC Data Preparation Manual; applicable links; add reference to the WECC Anchor Data Set; and the ISO check sheet regarding WECC base case review process.	Catalin Micsa and Jameson Thornton	9/19/2017
4.0	Add compliance obligations under ISO TPP BPM section 10. Update to the ADS section and new WECC Data Preparation Manual.	Catalin Micsa and Kathy Estrada	12/3/2018
5.0	Add responsibilities in reporting generator data to WECC. Update WECC Basecase Development and Review Processes in Appendix C and other miscellaneous changes.	Catalin Micsa and Sophie Xu	9/28/2020
6.0	Add requirements regarding generator resource ID mapping in long ID and add some exception and additions on generation model requirement in Appendix B. Update to distribution load modelling in section 2.2.3	Subrina Noureen. Preethi Rondla and Shengnan Shao	2/7/2024

Technical Review

Reviewed By	Name	Signature	Date
Regional Transmission Engineer, Transmission Infrastructure Planning (ISO)	Subrina Noureen	DocuSigned by: Subrina Sultana Noureen 203BECD871FD4FD...	2/8/2024
Senior Regional Transmission Engineer, Transmission Infrastructure Planning (ISO)	Preethi Rondla	DocuSigned by: Preethi Rondla 6F50A09B4B3A48B...	2/7/2024
Supervising Engineer, Transmission System Planning (PG&E)	Shengnan Shao	DocuSigned by: Shengnan Shao 8A51052FC64A421...	2/8/2024

Approval

Approved By	Name	Signature	Date
Manager, Regional Transmission North, Infrastructure Development (ISO)	Binaya Shrestha	DocuSigned by: Binaya Shrestha 3E1735ECBE89465...	2/7/2024
Manager, Transmission, Substation & Storage, Asset Planning (PG&E)	Marco Rios	DocuSigned by: Marco Rios CB48B6ACA276421...	2/14/2024

Appendix A. Modeling Requirements (MOD-032-1 R1, R2 & R3)

PG&E system model will be based upon the modelling guidelines specified in WECC Data Preparation Manual (DPM). WECC DPM is included in Appendix B. Additional modelling and reporting requirements for PG&E system and for meeting MOD-032-1 R1 are included in the following sections.

Per MOD-032-1 Requirement R1

R1. Each Planning Coordinator and each of its Transmission Planners shall jointly develop steady-state, dynamics, and short circuit modeling data requirements and reporting procedures for the Planning Coordinator's planning area that include: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*

1.1. The data listed in Attachment 1.

1.2. Specifications of the following items consistent with procedures for building the Interconnection-wide case(s):

1.2.1. Data format;

1.2.2. Level of detail to which equipment shall be modeled;

1.2.3. Case types or scenarios to be modeled; and

1.2.4. A schedule for submission of data at least once every 13 calendar months.

1.3 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.

Compliance with MOD-32 R1 will be achieved through the following:

Requirement 1.1. The data listed in Attachment 1

The Modelling data required in Attachment 1 will adhere to the WECC Data Preparation Manual (DPM). Additional data requirements are included in Section A.1.

Requirement 1.2.1 Data Format:

- Steady State and Dynamic model data should be provided in the General Electric International, Inc. (GEII) PSLF compatible format for Steady State and Dynamic information. PSLF licensees will have access to the PSLF documentation and PSLF block diagrams for dynamic models. GEII has provided the following instructions on how those that do not license the PSLF program can obtain the model library block diagrams and/or data sheets for models in the PSLF program. Those that do not license the GEII PSLF program may obtain copies of the Dynamic Simulation Data Export/Import document by contacting GEII (pslf.sales@ge.com) and signing a Non-Disclosure Agreement with GEII.

- Short Circuit Data shall be provided in ASPEN format.

For existing equipment, any change should be provided as an update to the existing model.

Requirement 1.2.2. Level of detail to which equipment shall be modeled;

The modelling requirement in WECC's DPM will be followed to meet this requirement. Additional requirements are included in Section A.1.

Requirement 1.2.3. Case types or scenarios to be modeled;

For WECC cases, the scenarios included in WECC's Annual Study Program will be used to model. In addition, the scenarios to be modeled for CAISO annual TPP will be developed jointly by PG&E and CAISO. The CAISO annual TPP study plan will include the scenarios to be modelled. Additional data requirement may be added for the scenarios identified in the annual study plan.

Requirement 1.2.4. A schedule for submission of data at least once every 13 calendar months.

Steady-state, dynamics, and short circuit modeling data to be provided by the applicable entities to PG&E and the CAISO by November 15th or as otherwise requested. For data that has not changed since the last submission, a written confirmation that the data has not changed is sufficient.

Requirement 1.3. 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.

The ISO will post this document to its web site under the Transmission Planning page in order to be available for those entities responsible for providing data. (http://www.caiso.com/planning/Pages/TransmissionPlanning/Default.aspx).

Entities responsible for providing data should send it to:

PC – ISO at: GridModelingData@caiso.com

TP – PG&E at: GenModel@pge.com

For modelling data submission the Subject line of the email should include the following text "***MOD-032-1: Modelling data submittal under Requirement R2***"

Generator Owner Procedures

Any Generator Owner will provide modeling data in accordance with NERC Reliability Standards, the WECC Data Preparation Manual, and the WECC Generating Unit Model Validation Guideline to PG&E and the CAISO, at e-mail addresses provide herein and according to the periodicity in the NERC Reliability Standards (MODs 025, 026, & 027 & PRCs 19 & 24) and WECC Generating Unit Model Validation Guideline. The document "WECC Generating Facility Data, Testing, and Model Validation Requirements" lists in detail the specific data that is required from the Generator Owners. This data is normally obtained during on-site testing and there are a number of firms which can be contracted to perform this testing. At this time all generators over a certain output, single unit capacity of 10 MVA or larger, or facilities with an aggregate capacity of 20 MVA or larger have to be re-tested every ten years according to NERC standards and every five years according to WECC standards. Please refer to the WECC Generating Unit Model Validation Guideline.

Upon any NERC or WECC standard changes, the time period required for generator testing/re-tests may be modified and should be applied. Testing and re-testing is required of renewable generation and this on-site testing will confirm the accuracy of the dynamic stability models and data (such as "regc_a" and "reec_b") that have been previously provided.

When this data is received from Generator Owners and/or the WECC, these models will be updated in both the power flow base cases and WECC's dynamic data file.

The CAISO updated its BPM for Transmission Planning Process (TPP) to include a multi-year phased approach to request data from generating units in the CAISO BA. Section 10 of the BPM[2] for TPP establishes: (1) what generator information and generator data must be submitted; and (2) the schedule, procedures, and format for submitting that information and data. Once the CAISO has accepted the submitted data as per section 10.4.3 of TPP BPM, the PTOs and CAISO will work together to submit the validated generating unit data to WECC and include the validated generating unit data in transmission planning process power flow and reliability studies as specified in Appendix C. Generating units that achieve commercial operation after September 1, 2018, will be subject to section 10.4.6 of TPP BPM. Notwithstanding this process, the CAISO may periodically request generator data, to meet requirements under NERC reliability standards. These requests will be due by deadlines set by the CAISO under those specific requests and will not be subject to the process outlined in this section 10 of the TPP BPM.

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 that the CAISO and PG&E are notified 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] https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Transmission%20Planning%20Process

A.1. Additional Data Modelling requirement

Steady State Data Requirements

PG&E Transmission System Model includes Transmission System > 60 kV. Steady state data requirements included in Section V of WECC's DPM will be applicable to all transmission facilities that are operated at or above 60 kV. In addition to the requirement included in DPM, the following are additional data will be required:

- Generator Qmax and Qmin at Pmin will be provided in simple text format. The steady state model will assume Qmax and Qmin at Pmin to be the same as that for Pmax [this is more conservative].
- For Transformers, number of No Load Tap Changers are will be provided in simple text format. A fixed value will be used for No Load Tap changer based on the field set point.

Dynamic Data Requirements

Dynamic models will adhere to Dynamic data requirements included in Section VI of WECC's DPM. The models should be in compliance with NERC modelling standards MOD 026 and MOD -27.

Short Circuit Data Requirements

Short Circuit model will adhere to data requirements included in Section VII of WECC's DPM. The required 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.

a. Positive Sequence

b. Negative Sequence

c. Zero Sequence

d. Mutual Coupling Line Impedance

e. Transformer Winding Connections

f. Auxiliary transformers / equipment connected at the tertiary (i.e. grounding transformers, series reactors, etc.)

Remedial Action Scheme Data Requirements

Contingency and Remedial Action Scheme data requirements included in Section VIII of WECC's DPM will apply.

Area, Zone, and Bus Number Assignment

Area, Zone, and Bus Number Assignment included in Appendix 2 of the DPM will be following. In addition, the following table includes PG&E Zone and Area assignments.

Table 4 Zone Assignments

ZONE	NAME
300	Intertie
301	Conf Load (Humboldt)
302	Conf Load (N. Coast)
303	Conf Load (N. Valley)
304	Conf Load (Sacramento)
305	Conf Load (Sierra)
306	Conf Load (North Bay)
307	Conf Load (East Bay)
308	Conf Load (Diablo)
309	Conf Load (S.F.)
310	Conf Load (Peninsula)
311	Conf Load (Stockton)
312	Conf Load (Stanislaus)
313	Conf Load (Yosemite)
314	Conf Load (Fresno)
315	Conf Load (Kern)
316	Conf Load (Mission)
317	Conf Load (De Anza)
318	Conf Load (San Jose)
319	Conf Load (Central Coast)
320	Conf Load (Los Padres)
321	Conf Load (Silicon Valley Power)
322	SMUD
323	Conf Load (MID)
324	Conf Load (TID)
325	Conf Load (Western)
326	Conf Load (LMUD)
327	Conf Load (CDWR)
328	Conf Load (NCPA)
329	Conf Load (Redding)
330	Roseville
331	Non-Conf Load (Humboldt)
332	Non-conf Load (N. Coast)
333	Non-conf Load (N. Valley)
334	Non-conf Load (Sacramento)
335	Non-conf Load (Sierra)
336	Non-conf Load (North Bay)
337	Non-conf Load (East Bay)
338	Non-conf Load (Diablo)

ZONE	NAME
351	City of Pittsburg
352	#N/A
353	DG Non-Assessment
354	Energy Storage
355	Solar PV
356	Solar DG, WDT
357	City and County of San Francisco
358	#N/A
359	Non-conf Load (Redding)
360	Generation Plant Load
361	Generation (Fossil & Non-peaker
362	Generation (Combustion Turbine)
363	Generation (Geothermal)
364	Generation (Nuclear)
365	Pumping Load
366	Generation (Pump/Generation)
367	INTERTIE
368	Generation (Syn. condenser)
369	Generation (Pit River)
370	Generation (Battle River)
371	Generation (Cow Creek)
372	Generation (CVP)
373	Generation (N. Feather River)
374	Generation (S. Feather River)
375	Generation (W. Feather River)
376	Generation (Black Butt River)
377	Generation (Eel River)
378	#N/A
379	Generation (Yuba/Bear River)
380	Generation (SMUD Hydro)
381	Generation (Middle Fork)
382	#N/A
383	Generation (Mokelumne River)
384	Generation (Stanislaus River)
385	Generation (Tuolumne River)
386	Generation (Merced River)
387	Generation (San Joaquin River)
388	Generation (Kings River)
389	Generation (Kern River)

ZONE	NAME
339	Non-conf Load (S.F.)
340	Non-conf Load (Peninsula)
341	Non-conf Load (Stockton)
342	Non-conf Load (Stanislaus)
343	Non-conf Load (Yosemite)
344	Non-conf Load (Fresno)
345	Non-conf Load (Kern)
346	Non-conf Load (Mission)
347	Non-conf Load (De Anza)
348	Non-conf Load (San Jose)
349	Non-conf Load (Central Coast)
350	Non-conf Load (Los Padres)

ZONE	NAME
390	Generation (QF Geothermal)
391	Generation (QF Hydro - North)
392	Generation (QF Hydro - Central)
393	Generation (QF Hydro - South)
394	Generation (QF Biomass)
395	Generation (QF Waste)
396	Generation (QF Oil-recovery)
397	Generation (QF Cogen)
398	Generation (QF Wind - North)
399	Generation (QF Wind - Central)
405	Southern Oregon

Table 5 Area Assignments

The following area assignments are used for non- full loop cases. For Full loop cases all the area numbers are converted to area 30.

Area Number	Area Name
1	HUMBOLDT
2	N. COAST
3	N.VALLEY
4	SACRAMENTO
5	SIERRA
6	NORTHBAY
7	EAST BAY
8	DIABLO
9	S.F.
10	PENNSULA
11	STOCKTON
12	STANISLAUS
13	YOSEMITE
14	FRESNO
15	KERN
16	MISSION
17	DE ANZA
18	SAN JOSE
19	CENTER COAST
20	LOS PADRES

Area Number	Area Name
21	ST CLARA
22	SMUD
23	MID
24	TID
25	WESTERN
26	LMUD
27	CDWR
28	NCPA
29	REDDING
30	PLANT LD
31	CCSF
32	COTP
33	PG&E500
34	PP&L
35	SPP
36	NORTHWEST
37	SCE
40	NORTHWEST
51	City of Pittsburg

Appendix B. WECC Data Preparation Manual

The latest available WECC Data Preparation Manual shall be used. As a first step one should search the WECC web site (https://www.wecc.biz/Pages/home.aspx) for the latest version of the WECC Data Preparation Manual. If one cannot be found; the following is the April 10, 2020 version of this manual. The modeling requirements as outlined in the latest approved WECC DPM shall be followed with the exceptions and additions 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*".

Additional generation data requirements

Long ID	Resource long identifier LID	Maintain and populate with a list of ISO market resource identifiers for Participating Generators

For convenience please also find the WECC Generating Unit Validation Policy and the WECC Generation Facility Testing and Model Validation Requirements.

Appendix C. WECC Base Case Development Process (MOD-032-1 R4)

This Appendix includes guidelines for developing a WECC base case.

WECC Base Case Development Process Overview

The WECC Base Case Development Process is to create several WECC wide cases each year of various scenarios and future year topologies. WECC sends out approximately 11 requests each year, based on a provided timeline. Case scenarios generally include 5 operating cases for the following year (heavy summer and winter, light summer and winter, heavy spring) and several general planning cases for the 5 and 10 year time frame which are usually heavy summer and heavy winter with some other variations.

After each request is received, modifications will be made to an existing PG&E base case to best reflect the case scenario requested. Usually the starting case is an approved Annual Transmission Planning Base Case summer peak system case. If the request warrants use of a different case then a different case may be used if the starting case is a closer representation to what is desired by the scenario. The starting case is sent out to the Muni's seeking updates and comments which are incorporated into the case. Based on the request from WECC the path flows are agreed upon by the appropriate parties (i.e. North West and SCE). Loads for the WECC case are either 1in5 for heavy summer, or are used from the 'seasonal' tab in the load forecast spreadsheet.

The case is then checked for various Replog errors and corrected to reduce or eliminate any errors. The case is then checked for a flat dynamic run and to ensure all dynamic data is available. The latest Master Dynamic file is read in, initialized, and run with no disturbance. Any missing dynamic data is gathered and provided to WECC with the submittal. Additionally any dynamic warnings that occur during initialization are also corrected as needed.

The last modifications to the case are to ensure all equipment has an area of "30" and that all 8 ratings are populated. Ratings 5-8 are overwritten with ratings 1 and 2 as PG&E does not have spring or fall ratings and instead uses summer ratings at these times as they are more conservative. The preparer shall also coordinate with CAISO to ensure that the WECC ten year out summer case meets the ADS data requirements.[3]

The final deliverables to WECC are a completed base case (.sav), any updated dynamic files (.dyd) and the completed load and resource excel sheet. The cases are then stitched into a full loop case by WECC and checked for any remaining errors before they are sent back to all parties for review and approval. After any remaining issues are resolved the sign off form is

[3] Refer to Appendix F for further details on Anchor Data Set development.

signed and sent to WECC for final approval confirmation. The cases are then published on WECC's website for members to use.

PG&E and CAISO's responsibilities in reporting generator data to WECC

The CAISO and PTO established a joint generator data review process in 2019 to implement Section 10 of the CAISO BPM for TPP to comply with the MOD-032-1 standard, which provides consistency in generator modelling data submission from generator owners and ensures the data be fully validated by the PTO 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 the CAISO and PG&E have validated the generator data and determined that compliance requirements are met by the GO, the CAISO will provide the validated generator data to PG&E within 60 calendar days after the CAISO sends out a compliance letter to the GO, unless a longer time period is agreed upon by the CAISO and PG&E. A complete package of the following validated data will be saved in a special folder for each generator, and CAISO will send a notice to PG&E representatives and GenModel@pge.com for them to access the complete package information.

- equipment data including short circuit data
- steady-state power flow model in GE PSLF .epc format
- dynamic model in GE PSLF .dyd format
- single-line diagram
- test report for generator real and reactive power capability
- test report for dynamic model
- electromagnetic transient model for sub-synchronous resonance study if applicable

PG&E will submit the generator data in GE PSLF format to WECC (via the Area Coordinator) in response to the first WECC base case data request letter received from WECC, after the validated generator data has been received from the CAISO, unless a longer time period is agreed upon by

the CAISO and PG&E[4]. To provide consistency in data submittals, PG&E will submit the generator data to the Area Coordinator per the guidelines outlined below.

- PG&E is responsible for generating units that are located in Area 30
- The latest steady-state power flow model up to generator's POI should be included in the generation representation. The Generator data should meet the WECC base case development requirements. Steady-state and dynamic models shall be consistent (i.e., Bus Number, Bus Name, Unit Id)
- The latest validated dynamic model shall be submitted per the dynamic data requirements of WECC Data Preparation Manual, WECC Data Preparation Manual for Interconnection-wide Cases, and WECC Solar Photovoltaic Power Plant Modeling and Validation Guideline
- The latest short circuit data should be used in PG&E's short circuit analysis

The CAISO and PG&E need to review the generator data in the WECC case sent out for review and provide comments to the Area Coordinator during the WECC base case review process.

Roles and responsibilities summary

Tasks	CAISO	PTO
Save validated generator data as a complete package in the MPP site and send a notice to PTO for them to access the package information within 60 calendar days of compliance letter sent to GO	X	
Submit generator data to WECC (via the Area Coordinator) in response to the next WECC base case data request letter received from WECC		X
Review the generator data in WECC base case review process (CAISO to provide comments to PG&E)	X	X
Provide review package to Area Coordinator and copy to CAISO (Not applicable to PG&E since it is also the Area Coordinator)		X

[4] If the due date for submitting the generator data for the "first" base case to WECC is less than 60 calendar days from the date of receiving the validated generator data from the CAISO, the PTO can submit the generator data in response to the second WECC base case data request letter received.

WECC Base Case Development Process

This section describes the WECC Base Case development process.

PG&E is designated as Area Coordinator for area 30. The following actions are taken by the Transmission Planner assuming the role of the Area Coordinator:

- Receive email from WECC specifying the assumptions in the WECC scenario.
- Adjust the TPP base case per WECC's specifications
- Incorporate the ongoing change files into the adjusted base case.
- Send out email to Munis requesting updates
- Send out email to North and South Coordinator (i.e. Columbia Grid and SCE) to coordinate tie-line flow if not specified in the Base Case specifications
- Once Muni updates are obtained, send out email with a starting case to the planner assigned to develop the next base case per the schedule.

The assigned Transmission Planner will work under the direction of the Area Coordinator to perform the following functions:

- Obtain files from Area Coordinator's email as well as the T drive (location specified in the email) and save files to local drive.
- Compile Muni changes
- Check Interties (i.e. COI, Path 15, Path 26, Path 24, Path 25, etc.), and find emails on T drive to ensure they are set to Target value. Ask Area Coordinator, if not certain of or can't find target values.
- Check system voltages and correct all normal overloads. System voltages should ideally be within ± 5 % of nominal voltage. All lines over 99.9% are considered overloaded so adjust generation dispatch to correct overloads and voltages, making sure not to adjust those that were adjusted by the Muni's or SCE and Columbia Grid.
- Balance swing bus by adjusting generation, making sure not to adjust those that were adjusted by the Muni or SCE and Columbia Grid.
- Document all generation dispatch changes on a change or text file
- Run All WECC data checks
    a. Run checkazo.p
    b. Run Replog.p
    c. Document all changes to resolve errors on change (*.m) or text file.
- Ensure Dynamic Flat Run
    a. Download the latest masterg.dyd file from the WECC website.
    b. Collect dynamic data for new generators. Document all the data collected onto a dyd or text file.

c. Document all changes made to fix initialization errors on a text or change file. Copy all new or changed dyd models into a new text file, which should be uploaded on T drive and sent off to the Area Coordinator when completed

- Notify Area Coordinator that you have completed the request.

Once the assigned Transmission Planner has completed the designated tasks, the Area Coordinator will:

Area Coordinator:

- Compile all Gen data on Load and Resource (L and R) spreadsheet
- Send email of spreadsheet to WECC (i.e. basecase@wecc.biz ; CC: Muni's) and copy the CAISO at GridModelingData@caiso.com

WECC Basecase Review Process

Upon receipt of notification from WECC regarding the review of the base case, the Area Coordinator will send out a notice to Muni's via email and the assigned planner.

The assigned Transmission Planner will perform the following functions:

- When Area Coordinator sends out notice to Muni's, check to ensure the changes proposed in the development phase do not cause any errors by running all WECC data checks and viewing resulting reports.
- When (and/or if) the Muni's provide Area Coordinator/ Assigned Planner changes, compile all muni changes into a single (change or epcl) file or a file to run multiple files. For instance, create a change file (*.m file), which calls upon the epcl (use EPCL command) and/or change file (use INSERT command) from each Muni.
- The CAISO will review PG&E base case data and provide comments to PG&E during the Base Case Review Process[5]. PG&E will provide written response to CAISO, using the case review sign-off sheet in Appendix G, confirming that the WECC Base Case has been updated to address CAISO's review comments or provide an explanation for maintaining the current data.

After completion for WECC base case review, the Area Coordinator will:

- Collect sign off sheets from Muni's
- Sign one for PG&E

[5] The ISO, in agreement with PG&E, has developed a case review sign-off sheet for providing WECC Base Case Review comments to PG&E (Appendix G)

- Send sheets (and change file, if applicable) to WECC (i.e. basecase@wecc.biz; CC: Muni's and copy the CAISO at GridModelingData@caiso.com

Appendix D. Evidence Retention

The following evidence for demonstrating compliance with MOD-032 will be retained for a period of 4 years unless one of the following is true:

1. Last audit performed by the Compliance Enforcement Authority was over 4 years ago, then at minimum maintain evidence from the last audit until a new audit is performed.
2. Maintain evidence for longer period of time if asked by the Compliance Enforcement Authority, as part of an investigation.
3. If an applicable entity is found non-compliant, it shall keep information related to the non-compliance at minimum until mitigation is complete and approved.

The following documents need to be retained:

- Documentation showing that PG&E and CAISO jointly developed required modeling data requirements and reporting procedures;
- Modeling requirements document;
- Posting and reporting procedures for modeling requirements documents;
- Written notification regarding technical concerns with data submitted under R2, including the technical basis or reason for the technical concerns.
- Dated request or schedule from WECC to provide models developed using data from R2; and
- E-mail records or postal receipts showing recipient and date for model submission to WECC (including the models developed).

Appendix E. Miscellaneous Modelling References

Generation Bus Naming:

For future generators in the CAISO Q, use of the Qnumber is acceptable. Once the project has been placed in service (operational) it is recommended to change the name to match the actual project title.

QXXXXTP for a tap bus
QXXXXSS for a new switching station {will require a modification to the master breaker list}

QXXXX for the project main bus at transmission level voltage
QXXXXC1 for the first collector system equivalent bus at medium voltage
QXXXXC2 for the second collector system equivalent bus at medium voltage
QXXXX for the generator bus at low voltage
At some point we will replace QXXXX with the switching station name or project names.

For combined cycle units use CT (Combustion turbine) or ST (Steam Turbine) in the bus name to indicate units that must run concurrently.

Appendix F. Anchor Data Set (ADS)

For many years, WECC has been aware that data used in its various reliability assessment models (e.g., Power Flow-PF; Production Cost Model-PCM) has varying degrees of consistency and, to some extent, redundancy in terms of the data's development and collection. The concept of an Anchor Data Set (ADS) has been created with the goal of providing a common starting point for WECC's long-term reliability assessments, as well as other planning studies undertaken by WECC stakeholders. The process for developing the ADS is designed to eliminate redundant data development and collection while providing a mechanism for ensuring the accuracy, consistency and completeness of the data.

The Anchor Data Set (ADS) is a 10 year out Heavy Summer compilation of load, resource and transmission topology information used by the Western Planning Regions (WPRs) in their regional transmission plans as well as by other stakeholders in various planning analyses. This data is compatible with Production Cost Models (PCM) and power flow (PF) models, including dynamic data and associated assumptions. The ADS is comprised of data developed by NERC Registered Entities in the U.S. and international entities in the Western Interconnection (Balancing Authorities (BAs'), Transmission Planners (TPs') and/or Planning Coordinators (PCs')) and used by FERC Registered Entities in the U.S. that may be affiliated to the WPR whether or not they have FERC planning obligations as well as Transmission Owners (TO), Generation Owners (GO) or Load Serving Entities (LSE) not represented by the WPR or IPR.

The data included in the ADS must reflect applicable state and federal statutory public policy requirements such as Renewable Portfolio Standards (RPS). Resource and Transmission representation must be aligned with the most recent regional plan of the Planning Region. To achieve the goals of the ADS it is essential that the data submitted for the annual 10 year out WECC power flow cases, as part of the MOD-032 process, is coordinated with the planning regions, and reflects the most recent regional planning case of the planning region.

Please refer to WECC ADS Webpage[6] for further information.

[6] https://www.wecc.biz/SystemStabilityPlanning/Pages/AnchorDataSet.aspx

Appendix G. 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