California Independent System Operator

And

San Diego Gas & Electric

Joint Transmission Planning Base Case Preparation Process

For Compliance with NERC Reliability Standard MOD-032-1

Version 1.6

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CAISO and SDG&E Transmission Planning Base Case Preparation Process

I. Introduction

1.1. Purpose

The purpose of this document is to establish consistent modeling data requirements and reporting procedures for development of planning horizon cases necessary to support analysis of the reliability of the interconnected transmission system. This document is a joint effort between the California Independent System Operator (CAISO) south regional transmission group and the San Diego Gas & Electric Transmission Planning Department, in order to support their compliance with NERC Standard MOD-032-1 R1, R2, R3, and R4. This document intends to establish consistent modeling data requirements and reporting procedures for the development of planning horizon cases necessary to support analysis of the reliability of the interconnected transmission system.

The distribution of this document will be made initially to applicable NERC registered entities who are required to submit data, including Generator Owners within SDG&E’s service area and upon any change to the document by SDG&E’s Transmission Planning group. The document will also be posted to the CAISO website by CAISO Representatives at www.CAISO.com ➔ Planning ➔ Transmission Planning ➔ Transmission planning documents ➔ Submittal Requirements - Data for Power System Modeling and Analysis MOD-032-1 ➔ ISO-SDGE MOD-032-1 Requirements.

1.2. Types of Base Cases

The following base case development processes are covered in this document:

- SDG&E Grid Assessment (GA) Base Cases
- CAISO Transmission Planning Process (TPP) base cases
- WECC base cases
II. SDG&E Grid Assessment Annual Base Case Process

SDG&E transmission planners, in consultation with the California ISO (CAISO) planners, use the following process to develop the study models used in the annual grid assessment studies. SDG&E’s transmission model is updated annually and more often as needed, to account for ongoing changes in the transmission topology, load forecasts, and resource plans. To ensure accuracy with outside entities, the annual grid assessment study models, known as “base cases”, are reviewed by the CAISO planners and other interested parties through the CAISO transmission planning process. In development of the “base cases”, SDG&E follows the WECC Data Preparation Manual as a guideline to meet the WECC data requirements and reporting procedures. Detailed system modeling requirements and reporting procedure to be used by applicable registered entities are identified in Section 4 of this document and within the WECC Data Preparation Manual.

The WECC Data Preparation Manual identifies the set of complete data that is needed to be supplied to both the CAISO and SDG&E in development of the “base cases” by applicable registered entities, including generators to SDG&E, Transmission Planning.

The detailed system models, both steady-state and dynamic, will be built using the PSLF program from General Electric. Any data submitted to SDG&E or the CAISO should be in the PSLF data format, or if the data is from outside these two organizations it can be submitted to the CAISO or SDG&E in the form of a text file in case the submitter does not have the use of the PSLF program.

Study Plan Development

The ISO initiates the annual process by posting a Draft Study Plan and schedule. Upon agreement with SDG&E and other Participating Transmission Owners (PTOs), the final Study Plan is posted on the ISO’s website.

Starting Transmission Planning Process

The CAISO Transmission Planning Process Unified Planning Assumptions and Study Plan determines which WECC approved system models would be appropriate for the CAISO transmission planning study purposes. These approved system models consist of steady state and dynamic data and are available to the WECC members on the WECC secure website. The power flow base cases and matching dynamic data¹ have already been submitted and reviewed by SDG&E and other participating members of the WECC.

¹ Only where applicable, however, SDG&E and others do not create individual dynamic files for each case.
GA Base Case Scenarios (Case Scenario Matrix)

The CAISO Study Plan describes the Base Case Scenarios. Generally, the annual study includes:

- Near-term (1 – 5 years)
- Long term (10th year)

The following loads are included for most years:

- Summer Peak Load
- Off Peak Load (65% of peak)
- Minimum Load (35% of peak)

Sensitivity Cases:

- N-1 of a 500 kV line
- G-1/N-1
- Maintenance-low load
- South of SONGS flow

The above scenarios are included to capture as many operating conditions as possible. This list may change based on need.

Base Case Development

The base cases are developed consistent with the ISO Study Plan and involve updating SDG&E's system representation in the WECC base cases to reflect the most recent information. The following assumptions are generally considered in the studies:

- Load forecast
- Resources
- Transmission topology, rating, and impedance updates
- Power factor
- Base case checks per SDG&E Grid Operations standards Operating Documentation
CAISO and SDG&E Joint Transmission Planning Base Case Preparation Process

Load Forecast

The load forecast used in the power flow cases include a combination of SDG&E’s 90/10 adverse weather Distribution Load Forecast\(^2\) and the California’s Energy Commission’s (CEC) Demand Forecast; and as listed in the CAISO’s study plan. Typically, the forecast used is the CEC’s 1-in-10 Low-Mid Additional Achievable Energy Efficiency (AAEE) forecast.

SDG&E’s Distribution Load Forecast (marked as “Pk” in the PSLF base case load table) is loaded into the power flow case, then the aggregate San Diego area load is scaled down accordingly to match the CEC’s 1/10 Demand Forecast (marked as “10” in the load table)\(^3\). The peak (“Pk”) loads are used to carry out local area peaking studies, where a high degree of coincidence can be expected (e.g. Poway load pocket, South Orange County, etc.)

The system load forecast includes the net effect of the following:

- Total customer load (+)
- System losses (+)
- Imports (-)
- Generation (-)

Resource Assumptions

Resources should be modeled according to the most recent load and resource plan and the grid assessment study examines plausible generation dispatch and import scenarios. Proposed merchant generating plants that have a signed interconnection agreement (LGIA) and an executed power purchase agreement (PPA) are typically modeled. Generator characteristic data (dynamic stability data) is provided to SDG&E by the developer who has built or will be building the new facility. However, given the data availability, generic dynamic data may be used for this future generation. Local Resource Adequacy (RA) data is used in the study cases according to CAISO Operating Procedure 7810, “San Diego Area Generation Requirements”.

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\(^2\) Distribution Load Forecast - a 10% probability that system peak load will exceed the adverse forecast.

\(^3\) Note, certain loads are not scaled up or down because the load history shows that they do not change from year to year. These loads are kept static in the PSLF cases by marking them with a “1” in the non-conforming load column in the PSLF edit table for loads. The Power Factor/VAR loading will also stay the same.
**Generator Owner Procedures**

Any Generator Owner within the SDG&E service area will provide modeling data in accordance with NERC Reliability Standards, the [WECC Data Preparation Manual](#), and the [WECC Generating Unit Model Validation Policy](#) to SDG&E representatives, Habibou Maiga at Hmaiga@semprautilities.com and to Dave Miller at DMMiller@semprautilities.com, and to the CAISO at GridModelingData@caiso.com according to the periodicity in the WECC Reliability Standards (MODs 025, 026, & 027 & PRCs 19 & 24) and [WECC Generating Unit Model Validation Policy](#). The document “[WECC Generating Facility Data, Testing, and Model Validation Requirements](#)” lists in detail the specific data that is required from the Generator Owners to SDG&E as the Transmission Planner. This data is normally obtained during on-site testing and there are a number of firms which can be contracted to perform this testing. According to the WECC, 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 Policy](#).

Upon any NERC 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 provided to SDG&E and the WECC.

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

In order to insure that all generator data is accurate and up-to-date a survey is conducted each year by SDG&E’s Grid Operations Department. Each of the major generators in SDG&E’s service territory receive a form which lists data for these generators and the Generator Owners are required to inform SDG&E, Grid Operations (GCCProcedureCtrl@semprautilities.com), ISO Transmission Planning (GridModelingData@caiso.com), and SDG&E Transmission Planning (DMMiller@semprautilities.com) of any changes to the generators, such as real and reactive capability, relay settings, etc., or to confirm that the present data is still correct. Response to this annual survey is required to be submitted in order to fulfill a registered entity’s obligations under this documented process data submittal obligations.

**Transmission Topology & Ratings Updates**

Transmission system upgrade projects such as reconductors, new lines, or substations, are contained in the SDG&E “TPP Project Matrix” document and are listed with the year they are scheduled to be completed. This document serves as a guide to the Grid Assessment personnel.
CAISO and SDG&E Joint Transmission Planning Base Case Preparation Process

who are building the cases in order to insure accuracy and timeliness of the models. Updates to the WECC and GA cases are dependent on the permitting process and therefore the in-service data is commonly subject to change. To ensure that GA is modeling the most current topology and that the “TPP Project Matrix” document is up-to-date, monthly project and outage coordination meetings are held to update the status on planned, in construction, or completed projects. In addition, a report, known as a long-term outage plan, is sent out by the SDG&E Grid Operations department every two weeks to Transmission Planning and many others. This is a list of all outages that will be needed in order to complete future projects such as a reconductor or a new substation. The report gives Transmission Planning the most current status of these projects and any project changes that might be needed. This ensures that project data in the base cases is up-to-date. The new information is then input into a change file where it’s used to easily update the WECC and GA cases.

Conductor updates, contained in SDG&E’s Grid Operations Standard Operating Procedures document TMC1015a (Transmission Line Ratings), are generated by the Grid Operations department and are then updated into the WECC and GA cases via a change file. Whenever there are changes to the TMC1015a, a revised copy of this confidential document is sent to the ISO.

Any impedance changes are provided as they occur, from the Protection Engineering section of SDG&E which uses the ASPEN program to determine these values. Changes affecting dynamic stability data are entered into the MDF (Master Stability Data) file as the changes occur and the revised MDF is then sent to the WECC.

**Power Factor**

Below are the power factor assumptions for each year:

- Near-term, 2\textsuperscript{nd} year – Actual Power Factor\textsuperscript{4}

- For all other cases the power factor is set to whatever is appropriate for that year, load, and particular season (summer, winter, etc.). Power factor data is considered to be confidential.

\textsuperscript{4} Actual Power Factor – Actual substation power factor from last year’s peak day. This data is provided by Grid Operations Control.
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Base Case Checks – Grid Operations Standards

* The slack machine (swing generator) for each control area represented in the power flow should be within its limits (generator output (Pgen) should be greater than minimum loading and equal to or less than the maximum rated output, (Pmax).

* The WECC and GA cases employ voltage criteria set forth in SDG&E’s current Grid Operations Standard Operating Procedures document TMC1005 (Transmission System Voltage and VAR Control). Transmission Planning is notified by Grid Operations when any changes (though infrequent) occur, and a revised copy is provided to the ISO.

* Interchanges should be at desired values that were determined through discussions with neighboring utilities.

* Transformer overloads should not be present, based on the loading criteria set forth in SDG&E’s current Grid Operations Standard Operating Procedures document TMC1105a (Transmission Transformer Ratings). Again, when changes occur to this operating document, a revised version is provided to the ISO.

* Other overloads should not be present, if so, they will be corrected.

* Include all projects that are currently planned for future years in the base cases. The in-service dates are based on the latest assumptions.

* When all the cases are complete they are compared using the ‘PSLF Comparison Function’ to ensure completeness and accuracy.

Contingency and Dynamic Data

The dynamic data used for stability studies is initially obtained from the WECC (Master Dynamic File, “MDF”) and updated as necessary. The contingency files are updated as well on an annual basis to include all valid contingencies. The finalized contingency and dynamic files are then sent to the CAISO. Any changes to the MDF are also sent to the WECC.

Base Case Completion

When the CAISO receives the completed base cases, contingency list and dynamic files, the CAISO then has the opportunity to review and comment on the base cases. The CAISO will communicate any concerns with SDG&E. Once all concerns are addressed, SDG&E and the CAISO begin the analyses portion of the study. For some base case assumptions, SDG&E may deviate
from the CAISO Study Plan for the base cases that SDG&E will study. SDG&E will notify the CAISO which assumptions in the SDG&E base cases are not aligned with the CAISO Study Plan, and will work with the CAISO to create a complete set of base case cases that are aligned with the CAISO Study Plan. SDG&E shall maintain a log file of all changes to the base cases and provide it to the ISO when requested.

Process Diagram

Chart 1 is a process diagram provided at the end of this document as a visual representation of the SDG&E Grid Assessment Base Case development process.

III. CAISO TPP Base Case Development

3.1. Overview of the CAISO TPP Base Cases Development

Every year CAISO posts the CAISO Transmission Planning Process Study Plan which is developed along with the stakeholders. CAISO planners review the study plan with SDG&E and then kicks off the Transmission Planning Process. The reliability assessment is performed on the bulk system and the local areas for a 10 year planning horizon to ensure that the performance of the system under the CAISO controlled grid will meet or exceed the applicable reliability standards.

As shown in Chart 4: the CAISO Transmission Planning Process (TPP) Base Case Development Process Map, TPP base cases should start from the latest SDG&E base cases. The SDG&E case should include up-to-date information of the existing facilities, future generation, and transmission projects for the next 10 year horizon.

SDG&E will provide a list of renewable projects that are either under construction, or recently went in service, to the CAISO Planners. SDG&E will provide a list of all additions and retirements of generation, transmission, and other projects that will be modeled in the planning cases. The CPUC provides the CAISO with the RPS portfolios to be used in the TPP annually. CAISO Planners will compare the SDG&E and CPUC list and identify the additional projects which need to be modeled in order to meet the 33% Renewable Portfolio Standard (RPS) requirements. CAISO Planners will provide to SDG&E the list of additional generation that needs to be modeled in the SDG&E base case and a list of any new conventional generation resources, as per CAISO study plan, that need to be modeled by SDG&E.

The CEC posts a 1-in-10 demand forecast and provides the allocation of Additional Achievable Energy Efficiency (AAEE) to bus-bar locations. SDG&E will update the SDG&E base cases according to the Study Plan incorporating topology changes, CEC load forecast, CEC allocation
CAISO Planners will review the provided information and communicate back any concerns identified in the base case to SDG&E via written comments. SDG&E will update the TPP base case, and as needed the SDG&E Grid Assessment Annual base case to address the CAISO’s written comments. Once any concerns are resolved, CAISO will work with SDG&E to merge the SCE base case with the SDG&E base case and will build the full loop base case as specified in the CAISO study plan. CAISO will work with SCE to obtain their TPP base case that is to be merged with SDG&E.

SDG&E will provide to the CAISO the base cases for the years specified in the study plan.

- **Evidence Retention**

The ISO and SDG&E will keep data or evidence for at least four years, to show compliance with MOD 032 Requirements R1 through R4, and Measures M1 through M4.

### 3.2 **The TPP Base Case Data Requirement**

- **Demand Forecast:**

The ISO collaboratively works with the California Public Utilities Commission (CPUC) and the California Energy Commission (CEC) to align the transmission planning assumptions between the ISO’s Transmission Planning Process and the CPUC’s Long-term Procurement Process (LTPP), as well as the demand forecast assumptions contained in the base cases.

The base cases will utilize the latest demand forecast adopted by California Energy Commission (CEC). In general, the following are guidelines on how load forecasts are used for each study area.

Since load forecasts from the CEC are generally provided for a larger area, these load forecasts may not contain bus-level load forecasts, which are necessary for reliability assessment. Consequently, the augmented local area load forecasts developed by the PTOs will also be used where the forecast from the CEC does not provide detailed load forecasts. Appendix A of this document presents descriptions of the methodologies used by SDG&E to derive bus-level load forecasts using CEC data as a starting point.
• Generation Projects

Existing, approved/planned future generation resources, and retirement plans are modeled and dispatched to reliably operate the system under stressed system conditions. Details of generation modeling is provided in Study Plan.

In addition to generators that are already in-service, approved/planned new generators will be modeled in the base cases as generally described below. Depending on the status of each project, new generators will be assigned to one of the five levels below:

- Level 1: Under construction
- Level 2: Regulatory approval received
- Level 3: Application under review
- Level 4: Starting application process
- Level 5: Press release only

Based on this classification, the following guidelines will be used to model new generators in the base cases for each study.

Up to 1-year Operating Cases: Only generation that is under construction (Level 1) and has a planned in-service date within the time frame of the study, will be modeled in the initial power flow case.

2-5 year Planning Cases: Generation that is under construction (Level 1) and has a planned in-service date within the time frame of the study, will be modeled in the initial power flow case.

Conventional generation in a pre-construction phase with an executed LGIA and progressing forward, will be modeled as off-line but will be available in the cases as a non-wire mitigation option.

6-10 year Planning Cases: Only generation that is under construction or has received regulatory approval (Levels 1 and 2) will be modeled in the area of interest of the initial power flow case. If additional generation is required to achieve an acceptable initial power flow case, then generation from Levels 3, 4, and 5 may be used. However, generally Level 3, 4, and 5 generation should only be used when they are outside the area of study, so that the generation’s impact on the facility addition requirements will be minimized.
Renewable generation with all permitting and necessary transmission approved and expected to be in-service within 5-years may also be modeled in the relevant cases. Interconnection agreement status will be utilized as the criteria for modeling specific generation. For long term cases, generation from the CPUC and CEC provided portfolios may be modeled as necessary, to ensure generation that is needed to be in-service to meet the 33% RPS requirement is represented. Given the data availability, generic dynamic data may be used for this future generation.

Generation Retirements: Existing generators that have been identified as retiring will be modeled. In addition to the identified generators the following assumptions will be made for the retirement of generation facilities:

- OTC replacement local capacity amounts in southern California that were authorized by the CPUC under the LTTP decisions will be considered along with the procurement activities to date from the utilities
- Renewable and Hydro Retirements – Assumes these resource types stay online unless there is an announced retirement date
- Other Retirements – Unless otherwise noted, assumes retirement based on a resource age of 40 years or more

The retiring generators along with their step-up transformer banks will be modeled as out of service starting in the year they are assumed to be retired. Their models are to be removed from base cases only when they have been removed from the site. Exception: models can be removed prior to physical removal only when approved plans exist to use the site for other reasons.

OTC replacement local capacity amounts in southern California that were authorized by the CPUC under the LTTP decisions will be considered, along with the procurement activities to date from the utilities.

- **Renewable generation projects and dispatch**

CAISO will work with SDG&E Planners to ensure that CAISO TPP base cases include renewable generation modeling and dispatch that is consistent with the CAISO TPP study plan. SDG&E will model this RPS renewable generation and dispatch these renewable generators pursuant to the ISO Study Plan. CAISO Planners will also work with SDG&E Planners to ensure that the renewable generation in the CAISO TPP study plan is also modeled in the WECC 10 year out heavy summer ADS case.
Transmission Projects

The transmission projects that the ISO has previously approved will be modeled in the base cases. This includes existing transmission projects that have been in service and planned future transmission projects that have received CAISO approval in earlier ISO transmission plans. Other network changes or upgrades that are officially driven by different program, such as SDG&E’s Wood-To-Steel program, maintenance, and/or distribution development, will be documented and modeled in the base case development.

If needed for support of the compliance with the MOD-032 standard, the following can be created and furnished to the CAISO.

- Bus-level load spreadsheet, including coincident peak and non-coincident peak load forecast, and CEC projected AAEE and Demand Response. Approved/planned resources spreadsheet, including retirements, preferred resources, energy storage, and conventional resources. Any approved/planned generation projects in the distribution system which directly affect the transmission system will be included.
- Approved/planned transmission projects spreadsheet, listing the project name, scope of work, construction status, facility rating, and the latest in-service date.
- Power flow change files of the approved/planned generation and transmission projects that have been applied in the base cases.
- Contingency files, conforming to current NERC/WECC/CAISO standards.
- Switch deck files for post-transient and transient simulations.
- DYD files including additional dynamic models of any approved/planned resources or automatic protection schemes, such as UFLS and UVLS. If any errors or misrepresentations are identified during and after the base cases development process, SDG&E will provide the ISO with change files to correct them.
- In case SDG&E engineering needs to modify the original scope of a project that has been approved by the ISO, an application for the modification will be submitted to the ISO for review and concurrence. The application will indicate project name, scope of work, construction feasibility, status, and updated in-service date, along with the power flow change file. The material modification that has been approved by the ISO will be included in the approved/planned transmission projects spreadsheet.
bullet Long-term scheduled outages in the 10 year planning horizon

bullet The existing facilities’ normal and emergency ratings in the base cases will be consistent with the normal and emergency facilities ratings registered in the ISO Transmission Register database, or will otherwise be reported to the ISO

bullet Current SDG&E Standard Operating Practices associated to transmission planning, such as the Spare Substation Power Transformer Policy, etc.

bullet Current documents of SDG&E’s Transmission Monitoring and Control that are related to transmission planning, such as, methodology on transmission facility rating, TMC1505 (Protection Schemes), TMC1015A (TL Rating Spreadsheet), TMC1110 (Transmission Scheduling Reliability Criteria), TMC1105 (Transformer Loading), TMC1015 (TL Loading-Overhead and Underground), TMC1005C (Transmission Reactor Setting Table), etc. However, the ISO will normally have copies of these documents.

To keep the base cases up-to-date, SDG&E will update the spreadsheets of approved/planned generation and transmission projects and share with the ISO the updated spreadsheets on a seasonal or as needed basis, during the ISO TPP.
IV. **WECC Base Case Development Process**

Charts 2 and 3 demonstrate the SDG&E’s initial WECC base case development and review process diagrams.

4.1. **SDG&E’s Role on the WECC Base Case Preparation**

The [WECC Data Preparation Manual](#) for Interconnection-wide Cases is available on the WECC’s website.

4.2. **SDG&E’s Role on the WECC Base Case Preparation and Review**

SDG&E, as Transmission Planner and Transmission Owner, is responsible for submitting WECC base cases to the Area Coordinator in accordance with the WECC’s Annual Study Program Base Case Compilation Schedule, and will copy the CAISO at GridModelingData@caiso.com.

The SDG&E Grid Assessment Annual Base Cases not only serve as original input into the CAISO TPP base cases development but also are used as starting cases for WECC base case development. The SDG&E Transmission Planning Department complies with the requirements in WECC’s Data Preparation Manual. SDG&E builds and maintains the WECC cases and its own Grid Assessment (GA) power flow base cases by working together with the ISO during the base case development.

SDG&E will review the WECC base cases after WECC sends out the base case data review letter. SDG&E will provide updates to the base cases and submit them to the Southern California Area Coordinator. In addition, SDG&E will copy the CAISO at GridModelingData@caiso.com.

WECC does not currently create interconnection-wide cases for the use of short circuit analysis. However, MOD-032-1 requires that short circuit data should be shared openly between applicable NERC functional entities. This data will be provided upon request by SDG&E in the data owners preferred software format (ASPEN).

4.3. **The ISO’s responsibility on the WECC Base Case Review**

As shown in Charts 2 and 3 and SDG&E’s WECC Base Case Preparation in Appendix A, the CAISO will review SDG&E’s WECC Base Case Data submittal and will provide comments to SDG&E during

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5 See Appendix C for additional details on the WECC base case preparation procedure and retention requirements.
the Base Case Review Process. In addition, the CAISO will keep documentation of SDG&E’s Base Case Data that was submitted to the Southern California Area Coordinator and of the Southern California Area Coordinator providing this Base Case Data to the WECC staff. SDG&E will provide written response to 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.

6 The ISO, in agreement with SDG&E, has developed a case review sign-off sheet for providing WECC Base Case Review comments to SDG&E (Appendix D)
V. Process Flow Charts

Chart 1: SDG&E’s Grid Assessment Base Case Development Process

ISO posts demand forecast and provides allocation of AAEE to two-year locations

SDG&E Distribution planning Department imports and scales load forecast (non-coincident loads)

SDG&E personnel determine which approved WECC base cases to use depending on year

SDG&E GA study includes six years:
  - Short-term (1-5 years)
  - Long-term (10+ years)
Studies include:
  - Summer Peak Load
  - Off Peak Load (50% of peak)
  - Minimum Load (35% of peak)
  - Sensitivity cases:
    - N-1 of a 500 kV line
    - G-1/N
    - Maintenance
    - South Of Sanger line

SDG&E report distribution forecast into base case (marked as "PA" in load table) and scales the load down to meet CEC’s 1 in 10 demand forecast (marked as "10")

Scenarios as necessary in fit for season (summer, spring, winter) and whether it is a light or heavy load case

SDG&E updates base case according to the Study Plan and regional changes (TPP Project Matrix)

ISO & SDG&E review Study Plan and SECE posts the plan

SDG&E personnel determine which approved WECC base cases to use, depending on year

ISO Planning Department communicates any identified concerns with SDG&E planners

ISO & SDG&E review Study Plan

Compare & select cases

Cases, revisions

SDG&E updates contingency and DYD files

SDG&E updates finalized base cases and updates contingency (DYD) files to ISO

Any concerns identified in the review?

ISO and SDG&E begin studies

ISO Planning Department communicates any identified concerns with SDG&E planners
Charts 2 and 3: SDG&E’s WECC Base Case Development and Review Processes

**Initial Process**

- Begin updating the Load and Resources excel spreadsheet (L&R).
- Obtain CEC 1 in 10 year forecast for year of case.
- Scale load as necessary to fit season (winter, spring, etc.) and whether it is a light or heavy load.
- Begin coordinating interchange values with neighboring entities IID and CFE.
- Request power, coordinate interchanges from SCE, APS, SRP, IID and CFE.
- Populate interchange values to the "SDG&E Interchanges" data of the L&R.
- Use latest SDG&E data to update SDG&E Topology in WECC starting case.
- Ensure updated SDG&E Topology is included in the L&R.
- Dispatch generation to balance the interchange & load in the "Generation" sheet of the L&R.
- Compare new case to WECC starting case and enter changes into the "Significant System Changes" sheet.
- Update L&R with transmission loss value from the base case. If necessary, re-dispatch generation to balance interchange, load, and losses.
- Adjust case to appropriate power factor, ensure voltages meet SDG&E standards, no thermal overloads exist and Bface table is current for the year of the case.
- Run data check function in PSLF file to ensure no data errors exist, find what the maximum flow is by using the TABR function in PSLF.
- SDG&E provides initial compilation to Southern California Area Coordinator and copies the CAISO.
- Initial compilations includes base case, L&R sheet, and, if necessary, dynamic models and epc files to update Bface table.
- WECC Staff e-mails Base Case Data Request Letter to SDG&E WECC Base case preparer is notified and downloads the WECC base case for review and refers to the replog to find and correct any errors.

**Review Process**

- For WECC Operating cases only, provide base case to Grid Ops for their review.
- Grid Ops provides comments or changes that are needed for SDG&E Transmission system.
- Incorporate comments into the review case as needed.
- CAISO reviews base case and provides comments and TSS Approval form.
- SDG&E provides approved Operating Committee member approval.
- Review case to WECC starting case and enter changes into the "Significant System Changes" sheet.
- Use latest SDG&E data to update SDG&E Topology in WECC starting case.
- Grid Ops provides signed Operating Committee member approval.
- SDG&E packages approval forms, change files to update the case, and if necessary, dynamic models.
- Provide final review case to TSS representative. Collect approved form from TSS member.
- SDG&E provides Final review package to Southern California Area Coordinator and copies to the CAISO.
- Southern California Area Coordinator provides SDG&E's Final review package compilation to WECC staff.

**Final Comments**

- CAISO and SDG&E Joint Transmission Planning Base Case Preparation Process.
Chart 4: CAISO TPP Base Case Development Process Map for SDG&E Area - Draft
VI. Document Ownership

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<thead>
<tr>
<th>Reviewed By:</th>
<th>Name</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDG&amp;E Transmission Planning Manager</td>
<td>Original signed by John Jontry</td>
<td>September 8(^{th}), 2017</td>
</tr>
<tr>
<td>CAISO Regional Transmission – South Manager</td>
<td>Original signed by Robert Sparks</td>
<td>September 8(^{th}), 2017</td>
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Version History

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<th>Issue Date</th>
<th>Description of Change</th>
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<td>7/1/2015</td>
<td>Initial Publication</td>
<td>Version 1.0</td>
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<tr>
<td>7/1/2016</td>
<td>Minor edits to clarify and ensure compliance obligations</td>
<td>Version 1.4</td>
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<tr>
<td>9/8/2017</td>
<td>Minor edits to ensure compliance obligations and to accommodate the WECC 10 year Heavy Summer Anchor Data Set requirements</td>
<td>Version 1.6</td>
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Appendix A: SDG&E’s Methodologies on bus-level load forecasts

The substation load forecast reflects the actual, measured, maximum coincident load on the substation distribution transformers. This max load is obtained either from SCADA historical data or in a few cases from SDG&E’s remaining mechanical charts. That measured max load is then weather normalized to produce the adverse substation load. The adverse substation loads are then adjusted across SDG&E so that area loads plus losses sum to the CEC 90/10 forecast. Thus, two substation loads for each distribution bus are modeled: the adverse load, and the coincident load. The difference between the adverse and coincident loads includes about 3% of transmission losses - while simulating a single substation or zone peak, transmission losses are neglected because the system is not adjusted to reflect a system-wide coincident peak.

The distribution substation annual load forecast uses the actual peak load on the low side of each substation bank transformer or transformers if running in parallel. Once the peaks are determined, weather factors, i.e. normalizing and ‘adversing’ factors are applied to the peaks.

The Normalizing Factor is used to take the total MVA for the summer and adjust it to a normal year (50/50) value.

- 50/50 value – the value you would expect 5 years out of 10.
- If the weather condition on the summer peak date was abnormally hot, the normalizing factor would be <1.0.
- If the weather condition on the summer peak date was abnormally cool, the normalizing factor would be >=1.0

- Normalized Peak = Total Peak MVA * Normalizing Factor

- The Adverse Factor takes the normalized peak value and ‘adverses’ it up to what the load would be if the peak occurred in an adverse year.

- The adverse peak is the adjusted peak that would be expected 1 out of 10 years.

- Adverse Peak = Normalized Peak * Adverse Factor
The distribution substation annual forecast submitted to transmission planning is an Adverse Peak forecast. The distribution substation forecast will always be higher than the system forecast which is a coincident forecast that is ‘adversed’. The distribution circuits are de-coupled from the substation banks and buses, and are therefore not used to complete the substation forecast.
Appendix B: CAISO TPP Base Case Checklist

The ISO TPP Study Plan related to base case preparation should be followed. Below are key actions and procedures that are necessary to developing the CAISO TPP 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 Intertie Planning study for which you are responsible. The base case should be reviewed based on the checklist by the CAISO and SDG&E area planners prior to being used for the TPP studies. Following table is an example checklist based on the 2017~2018 TPP base cases.

### 2017~2018 TPP Base Cases Checklist -- for the SDG&E Study Area

<table>
<thead>
<tr>
<th>No</th>
<th>Equipment</th>
<th>Checks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Bus</td>
<td>1. Bus voltages follow planning criteria (0.95&lt;V&lt;1.05)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Check for type 2 buses without machines and multiple type 0 buses</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Check to ensure Owner and Zone numbers are set appropriately (not 0 or 1)</td>
</tr>
<tr>
<td>2</td>
<td>Generator</td>
<td>1. In-service date for generators should be appropriately reflected in the generator modelling</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Out-of-service units (retired, planned outage, mothball, not-in-use, etc) should have status set to zero (Pgen =0, should have status =0).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Offline generators with associated Aux load should have aux load status off.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. If Status = 1: check for Pmin ≤ Pgen ≤ Pmax1 (nameplate capacity)</td>
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<td></td>
<td></td>
<td>5. Check for Qmin ≤ Qmax</td>
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<td>6. All swing buses are in generation mode and fall within their respective Pmin and Pmax values.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>7. Transmission connected renewables are modelled consistent with assumptions in study plan</td>
</tr>
<tr>
<td>3</td>
<td>Branches (for ISO BES)</td>
<td>1. Rating MVA 1 &gt; 0 and MVA 2 &gt; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Following parameters are appropriately modeled:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. Rating 1 &amp; 2 wrt ISO Transmission Registry and previous year base case</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Following parameters are appropriately modeled:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>a. R, X, B as compared to previous year base case</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Check branches loading above 100% of RATE1 or RATE2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Check tie line flows to be within rating</td>
</tr>
<tr>
<td>4</td>
<td>Transformer (for ISO BES)</td>
<td>1. Variable V Tap or Variable Angle shall be at or within Max VAR Tap and Min VAR Tap for Transformers that are in-service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Rating MVA 1 &gt; 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Rating MVA 2 &gt; 0</td>
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<td></td>
<td>4. Maximum voltage (power) at controlled bus (pu or MW) &gt; Min Cont V. Minimum voltage control range shall be 0.02 p.u.</td>
<td></td>
</tr>
</tbody>
</table>
| 5 | Shunts | 1. The minimum dead band shall be 0.02  
2. Represent shunts at the same bus as being in the same area and zone as the bus |
| 6 | Loads | 1. Represent loads at the same bus as being in the same area and zone as the bus  
2. Load modeling generator station service shall have Load ID set to ‘SS.’ |
| 7 | DER | 1. Behind-the-meter PV are modelled consistent with assumptions in study plan  
2. LSE procured energy storage facilities are modeled consistent with size and location provided by CPUC, are modeled offline and to be used as potential mitigation for reliability concerns.  
3. Demand Response, if any that meet ISO criteria, are modeled offline and to be used as potential mitigation for reliability concerns. |
| 8 | Dyd check | 1. Behind-the-meter PV is modeled as a discrete element using CMPLDWG model consistent with assumption in study plan.  
2. Turbine Type shall be used to identify solar and wind generators  
3. Unit Base MVA shall be equal to the MVA Base parameter of the unit’s Dynamic machine model.  
4. Generator representation should be consistent between steady state and dynamic data (i.e., Bus Number, Bus Name, Unit Id, Bus Voltage)  
5. Pmax ≤ Governor Max |
| 9 | Other | 1. Path definitions are correct (latest WECC Path Rating Catalog) |
Appendix C: WECC BASE CASE PREPARATION

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
3. Download the WECC starting base case and associate materials (zip file) as required in the WECC Data Request Letter from the WECC website
   a. Starting base case will only be used to be able to create the “Significant Changes” list in the L & R table.
   b. Starting base case is compared to the new base case and the changes are what will appear in this L & R section.
4. Base case is created from the latest and most appropriate case that is already existing
   a. Example, if a light winter case needs to be developed the recently built heavy winter case is used as a starting point and only the load, generation, and interchange would need to be adjusted.
5. Use the latest Load & Resources (L&R) information to populate generation, load, interchange flows, and loss data in accordance with the WECC Base Case Data Request Letter
6. Dynamic Data Check
   a. Obtain latest WECC Master Dynamic File (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 Pgen amount exceeds a Pmax amount
            b. Ensure there are no overloads
            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-SDG&E generators that have a large
spread and then re-run a non-disturbance evaluation that should produce a flat line.

2. Note, SDG&E does not create or submit separate DYD files for each case. The MDF is kept up to date by SDG&E and this is what contains the correct data for each SDG&E case.

7. **Power Flow Base Case Data Check:**
   a. Re-open solved base case
   b. Solve the base case again and run the EPCLs or PSLF routines that will check the following:
      i. Check maximum and/or minimum 230 kV and 500 kV substation voltages in SDG&E area (Area 22)
      ii. Check for Area 22 errors (i.e. zone, owner, overloads)

Submit the following to the Southern California Area Coordinator/CAISO by the deadline:
   - Solved power flow base case
   - L&R Spreadsheet
   - EPC files to update bface or iface tables, as necessary

**B. WECC Final Base Case Review**

8. WECC’s Review Request Letter is emailed to WECC Members
9. Download the WECC base case to be reviewed and its associated materials (zip file) from the WECC website
10. Repeat power flow base case data check, as stated above
11. Incorporate any changes/corrections that are necessary because of being listed in the “Replog” (error list) downloaded for that case from the WECC
12. Incorporate any changes/corrections from the CAISO. These changes will be sent to SDG&E by the time the WECC sends the case out for a final review.
13. Ensure the base case meets the following:
   a. Voltage requirements
   b. Thermal loadings are not exceeding normal ratings identified in the CAISO Registry
   c. Iface/bface tables are correct
   d. Use the most recent MDF to ensure a flat line is achieved with a non-disturbance run.
14. Incorporate comments provided by the CAISO into the base case
15. If changes were made to the base case, create a change file using the extract epcl file
16. Obtain the following signed approval forms
   a. SDG&E TSS member form and, for operating base cases, OC member form
17. Submit the following to the Southern California Area Coordinator by the deadline
   a. Signed approval forms
   b. If necessary, a change file (*.p)
   c. EPC files to update bface or iface tables
   d. DYD files for any missing dynamic models
18. File all documentation, including change files, approval forms, and evidence of submittals on the shared server (WECC base case submittals)
19. Submit all documentation to CAISO, WECC or Southern California Area Coordinator, and save for NERC Compliance evidence.
20. This documentation is already being done by SDG&E and the data is on a secure shared server.

C. SDG&E Base Case Retention Requirements

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

1. WECC Base case data request
2. Email correspondence or coordination with entities for interchanges
3. Email correspondence for an entity’s system representation
4. Email of submitting base case to the Southern California Area Coordinator, or if SDG&E is the Southern California Area Coordinator, email of submitting base case to WECC and copying the CAISO.

D. Additional Base Case Preparation Guidelines – As Applicable

Below are additional items SDG&E incorporates into WECC Bases Cases as needed:

☐ 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.

☐ The load is modeled with the appropriate power factor.

☐ All voltage profiles are within limits
☐ The VAR flows between SDG&E and other utilities are within operating limits.
☐ All thermal, voltage and stability results meet the appropriate performance standards (NERC/WECC/ISO/SDG&E/ criteria).
☐ Any replog items have been corrected
☐ Owner and Zone numbers are not 0, 1 or 999, etc.
☐ The dyd data file matches the power flow base case and a non-disturbance run results in a “flat line.”
☐ TSS Signature Form has been signed (Review Only)
☐ Grid Operations have reviewed the case (Review of Operating Case Only)
☐ OC Signature Form has been signed (Review of Operating Case Only)
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:

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<th>S.No</th>
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<th>Recommended Change/s</th>
<th>PTO’s comment</th>
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<tr>
<td>6</td>
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</table>

ISO Engineer Name: Name
Review being submitted for PTO: PTO name
Date: date
Appendix E: 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 10 year out Heavy Summer WECC Powerflow ADS case, as part of the MOD-032 process, is coordinated with the planning regions, with incremental change files and/or change log provided with reference to the changes being made to the WECC approved/provided 10 year out Heavy Summer seed case.

Please refer to WECC ADS Webpage\(^7\) for further information.

\(^7\) [https://www.wecc.biz/SystemStabilityPlanning/Pages/AnchorDataSet.aspx](https://www.wecc.biz/SystemStabilityPlanning/Pages/AnchorDataSet.aspx)