

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  
and  
WECC's Anchor Data Set Process

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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 and to support WECC's Anchor Data Set (ADS) process.

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](http://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 on-going 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..

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 (e.g., generators, conductors, capacitors, reactors) consist of steady state and dynamic data and are available to the WECC members on the WECC secure website. The system

models and matching dynamic data<sup>1</sup> have already been submitted and reviewed by SDG&E and other participating members of the WECC.

### **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 (10<sup>th</sup> year)

The following loads are included for most years:

- Summer Peak Load for a one-year-in-ten weather condition
- Off Peak Load (65% of peak)
- Light Load

Sensitivity Cases:

- N-1 of a 500 kV line
- G-1/N-1
- Maintenance-low load
- Stressed South and North of San Onofre flows

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 currently-posted 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

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<sup>1</sup> Note that some entities create dynamic files that are unique to each case. This is not SDG&E's practice. SDG&E updates WECC's MDF on an on-going basis and uses this file for all of the cases developed by SDG&E.

- Base case checks per SDG&E Grid Operations standards and Operating Documentation

### 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<sup>2</sup> 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 plus transmission losses are scaled down accordingly to match the CEC's 1/10 Demand Forecast (marked as "10" in the load table)<sup>3</sup>. 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 included in the ISO study 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. Generation projects would also be modeled if they have a GIA and are under construction (or will be in construction during the studied TPP cycle). Generator characteristic data (dynamic stability data) is provided to SDG&E through CAISO and PTO generator data review process and the developer who has built or will be building the new facility. However, given 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 7820, "San Diego Area Generation Requirements".

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<sup>2</sup> Distribution Load Forecast - a 10% probability that system peak load will exceed the adverse forecast.

<sup>3</sup> 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.



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.

### **Generator Owner Procedures**

Any Generator Owner within the SDG&E service area will provide modeling data in accordance with NERC Reliability Standards (MODs 025, 026, & 027 & PRCs 19 & 24), the [WECC Data Preparation Manual](#), and the [WECC Generating Unit Model Validation Policy](#). This modeling data will be provided to SDG&E representatives at [basecase@semprautilities.com](mailto:basecase@semprautilities.com), and to the CAISO at [GridModelingData@caiso.com](mailto:GridModelingData@caiso.com). The document "[WECC Generating Facility Data, Testing, and Model Validation Requirements](#)" lists in detail the specific data that Generator Owners are required to provide 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. 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 master dynamic data file (MDF). The new data will be promptly forwarded to the WECC and the CAISO and a log is kept showing when the data was sent, and then acknowledged, by the receiver.

The CAISO recently updated its Business Practice Manual (BPM) for the 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<sup>4</sup> for the 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 the TPP BPM, the PTOs and CAISO will work together to submit the validated generating unit data to WECC and include them in transmission planning process power flow and reliability studies as specified in Section 4.3. Generating units that achieve commercial operation after September 1, 2018, will be subject to section 10.4.6 of the 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 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 SDGE 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.

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<sup>4</sup> <https://bpmcm.caiso.com/Pages/BPMDetails.aspx?BPM=Transmission%20Planning%20Process>

## **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 who are building the cases in order to ensure accuracy and timeliness of the models. Updates to the WECC and GA cases are dependent on the expected timing of transmission additions (which can be affected, for example, by permitting processes). 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 GA cases via a change file. GA cases is then used as a base case to create WECC base cases. 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. Changes affecting dynamic stability data are entered into the MDF (Master Dynamic 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<sup>nd</sup> year – Actual Power Factor<sup>5</sup>
- For all other cases the power factor is set to whatever is appropriate for that year, load, and particular season (summer, winter, etc.). This value is derived from the estimated summer preparedness study done by the Grid Operation. Power factor data is considered to be confidential.

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<sup>5</sup> Actual Power Factor – Actual substation power factor from last year’s peak day. This data is provided by Grid Operations Control.

### **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 ( $P_{gen}$ ) should be greater than minimum loading and equal to or less than the maximum rated output, ( $P_{max}$ ).
- \* Line loading must be within the criteria listed in SDG&E's current Grid Operations Standard Operating Procedures document TMC1015a.
- \* 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. Alternatively, interchange can be set to "free flow" and the power flow program will determine the interchange among 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.
- \* For the 10-year case, include in the base case all generation and transmission projects that the CAISO is including in its annual TPP for future years. The in-service dates should reflect the in-service dates assumed in the CAISO's annual TPP.
- \* 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**

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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 case data for the SDG&E power flow study area 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 6-9 year planning cases. For the 10-year planning case, 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 applicable 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 of AAEE, path flows, and new resources as reflected in the CAISO's annual TPP. SDG&E will create dyd files, p1-p7 contingency files, substation load forecast tables, switch deck files for transient simulation, and will then provide this information to the CAISO.

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

Level 6: Conceptual

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.

6-9 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 RPS requirements. Given the data availability, generic dynamic data may be used for this future generation until on-site testing is completed.

10-year Planning Case: All generation that is included in the CAISO's ten-year out TPP. This will normally include generation that is under construction or has received regulatory approval (Levels 1 and 2) and may include planned generation with varying levels of regulatory, commercial and locational certainty (Levels 3 through 6). In particular, CAISO Planners will work with SDG&E Planners to ensure that the renewable generation additions and storage additions in the CAISO TPP study plan is modeled in the WECC 10 year out heavy summer ADS case. CAISO Planners will also work with SDG&E Planners to ensure that forecast Distributed Energy Resource (DER) additions, Additional Achievable Energy Efficiency (AAEE), forecast demand response and projected electric vehicle loads are appropriately modeled in the WECC 10 year out heavy summer ADS power flow case (either as discrete generating units or reduced/increased load).

The resources, and transmission topology in the 10-year Planning Case should be submitted to WECC in response to WECC's base case compilation process for development of WECC's ten-year out heavy summer power flow case. WECC's ten-year out heavy summer power flow case will be the power flow case included in the Anchor Data Set and will also be used to populate the Anchor Data Set production cost model with resource and transmission topology data.

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.



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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.

## 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 (Under Frequency Load Shed) and UVLS (Under Voltage Load Shed). 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
- Long-term scheduled outages (e.g. more than 6 months) in the 10-year planning horizon

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- 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
- Current SDG&E Standard Operating Practices associated to transmission planning, such as the Spare Substation Power Transformer Policy, etc.
- 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<sup>6</sup>**

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 and Review**

SDG&E, as Transmission Planner and Transmission Owner, is responsible for submitting WECC base cases and review comments for Area 22 to the Area Coordinator in accordance with the WECC's Annual Study Program Base Case Compilation Schedule or revised schedule/dates as communicated by WECC, and will copy the CAISO at [GridModelingData@caiso.com](mailto:GridModelingData@caiso.com). The [WECC Data Preparation Manual](#) for Interconnection-wide Cases is available on the WECC's website.

The SDG&E Grid Assessment Annual Base Cases not only serve as original input into the CAISO TPP base cases development but also can be 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 request 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](mailto:GridModelingData@caiso.com). The CAISO conducts their own review of the base cases and sends a list of any changes that are necessary to SDG&E which will input the needed changes. The revised case or change files are sent back to the CAISO to show that these changes have been made.

The SDG&E Transmission Planning Department periodically receives new updates from respective departments and update the WECC base cases. During the year, Transmission planning personnel saves changes to line ratings, transformer ratings, and line impedances on a data base. The changes to line ratings and transformer ratings are normally from the SDG&E Grid Operations Department and line impedance changes are sent out by the SDG&E Protection Engineering Department.

In addition, there might be changes to generator data that is contained in test reports. This new data is extracted from the test reports and sent to the WECC and change files for PSLF cases are created as necessary. The actual, complete test reports are also forwarded to the WECC and to the CAISO. A **MOD-032 2016-20xx Email Correspondence** log, "**Dynamic Data Submissions to WECC, 2016-20xx.xlsx**", is created and maintained to list all emails to and from the WECC and SDG&E. When a change is made to the

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<sup>6</sup> See Appendix C for additional details on the WECC base case preparation procedure and retention requirements.

MDF (WECC's Master Dynamic File) SDG&E keeps a copy of the email which confirms the change and the confirming email is listed in the log.

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).

#### **4.2. PTO 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 PTO have validated the generator data and determined that compliance requirements are met by the GO, the CAISO will upload the final data and documents for each generator and share the information with PTO 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 PTO. A complete package of the following validated data and documents will be posted in a special folder for each generator in the Market Participant Portal, and CAISO will send a notice to PTO representatives, and [basecase@sdge.com](mailto:basecase@sdge.com) for them to access the folder.

- 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

The PTO 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 PTO<sup>7</sup>. However, if the only remaining data that has not been received and validated is the electromagnetic transient model (EMT) data, then the PTO should provide the validated GE-PSLF power flow and dynamic data to WECC without waiting for receipt of the EMT data. If the only remaining data that has not been validated is the electromagnetic transient model data, then the PTO and CAISO should discuss providing the validated GE-PSLF powerflow and dynamic data to WECC to avoid unreasonable delay. To provide consistency in data submittals, PTO will submit the generator data to the Area Coordinator per the guidelines outlined below.

- PTO is responsible for generating units that are located in Area 22
- 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 PTO’s short circuit analysis

The CAISO and PTO 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	X	

<sup>7</sup> If the due date for the submitting the data for the “first” base case to WECC is less than 60 days from the date of receiving the validated generator data from the CAISO then the PTO can submit the generator data in response to the second WECC base case data request letter received.

data within 60 CD of compliance letter sent to GO		
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 PTO)	X	X
provide review package to WECC (via the Area Coordinator) and copy to CAISO		X

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

As shown in Charts 2 and 3, 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 the Base Case Review Process<sup>8</sup>. 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. Below are critical actions and procedures that are necessary to review the WECC base cases effectively and accurately.

Data Category	Check
<b>Transmission</b>	Approved transmission projects are modeled in accordance to the most recent expected in-service date.
	Canceled projects are removed from the base case.
	Known outages, as per the ISO TPP Study Plan, of transmission facilities with a duration of at least six months are modeled appropriately.
	Line rating (MVA1 and MVA2) are greater than zero.

<sup>8</sup> 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)

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	Check for branches loading above 100% of RATE1 or RATE2
<b>Generation</b>	Generator (new and to be retired) are modeled in accordance with assumptions in the study plan.
	Check- $P_{min} > P_{max}$ & $Q_{min} > Q_{max}$
	Reactive resources output are at appropriate level based on their types.
	Known outages, as per ISO TPP Study Plan, of generation facilities with a duration of at least six months are modeled
	Check the accuracy of each generators representation and ensure that all data validated through the CAISO and PTO generator data review process has been included.- Make sure that interconnection facilities are modelled up to its POI
<b>Load</b>	Area loads are consistent with CEC load forecast.
	Load modeling generator station service shall have Load ID set to 'SS.'
	Load power factor at major load buses is reasonable.
<b>Dynamic Data</b>	Read and initialize dyd file for errors
	Check for any missing generator models
	Check the accuracy of each generators representation and ensure that all data validated through the CAISO and PTO generator data review process has been included.
<b>General</b>	Make sure the base case has representation of entire WECC system (full loop).
	Check and report 'dchk' in PSLF for NERC Quality Metrics violations
	Check the inerties are modeled as appropriate facilities and not as a fictitious generator or a very-high impedance line.
	Area swing is within the $P_{max}/P_{min}$ limits and is located outside of the local area of study.
	Generator zone numbers are accurate.
	Major path flows are set consistent with assumption in study plan.

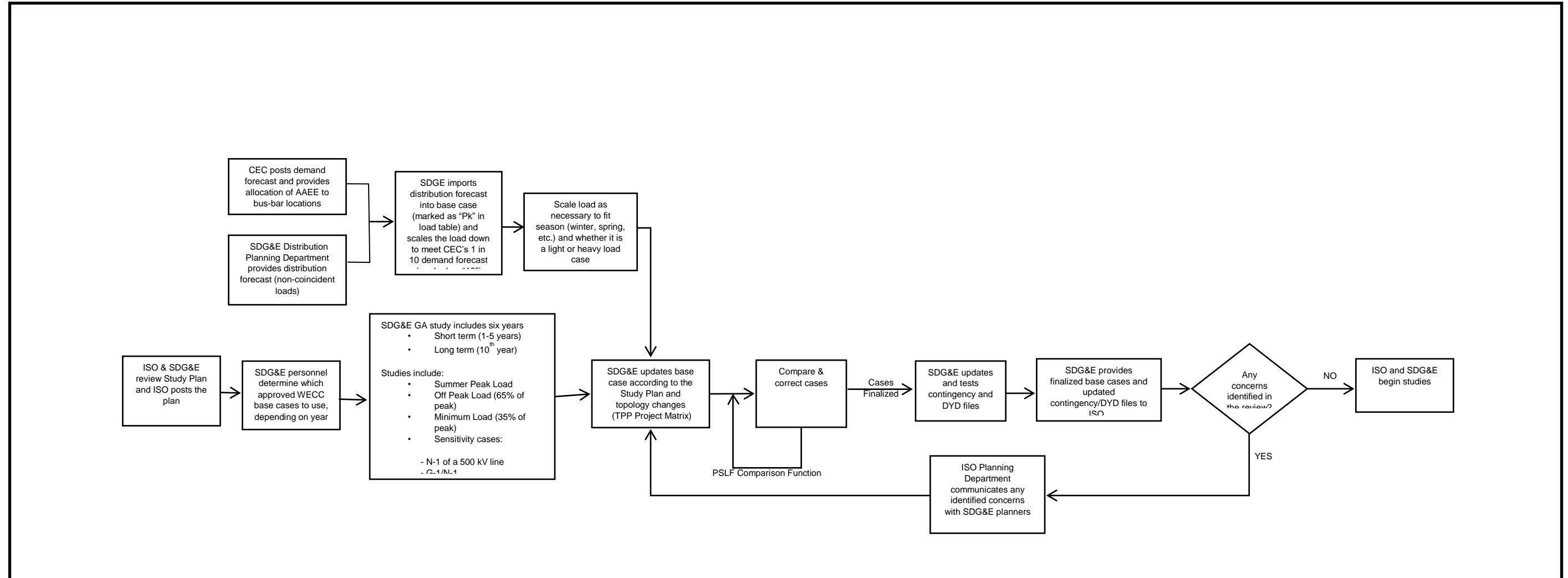


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	The sum of net Area Interchange Schedules in the PSLF Area Table is equal to zero
	Path definitions are accurate
	Voltages at critical substations are reasonable.
	Modeling of Imperial Valley phase-shifting transformer's angles

V. Process Flow Charts

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



### Charts 2 and 3: SDG&E's WECC Base Case Development and Review Processes

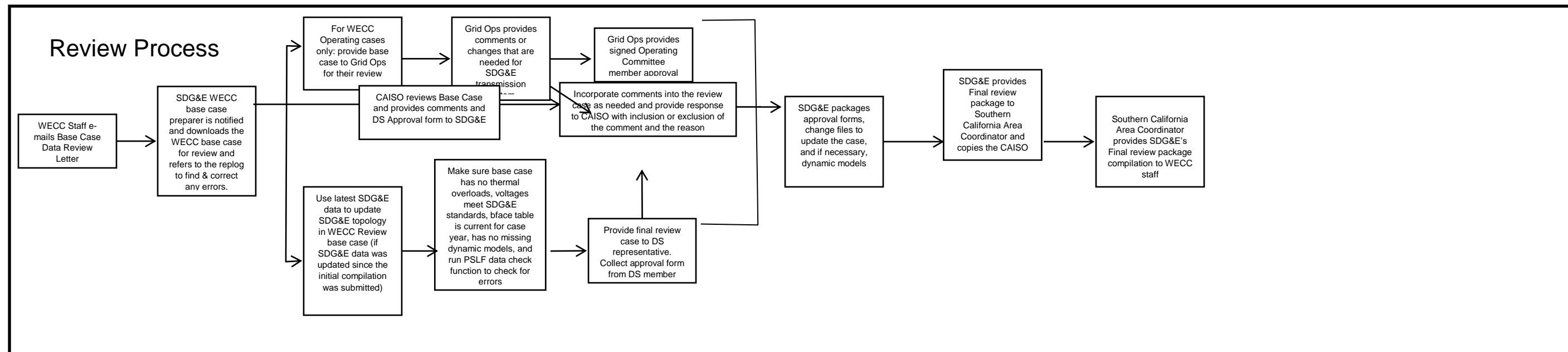
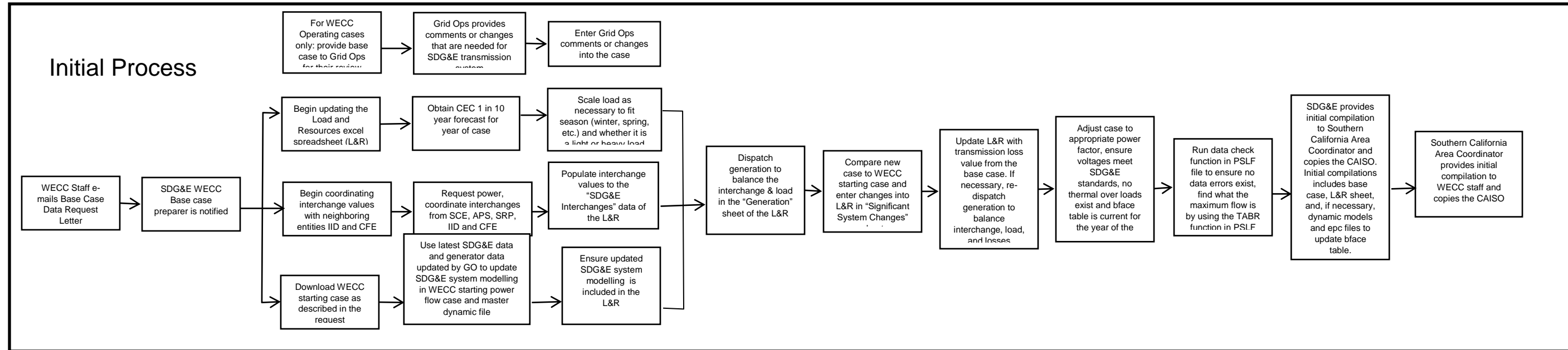
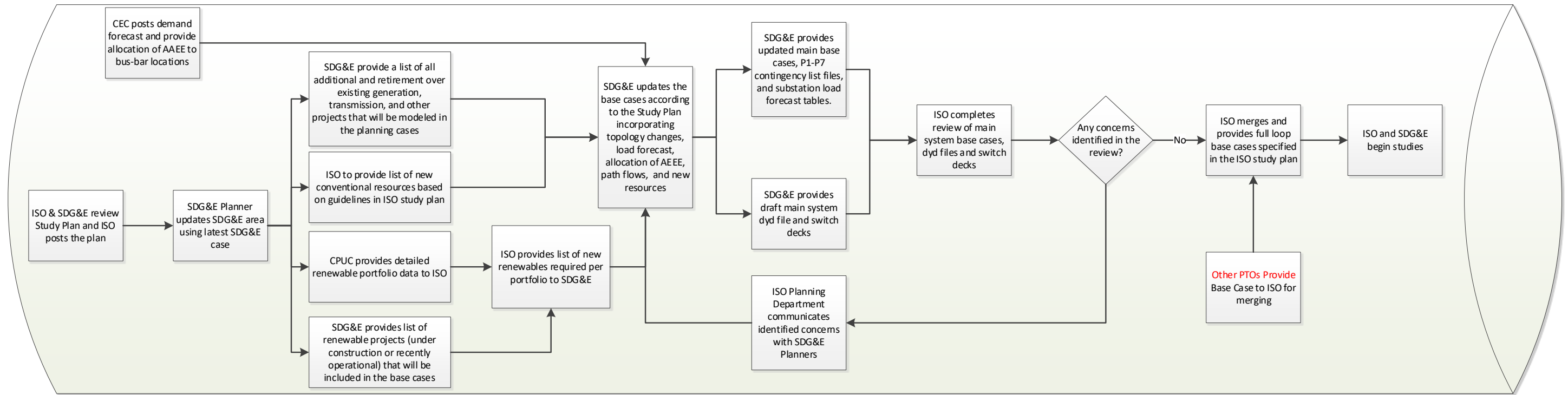


Chart 4: CAISO TPP Base Case Development Process for SDG&E Area

# Chart 4: CAISO TPP Base Case Development Process Map for SDG&E Area- Draft



**VI. Document Ownership**

	<b>Name</b>	<b>Date</b>
Reviewed By: SDG&E Transmission Planning Manager	Original signed by Habibou Maiga,	October 19, 2020
Reviewed By: CAISO Regional Transmission – South Manager	Original signed by Robert Sparks	October 14, 2020

**Version History**

<b>Version</b>	<b>Issue Date</b>	<b>Description of Change</b>
Version 2.1	December 2020	Minor edits to provide the validated power flow and dynamic data to WECC without waiting for the EMT data
Version 2.0	October 2020	Major edits to specify roles and responsibilities for submitting generator data to WECC through its base case development process
Version 1.9	4/23/2019	Replace R. Ayass with D. Tekeste as SDG&E Rep, other minor edits
Version 1.8	9/24/2018	Minor edits to Generator Owner Procedures and ADS data submittal
Version 1.7	12/1/2017	Minor edits for generator survey to be conducted
Version 1.6	9/8/2017	Minor edits to ensure compliance obligations and to accommodate the WECC 10 year Heavy Summer Anchor Data Set requirements
Version 1.5	4/8/2017	Replace F. Castro with H. Maiga as SDG&E Rep
Version 1.4	7/1/2016	Minor edits to clarify and ensure compliance obligations

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Version 1.0	7/1/2015	Initial Publication
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## **Appendix A: SDG&E's Methodologies on bus-level load forecasts**

The substation load forecast reflects the actual, measured, true maximum coincident load on the substation distribution transformer(s). This max load is obtained either from SCADA historical data or in a few cases other sources (i.e. transmission data, meter data or legacy systems). If a correlation of load to weather is found, that measured max load is then weather normalized (i.e. value you expect 5 out of 10 years) as well as adverse (i.e. value you expect 1 out of 10 years) to produce a weather adjusted substation load. The weather adjusted substation load, is then adjusted based on location specific values such as, load growth from special allocation and DER growth. The location specific values utilize the latest California Energy Demand Updated Forecast issued by the CEC. Additionally, an adjustment is made for the removal of the largest generation at the substation which was on during peak (generation larger than 500kW) and economic variables. The final distribution substation values 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 non-coincident load, and the coincident load.

The distribution substation annual forecast submitted to transmission planning is a non-coincident adverse peak forecast. The distribution substation forecast will always be higher than the system forecast, which is a coincident forecast that is adjusted to a peak that would be expected 1 out of 10 years.

## 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 2020~2021 TPP base cases.

### 2020~2021 TPP Base Cases Checklist -- for the SDG&E Study Area

No	Equipment	Checks
1	Bus	1. Bus voltages follow planning criteria ( $0.95 < V < 1.05$ )
		2. Check for type 2 buses without machines and multiple type 0 buses
		3. Check to ensure Owner and Zone numbers are set appropriately (not 0, 1, or 999)
2	Generator	1. In-service date for generators should be appropriately reflected in the generator modelling
		2. Out-of-service units (retired, planned outage, mothball, not-in-use, etc.) should have status set to zero ( $P_{gen} = 0$ , should have status = 0).
		3. Offline generators with associated Aux load should have aux load status off.
		4. If Status = 1: check for $P_{min} \leq P_{gen} \leq P_{max1}$ (nameplate capacity)
		5. Check for $Q_{min} \leq Q_{max}$
		6. All swing buses are in generation mode and fall within their respective $P_{min}$ and $P_{max}$ values.
		7. Transmission connected renewables are modelled consistent with assumptions in study plan
		8. check the accuracy on generator representation validated through the generator data review process- CAISO and PTO procedure V1, and make sure generator interconnection facilities accurately modelled up to its POI



<b>3</b>	<b>Branches (for ISO BES)</b>	1. Rating MVA 1 > 0 and MVA 2 > 0
		2. Following parameters are appropriately modeled: <ul style="list-style-type: none"> <li>a. Rating 1 &amp; 2 with respect to ISO Transmission Registry and previous year base case</li> </ul>
		3. Following parameters are appropriately modeled: <ul style="list-style-type: none"> <li>a. R, X, B as compared to previous year base case</li> </ul>
		4. Check branches loading above 100% of RATE1 or RATE2
		5. Check tie line flows to be within rating
<b>4</b>	<b>Transformer (for ISO BES)</b>	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.
		2. Rating MVA 1 > 0
		3. Rating MVA 2 > 0
		4. Maximum voltage (power) at controlled bus (pu or MW) > Min Cont V. Minimum voltage control range shall be 0.02 p.u.
<b>5</b>	<b>Shunts</b>	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
<b>6</b>	<b>Loads</b>	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.'
<b>7</b>	<b>DER</b>	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

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		and to be used as potential mitigation for reliability concerns.
<b>8</b>	<b>Dyd check</b>	<ol style="list-style-type: none"> <li>1. Behind-the-meter PV is modeled as a discrete element using CmplDwg model consistent with assumption in study plan.</li> <li>2. Turbine Type shall be used to identify solar and wind generators</li> <li>3. Unit Base MVA shall be equal to the MVA Base parameter of the unit's Dynamic machine model.</li> <li>4. Generator representation should be consistent between steady state and dynamic data (i.e., Bus Number, Bus Name, Unit Id, Bus Voltage)</li> <li>5. <math>P_{max} \leq \text{Governor Max}</math></li> <li>6. Check for any missing generator models</li> <li>7. Check the accuracy of generator model validated through the generator data review process- CAISO and PTO procedure V1</li> </ol>
	<b>Other</b>	<ol style="list-style-type: none"> <li>1. Path definitions are correct (latest WECC Path Rating Catalog)</li> </ol>

## 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 data 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 " Steadystate\_And\_Dynamics\_Dashboard" (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 provided by the WECC for the PSLF program
16. Obtain the following signed approval forms
  - a. SDG&E DS 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 transmission projects in the case
  - 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 relog 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."

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- DS Signature Form has been signed (If it is not an Operating case)
- 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

**ISO to PTO** (current form)

- 1) PTO to AREA COORDINATOR
- 2) 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

## 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 CAISO's annual 10 year out TPP case and for the WECC's 10 year out Powerflow case(which may be used for MOD-032 compliance purposes), is coordinated with the planning regions, and reflects the most recent regional planning case of the planning region (i.e., is consistent with the CAISO's 10 year Planning Case used in the TPP).

Please refer to WECC ADS Webpage<sup>9</sup> for further information.

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<sup>9</sup> <https://www.wecc.biz/SystemStabilityPlanning/Pages/AnchorDataSet.aspx>