California Transmission Planning Group (CTPG)

DRAFT STUDY PLAN
for the
Joint Performance of the
2020 California-wide Transmission Plan

July 22, 2009

Revised November 2, 2009

Developed by the
Technical Steering Committee

I. OBJECTIVES

The objectives of this study are:

1. To develop a California state-wide transmission plan to meet the state's 33% RPS renewable goal using the RETI Phase 2A conceptual plan as a starting point.

2. To ensure coordination with all members' individual transmission plans.

II. ASSUMPTIONS

A. The following three base cases will be developed and studied:

- Case A: 2020 Northern California adverse weather (90/10) case[1]
- Case B: 2020 Southern California adverse weather (90/10) case[2]
- Case C: 2020 Normal Weather (50-50) case

Each California utility will provide expected 50/50 and 90/10 annual peak load forecasts, disaggregated across the individual load buses with the utility's distribution service area, with applicable energy efficiency and demand response assumptions embedded in the forecast.

Table 1 shows existing path ratings. When the applicable base cases have been developed, the unpopulated columns in Table 1 will be filled in with the simulated all-lines-in-service power flows across the identified paths for the indicated cases.

In addition to the above 3 scenarios, SMUD volunteered to add a Path 15 S-N sensitivity study to evaluate the impact of the renewable generation during Path 15 heavy S-N flow conditions. This is a variation to the Northern California adverse weather case.

B. Added studies at the direction of the Executive Committee

Two additional study scenarios were added in October 2009 to the study scope of 2009 as follows:

- A light load scenario to capture high wind, light load conditions in California. Study plan for this scenario can be found in Attachment 1
- An Once-Through-Cooling (OTC) scenario to examine the impact of OTC on transmission and renewable resources. Study plan for this scenario can be found in Attachment 2.

[1] Northern California loads will be set at forecast 1-in-10 year load levels for year 2020. All other WECC loads will be based on the load levels reflected in the starting point WECC powerflow case, adjusted for expected load growth to the year 2020.

[2] Southern California loads will be set at forecast 1-in-10 year load levels for year 2020. All other WECC loads will be based on the load levels reflected in the starting point WECC powerflow case, adjusted for expected load growth to the year 2020.

C. Table 1

			Northern California Adverse Summer Weather		Southern California Adverse Summer Weather		Normal Summer Weather	
Path	Transfer Path	Path Rating (MW)	Case A0 (WECC case) (MW)	Case A1 (WECC Case w/ RETI upgrades and WECC renewables) (MW)	Case B0 (WECC Case) (MW)	Case B1 (WECC Case w/ RETI upgrades and WECC renewables) (MW)	Case C0 (WECC case) (MW)	Case C1 (WECC Case w/ RETI upgrades and WECC renewables) (MW)
66	California Oregon Intertie (COI)	4800						
65	Pacific DC Intertie (PDCI)	3100						
49	East-of-the-River (EOR)	9300						
46	West-of-the-River (WOR)	10623						
26	Midway-Vincent	4000 (N-S), 3000 (S-N)						
27	Intermountain DC (IPP DC)	2400						
15	Midway-Los Banos	3265 (N-S), 5400 (S-N)						

Load and Resource (L&R) tables for each case will be assembled and appended to the study report as an Appendix. Resource additions will include (a) renewable resources located within the Competitive Renewable Energy Zones (CREZs) and out of state regions within the RETI footprint that are contained in the RETI Phase 2A report, and (b) renewable resources located outside the RETI footprint that are identified in the Western Renewable Energy Zone (WREZ) – Phase 1 Report. The additions will be sufficient to achieve California's 33% renewable goal as well as the established renewable goals of the other WECC regions.

N-1 List
For Power Flow Runs Only

N-1 Contingencies[3]
PDCI bipole outage
[All 230 kV, 287 kV, and 500 kV lines in California]
[Selected major external 230, 345, and 500 kV lines]
[Selected major lower voltage lines in California]

G-1 Contingencies
[All generators exceeding 500 MW in California]
[Selected external generators exceeding 500 MW]

N-2 List
For Power Flow Runs Only

N-2 Contingencies
Malin - Round Mt. #1 and #2 500kV
Round Mt. - Table Mt. #1 and #2 500 kV
Table Mt. – Tesla and Table Mt.- Vaca 500 kV
Table Mt. – Tesla and Vaca – Tesla 500 kV
Tesla – Los Banos and Tesla – Tracy 500 kV
Tesla – Los Banos and Tracy – Los Banos 500 kV
Diablo – Midway #1 and #2 500 kV
Los Banos - Gates #1 and Los Banos – Midway #2 500 kV
Los Banos – Midway #2 and Gates – Midway #1 500 kV
IPP DC 500 kV Bipole
Midway - Vincent #1 and #2 500 kV
Palo Verde - Westwing #1 and #2 500 kV
McCullough – Victorville #1 and #2 500 kV
Lugo – Mira Loma #2 and #3 500 kV
Lugo – Mohave and Lugo – Eldorado 500 kV
Lugo – Vincent #1 and #2 500 kV
Adelanto-Rinaldi 500 kV and Victorville-Rinaldi 500 kV
Adelanto-Victorville #1 and #2 500 kV
Victorville-Century #1 and 2 287 kV

G-2 Contingencies
SONGS 2&3
Diablo Canyon 1&2
Palo Verde 2&3

[3] Including all transmission line segments added as part of the RETI upgrades.

III. STUDY GUIDELINES AND CRITERIA

1. General

The criteria contained within this document are intended to provide a framework from which computer simulation studies will be performed to model future system conditions and evaluate the system performance.

The General Electric Power System Planning Program (GE-PSLF) will be used in conjunction with in-house Engineer Programming Control Language (EPCL) routines to help analyze the study results. Analysis using GE-PSLF may be augmented with other powerflow applications, including the Powertech Voltage Stability Analysis Tool (VSAT).

In general, the criteria applied will be based on the following procedures and criteria currently in use:

1. WECC "Reliability Criteria For Transmission System Planning"
2. WECC "Procedures for Regional Planning Project Review and Rating Transmission Facilities"
3. Cal-ISO Grid Planning Criteria
4. WECC "Voltage Stability Criteria, Undervoltage Load Shedding Strategy, and Reactive Power Reserve Monitoring Methodology"; and
5. NERC Reliability Standards TPL-001, TPL-002, TPL-003
6. Each member's Specific Local Planning Criteria

2. System Representation

All system studies will be performed using the latest available data for the WECC interconnected system for the 2020 time frame being studied. A WECC full-loop representation will be used; this includes the Western United States, Western Canada and the system of Comisión Federal de Electricidad (CFE) of Baja California, Mexico.

3. Methodology to Incorporate the RETI Conceptual Transmission Plan

To the extent not already included in the WECC base case, the network upgrades identified in the RETI Phase 2A process (including new substations as well as expansion of existing substations in order to accommodate renewable generation from the CREZs included in the RETI Phase 2A final report) will be added to the WECC-full loop representation described above. These additions will be reflected in Case A1, Case B1 and Case C1 (refer to Table 1).

4. Power Flow Guidelines

Power flow studies will be performed utilizing the following guidelines:

WECC Generation Dispatch Assumptions

For performance of the peak load power flow cases, the following simultaneous generator output assumptions will be made:

- Wind: 20% of nameplate capacity
- Solar: 80% of nameplate capacity
- Geothermal: 100% of nameplate capacity
- Biomass: 100% of nameplate capacity
- Existing gas-fired generation: Dispatchable gas-fired generation throughout the WECC should be shut-down/curtailed in an economically rational manner as needed to balance load and generation.
- All Northern California hydro systems north of Midway will be dispatched within existing nomogram limits considering historical dispatch patterns for average hydro year
- Historical hydro dispatch for remaining hydro generation for average hydro year

Renewable Dispatching and Fossil Displacement

To ensure consistent assumptions are used for this study; a general renewable dispatching and fossil displacement guideline was developed for entities that do not have 2020 resource plan (Appendix 2). Entities with 2020 resource plans follow the applicable resource plans accordingly.

Thermal Capacity Limits

No transmission element will be loaded above 100% of its continuous rating under base case (all facilities in service) conditions. For loss of the next system element(s), no transmission system element will be loaded above its time-duration emergency rating after the application of applicable remedial action schemes (RAS).

See Table 2 for a description of the contingency analysis and criteria, including the test for adequate reactive margin.

Table 2

Power Flow Contingency Analysis	**Transient Stability Analysis** (Three-phase Fault at / Outage)	**Reactive Margin Adequacy**	**Voltage Stability Analysis**
• All 500 and 230 kV lines in California • Selected external major transmission lines • Selected N-2 contingencies with RAS • See list below.	• Selected major N-1 and N-2 contingencies • WECC criteria	• Selected major WECC transfer paths WECC reactive margin criteria (5% for N-1, 2.5% for N-2 in accordance with WECC Criteria TPL-(001 thru -003 WECC-1-CR[4], Requirements WRS3 and related Sub-Requirements WRS3.1, WRS3.2, WRS3.3 and WRS3.4)	• All 230 kV and 500 kV buses • WECC voltage stability criteria (5% for N-1, 10% for N-2) • 7% N-1 voltage drop permitted for SCE buses

[4] http://www.wecc.biz/Standards/WECC%20Criteria/TPL%20–%20(001%20thru%20004)%20–%20WECC%20–%201%20–%20CR%20-%20System%20Performance%20Criteria.pdf

N-1 List
For Power Flow, Reactive margin, and Post-Transient Voltage Stability Runs Only
(note that this list is a guideline and is not necessarily complete)

N-1 Contingencies[5]
PDCI bipole outage
[All 230 kV, 287 kV, and 500 kV lines in California]
[Selected major external 230, 345, and 500 kV lines]
[Selected major lower voltage lines in California]

G-1 Contingencies
[All generators exceeding 500 MW in California]
[Selected external generators exceeding 500 MW]

N-2 List
For Power Flow, Reactive margin, and Post-Transient Voltage Stability Runs Only
(note that this list is a guideline and is not necessarily complete)

N-2 Contingencies
Malin - Round Mt. #1 and #2 500kV
Round Mt. - Table Mt. #1 and #2 500 kV
Table Mt. – Tesla and Table Mt.- Vaca 500 kV
Table Mt. – Tesla and Vaca – Tesla 500 kV
Tesla – Los Banos and Tesla – Tracy 500 kV
Tesla – Los Banos and Tracy – Los Banos 500 kV
Diablo – Midway #1 and #2 500 kV
Los Banos - Gates #1 and Los Banos – Midway #2 500 kV
Los Banos – Midway #2 and Gates – Midway #1 500 kV
IPP DC 500 kV Bipole
Midway - Vincent #1 and #2 500 kV
Palo Verde - Westwing #1 and #2 500 kV
McCullough – Victorville #1 and #2 500 kV
Lugo – Mira Loma #2 and #3 500 kV
Lugo – Mohave and Lugo – Eldorado 500 kV
Lugo – Vincent #1 and #2 500 kV
Adelanto-Rinaldi 500 kV and Victorville-Rinaldi 500 kV
Adelanto-Victorville #1 and #2 500 kV
Victorville-Century #1 and 2 287 kV

[5] Including all transmission line segments added as part of the RETI upgrades.

G-2 Contingencies
SONGS 2&3
Diablo Canyon 1&2
Palo Verde 2&3

Contingency List For Transient Stability Runs Only
(note that this list is a guideline and is not necessarily complete)

[To Be Determined]

Table 3

Bus	Pre-Outage Min. Volt (p.u.)	Post-Disturbance Min. Volt (p.u.)	Remarks
Adelanto 500 kV	Flag if < 1.025	0.95	
Devers 500 kV	Flag if < 0.987	0.945	
Valley 500 kV	Flag if < 0.987	0.945	
SCE 500 kV	Flag if < 0.9975	0.966	*[Doesn't allow 5% drop]*
Sylmar 230 kV	Flag if < 0.99	0.95	
LADWP	1.00	0.95	
SDG&E 500 kV	Flag if < 0.94	0.90	
SDG&E 230 kV	Flag if < 0.98	0.97	
SCE 230 kV	Flag if < 0.95	0.90	
Devers 230 kV	Flag if < 0.95	0.90	
Mirage 230 kV	0.90	0.90	*[Doesn't allow 5% drop]*
Blythe 161 kV	Flag if < 0.95	0.91	
MWD	Flag if < 0.9875	0.95	

5. Stability Study Guidelines

Stability studies will be performed to establish stability transfer limits and to ensure system stability following a critical fault on the system. These studies will facilitate the development of the dynamic voltage support requirements, if required.

Machine Representation

- For the stability analysis, resources consistent with the time period studied will be dispatched to meet the load requirements in the base cases.
- Representation of turbine generators will be consistent with available turbine generator data.
- The base case power system stabilizers that are normally in-service within the WECC system will be modeled for the Heavy Summer operating period studied.
- For new generator technologies that do not yet have specific representations, the study group will make reasonable assumptions and choose the closest existing generator representation.
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Load Representation

- Induction Motors will be modeled at 20% of the total load across the WECC Region

System Disturbances

- System disturbances for stability studies will be initiated by a three-phase fault on the EHV bus adjacent to the major interconnection point and/or power plant of interest.

Fault Clearing Time

- Faults on the transmission lines being evaluated will be cleared in accordance with guidelines provided by the appropriate operating agents.

Underfrequency Load-Shedding Simulated

- The frequency will be monitored at key buses. If any stability run causes the frequency to drop sufficiently such that relays will "pick up", the underfrequency load-shedding data will be reviewed and updated as necessary.

Series Capacitors

- Series capacitor modeling during transient conditions is indicated by the attached switching sequences.

Unit Tripping

- Unit tripping of other utility generation and pumping loads on under-frequency will be modeled in accordance with WECC guidelines or those provided by the appropriate operating agent.

Generator Voltage Ride Through

- WECC regional standard.

Evidence of System Stability

The system will be considered stable if the following conditions are met:

- Machine Synchronism
  - All machines in the WECC interconnected system must remain in synchronism as demonstrated by relative rotor angles (unless modeling problems are identified and concurrence is reached that a problem does not really exist).
- Simulation Time and System Damping
  - A stability simulation will be deemed to exhibit positive damping if a line defined by the peaks of the machine relative rotor angle swing curves tends to intersect a second line connecting the valleys of the curves with the passing of time.
  - Corresponding lines on bus voltage swing curves will likewise tend to intersect. A stability simulation which satisfies these conditions will be defined as stable.
  - Duration of a stability simulation run will be ten seconds unless a longer time is required to ascertain stability.

- The analysis will start after the typically "noisy" transient period of up to about one second after the fault and associated system switching and remedial actions, and conclude at the end of the simulation.
- A case will be defined as marginally stable if it appears to have zero percent damping and the voltage dips are within (or at) the WECC Reliability Criteria limits.

6. Post-Transient Voltage Stability Study Guidelines

Post-transient studies will be performed to ensure the WECC Voltage Stability Criteria is met following credible outages within the system. Certain contingencies may activate RAS/SPS which will be included in the switching sequences as appropriate. See Table 2 for a list of the contingencies to be analyzed and criteria.

A. Study Assumptions:

- All loads will be modeled as constant MVA during the first few minutes following an outage or disturbance.
- All voltages at distribution substations will be restored to normal values by the transformer tap changers and other voltage control devices.
- Generator MVAR limits will be modeled as a single value for each generator since the reactive power capability curve will not be modeled in the program output.
- No manual operator intervention is allowed to increase the generator MVAR flow.
- Remedial actions such as generator dropping, load shedding and blocking of automatic generation control (AGC) will not be considered for single contingencies.
- Shunt capacitors (132 MVAR) at Adelanto and Marketplace will be used if the post-transient voltage deviation exceeds 5% at those buses. Although modeled as shunt capacitors the actual devices are automatically controlled SVCs.
- Shunt capacitors in the SCE service area will be modeled according to the SCE Centralized Grid Capacitor Control to be provided by SCE.
- All automatic switching will be allowed if the switching action can be completed within 3 minutes after the disturbance.
- Other assumptions:
  - Area Interchange: Disabled
  - Governor Blocking: Base load flag will be used per WECC practice

- DC Line Transformer Tap Automatic Adjustment: Enabled
- Generator Voltage Control set to local except for Palo Verde, and selected Northwest generation
- Phase Shifter Control: Disabled
- Switched Shunt Devices: Disabled

B. Study Criteria:

The post-transient voltage deviations shall meet the WECC/NERC Planning Standards except for SCE area which allows 7% voltage drop for N-1 contingencies.

IV. STUDY METHODOLOGY

The methodology by which the studies will be performed is outlined as follows:

1. Development of Base Cases
   a. 2020 Heavy Summer Base Case (derived from the WECC 2019 HS case)
   b. Adjustment of system loads
   c. Agreement on major project assumptions
   d. Application of RETI-identified projects
   e. Development of contingency lists
   f. Agreement on system criteria

2. Sensitivities
   a. To the "North" cases: COI/PDCI at 4800/3100 MW (nomogram point)
   b. To the "North" cases: Path 15 5400 MW (South to North)
   c. A case simulating light load Winter Conditions: Starting from WECC Base Case WECC 2016-17HW1A, revise to simulate system conditions expected around 1700 - 1900 hour midweek in January for year 2020, with Northern California Load at approximately 60% of 2020 summer peak load.
      - Wind: 100% of nameplate
      - Solar: 0% of nameplate capacity
      - Geothermal: 100% of nameplate capacity
      - Biomass: 100% of nameplate capacity
      - Existing gas-fired generation: Dispatchable gas-fired generation throughout the WECC should be shut-down/curtailed in an economically rational manner as needed to balance load and generation.
      - All Northern California hydro systems north of Midway will be dispatched within existing nomogram limits considering historical dispatch patterns for average hydro year
      - Historical hydro dispatch for remaining hydro generation for average hydro year

3. Analysis

   a. Base-Case contingency analysis for thermal and voltage stability.
   b. Renewable generation is ramped up, displacing fossil generation
      i. Identification of maximum simultaneous dispatch for each renewable generator
      ii. Identification of limiting elements
      iii. Identification and testing of possible system upgrades
      iv. Repeat until the 33% RPS goal is attained
   c. Upgrade case analysis
      i. Thermal
      ii. Post-transient voltage
      iii. Transient stability
      iv. Reactive margin adequacy
   d. Final system topology
4. Report

V. STUDY SCHEDULE

The following table indicates the proposed study schedule.

Task	Completion Date
Final Study Plan available for Stakeholder comment --------------------------	*July 22, 2009*
Stakeholder Pre-Meeting (San Francisco) --------------------------------------	*August 10, 2009*
Stakeholder Meeting (San Francisco) (Review Study Plan/Assumptions) ---	*August 11, 2009*
Complete Base Case Development ------------------------------	*September 15, 2009*
Two new study scenarios added	*October 13, 2009*
Complete Technical Studies ------------------------------------	*December 1, 2009*
Study Presentation to Exec Committee-------------------------	*December 15, 2009*
Draft Report--	*January 5th, 2010*
Stakeholder Meeting (Present Draft Results)-----------------------------	*TBD*
Final Report	*February 15, 2010*

APPENDICES

Appendix 1

Study Report Draft Outline

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II INTRODUCTION AND OBJECTIVES

III SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

IV WECC PROCESS FOLLOWED

V BASE CASE ASSUMPTIONS

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- Major Flows

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STUDY PLAN

Appendix 2

California Transmission Planning Group (CTPG)

Proposed Methodology for
Allocating Load Serving Entities' Renewable "Net Short" Amounts
Across Identified Renewable Resource Development Potential

Introduction

The CTPG Technical Steering Committee's July 22, 2009 *Draft Study Plan for the Joint Performance of the 2020 California-wide Transmission Plan* provides that resource additions in "A1", "B1" and "C1" power flow cases will include:

> "(a) renewable resources located within the Competitive Renewable Energy Zones (CREZs) and out of state regions within the RETI footprint that are contained in the RETI Phase 2A report, and (b) renewable resources located outside the RETI footprint that are identified in Western Renewable Energy Zone (WREZ) – Phase 1 Report. The additions will be sufficient to achieve California's 33% renewable goal as well as the established renewable goals of the other WECC regions." (Section II)

Owing to difficulties in identifying the types of certain generators included in the power flow cases[6], the CTPG technical working group has decided to initially include only the renewable resources located within the CREZs and out of state regions within the RETI footprint that are contained in the RETI Phase 2A report (item "(a)" above). Power flow analysis that reflects renewable resources located outside the RETI footprint (item "(b)" above), is being deferred until the type of each generator included in the power flow case is identified.

Section IV.3 of the study plan describes the study methodology to be used to confirm that the transmission upgrades included in the RETI conceptual transmission plan (see Appendix 2 of the study plan) are adequate to accommodate the required level of renewable resource development, and to identify any other transmission upgrades that may be needed to accommodate this development.

The basic approach is to ramp-up renewable generation in the identified CREZs in increments, testing for contingency-based criteria violations at each level of increment. A mitigation plan (e.g., transmission upgrades, generator tripping, etc.) will be developed to address any reliability criteria violations. The analysis stops when enough renewable generation has been incremented to meet California's 33% Renewable Portfolio Standard (RPS) requirement.

As discussed at the September 29, 2009 meeting of the CTPG Technical Steering Committee, the CTPG Executive Committee has provided direction to the steering committee concerning which renewable resources are to be included in the analysis. The Executive Committee has directed that each utility participating in the CTPG that has load serving responsibilities provide the technical working group with a listing of the location-specific generator type and quantity of renewable resources that the load serving utility intends to use to meet its year 2020 renewable resource goals.

As discussed at the September 29, 2009 meeting, the data that will be provided is unlikely to be adequate to satisfy California's 33% RPS goal. There are a number of reasons. First, the utilities participating in the CTPG that have load serving responsibilities have supply responsibility for only a portion of California's loads. Load serving entities (LSEs) that supply Direct Access (DA) loads in California are not represented in the CTPG.

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[6] By itself, the power flow case does not provide enough information to identify the type of generator being modeled. Dynamic machine data is also insufficient because there is no easy way to distinguish between fossil-fueled thermal units, geothermal units, solar thermal units and biomass units. Cross-referencing generator names and bus numbers with generators listed in the PROMOD IV database has not provided the required information because many of the generators included in the power flow case are represented as "cancelled" in the PROMOD IV database. PROMOD IV does not provide an efficient way to determine the type of generator when the generator is designated as "cancelled."

Second, many of the utilities participating in the CTPG that have load serving responsibilities have not yet made commitments for satisfying all of their projected year 2020 renewable requirements so do not know the location-specific generator type and quantity of a significant portion of the renewable resources that will be used to meet their renewable resource obligations.

Third, much of the ongoing renewable resource contracting activity is commercially sensitive. Except for those arrangements which have already been made public, it is unlikely that utilities will be willing to disclose location-specific generator type and quantity information associated with contracting activity that is not yet public.

Given the above limitations on the renewable resource data that will be supplied by the utilities participating in the CTPG that have load serving responsibilities, the following approach is proposed as a mechanism for identifying renewable resource additions sufficient for California to meet its 33% RPS goal by 2020.

Proposal

1. Each utility participating in the CTPG that has load serving responsibilities in California and that is subject to the state's RPS goals, submits—to the extent it is willing and able—location-specific generator type and quantity information pertaining to the utility's plans to meet its year 2020 renewable goals. The submitted information should distinguish between renewable resources which are (i) already operating or under construction, and (ii) renewable resources which are planned but have not yet begun construction.

2. Each CTPG participant submits—to the extent it is willing and able—its plans and/or suggestions for reducing fossil-fired generation output as may be required to accommodate the increase in renewable energy generation that will be needed to meet California's 33% RPS goal. These plans and/or suggestions should be as specific as possible as to the affected generating units and quantities of reductions, and adhere to the following principles:

    a. .Maintain transmission system reliability and security
    b. Maintain ramping capability and spinning reserve sufficient to serve all non-interruptible load while meeting applicable reliability criteria
    c. Reflect responsiveness to market prices for energy. (For example, most QFs are relatively insensitive to market prices for electric energy and would not reduce their output in order to accommodate increased renewable energy production. On the other hand, the output of most conventional gas turbines and combined cycle plants is strongly correlated with the market price for energy and therefore would reduce their output in response to lower market prices for electric energy brought on by increased renewable energy production.)
    d. Each participating utility will provide its list of candidate back down generators, their back down order and its assumptions used to develop the candidate generator list and their back down order. The assumptions to be specified by the participating utility can include:
        i. Decrease the use of high cost generation
        ii. Reduce generation from polluting sources
        iii. Reduce GHG

    If the generators to be displaced are located in load areas with known minimum must-run requirements, the back down of generators in such areas should not exceed the established minimum must-run level. Further back-down will need to be accompanied by the appropriate transmission reinforcements, in-area generation or additional demand-response programs to maintain reliability, which, if known, will be identified by the associated participating utility as part of the study assumptions

    Fossil-fired Generating units outside a participating utility's Balancing Authority Area can be backed down where the participating utility has, or expects to have, ownership of, or a contractual entitlement to, the output of the generator during the time period being studied. If the participating utility does not have enough high cost fossil-fired generation of its own, or under contract, to back down in order to balance its loads and resources, then the participating utility may identify other fossil-fired generation in the WECC for back-down provided there are no known reliability or operating restrictions that would preclude such back-down, but only to the amount of power participating utility has contracted or has planned to purchase to serve its load.

The latest calculation of California's year 2020 renewable "net short" indicates that in addition to existing and under-construction renewable generation sources (39,324 gWh as of the end of year 2008), and accounting for the expected development of renewable resources that are unlikely to require major new transmission facilities (2670 gWh), there is a need for an additional 50,862 gWh of renewable energy. (See embedded Excel file.)

RETI_Net_Short_09-09-23.xls

3. The CTPG technical working group will review the submitted information and assemble the following summary:
    a. Amounts and types of renewable generation that are existing or under-construction. This summary will be prepared at the California load serving entity level of aggregation and identify the specific generators in the power flow case. If the specific renewable generator does not exist in the power flow case, it will be added.

    b. Amounts and types of renewable generation that are planned but not yet under construction. This summary will be prepared at the California load serving entity level of aggregation. The summary will establish which of the identified generators is within a RETI CREZ and which are not. If the specific renewable generator is not within a RETI CREZ and does not otherwise exist in the power flow case, it will be added.

    c. Identification of the individual fossil-fired generating units that are planned or suggested to be backed-down or shut-off in order to accommodate the increase in renewable energy generation that will be needed to meet California's 33% RPS goal. This summary will aggregate input from all CTPG participants submitting information. If the summary appears not to include enough fossil-fired generator back-down to accommodate the output of renewable generation necessary to meet California's 33% RPS goal, then the CTPG technical working group will augment this listing of generators with additional fossil-fired generators. These additional fossil-fired generators may be anywhere in the WECC and will be backed down pro-rata in groups in the following order:
        i. Least efficient gas turbines (full load heat rates > 10,000 BTU/kWh),
        ii. Least efficient gas-fired boiler units (full load heat rates > 10,000 BTU/kWh)
        iii. More efficient gas turbines (full load heat rates < 10,000 BTU/kWh),
        iv. More efficient gas-fired boiler units (full load heat rates < 10,000 BTU/kWh
        v. Less efficient combined cycle units (full load heat rates > 9,000 BTU/kWh)
        vi. More efficient combined cycle units (full load heat rates < 9,000 BTU/kWh)
        vii. Coal generation, if additional re-dispatch required.

    Within a given efficiency category, fossil-fired generation within California will be backed-down before fossil-fired generation outside California. A generator may not be backed-down if there are known reliability or operating restrictions that would preclude such back-down.

4. Based on the summary assembled in step 3a and the amount of renewable energy resources that are existing and under-construction as of the end of 2008 (39,324 gWh), the CTPG technical working group will determine the amount of renewable energy that is existing or under construction but which has not been included in any of the submittals by utilities participating in the CTPG that have load serving responsibilities in California. If renewable generators sufficient to supply this amount of renewable energy do not exist in the power flow case, they will be added on a pro-rata basis from the identified RETI CREZs.

5. Based on the amounts and types of renewable generation identified in steps 3a, 3b and 4, the CTPG technical working group will determine the remaining amount of renewable energy production that will be need to be added in order to meet the states 33% RPS goal in year 2020.

6. The renewable resources identified in steps 3a, 3b and 4 will be modeled in the power flow case at output levels corresponding to the hour being simulated in the power flow case, e.g., July 8, 2020 at 4:00 pm (Pacific Standard Time) for the 1-in-2 year "expected" WECC peak load case. Renewable resource output in the peak load cases will generally correspond to the output profile described at section III.4 of the CTPG Technical Steering Committee's July 22, 2009 *Draft Study Plan for the Joint Performance of the 2020 California-wide Transmission Plan.* Renewable resource output in off peak load cases will generally correspond to the output profile described at section IV.2 of the study plan.

7. Based on the renewable resource dispatch established in step 6, and the fossil-fired generation back-down list established in step 3c, the CTPG technical working group will balance load and generation in the power flow case.

8. The output of the renewable generators within the identified CREZs that are not identified as part of steps 3a, 3b and 4 (i.e., those generators which will provide the amount of energy determined in step 5) will be incrementally raised in the power flow case. The power flow case will reflect a corresponding decrease in the output of fossil-fired generators identified in step 3c. It is suggested that the increments be in 100 MW blocks where the 100 MW of incremental renewable generation is spread pro-rata across all CREZ in proportion to the amount of uncommitted renewable generation development potential in each CREZ.

9. At each increment of renewable generation established in step 8, the power flow case will be tested for contingency-based criteria violations. A mitigation plan (e.g., transmission upgrades, generator tripping, etc.) will be developed to address any reliability criteria violations. The analysis stops when enough renewable generation has been incremented to meet California's 33% Renewable Portfolio Standard (RPS) requirement.

Attachment 1

California Transmission Planning Group

Light Load Sensitivity Study

Draft Study Plan 10-28-2009

Objective:

To identify the impacts and transmission reliability needs for a statewide light load condition with and without the RETI upgrades.

Start Case:

WECC approved 2018-2019 Heavy Winter case

CTPG Light Load Case Assumptions:

-California-based LSE's 2020 loads are approximately 65% of 2019 Heavy Winter loads

-Generation and Load dispatch and distribution represents a light Spring season during the evening hours

-Non-California loads remain constant

Case Designations:

L0 – 2020 Light Spring without RETI upgrades

L1 – 2020 Light Spring with RETI upgrades and Renewable Resources

Case Development:

Generation should represent a high level of wind generation and represent hydro runoff. Non-renewable generation will be backed down in accordance with the "Proposed Methodology for Allocating Load Serving Entities' Renewable 'Net Short' Amounts across Identified Renewable Resource Development Potential" document.

CREZ renewable generation will have zero added reactive capabilities.

Analysis:

Analysis of the case will be in accordance with the Study Guidelines as described in the "CTPG DRAFT STUDY PLAN for the Joint Performance of the 2020 California-wide Transmission Plan."

To be filled in later:

Table 1 - N-0 Path Ratings and Flows

			California Light Spring Weather	
Path	**Transfer Path**	**Path Rating (MW)**	**Case L0 (WECC case) (MW)**	**Case L1 (WECC Case w/ RETI upgrades and WECC renewables) (MW)**
66	California Oregon Intertie (COI)	4800		
65	Pacific DC Intertie (PDCI)	3100		
49	East-of-the-River (EOR)	9300		
46	West-of-the-River (WOR)	10623		
26	Midway-Vincent	4000 (N-S), 3000 (S-N)		
27	Intermountain DC (IPP DC)	2400		
15	Midway-Los Banos	3265 (N-S), 5400 (S-N)		

Attachment 2

Sensitivity Analysis for Retirement of Once-Through Cooling Generators in California

1. Introduction

This sensitivity study is to evaluate transmission system impact of the retirement of those Once-Through Cooling (OTC) generators in northern and southern California.

2. Once Through Cooling Units

Based on CAISO's presentation "Impacts on electric System Reliability from Restrictions on Once-Through Cooling in California" in November 2008, the OTC generation plants in CAISO control area are as follows:

1. Northern California (Excluding Diablo Canyon Nuclear Plant)

   - Humboldt – 105MW
   - Contra Costa – 674MW
   - Pittsburg – 1311MW
   - Potrero – 206MW
   - Morro Bay – 673MW
   - Moss Landing – 2530MW

   Total 5,499 MW

2. Southern California (Excluding San Onofre Nuclear Plant)

   - Alamitos – 2010MW
   - El Segundo – 670MW
   - Encina – 950MW
   - Huntington Beach – 904MW
   - Mandalay – 430MW
   - Ormond Beach – 1516MW
   - Redondo Beach – 1343MW
   - South Bay – 693MW

   Total 8,516 MW

3. Los Angeles Basin (LADWP)

   - Haynes –
   - Harbor –
   - Scattergood -

3. Starting Base Cases:

1. Northern California System

2020 summer peak base case modeling 1-in-10 load forecast in northern California ("A" case).

2. Southern California System

2020 summer peak base case modeling 1-in-10 load forecast in southern California ("B" case).

4. OTC Base Cases:

1. Displace OTC generators with renewable resources according to the same principle.
2. Turn off those OTC generators with a known shut down schedule. Turn off the remaining generators without a plan to repower and fix cooling system.
3. Model fictitious synchronous condenser, if needed, to make case converge.