Jim Blatchford
Facilitator

C3ETP Stakeholder Meeting (Teleconference)
Sept. 28, 2009
Overview of Meeting Objectives

- Review of Objectives of C3ETP Project
- Changes to reliability and economic assessment methodology since prior stakeholder call, including:
  - Determination of Need
  - Revised Reference Cases
  - New assumptions for economic evaluation of C3ETP alternatives
- All prior materials on C3ETP Project can be found at http://www.caiso.com/1f42/1f42daf7415e0.html
## Stakeholder Meeting Agenda

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Update on C3ETP Reliability and Economic Assessment

Gary DeShazo
Director, Markets and Infrastructure Division

Udi Helman
Principal, Markets and Infrastructure Division
California ISO

Robert Sparks
Lead Engineer, Markets and Infrastructure Division
California ISO

Xiaobo Wang
Senior Engineer, Markets and Infrastructure Division
California ISO
Objectives of C3ETP Project

1. To facilitate efficient management of renewable resources procured to meet the state-mandated Renewable Portfolio Standards (RPS);
2. To meet reliability standards on the electric transmission grid in the Greater Fresno area;
3. To allow for efficient use of renewable, off-peak (night time) generation to support pumping at the Helms Pumped Storage Plant; and
4. To increase transfer capability to relieve anticipated congestion between Southern California and Northern California.
Revisions to Modeling Framework

- Purpose of today’s meeting is to review changes to the CAISO reliability and economic assessment methodology since the last meeting.

- New elements include:
  - Further defined determination of need
  - Assumptions in Reliability Reference Case
  - Enhanced Reference Case
  - Choice of initial top 5 alternatives for evaluation (and other alternatives that will be considered)
  - Revised modeling assumptions for economic assessment
Determination of Need

- A determination of a need for transmission upgrades is triggered by the identification of a reliability criteria violation in the Fresno area within the planning horizon.
- Previously, the approach to determining need was based on an analysis of transmission and generation capacity required to support peak, partial peak, and off-peak load scenarios.
- In addition, new analysis has been undertaken to evaluate the hourly energy needs in Fresno from Helms.
- A Helms reliability dispatch model was developed for this purpose (described next).
Determination of Need – Purpose of Helms Reliability Dispatch Model

- Reliable electric service in Fresno is currently dependent on the availability of Helms generation.
- The availability of Helms generation is dependent on its ability to pump.
- Transmission upgrades are expected to be needed in the Fresno area to maintain the ability to pump with Helms and would also reduce the amount of Helms generation that is required for local reliability.
- The point in time that transmission upgrades are required to maintain the availability of Helms for the purpose of serving Fresno load is expected to be the need date for reliability upgrades.
Determination of Need – Assumptions in Helms Reliability Dispatch Model

- Hourly model of summer months
  - 2007 – dry hydro generation and load shape
- Model transmission constraints
  - Limitations on pumping
  - Requirements for generation
- Generate only to meet load
- Pump to fill reservoir whenever transmission is available to support pumping and load
Reliability Reference Case (Alt-RF)

- Once the need date is determined, a minimum set of transmission upgrades can be determined that would alleviate constraints on Helms pumping and reduce demand for Helms generation dispatch for local reliability purposes.
- It is expected that many transmission lines would need to be reconductored and reactive support and/or new generation would need to be added to sufficiently alleviate various network constraints in the Fresno area.
- The exact set of upgrades is still being determined.
- The reliability planning horizon for this analysis is at least 10 years.
Enhanced Reference Case (Alt-1)

- However, the Reliability Reference Case is not designed to allow full access to Helms to support reliable system operations for renewable integration under RPS
  - ISO’s 2007 Integration of Renewable Resources report identified need for additional storage capacity
- To address this baseline need for renewable integration, ISO is also evaluating a new “Enhanced” Reference Case that allows full access to Helms during off-peak hours over the next 10 to 15 years
- It is expected that such an Enhanced Reference Case would not require any new transmission lines or substations
- The Enhanced Reference Case also results in additional economic benefits over the Reliability Reference case, which will be evaluated
ISO and PG&E (and PG&E consultant E3) will build upon the Helms reliability dispatch model to estimate Helms’ market-based profits for energy and ancillary services:

- Spreadsheet-based model
- Assumes that future market prices for energy and ancillary services are escalated from 2007 prices
- Assumes a simple profit maximizing dispatch algorithm

ISO will also run a production cost simulation for economic evaluation of the Enhanced Reference Case.
Selection of C3ETP Alternatives to Evaluate

- Original methodology proposed to evaluate 18 C3ETP Alternatives
- ISO and stakeholders later identified additional Alternatives (as shown in C3ETP Draft Report, October 21, 2008)
- Most recent analysis focused on top 5 representative Alternatives for initial evaluation
- These Alternatives were selected based on various considerations
  - Reliability and transfer capability study results
  - Allow full access in off-peak hours to Helms (the C3ETP Alternatives are roughly similar in this regard to the Enhanced Reference Case)
  - Provides solution for reliably serving both Fresno and SCE’s San Joaquin valley load
  - Increases transfer capability on both Path 15 and Path 26
Economic Assessment

Topic 1 of 2: Major Study Assumptions

• Implementation of TEPPC database
• Fixes and additions to the TEPPC database
• Examples of CAISO change-sets
• What difference did we make? – Example 1
• What difference did we make? – Example 2
• What difference did we make? – Example 3

Based on TEPPC production cost database for planning, we model the California grid in more detail

(Topic 2 of 2) C3ETP Congestion Evaluation
Implementation of TEPPC Database
C3ETP keeps up with the latest TEPPC database

TEPPC Straw Man Work Plan

Work-in-progress versions

Database releases

TEPPC database development - Efforts of WECC workgroups
Base cases released:
- 2017 PC1 (26-Aug-08): 10-year case with 7.5% renewables
- 2017 PC4A (10-Nov-08): 10-year case with 15% renewables
- 2012 PC5 (10-Jan-08): 5-year planning case

Currently, TEPPC is developing the next version of the 10-year planning base case for year 2019. The new base case is expected to be released at the end of 2009 or in mid 2010

California modeling - Efforts of the California ISO
Base cases implemented:
(1) 01-May-08: A work-in-progress database
(2) 19-Jun-08: Another work-in-progress database
(3) 21-Aug-08: PC1 (1st release) of the 2017 database
(4) 04-Sep-08: Patch - Hydro Proportional Load Following (PLF)
(5) 10-Nov-08: PC1A – Patch to PC1 for Northwest load fix
(6) 16-Feb-09: PC4A (2nd release) of the 2017 database
Fixes and Additions to the TEPPC Database

CAISO change-sets model the California grid in more detail

In five categories, there are in total 81 CAISO change-sets developed.
Each change-set encapsulates a number of modified data items.

Note: The values in brackets are numbers of CAISO change-sets.
Examples of CAISO Change-Sets
Model the California grid in more detail

- Re-modeled California RPS 33% by using CPUC/RETI data (1)
- Added 767 MW of new thermal generation in north CA and 2133 MW in south CA (10)
- Modeled 5 CAISO operating procedures (5)
- Modeled numerous transmission contingency constraints (500 kV and 230 kV) (6)
- Modeled summer load pattern in addition to the winter load pattern (1)
- Emulated pumped-storage operations in price-driven mode (2)
- Many other changes .... (56)

Note: The values in brackets are numbers of CAISO change-sets
Model the California grid in more detail – What difference did we make?
Cleared some false alarms and identified more congestion

- Portions of Identified Congestion

- Blue: Found in the original TEPPC base case
- Black: Found in the original TEPPC base case but eliminated as false alarms
- Red: Found by detailed modeling of the California grid
Model the California grid in more detail – What difference did we make?

LMP became more volatile with much larger variations
Model the California grid in more detail – What difference did we make?

Path 15 south-to-north energy transfer doubled and tripled

CAISO baseline cases = TEPPC base case + CAISO change-sets

- C2020
- C2019
- C2017
- C2015
- C2014

Simulation results (average hydro condition) 2002-08 historical range (mostly dry hydro conditions)

South-to-north maximum 5400 MW (Actual limit varies according to operating transfer capability based on Path 15 RAS)

TEPPC base cases:
- 2017 PC4A
- 2017 PC1

North-to-south maximum 3265 MW

South-to-North Energy Transfer (GWh)

- doubled
- tripled
Economic Assessment

Topic 2 of 2: C3ETP Congestion Evaluation

• Hierarchy of C3ETP base cases
• The pre-project case
• Alt-RF: The reference case
• Alt-1: The enhanced reference case
• Alt-2a: Midway – E2 500 DCTL with S2 loop-In
• Alt-2e: Midway – Gregg 500 DCTL with S1 loop-In
• Alt-4: Whirlwind – E2 500 DCTL with S2 loop-In
• Alt-6b: Fresno – Big Creek 230 kV intertie
• Alt-7a: Midway – McCall – E2 230 kV DCTL

If an alternative is more effective in mitigating congestion, the alternative is more likely to have economic benefits
In the following slides, we will compare the effectiveness congestion mitigation of each alternative in comparison with the pre-project case.

The “no nothing” case where there is no upgrade at all.

With certain upgrades in external system:
- Add a new 500/230 kV transformer at Tesla
- Upgrade of Los Banos – Westley 230 kV line

We do not want these severe congestion to distort the benefits of C3ETP alternatives.

Minimum cost case that meets reliability criteria:
- Alt-RF
- Alt-1
- Alt-2a
- Alt-2e
- Alt-4
- Alt-6b
- Alt-7a
The Pre-Project Case

Congestion hours in year 2020

Path 15

Path 26

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar
- Substation
- 500 kV line
- 230 kV line

Tracy
Moss Landing

Warnerville

Los Banos

Metcalf

Tesla

Westley

Kerckhoff

San Joaquin

McCall

Wilson

Moss Landing

Big Creek

Pine Flats

Kings River

Path 15

Path 26

Vestal

Springville

Herndon

Storey

Gregg

Kearney

McMullin

Wilson

McCall

McMullin

Rector

Kern PP

Midway

Magunden

Path 26

Path 15

11

0

16

7

8

16

92

16

26

5

236

C2020_0916+
As Alt-RF and Alt-1, as defined so far, are similar to each other in 2020, skip this slide and proceed to the next page that shows congestion results of Alt-1.
Alt-1: Enhanced Reference Case

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar

Substation
- 500 kV line
- 230 kV line

Congestion hours in year 2020 from pre-project to post-project case

16 → 8
8 → 2

16 → 0
11 → 0
22 → 0
92 → 141
7 → 29
355 → 4
0 → 0
0 → 5
0 → 0

Tracy
Warnerville
Westley
Westley
Los Banos
Moss Landing
Metcalf
Helms
Eastwood
Helms
Kern PP
Magunden
Path 15
Path 26

California ISO
Alt-2a: Midway – E2 500 DCTL with S2 Loop-In

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar

Substation
- 500 kV line
- 230 kV line

Congestion hours in year 2020 from pre-project to post-project case
Alt-2e: Midway – Gregg 500 DCTL with S1 Loop-In

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar
- Substation
- 500 kV line
- 230 kV line

Congestion hours in year 2020
from pre-project to post-project case
Alt-6b: Fresno – Big Creek 230 kV Intertie

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar
- Substation
- 500 kV line
- 230 kV line

Congestion hours in year 2020 from pre-project to post-project case

- Path 15: 355 → 7
- Path 26: 16 → 6
- Alt-6b_2020_0916+
Alt-7a: Midway – McCall – E2 230 kV DCTL

Legend
- Hydro
- Pumped Storage / Pump
- Nuclear
- Simple Cycle
- Combined Cycle
- Biomass / Land Fill Gas
- Wind
- Solar
- Substation

5 → 0
26 → 25
236 → 0
16 → 0
7 → 0
355 → 14
16 → 0
0 → 0
92 → 36
22 → 0
8 → 6

Congestion hours in year 2020
from pre-project to post-project case
Other Benefits

- So far, ISO analysis has not identified other categories of benefits that are significant between the Alternatives.
- All Alternatives are expected to deliver similar magnitudes of capacity (LCR) benefits.
- In addition, no significant renewable resource substitution benefits are anticipated.
- As noted in prior Draft Report, benefits from reduction of market power will not be assessed for this analysis.