California ISO
Your Link to Power

Summer 2006 Operating Plan: Focusing on the CAISO South

MSC Meeting – May 31, 2006

Dariush Shirmohammadi
Director, Regional Transmission – South

California ISO
Your Link to Power

Outline

- Objective
- CAISO resource assessment for the Summer of 2006
- Special considerations for SP26
- Strategies to address capacity needs for SP26
- Concluding remarks

California ISO
Your Link to Power

Objective

- Objective: Review system operating condition for the CAISO controlled grid in the Summer of 2006 and develop the operating plans and tools to address potential operating problems. Place special emphasis on SP26* given the prevailing concerns about the capacity picture in that area under extreme conditions.

* SP26 refers to the CAISO electrical footprint South of Path-26 - also known as SP15

California ISO
Your Link to Power

Summer 2006 California ISO Control Area Peak Forecast Capacity Picture

Most Likely ("1 in 2") Condition*

• Control Area Generation Capacity (includes 4000MW forced and planned outage rate)	42,600MW
• Control Area Imports	9,000MW
• Total Control Area Supply	51,600MW
• Most Likely Control Area Demand	46,063MW**
• Operating Reserve Requirement	2,856MW
• Total Reserve Capacity	5,537MW
• Surplus Reserve	2,681MW
• Operating Reserve Margin	12 %
• Planning Reserve with DR and Interruptible programs	24.6%

* "Most likely" conditions includes expected "1-in-2" temperatures or average temperatures, all major lines in service, most likely economic conditions, average forced outage rates for generation, known generation retirements and most likely import conditions.

** 1,770MW higher than the 2005 peak demand. 2005 was considered a cooler than normal year. The 2006 forecast includes temperature adjustments as well as growth.

In the control area, there are approximately 1,808MW available in demand response and interruptible programs.

California ISO
Your Link to Power

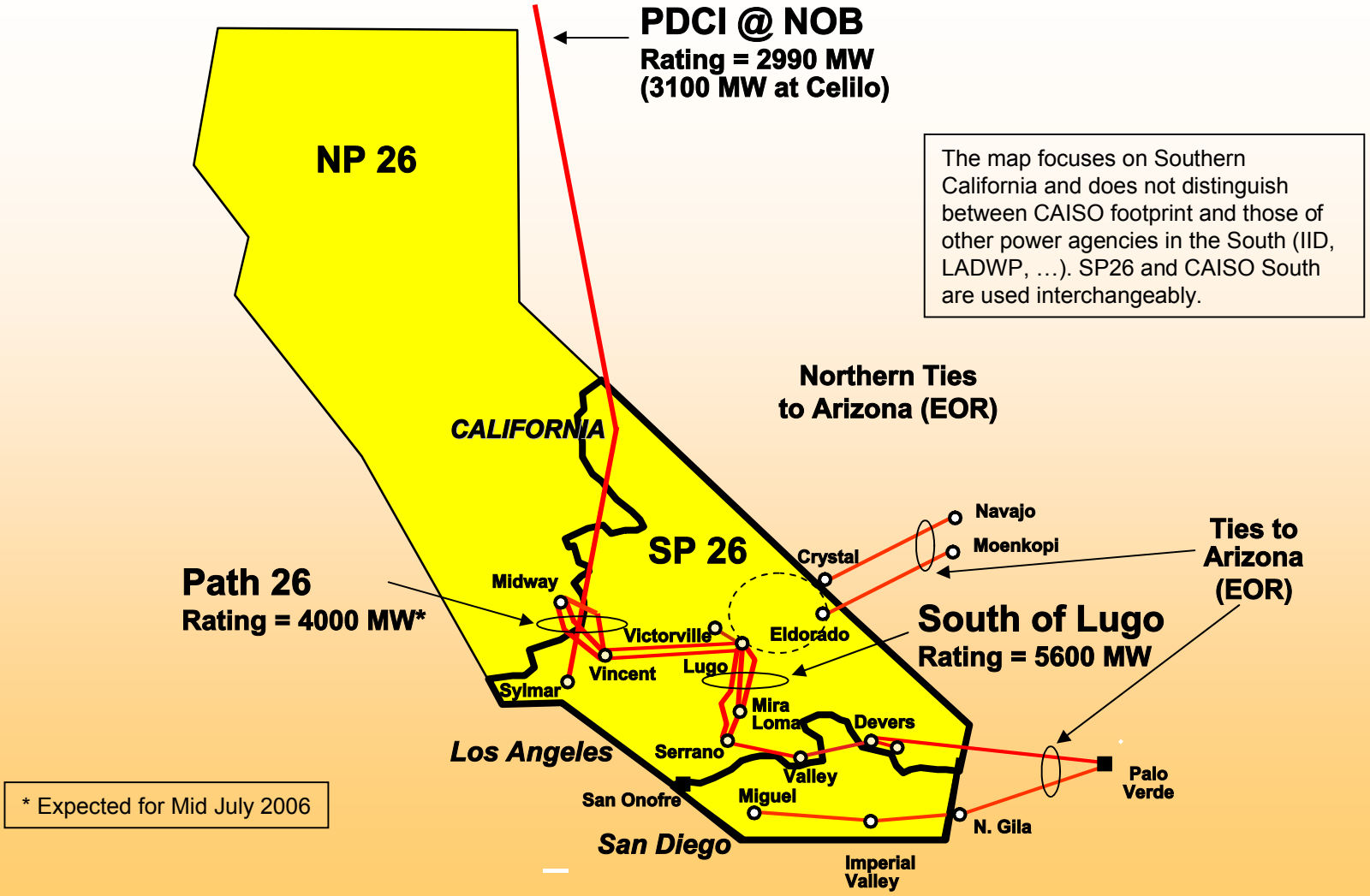
Summer 2006 Capacity Picture: General Findings

- CAISO's summer assessment shows that on a system-wide basis, there is sufficient supply capacity to address the CAISO control area needs
  - Capacity picture in NP26* is forecasted to be good given the forecasted availability of resources in NP26 and transmission system flow pattern and transmission availability into NP26 at the time of NP26 summer 2006 peak load
  - Capacity picture south of Path-26 ("SP26") may be a source of concern under extreme conditions and in need of careful review given the the forecasted availability of resources in SP26 and transmission system flow pattern and transmission congestion into SP26 at the time of SP26 summer 2006 peak load

* NP26 refers to the CAISO footprint north of Path-26 – covering the area generally known NP15 and ZP26 zones

California ISO
Your Link to Power

Focusing on SP26: Major Transmission into SP26



California ISO
Your Link to Power

Base Operating Scenario for the CAISO South (SP26): Loads & Resources Picture

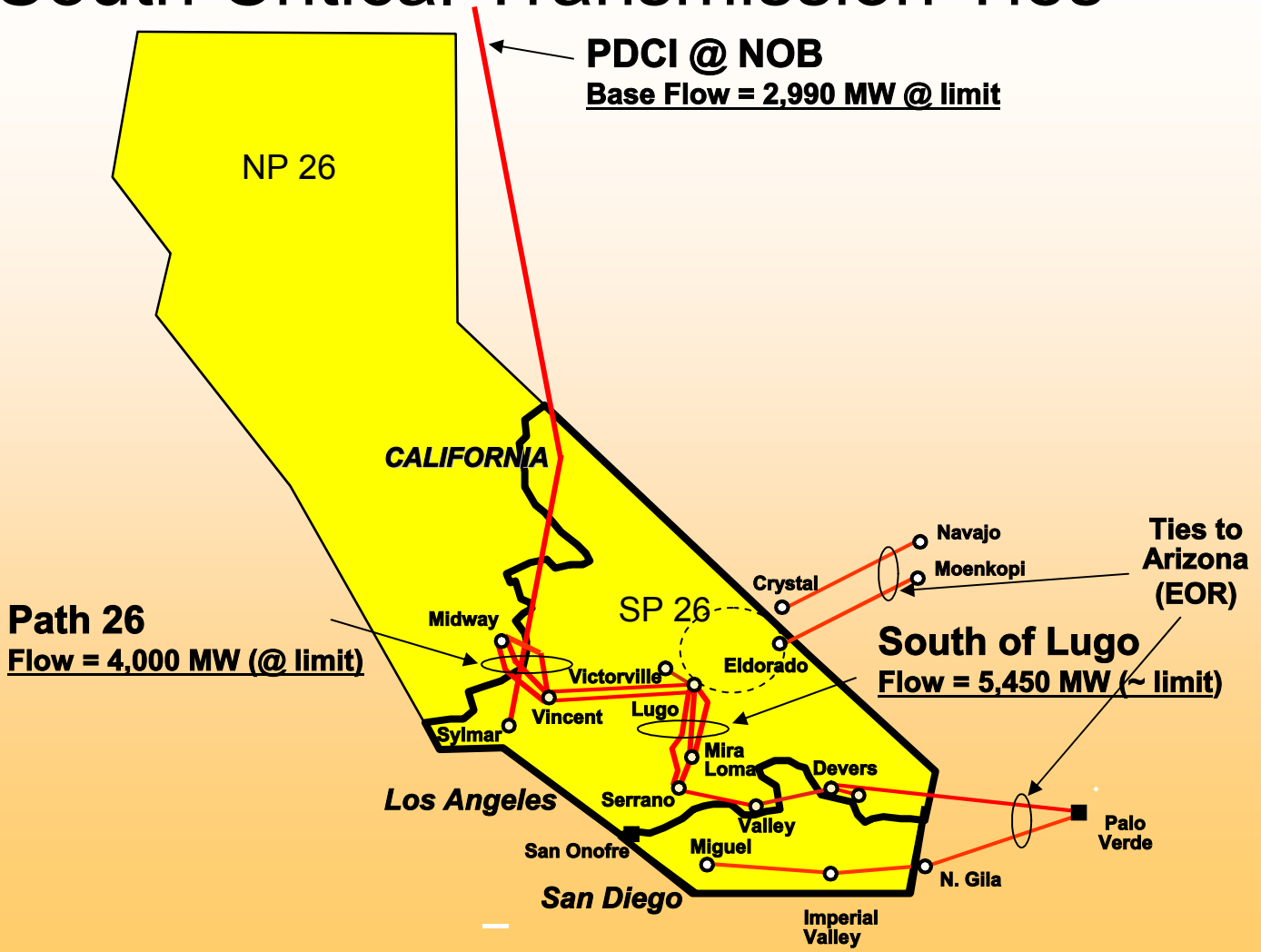
SP26 Normal Condition Under Most Likely Peak Demand

• Most Likely SP26 Demand ("1 in 2")*	27,299 MW
• SP26 Total Generation Capacity**	19,976 MW
• SP26 Imports	10,100 MW
• Total SP26 Supply	30,076 MW
• Generation Dispatched in Base Scenario	17,199 MW
• SP26 Unloaded Capacity	**2,777 MW**

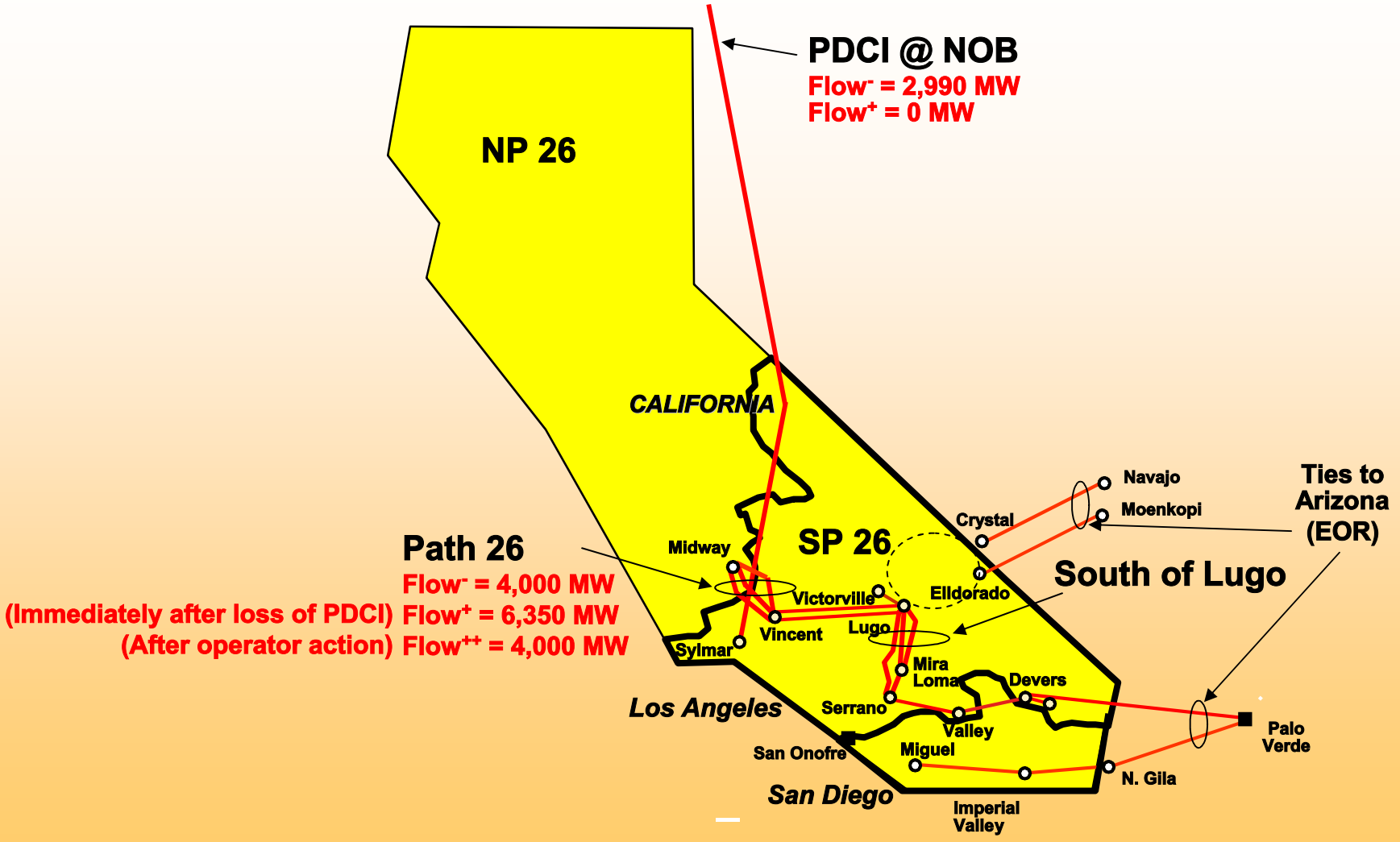
* Includes losses
** Accounts for 1,500MW forced/planned outage - although normally no planned generation outages are scheduled during the summer months.

California ISO
Your Link to Power

Base Scenario Flows on South Critical Transmission Ties



Loss of PDCI: Critical Tie Flows



California ISO
Your Link to Power

PDCI Post Contingency Scenario: Loads and Resources Picture

SP26 Post-Contingency Condition for Most Likely Peak Demand

• SP26 Demand	27,069 MW
• SP26 Total Generation Capacity	19,976 MW
• SP26 Imports	7,920 MW
• Total SP26 Supply	27,896 MW
• Generation Dispatched in Base Scenario	17,199 MW
• Additional SP26 Generation Dispatched	1,950 MW
• SP26 Remaining Unloaded Capacity	**827 MW**

California ISO
Your Link to Power

Study of Loss of PDCI for Base Scenario: Major Findings

- After loss of PDCI, Path-26 flow is brought back within its rating by CAISO operator action using existing unloaded capacity:
  - Magnitude of dispatch in SP26 would be1950 MW
    - Equal to CAISO's 70% of PDCI flow
    - Dispatching this amount of energy, if available, within the required 20 minutes will be a challenge
  - LADWP is responsible for 30% of the lost DC schedule and is expected to make up for 825 MW from its reserves in the South to replace its portion of lost DC capacity
- There is very little capacity margin available specially after the PDCI outage for this most likely load scenario
  - Any of the following conditions may exhaust this margin and could lead to non-firm/firm load curtailment:
    - Southern California load higher than average
    - Import capacity/availability less than normal
    - Out-of-service generation capacity higher than normal
    - Sustained outage of major transmission lines
  - This scenario is not limited to the loss of PDCI

California ISO
Your Link to Power

Capacity Picture Under Extreme Load Condition: Loads and Resources Picture

SP26 Pre-Contingency Condition for Extreme Peak Demand

• Extreme SP26 Demand ("1 in 10")	29,560 MW
• SP26 Total Generation Capacity*	19,976 MW
• SP26 Imports	10,100 MW
• Total SP26 Supply	30,076 MW
• SP26 Generation Dispatched in This Scenario	19,460 MW
• SP26 Unloaded Capacity	**516 MW**

* Accounts for 1,500MW forced and planned outage.

California ISO
Your Link to Power

Capacity Picture Under Extreme Load Condition: Post Contingency Resource Picture

SP26 Post-Contingency Condition for Extreme Peak Demand .

• SP26 Demand	29,316 MW
• SP26 Total Generation Capacity	19,976 MW
• SP26 Imports	7,850 MW
• Total SP26 Supply	27,826 MW
• SP26 Generation Dispatched in Base Scenario	19,460 MW
• Additional SP26 Generation Dispatched (if available)	516 MW
• Other Sources of Capacity Dispatched	1,490 MW

- May include curtailed firm/non-firm load

California ISO
Your Link to Power

Strategies to Address Capacity Needs in SP26 for the Summer of 2006: LSE Contribution

- Secure additional contracted SP26 resources for the Summer of 2006 – well under way
- Allow CAISO to "curtail" all SP26 interruptible loads and secure additional SP26 interruptible demand contracts for the Summer of 2006
- Assist CAISO with summer conservation programs, particularly in SP26:
  - Flex Your Power NOW!
  - SAVE-A-WATT Voluntary Load Reduction Programs
- Plan for interruptible and firm load curtailment in preparation for "extreme conditions"
- Improve on load forecasting accuracy

California ISO
Your Link to Power

Strategies to Address Capacity Needs in SP26 for the Summer of 2006: Generators Contribution

- Complete maintenance of all generating plants to insure maximum generation availability for the Summer of 2006
- Ensure maximum communication with CAISO prior to, during and after unit outages during the Summer of 2006
- Ensure that plans in place to bring generation back from forced outage state as quickly as possible during the Summer of 2006

California ISO
Your Link to Power

Strategies to Address Capacity Needs in SP26 for the Summer of 2006: PTO Contribution

- Ensure that all transmission projects for the Summer of 2006, specially those impacting SP26, are on time (see next page)
- Coordinate with California Department of Forest Services so that they would inform PTOs and the CAISO of the GPS coordinates of all summer fires
- Complete maintenance/outage plans prior to the Summer of 2006 and ensure maximum transmission availability during the summer season
- Coordinate with CAISO and LSEs on load curtailment

California ISO
Your Link to Power

Major Transmission Projects for the Summer of 2006

1. Path 26 RAS Upgrade
2. Imperial Valley - El Centro 230kV SPS
3. Palo Verde - Devers 500kV series caps
4. Hassayampa - N.Gila - Imperial Valley 500kV series caps
5. Devers 165 MVAR MSC
6. Devers SVC
7. West of Devers Short-Term Upgrades or SPS
8. 525kV Circuit breaker installation at Devers to open line shunt reactors

- Accelerating the timeline of these upgrades, all currently slated for the Summer of 2006, will help provide crucial additional operating margins in early part of summer

California ISO
Your Link to Power

Strategies to Address Capacity Needs in the South for the Summer of 2006: CAISO Contribution

- Roll out the annual summer conservation campaign
- Follow up with completion of transmission line upgrades in the south before summer peak to capture increased import capability.
- Meet with utilities, generators and WECC control areas to discuss supply and demand outlook and unit readiness
- Conduct summer workshops to prepare ISO and utility dispatchers
- Assess utility procurement plans to meet Resource Adequacy requirements
- Participate in regional demand and supply assessments of WECC/NERC to determine areas of excess or deficiencies in neighboring control areas
- Implement initiatives to improve communication and coordination with LADWP and BPA particularly in relation to the recent rash of PDCI outages
- Implement new market rules intended to pay generators a fair price for capacity and encourage forward contracts (RCST, 95% DA scheduling requirement, etc.)
- Improve the short term forecasting process and tools – well underway
- Review supply and demand picture to ensure coordinated generation maintenance
- **Perform engineering studies to identify trouble spots and develop operating plans and tools to remedy them**

California ISO
Your Link to Power

CAISO Operating Plan to Meet the Capacity Needs of SP26: Goals

- Ensure that CAISO meets NERC/WECC operating standards on a control area basis
- Ensure that there is sufficient capacity to address SP26 capacity requirements due to the Most Severe Single Contingency (MSSC) impacting the SP26 and in light of potential transmission constraints into SP26
- Ensure that various capacity sources are deployed effectively, based on their deployment response, when addressing contingency situation in SP26

California ISO
Your Link to Power

CAISO Operating Plan for Capacity Adequacy in SP26: Day Ahead (1)

1. After DA Preferred Market closes, calculate SP26 capacity requirement (CAP_{Req}^{SP26}) for each operating hour based on the MSSC for that hour:
   - Use tie flows & generation schedules from DA Preferred Market adjusted using load & loop flow forecasts based on historical data
2. Compare CAP_{Req}^{SP26} with operational reserve procured in SP26 in the Preferred Market (RES_{DAP}^{SP26}) plus Path-26 available transmission capacity (ATC^{P26})
   - If $RES_{DAP}^{SP26} + 1.18 \times ATC^{P26} \geq CAP_{Req}^{SP26}$, ***we are done***
     - ATC^{P26} is determined based DA Preferred schedules adjusted using forecasted load and loop flows*
     - Will use this information as part of the input in determining the magnitude of Must Offer Waiver Denial

* Assumes sufficient operating reserves in NP26 – factor 1.18 accounts for the reserve flows on the eastern WECC loop.

California ISO
Your Link to Power

CAISO Operating Plan for Capacity Adequacy in SP26: Day Ahead (2)

3. Tally "available" capacity in SP26 from all sources for each operating hour of the DA:*
   - 10-Minute response available capacity (CAP_{10}^{SP26})
   - 20-Minute response available capacity (CAP_{20}^{SP26}):
   - Slow response available capacity (CAP_{SLOW}^{SP26})
     - Available capacity in SP26 with 20^{+} Minute response
   - Contracted available interruptible loads (ILD^{SP26})
   - Total available capacity (CAP_{Total}^{SP26}):

     $$CAP_{Total}^{SP26} = CAP_{10}^{SP26} + CAP_{20}^{SP26} + CAP_{SLOW}^{SP26} + ILD^{SP26} + 1.18 \text{ X } ATC^{P26}$$

   - Comparison of CAP_{Total}^{SP26} and CAP_{Req}^{SP26} can be used as one input on CAISO's decision on Must Offer Waiver requests on 20-minute and slow-response units

* For an operating hour of the next day, the available capacity of a specific response type (10-minute, 20-minute, slow, or interruptible load) is determined by the system operator with consideration for: 1) the total unloaded capacity of that response type from all scheduled and unscheduled units, 2) deployment response capability of the unloaded capacity; 3) predicted severity of the system condition for that hour (mainly in determining available interruptible load capacity), and 4) the number of times that capacity source (specially if interruptible load) has been recently used.

California ISO
Your Link to Power

CAISO Operating Plan for Capacity Adequacy in SP26: Day Ahead (3)

4. Determine operating reserve to be procured for a particular operating hour of the next day in SP26 (RES_{Req}^{SP26}) in the Revised Preferred Market as the minimum of:
   a) Total available operating reserve quality (10-minute response) capacity in SP26 (CAP_{10}^{SP26}), or
   b) Difference between capacity requirement in SP26 (CAP_{Req}^{SP26}) and non-operating reserve quality capacity in SP26, as determined by the system operator:

      $CAP_{Req}^{SP26} - 1.18 \text{ X } ATC^{P26} - CAP_{20}^{SP26} - CAP_{SLOW}^{SP26} - ILD^{SP26}$

- CAISO decision to procure locational reserve in DA Revised Preferred Market (per above) may lead to changes in SP26 DA schedules prior to that market in order to free up additional SP26 operating reserve quality capacity to bid into the Revised Preferred A/S Market
- Remaining overall operating reserve would be procured in NP26
  - Overall operating reserve is based on control area requirement

CAISO Operating Plan for Capacity Adequacy in SP26: Day Ahead (4)

5. Estimate magnitude of firm load to be curtailed in response to the MSSC if after DA A/S market, there is still capacity shortfall in SP26:

   $CAP_{Req}^{SP26} - CAP_{Total}^{SP26}$

California ISO
Your Link to Power

CAISO Operating Plan for Capacity Adequacy in SP26: Hour Ahead

1. Before each HA Market for a particular operating hour, repeat the process developed for DA market for that hour except that use information from the Revised Preferred (Final) Market, rather than the Preferred Market, for that hour
   - If necessary, adjust all information based on previous hour HA Market results, most recent load and loop flow forecasts, and actual readings
   - This process may lead to procuring additional locational reserves in SP26 in HA market (RES_{HA}^{SP26})

California ISO
Your Link to Power

Strategies to Address SP26 Capacity Needs for the Summer of 2006: Near Real-Time

1. "Near Real-Time (NRT)" refers to the time around 30 minutes prior to an operating hour
   – Repeat the calculation performed in HA time frame, if necessary, to update required and available capacity values and determine whether there is shortfall of proper quality capacity in SP26:

   $CAP_{Req}^{SP26} > RES_{HA}^{SP26} + CAP_{20}^{SP26} + 1.18 \text{ X } ATC^{P26}$

2. If such shortfall exists, start taking the following remedial actions in preparation for the operating hour:
   a) Ramp up available slower response units in SP26, through Real-Time Market, accompanied with an equal ramp down in NP26, up to the lesser of their available capacity or SP26 capacity shortfall (divided by 1.18), in order to free capacity on Path-26
   b) Curtail interruptible load in SP26 up to the lesser of the available value in SP26 or the SP26 capacity shortfall, if necessary*
   c) Prepare to curtail firm load equal to (most up-to-date values):

   $CAP_{Req}^{SP26} - CAP_{Total}^{SP26}$

* Pending further regulatory research, some interruptible loads may be curtailed even before dispatching slow response units

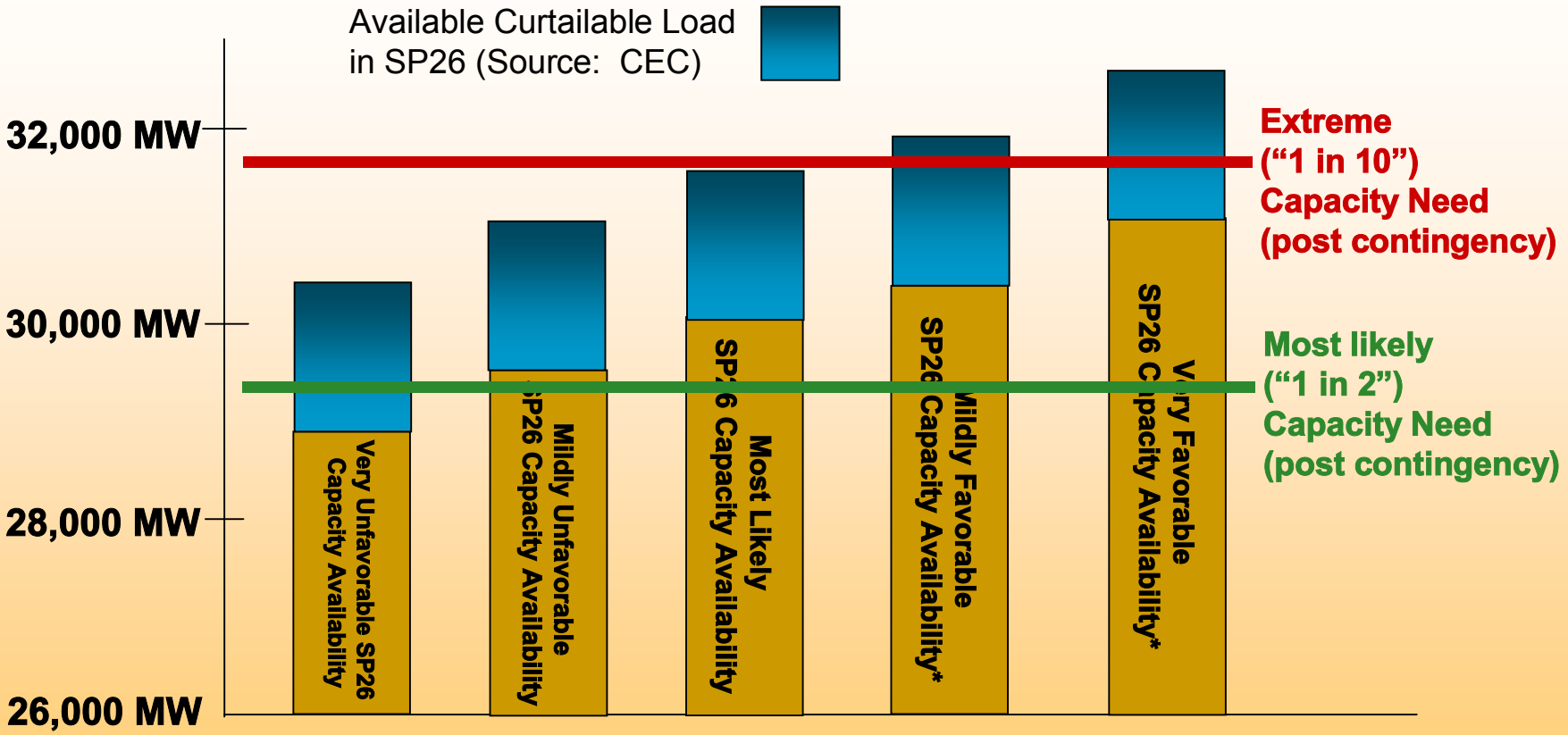
California ISO
Your Link to Power

Strategies to Address SP26 Capacity Needs for the Summer of 2006: Post Contingency

1. Dispatch operating reserves and 20 minute capacity as available up to the lesser of their available magnitude or SP26 capacity shortfall
2. Curtail firm load as calculated in the NRT time frame preceding the outage (Step 2c of NRT), if necessary
3. Get prepared for the next MSSC

California ISO
Your Link to Power

Post MSSC Capacity Picture in SP26 in Presence of CAISO Operating Plan



* Favorable SP26 capacity availability comes about if less than 1500 MW of generation capacity is under forced outage in SP26 and/or if there is more import capacity than 10,100 MW into SP26

California ISO
Your Link to Power

Concluding Remarks

- Operational study of SP26 for the Summer of 2006 shows that there is potential for capacity shortfall in SP26 under extreme operating conditions:
  - Strategies and operating plans have been developed by the CAISO to address the shortfall in various timeframes
- Related operational tools for DA, HA and NRT timeframes are being developed for deployment on the Floor by May 31, 2006:
  - The operating tools will recommend proper operator actions (including firm load drop) based on the overall capacity picture in SP26