

Aspects of CAISO Electrical Power System and Market Rules Discussion with Seed

Karen M. Shea

KMS0@pge.com

Pacific Gas and Electric Company

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Key Terms

- Independent System Operator (ISO)
 - Grid Operator for Wholesale and Retail Markets
 - ◆ Responsible for System Reliability
 - ◆ Manages Transmission Congestion
 - ◆ Wheeling Transactions Through ISO Grid
 - ◆ Controls IOU Transmission Systems and Other Joining Entities
 - ◆ Arranges for Ancillary Services
 - ◆ Manages Real Time Market
 - Scheduling Coordinator (SC)
 - ◆ Responsible for Submitting Schedules into ISO
 - Submits Balanced Schedules to ISO (Generation = Load)
 - Self Provides or Procures Ancillary Services Needs from ISO
 - ◆ Responsible for Financial Settlements with the ISO

Key Terms (cont.)

- Power Exchange (PX)
 - Administers Energy Market, Separate from ISO
 - ◆ Conducts Bid-Price Auctions (Transparent MCP)
 - ◆ CA IOUs Must Initially Sell its Generation
 - ◆ CA IOU-UDCs Must Initially Buy its Power from PX
 - ◆ Power Exchange is Treated as a Scheduling Coordinator by ISO

Types of Markets

- Forward Energy - PX
 - Day-Ahead
 - Hour-Ahead
- Ancillary Service
 - Day-Ahead
 - Hour-Ahead
- Reliability Must Run Service - ISO Contracts
- Transmission - ISO
- Real Time Energy - ISO

Ancillary Services

Ancillary Services (A/S) Markets: Daily Auctions

Service*	Description
AGC/Regulation	Generator's equipment that provides regulation service direct control by ISO to increase or reduce power
Spinning Reserve	A quantity of unloaded capacity synchronized to the grid that will ramp up in 10 minutes
Non-Spinning Reserve**	A quantity of capacity that is not synchronized to the grid but can ramp up in 10 minutes
Replacement Reserve	A quantity of capacity that will ramp up within 60 minutes

Note: Reactive Power/Voltage and Black Start Procured Contractually.

* *Scheduling Coordinators responsible for pro rata share of non self provided ancillary services charges. WSCC requirements must be met for spinning reserve, nonspinning reserve and AGC/regulation.*

** *Non-spinning reserve capacity includes generation or load resources.*

Ancillary Service Markets: Payments

- ISO Holds A/S Auctions in Sequence
- Bidders Submit a Capacity Bid and Energy Bid
- ISO Pays Winning Bidders Capacity Payment Based on a MCP
- The Energy Bid is Used to Dispatch
- ISO Instructed A/S Dispatch Paid Based on Interval Price (e.g. Highest Price Energy Instructed in 10-Minute Interval)
- ISO Proposing “No Pay” of Capacity and Energy if Metered Output of a Resource is Less Than Dispatch Instruction

Determination of Ancillary Service Requirements

Operating Reserves (Spin and Nonspin) 2.5.3.2:

- Based on Minimum Operating Reliability Criteria (WSCC/NERC)
- Minimum Requirements: 5% of Demand Met from Hydro, 7% Other or Single Largest Contingency, if Greater or More Stringent Criteria as ISO May Determine: Recently ISO Required 6% Hydro, 8% Other
- These Requirements May be Distributed on a Locational Basis

Determination of Ancillary Service Requirements

Replacement Reserves (2.5.3.3):

- Based on ISO Forecast Which May Include:
 - a) Historical Analysis of the Deviation Between Actual and Day- Ahead Forecast Demand
 - b) Historical Patterns of Unplanned Generation Unit Outages
 - c) Historical Patterns with Shortfalls Between Final Day-Ahead Schedules and Actual Generation and Demand
 - d) Historical Patterns of Unexpected Transmission Outages

AGC/Regulation (2.5.3.1):

- ISO Shall Maintain Sufficient Generating Units Immediately Responsive to AGC to Provide Regulation to Meet WSCC \NERC Criteria by Continuously Balancing Generation to Meet Deviations Between Actual and Scheduled Demand and to Maintain Interchange Schedules

Technical Requirements (Certificate Required)

- Regulation/AGC
 - Generation Units Need Equipment to Directly Receive Control Signals From ISO Power Management System
- Communications Equipment
 - 24-Hour Person Point of Contact, Must be Reachable by Phone
- Metering Infrastructure
 - Appropriate Metering Capability per ISO Requirements
 - i.e., Metering Capability in Regard to AGC Response
- Black Start
 - Equipment to Start Without Energy From Grid

Failure to Perform Unannounced Tests

2.5.2.6 Penalties for Failure to Pass Tests

- An Ancillary Services Provider that Fails an Availability Test Shall be Deemed not to Have Been Available to Provide the Ancillary Service for the Entire Period the Generating Unit or Load was Committed to Provide the Service, Unless Appropriate Documentation is Presented to the ISO.
- The Committed Period is all Hours that A/S was Scheduled Beginning From:
 - i) Last Successful Availability Test
 - ii) Last Time A/S Provided, Whichever is Shorter

Ancillary Service Markets - Initial Lessons

- Artificial Barriers to Supply Being Fixed
- Unexpectedly High Demand for A/S
 - Extremely High Demand for Regulation
- Inelastic and Irrational Procurement
- Asymmetric Regulation of Suppliers: Cost-Based Caps and Market-Based Rates
- Software Problems
- Tight Supplies During Peak Demand
- Purchased “Out of Market” Supplies
- Caps in Effect \$250/MW

Ancillary Services Markets - Charges

A/S Redesign Proposal Filed at FERC May 31, 1999*

- 1) Rational Buyer
- 2) Automated BEEP/Real Time Instruction
- 3) Replacement Reserves
- 4) Fix Incentives for Uninstructed Deviations
- 5) “No Pay” Proposal--Eliminate Capacity and Energy Payments if Uninstructed Deviations Use
- 6) Reg Up/Reg Down Capacity Priced Separately
- 7) Inter-SC Scheduling Tracks of A/S

* PG&E Proposed a Load Following Service not Filed

The Real Time Market

ISO Real Time Energy Market

- ISO Sets Ex-Post Price for Energy Imbalances (So-Called “Real Time Price”)
- Imbalance Prices are Volatile, as Expected
- Imbalance Prices Generally Track PX Prices
- Generator and Line Outages Cause Price Jumps
- Imbalance Price Capped at \$250/MWh

Components

Sources for Balancing in Real-Time:

- Intrazonal Congestion Energy
- *Supplemental Energy*
- Ancillary Services Energy
 - AGC
 - *Spinning Reserves*
 - *Non-Spinning Reserves*
 - *Replacement Reserves*

Only Italicized resources can set prices. The Real time, Ex-Post Price is calculated from a stack of energy bids that have been instructed to be dispatched by the ISO.

Real Time Energy Payments

Type	Payment
A/S and Supplemental <u>Instructed</u> Energy	Interval Ex-Post Price (e.g. Based on Highest Price Energy Instructed Each 10 Minutes)
<u>Uninstructed</u> Energy	Average Hourly Ex-Post Price
Intrazonal Congestion	As - Bid

Ancillary Services Payment Changes

- “No Pay” Proposal will Eliminate Both Capacity and Energy Payments if Uninstructed Deviations Use Capacity Obligated to be Unloaded and Available for A/S.
- The “Effective Price” Proposal will Revise Net Hourly Payments to Give Back the Profit When a Resource that Received a Dispatch Instruction Also has Uninstructed Deviations.

Real Time Congestion Management

Intrazonal

- Occurs Within a Zone, Occurs Infrequently
- Cost Based
- Allocated to all SCs in the Zone

Transmission Congestion Zones

