Least Cost Dispatch Overview
2010 ERRA Compliance Review – A.11-02-011

Presentation To
The Office of CPUC Commissioner Florio

September 04, 2013

Agenda

- What is Least-Cost Dispatch (LCD)?
- Implementation of MRTU
- LCD Principles
- How PG&E Executes LCD
- How PG&E Demonstrates LCD Compliance
- DRA Recommendations
- Conclusion
- Appendix

What is LCD?

- The Commission defined LCD in Standard of Conduct No. 4 (SOC4)
  - Established in D.02-10-062

    "The utilities shall prudently administer all contracts and generation resources and dispatch the energy in a least-cost manner. Our definitions of prudent contract administration and least-cost dispatch are the same as our existing standard."

  - Clarified in D.02-12-074

    "Prudent contract administration includes administration of all contracts within the terms and conditions of those contracts, include dispatching dispatchable contacts when it is most economical to do so. In administering contacts, the utilities have the responsibility to dispose of economic long power and to purchase economic short power in a manner that minimizes ratepayer costs. Least-cost dispatch refers to a situation in which th most cost-effective mix of total resources is used, thereby minimizing the cost o delivering electric services. The utility bears the burden of proving compliance with the standard set forth in its plan."

Implementation of MRTU

- Pre MRTU
  - Scheduling Coordinators submitted balanced load and generation schedules and engaged in Day Ahead bilateral trading
- Post MRTU (effective April 2009)
  - PG&E bids its load and resources in FERC jurisdictional, centralized day ahead and real time markets
  - Increased number of interconnection points
  - Financial settlement done using locational marginal price
- In a post MRTU world, LCD review should focus on process and inputs

> "On April 1, 2009, the CAISO began implementation of the Market Redesign and Technology Upgrade, which substantially changed the least-cost dispatch processes of SCE and other utilities." (D.11-10-002, FOF 1)

SCE maintained that the record showed that its scheduling and bidding processes and actions "enabled the CAISO to dispatch SCE's dispatchable resources in an economic manner throughout the Record Period." (D.11-10-002, p. 7)

Least Cost Dispatch Principles

- With the implementation of MRTU, least cost dispatch is performed in the CAISO day ahead and real time markets
- PG&E offers its resources at incremental cost (consisting of variable cost and in some circumstances opportunity cost)
- The CAISO markets use PG&E resources when they have lower incremental cost than the alternatives
- PG&E buys from the market when the market price is below PG&E's incremental supply cost
- PG&E sells to the market when the market price is above PG&E's incremental supply cost

How PG&E Executes LCD

For every hour and every resource:

- PG&E implements LCD using variable cost, subject to operational constraints, and submitting bids to CAISO
  - If a dispatchable resource can recover its variable costs, it should run to minimize customer cost
  - If a dispatchable resource cannot recover its variable costs, it should not run to minimize customer cost
- Variable costs determine when dispatchable resources are economic to operate in cost-based bidding
  - Fuel
  - O&M
  - Non-fuel startup cost (also referred to as "fixed startup cost")
- Opportunity cost-based bids, including adders reflecting resource use limitations or downstream market opportunities, are appropriate in certain circumstances (e.g., hydro resources)
  - Water is a limited resource due to storage and regulatory license requirements
  - Therefore, water is optimized for energy at the most valuable time based on forecast
- Dispatchable resources were self-committed at minimum and bid to maximum into the market because, in 2010, the CAISO market structure was limited
- When self-scheduling a resource, the resource is a price taker. These resources are primarily non-dispatchable such as qualifying facilities, must-take resources, Diablo Canyon

How PG&E Demonstrates LCD Compliance

- The CAISO market determines the daily dispatchable resource mix, so PG&E demonstrates LCD compliance in ERRA by bidding its resources portfolio into the market
- PG&E includes detailed process descriptions in ERRA testimony (Chapter 2 testimony, rebuttal, and surrebuttal), with extensive supporting data (see Appendix)
- The record shows that PG&E's scheduling and bidding processes and actions enabled the CAISO to dispatch PG&E's dispatchable resources in an economic manner throughout the Record Period to lower costs for customers
- Supporting data includes "deep dives" on three sample days (highest load, lowest load, and average load days), a method agreed to by DRA to demonstrate LCD (2010 Master Data Request No. 61)
  - Dispatchable resource cost and bid data
  - Dispatchable resource (including hydro) availability
  - Power and natural gas prices
- Other testimony and data provided for 2010 showing (see Appendix)
  - Daily resource plans
  - Power and natural gas procurement
  - CAISO costs
  - Discovery --- master data request responses

Additional Information Regarding PG&E's LCD Demonstration

1. PG&E bids its dispatchable resources at incremental cost

a) Public testimony explains how PG&E constructs incremental cost bids.

b) Workpapers provide detailed support of bid calculations. Prior to 2011, calculations were detailed for test days; since 2011, they have been documented for all resources, days and hours.

2. The CAISO markets optimize system dispatch based on bids, subject to transmission and reliability constraints

a) CAISO reports publicly on efficiency of markets and optimality of market algorithms.

b) Market design and dispatch algorithms have been supported by CPUC and other regulatory bodies as well as market participants.

c) CAISO Market Monitoring, CAISO Market Surveillance Committee, and regulatory bodies have caught, corrected and penalized bad behavior by bidders who (unlike PG&E) are not mandated to bid at incremental cost.

d) PG&E has supported and responded to DRA questions and concerns regarding CAISO dispatch optimization, and initiatives to better capture true costs in the markets.

DRA's Recommendations

- DRA's opinion is based on the faulty premise that PG&E did not adequately utilize its UOG, at the expense of lower cost options
- DRA recommends that PG&E self-schedule Helms and other dispatchable resources irrespective of cost and to the exclusion of th CAISO competitive market
  - Forces Helms and other units to run when they are "out of the money" resulting in higher customer costs
  - Customers would have incurred approximately $11.6 million per year in additional costs from self-scheduling Gateway as proposed by DRA (PG&E rebuttal testimony, p. 1-8)
- DRA erroneously compares variable costs to average costs reported on FERC Form 1 to support its proposed disallowance

Conclusion

- PG&E offers dispatchable resources to the CAISO market under cost-based terms, with the overall goal of efficient market outcomes that benefit customers
  - Force-running resources "out of the money" will reduce resource flexibility and increase costs by displacing other lower cost alternatives that would have been scheduled by CAISO
- DRA's self-scheduling recommendation, if adopted by the Commission, would force PG&E to disregard core LCD principles and would raise overall costs
- DRA's assertion that PG&E has not met its LCD burden of proof is without merit
  - There is a preponderance of evidence in the record to find that all dispatch-related activities PG&E performed during the Record Period complied with LCD principles and PG&E's procurement plan
- In 2010, the LCD filing was consistent with the 2009 filing, which the CPUC found in compliance (D.11-07-039)

Appendix

Least Cost Dispatch Documentation

LEAST COST DISPATCH SHOWING	2010 ERRA
Summary and detail of all electric Day Ahead (DA) and Hour Ahead (HA) transactions, all trades for all trading days	Workpapers [1]
Summary and detail of all gas physical and financial transactions	Workpapers
All monthly DA trade sheets (25- 28 DA trade sheets per month)	Workpapers
All monthly HA trade sheets (25- 28 DA trade sheets per month)	Workpapers
System Load Requirements/Conditions	Workpapers
Detailed Trading strategies for term transactions by month/quarter	Workpapers
Peak load forecast for DA and HA and comparison to actual	MDR 61
Comparison of DA and HA on-peak energy purchases and prices	MDR 61
Comparison between DA and HA off-peak energy purchases and prices	MDR 61
Comparison between DA and HA energy sales and prices	MDR 61
Comparison between DA and HA off-peak energy sales and prices	MDR 61
Analysis of whether the lowest cost mix of resources within given constraints was achieved for the highest, lowest, and average energy (MWh) load days during the record period	MDR 61
MWh (Detailed Hourly Loads) for sample days	MDR 64
Workpapers on DA and HA Deliveries for sample days	MDR 65
Analysis on the cost impact on customers relative to other available choices	MDR 71
Description of short-term load forecast models	MDR 72
Description of Hydro Models	MDR 73
Discussion of short-term load forecasts, rules of thumb, temperature derivation, and actual to forecast analysis for sample days	MDR 74
Least-cost dispatch Desk Procedures including explanation of real-time dispatch decisions made by utility.	MDR 85

[1] PG&E's 1st through 4th Quarter Quarterly Compliance Reports