Customer Service Business Unit
Tariff Programs & Services

SOUTHERN CALIFORNIA EDISON®
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Leading the Way in Electricity™

SCE's Participating Load Pilot

Initial Results Presentation

Demand Side Working Group of the Electric Reliability Council of Texas (ERCOT)

April 23, 2010

The Present

- SCE is a leader in advancing new programs and technologies
  - *Largest portfolio of renewable power in the U.S.*
  - *One of the largest Demand Response DSM portfolios in the world*
  - *SCE and its customers are the nation's leaders in reducing greenhouse gases (GHG) through energy efficiency*
    - Over the past five years, our customers have saved 5 billion kWh - Enough energy to power 725,000 homes for an entire year
  - *Rolling out 5.3 million Edison SmartConnect™ Advanced Metering Infrastructure (AMI) meters*
  - *Developing research and partnerships focusing on long-term energy saving opportunities*

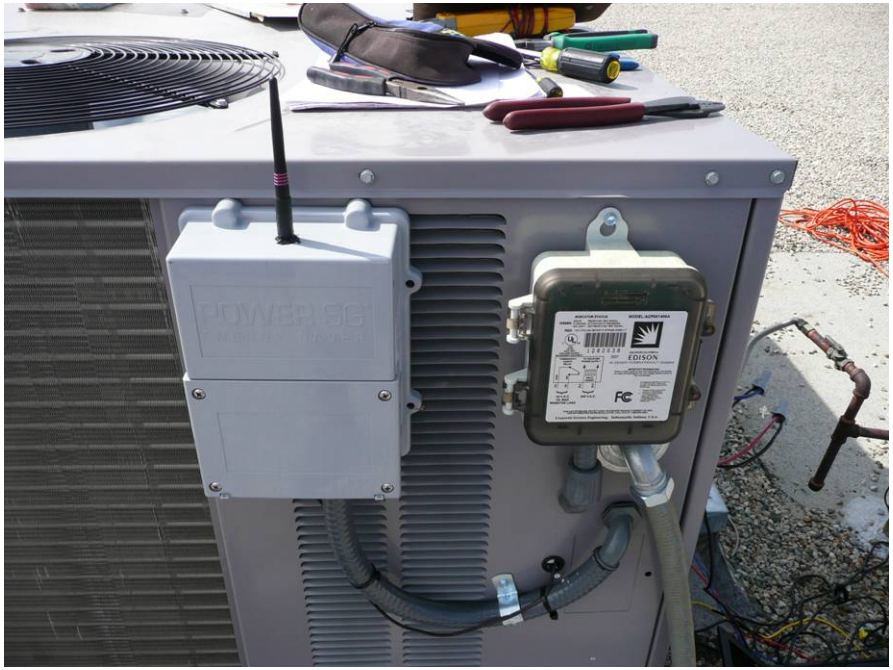
Customer Behavior

Three approaches to energy usage to achieve better utilization

- *Demand Response*
  - Responding to electricity price or reliability events
- *Conservation*
  - Curtailing discretionary usage
- *Energy Efficiency*
  - Getting the most out of every kWh used

Demand Response Program Evolution

1. Reliability Based DR
2. Price Responsive DR and Time Differentiated Rates
   - *Enabled with Advanced Metering*
3. Wholesale Market Integrated Demand Response



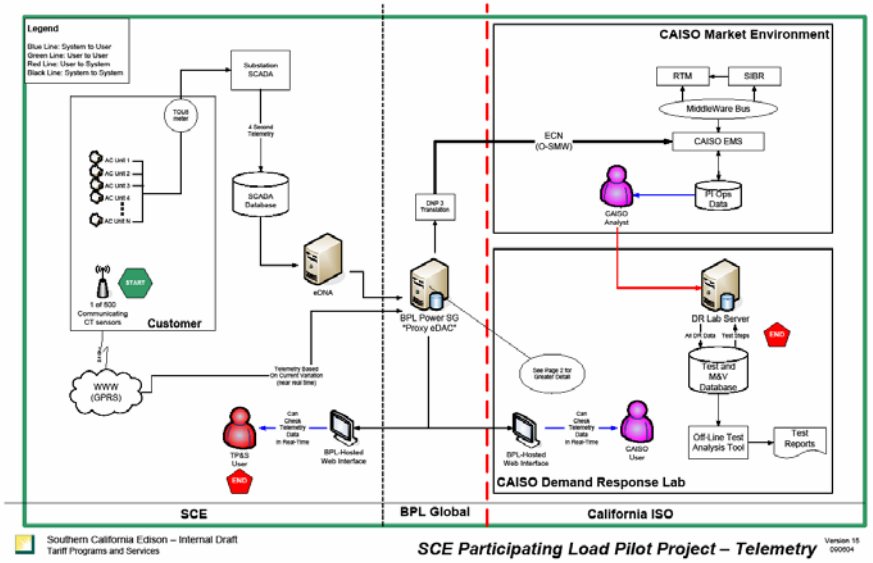
What was SCE's 2009 Participating Load Pilot?

- The CAISO MRTU wholesale market product for providing all or a portion of scheduled load as Demand Response is called Participating Load (PL).
- In 2008, at the request of CAISO, the CPUC instructed the IOUs to conduct PL Pilot programs for different customer classes:
  - *Large – PG&E*
  - *Medium Aggregated – SDG&E*
  - *Small Aggregated - SCE*
- SCE leveraged a portion of the existing Air Conditioning Cycling program "Summer Discount Plan (SDP)" to deliver small aggregated load DR to function as Non-Spinning Reserves in the wholesale Ancillary Services (AS) market.

SCE's PLP Customer

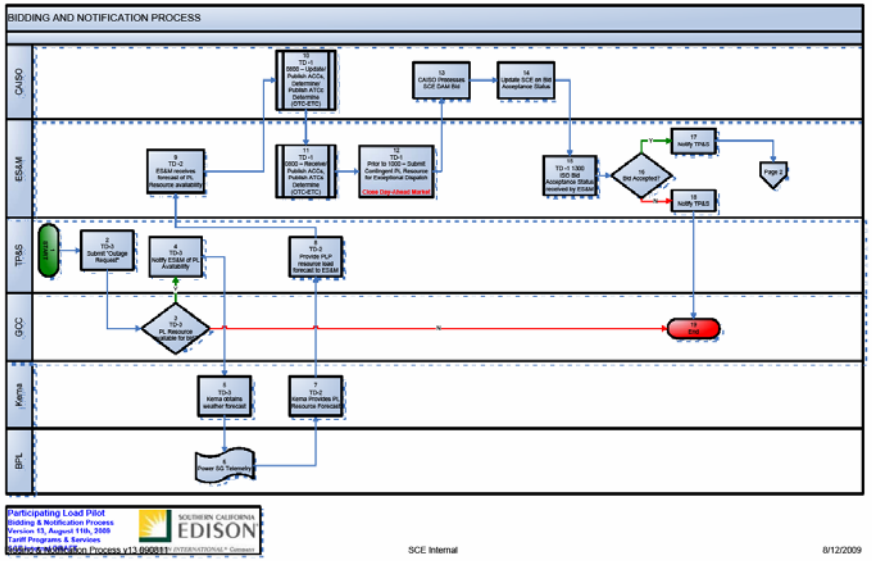
- The National Training Center and Fort Irwin is a large Army base located 34 miles northeast of Barstow.
- The Fort was an ideal customer for a few reasons…
  - *Already an SDP participant with over 3200 switches installed.*
  - *Fed by a single substation (simplifies statistical analysis).*
  - *Located in the desert, where air conditioning load is more predictable.*
  - *No marketing costs!*
  - *Possesses a good mixture of residential and commercial buildings (red polygon) that resemble a small civilian town.*

PLP Processes and Data Flows



- Ensuring that all the right people and systems communicated smoothly required extensive documentation.

- Some of these data and process flow diagrams required over a dozen iterations in development.



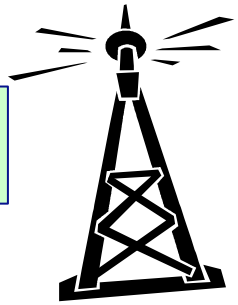
Participating Load Pilot Process

1 Telemetry Monitoring

2 Telemetry Communication

3 Bid Participating Load Into Day Ahead Market

4 Dispatch Instructions



5 Broadcast Dispatch

6 Measure Load Drop

7 Settlement

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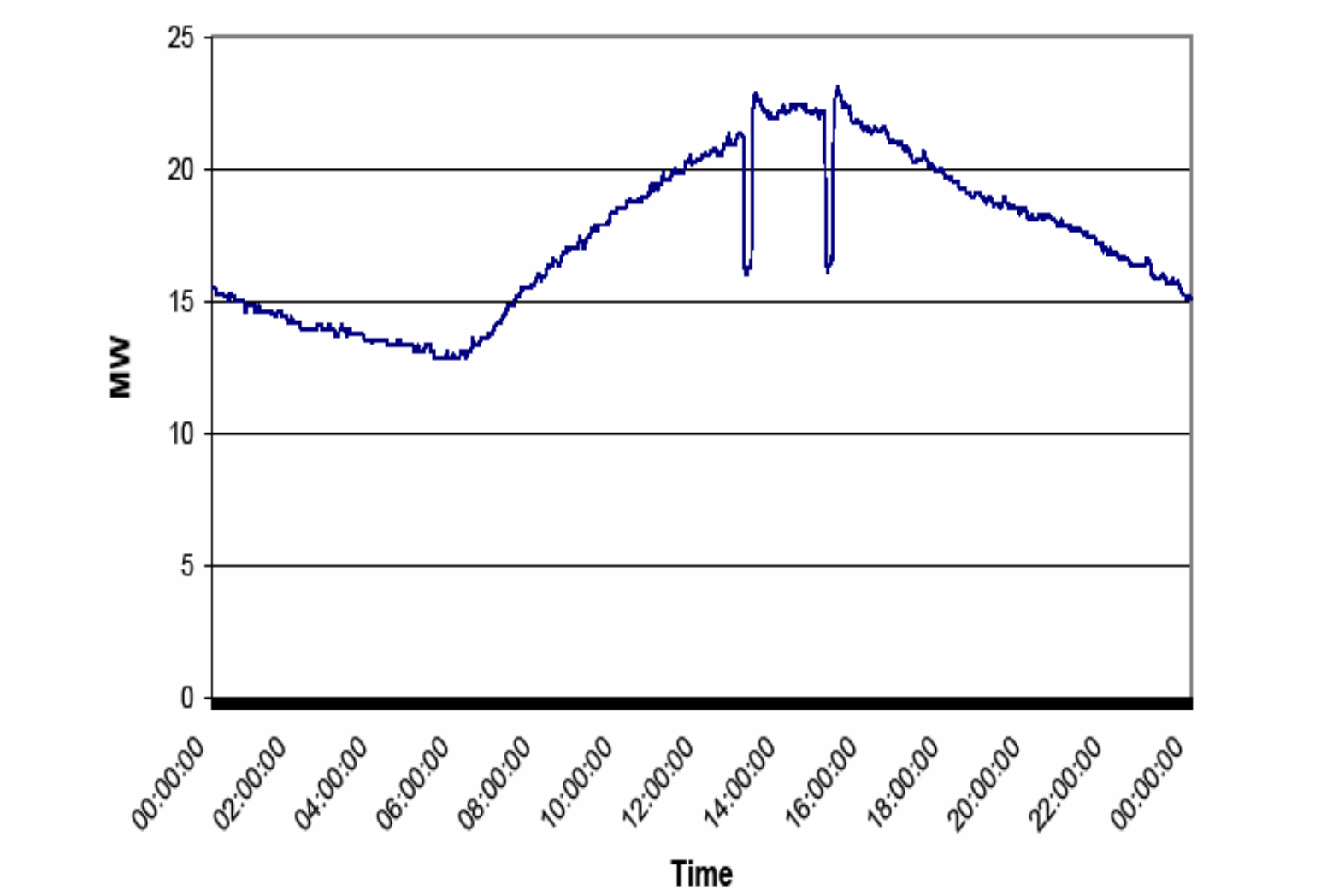
PLP Partners

- Telemetry sensors are the devices that provide near real time monitoring of the amount of energy being consumed.
- Utilized 2300 existing AC Switches from Corporate Systems Engineering
- Installed 500 of the devices to sample Ft. Irwin's population of 3200 air conditioners.
  - *SCE examined devices from four separate companies before choosing BPL Global's Power SG system.*
  - *Unknown whether a similar mesh network solution would be utilized for any potential future general population program rollout.*
- SCE contracted with long-time partner Good Cents and completed telemetry sensor installation in less than three weeks.
- Contracted with Kema to develop the algorithms which would allow this telemetry proxy to predict total load.
- Partnered with LBNL to provide input and advise on research approach and findings.

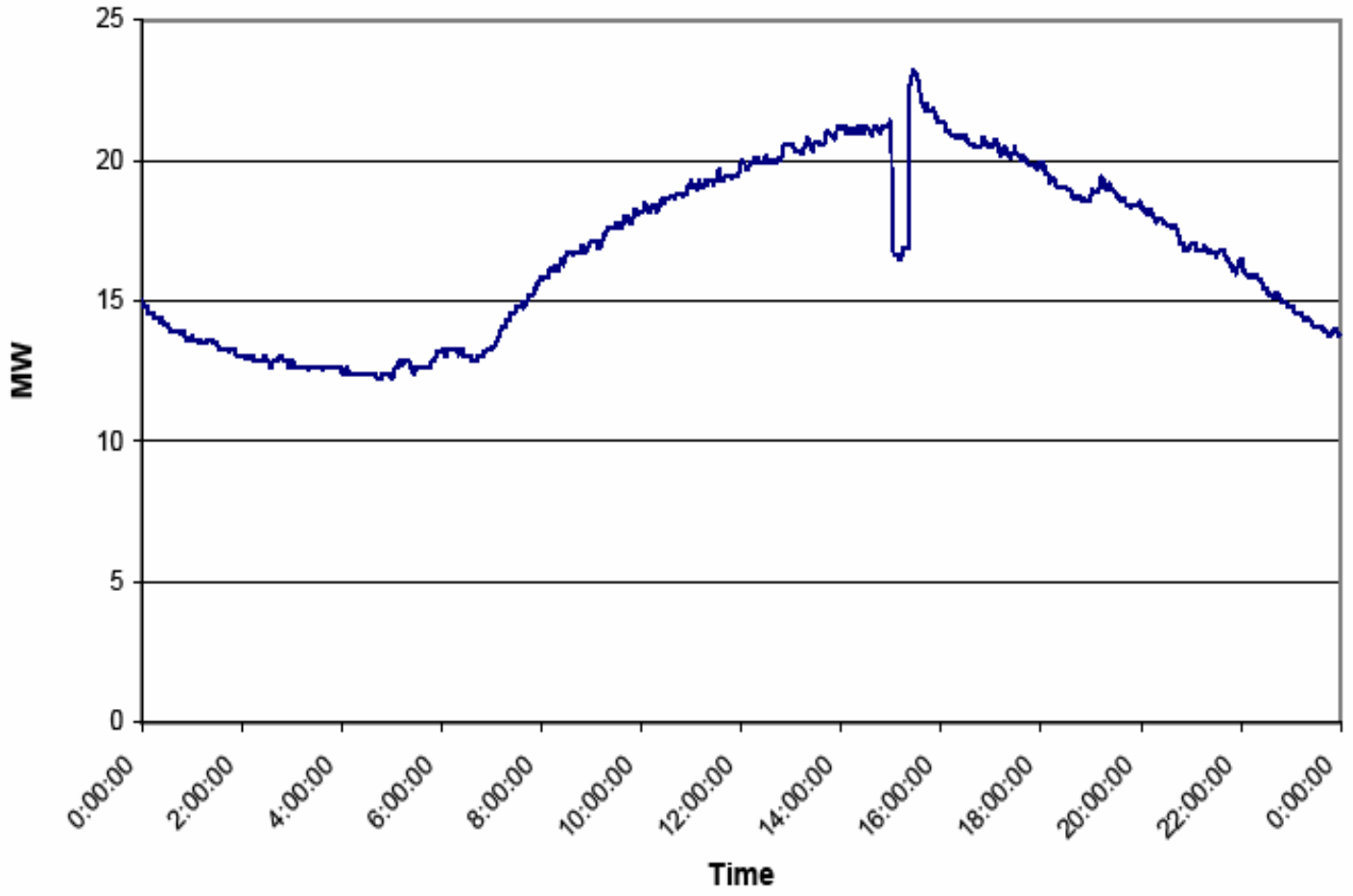
Load Estimation Algorithms

- One key deliverable of this pilot is determining whether the methodologies developed for proxy telemetry and settlement are sufficient for CAISO monitoring and settlement purposes.
- The PLP leverages three sources of data for forecasting, monitoring and settlement.
  1. *Telemetry Units on Air Conditioners*
  2. *SCADA data from T&D substation*
  3. *Interval Meter Data*
- PLP also monitored indoor air temperatures for a small subset of customers
- SCE partnered with BPL Global to collect telemetry data and Kema to develop forecast, monitoring and settlement algorithms.
  - This team built on work from 2008's Spinning Reserves Pilot.

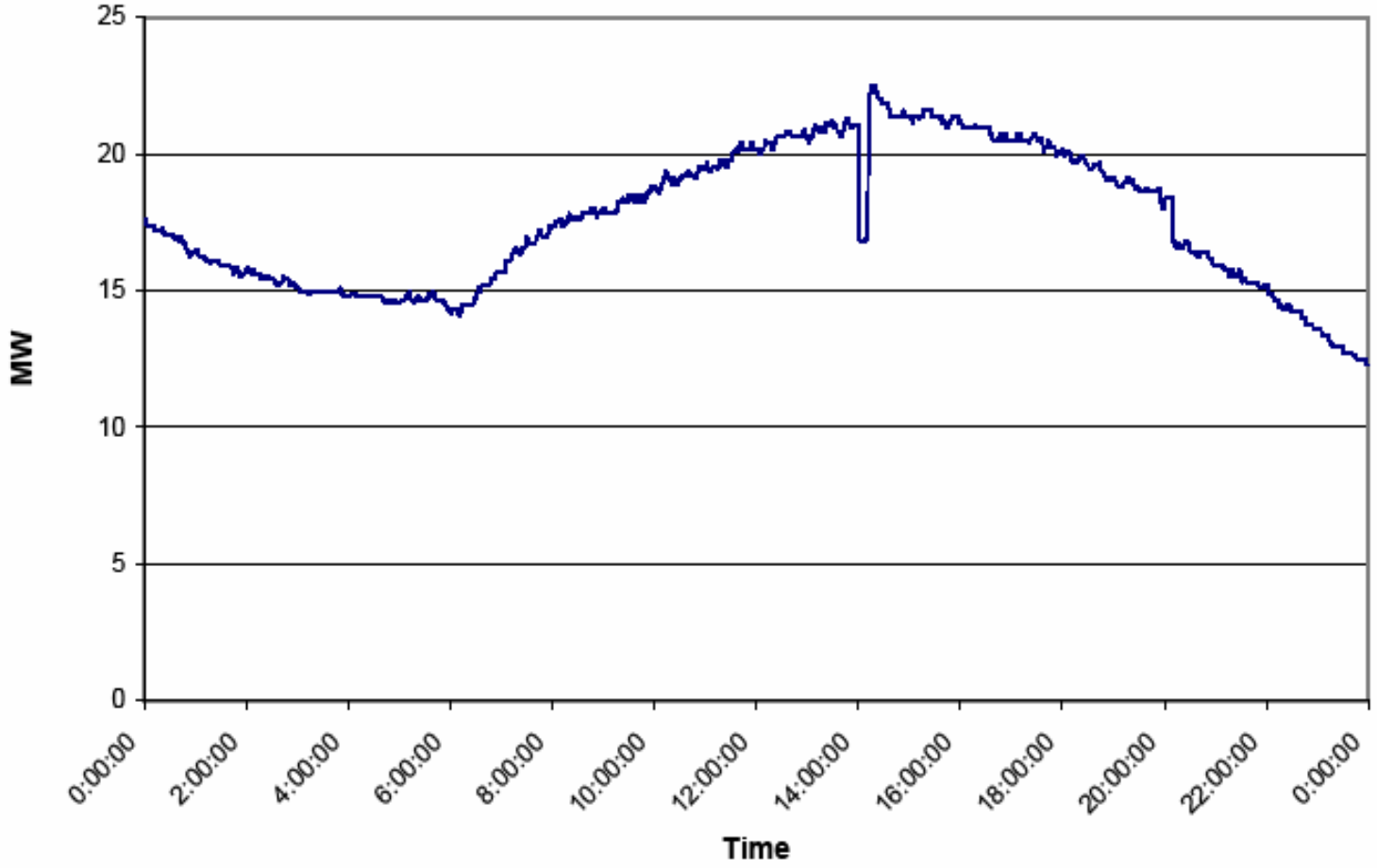
Tested the Systems June



Conducted test dispatches (July)



Bid into the Wholesale Market (Aug – Oct)



Published Our Findings

- Highlights of our Final Feasibility Report include the following initial findings…

1. Load drops are clearly visible from SCADA data which could be utilized as an aggregated meter point for settlement purposes.
   - *However, this sub station was at the end of the line*
2. Telemetry, once refined, can explain up to 94% of underlying load.
3. Weather data can explain up to 88% of underlying load.

Additional findings

1. A small survey of 110 participants with only 16 responses indicates
   - *Short (20 min) duration events are not noticed by residents*
   - *Majority of residents turned on and off the AC manually rather than utilizing their Programmable Thermostat functionality*
2. At least 10% sampling is needed to achieve an acceptable level of proxy telemetry given a proxy telemetry sampling approach
3. AC load rebound after 100% cycling DR events can result in:
   - *6% increase in load compared to anticipated load absent the event*
   - *Area under rebound curve can be 20% of the event energy*
4. Indoor air temperature analysis of 3% of participants:
   - *86% of monitored homes experienced less than 0.5º F increase during events*
   - *9% of monitored homes experienced more than 1.5º F increase during events*

2010 Proposed Pilot

- Interested in applying findings to a more general population
- Further explore leveraging SCADA data and temperature forecast to predict DR performance and settle the resulting load drop
- Begin utilizing CAISO Proxy Demand Resource (PDR) market product for bidding, scheduling, dispatching and settling DR in the wholesale market

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Backup Information

CAISO MRTU & PDR

What is PDR?

- PDR is a wholesale market product for Demand Response (DR) in the California Independent System Operator's (CAISO's) Market Redesign and Technology Upgrade (MRTU)
  - *ISO Board of Governors Approved PDR proposal in September, 2009*
  - *More Information: http://www.caiso.com/23bc/23bc873456980.html*
- PDR is essentially paying a Demand Response Provider (DRP) to initiate DR instead of paying a generator to produce more electricity to meet demand
- PDR meets the requirements of FERC Order 719 requiring "direct participation" of DRPs in wholesale electric markets
  - *SCE (a regulated IOU) can play the role of a DRP*
  - *Independent parties with a Schedule Coordinator can also be DRPs*
- CPUC opening a proceeding on "Direct Participation" to work out the details
  - *More Information: http://docs.cpuc.ca.gov/published/proceedings/R0701041_doc.htm*

MTRU is based on Locational Marginal Pricing (LMP)

- Electricity costs more when it is in a transmission constrained area or when it is far away from a generation resource
- SCE territory is our Default Load Aggregation Point (DLAP)
- CAISO has initially divided SCE territory into six Sub LAPs (SLAP)
- PDR is bid at the Aggregated Pricing Node (APNode)
  - *APNodes are defined by the DRP*
  - *An APNode can be as large as a SLAP*
  - *An APNode must be contained within a SLAP and cannot span between two SLAPs*
  - *Pricing is based on the weighted average of the Pricing Nodes (pnodes) within the APNode*
  - *A PDR resource in a APNode can be defined as a single resource or an aggregation of resources*

How does PDR Work?

- A PDR bid is submitted by a DRP to curtail load at a APNode using a “proxy generator resource”
  - *LSE continues to schedule forecasted load at the DLAP*
  - *The LSE and the DRP may be the same or different entities*
  - *Settlement for the curtailed portion of the load would be settled by the ISO directly with the DRP at the PDR’s specified APNode*
  - *Determination of actual PDR delivery will be derived from revenue meter data and calculated from a “10 in 10” aggregated baseline*
  - *A PDR resource can be registered with CAISO as a single resource or an aggregation of resources*


Questions
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