



# **Transactive Applications of OpenADR**

Sila Kiliccote and Mary Ann Piette

Demand Response Research Center Lawrence Berkeley National Laboratory

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## **Outline of the Presentation**

- Overview of OpenADR
- **Sample** transactive applications of OpenADR (2009present)
  - Small Commercial Buildings (Taco Bell)
  - An Office Building in CAISO's Participating Load Program
  - Price Response in NY
  - Automated Demand Bidding Program
  - Automated Capacity Bidding Program



# Automation is key to participation



- Provides non-proprietary, open standardized DR interface
- Allows electricity providers to communicate DR signals directly to existing customers
- Uses common XML language and existing communications such as the Internet



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# **Small Commercial Buildings**

- Small Commercial study with SCE
- Two Taco Bell sites in SCE's territory

#### Objective:

To evaluate the use of programmable communicating thermostats (PCT) in small commercial buildings in closed-loop control with utility demand reduction signals and understand the market for the PCT beyond residential buildings.



## **Small Commercial Building - Architecture**



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# Small Commercial Building – Extent/Transactions/Parties

- Designed to be used from end-to-end (utility to end-use)
- Multi-site (two Taco Bells in two cities)



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### Small Commercial Building – Cont.

- Transactions: % reduction in load for a pre-negotiated \$/kWh
- Transacting Parties: Utility and thermostat, fully automated.
- Temporal Variability: Event driven and hourly granularity
- Interoperability: OpenADR 1.0
- Value Assignment: Utility determined.
- Alignment of Objectives: Customer weight the cost/benefits of participation and set the limits. Opt-out available
- Stability Assurance: Utility monitors and controls it.



Kiliccote, S., M. A. Piette, J. H. Dudley, E. Koch, D. Hennage. Open Automated Demand Response for Small Commercial Buildings. July 2009. LBNL-2195.

# **Participating Load – Office Building**

- Participating Load Pilot with PG&E
- Three sites focus is one of the sites

#### Objectives:

- Using day-ahead DR strategies for nonspinning reserves.
- Measuring response time and signal latencies





#### **Participating Load - Architecture**



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# Participating Load Pilot– Extent/Transactions/Parties

- Designed to be used from end-to-end (CAISO to end-use)
- Multiple sites



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# **Participating Load Pilot – Cont.**

- Transactions: kW reduction in load for market price
- Transacting Parties: CAISO and HVAC system, fully automated.
- Temporal Variability: Event driven. 4 second measurement and hourly settlement granularity
- Interoperability: OpenADR 1.0
- Value Assignment: DR is a price taker, value is CAISO market determined.
- Alignment of Objectives: Customer like short duration events. Opt-out available
- Stability Assurance: CAISO monitors and controls it.



Kiliccote, Sila, M. A. Piette, G. Ghatikar, E. Koch, D. Hennage, J. Hernandez, A. Chiu, O. Sezgen and J. Goodin. Open Automated Demand Response Communications in Demand Response for Wholesale Ancillary Services. Grid Interop. November 2009. LBNL-29-45E

# Mandatory Hourly Pricing (MHP) in NY



Metropolitan Transportation Authority



One World Financial Center

Purpose: demonstrate OpenADR to support hourly price responsive demand for large customers in NYC

- Partners: LBNL, Honeywell, with review from NYISO & ConEd
  - Methods: Optimal DR strategies
    - Energy Cost Minimization
    - Peak Demand Minimization



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# **Mandatory Hourly Pricing in NY- Architecture**





# **MHP in NY– Extent/Transactions/Parties**

- Designed to be used from end-to-end (NYISO/LBMP to end-use)
- Multiple sites





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# **Participating Load– Cont.**

- Transactions: kW reduction in load for market price
- Transacting Parties: Utility and HVAC system, fully automated.
- Temporal Variability: Hourly price driven. Hourly settlement granularity
- Interoperability: OpenADR 1.0
- Value Assignment: value of electricity reduced is loacational marginal prices
- Alignment of Objectives: Customers choose price thresholds for low power mode action
- Stability Assurance: NYISO monitors and controls it.



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# Automated Demand Bidding Program (AutoDBP)

- Offered to PG&E and SCE customers
- 100s of sites

#### Objectives:

• Flexible, voluntary program with no penalties



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#### **Automated Demand Bidding Program- Architecture**



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### **AutoDBP– Extent/Transactions/Parties**

- Designed to be used from end-to-end (utility to end-use)
- Multiple sites







Bid, Ack, Telemetry/Meter data

- PG&E may issue day-ahead event under 1 or more conditions:
- CAISO day-ahead load forecast exceeds 43 GW;
- CASIO issues an Alert or higher level notice;
- Forecasted temp for Load Zone exceeds temp threshold for Load Zone; or
- PG&E forecasts that generation resources or electric system capacity may not be adequate.



#### AutoDBP– Cont.

- Transactions: Auto-bid (kW) Auto-shed kW reduction in load fixed price (\$0.50/kWh)
- Transacting Parties: Utility and end uses, fully automated.
- Temporal Variability: Event driven. Hourly settlement granularity
- Interoperability: OpenADR 2.0b
- Value Assignment: fixed pre-set value for DR
- Alignment of Objectives: Flexible duration, voluntary participation, opt-out available
- Stability Assurance: utility monitors and controls it through scheduling events.



# Automated Capacity Bidding Program (AutoCBP)

- Offered to PG&E and SCE customers
- 100s of sites





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#### **Objectives:**

- Flexiblilty,
- Allows aggregation
- Customers are available to provide DR as a capacity resource



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# Automated Capacity Bidding Program (AutoCBP)



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### **AutoCBP – Extent/Transactions/Parties**

- Designed to be used from end-to-end (utility to end-use)
- Multiple aggregated sites or self aggregated participants





### AutoCBP – Cont.

- Transactions:
  - Auto-bid (kW) Auto-shed kW reduction in load fixed price
  - Capacity and energy payments
- Transacting Parties: Utility and end uses, fully automated.
- Temporal Variability: Event driven. Hourly settlement granularity
- Interoperability: OpenADR 2.0b
- Value Assignment: fixed pre-set value for DR
- Alignment of Objectives: Flexible duration, voluntary participation
- Stability Assurance: utility monitors and controls it through scheduling events.



#### Thank you.

Mary Ann Piette MAPiette@lbl.gov Director, Demand Response Research Center Dept. Head, Building Technologies and Urban Systems Lawrence Berkeley National Laboratory

