

### Integrating Demand Response into Wholesale Electricity Markets

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### **Overview: Willingness to Have More DRs**

- Federal Energy Regulatory Commission, as well as some state Public Utility Commissions, are requiring Demand Response Integration
- The number of Demand Response Programs in various U.S. electricity markets is increasing
- The ultimate goal is to have DR programs fully integrated with the wholesale market and thus available to ISOs in a manner similar to generation



#### **Overview: Opportunities for DRs to Contribute**

#### • DR programs are available through:

- Regulated utilities (both Integrated IOUs and Unbundled Wire Companies)
- Competitive Retailers (Retail Electric Providers and Energy Service Providers)
- Aggregators (End-Use Aggregators or Curtailment Service Providers)
- DR programs could be offered in:
  - Real-Time Demand Response to Supplement Energy and Reserves
    - Energy Price Responsive Programs
    - Reliability Enhancing Services
      - Ancillary Services (Operating Reserves)
      - Emergency Curtailments

Day-Ahead Demand Response to Optimize Market Efficiency and Mitigate Market Power Abuses



#### **Overview: Generation and Load are Different**

#### Generation

≻Large scale

Dedicated to supplying power

#### • Load

Usually smaller scale

Electricity is usually a small input and not one of the important elements of the business

# • But the wholesale market is designed for generation and not load



### **Barriers: Market and Operational**

- Many challenges have to be overcome in integrating more Demand Response into the electric grid, including:
  - To identify the best use of demand resources
  - To determine reasonable technical requirements, which may be different from those imposed on conventional generation resources, that still maintain system reliability
  - To develop accurate performance measures and clearly define consequences for nonperformance
- The key barrier and the first step to overcome is to realize that Demand Response and Generation Resources are different and these differences must be considered in DR program design.



### **Barriers: Realizing Loads Perspective**

- The load customer perspective must be considered
  - Demand is driven by commercial interests such as manufacturing, services and retail sales
  - Demand response is a secondary consideration to the primary business
  - The cost to participate in a demand response program must be reasonable as compared to the potential financial benefit of participation



### **Barriers: Need for Different Technologies**

#### Generation

Connection to transmission system require highly reliable equipment, e.g. SCADA, which is often expensive

#### Demand

Many C&I customers have interval meters, but no realtime telemetry to the control area

The challenge is finding telemetry that provides sufficient data to the ISO and at reasonable cost to the customer



### **Addressing Integration Challenges**

#### • The importance of Pilots:

- DR Pilots are valuable and should be pursued first
- Building on successful pilots is the safest approach
- Addressing the key questions before full integration:
  - To what extent should DR participants be treated differently from generation resources?
  - What are the differences in technical and operational requirements for various DR programs?
  - > Are there any differences regarding system reliability?
  - What are the differences (if any) between participation from DA customers, bundled customers, and aggregators



### **Technical and Operational Requirements**

#### Technical

> Telemetry

Measurement and Verification

#### Operational

 Following instructions and responding within specified time period (automated or manual control)
 Remaining off the grid for specified down term

> Meeting the minimum performance measures



### Successful Examples: ERCOT Market

#### • Demand Response Programs:

- Load acting as Resource (LaaR) participates in Ancillary Service (A/S) in Day-Ahead Market (DAM):
  - Controllable Load to meet Regulation Services (100 MW)
  - Under Frequency Relay to meet Responsive Reserve Service (2,000 MW)
  - Providing Non-spinning Reserve
- Being curtailed voluntarily during emergency conditions as Emergency Interruptible Load Service (EILS) (310 MW)
- Curtailing energy consumption in Real-Time Market (RTM) as Balancing Up Load (BUL)
- Capacity payments are associated with all programs
- Such programs are offered through Qualified Scheduling Entities (QSEs)



### Successful Examples: NYISO Market

- Reliability-based programs NYISO controls activation
  - Purpose: Provide load reductions to supplement generation when operating reserves are forecast to be short or actual Operating Reserve Deficiency
    - Emergency Demand Response Program (EDRP) (364 MW)
    - ICAP-Special Case Resources (ICAP/SCR) (1,744 MW)
- Economic-based programs Resource determines when to participate through bidding
  - Purpose: load reduction acting as and competing with generation
    - Day-Ahead Demand Response Program (DADRP) (331 MW)
    - Demand-Side Ancillary Service Program (DSASP) (New DR)

Source: Donna Pratt, NYISO's Demand Response Programs, January 2009, Slide No. 6.



### **Successful Examples: ISO-NE Market**

#### • Reliability Programs:

Customers respond to reliability conditions as determined by the ISO-NE Operators

#### • Price Responsive Programs:

- Customers respond to Real-Time prices in the market
- Customers can participate in Day-Ahead Wholesale Market offering to reduce their load next day based on market prices

#### • Forward Capacity Market:

- Other Demand Resources ("ODRs") with durability and sustainable performance may participate in the wholesale capacity markets where a minimum of 100 KW is required:
  - Energy efficiency
  - Load management
  - Baseload distributed generation

## • There were about 2,000 MW of DR enrolled as of January 2008



### Successful Examples: PJM Market

#### • Economic Load Response:

- Day Ahead Market
- Real Time Market
- Dispatched by PJM in Real Time

#### • Emergency Load Response:

- Energy Only Option (Voluntary)
- Capacity Only Option (Mandatory)
- Full Emergency Option (Mandatory)



### **Successful Examples: Lessons Learned**

- Electricity markets have about 10 years of experience with DR integration and key Issues have been either addressed or are pending solutions
- Solutions are predominately market based
- While variety of approaches are used to address key challenges, it is still possible to identify "best practices"
  - > Customer education is critical to encourage more DR participation
  - Several DR options should be provided to attract different classes of customers
  - Interconnection agreements between Retailers and Customers should be standardized and properly reflect "net metering"
  - > Technical requirements by ISOs should be minimal and reflect the type of DR in question
  - > Market rules should be clearly defined and penalties for nonperformance should be reasonable
  - Customer Baseline Load calculation should be easy to understand
  - Accurate and time-sensitive price signals should be provided in a timely manner to allow adequate time for Demand Response
  - > Pilot programs should be relied upon to identify practical and effective DR options



### **Pilot – Bridging the Gap**

#### Technology Challenge

- Provide sufficient load usage data to the ISO
  - Replicate SCADA Instantaneous rather than interval information
  - Is 4 second data really required?
- How reliable is manual dispatch?
  - Collect data and analyze
- If possible send ISO dispatch orders to dispersed distribution system loads (Demand Response)
  - When practical, test Auto DR



### **SDG&E Participating Load Pilot**

- SDG&E's pilot is an ambitious attempt to answer many of these questions.
  - The pilot will include both bundled and Direct Access customers
  - Customers can participate directly with the utility or through an Aggregator (Curtailment Service Provider)
  - The pilot will install near real-time usage data to the CAISO
  - Some loads may be controlled using Auto DR



### **Need for Standard Approach**

#### Markets to Participate

- Energy (Day-Ahead and Real-Time)
- Capacity (Reserves and Emergency)

#### • Pricing Options

- > Wholesale
- Retail

#### Requirements

- Telemetry
- Accurate Metering
- Operational Requirements

#### • Performance Measurements

- Customer Baseline Load
- Nonperformance penalty



### **Conclusions & Final Remarks**

- Barriers to Demand Response participation should be avoided
- Retail Electric Providers/Load Serving Entities
  should be encouraged to facilitate/explore demand
  response opportunities
- Technical requirements should be the minimum necessary for integration
- Measurement and Verification should be implemented to verify the impacts
- Pilot projects should be implemented to address shortcomings



### **Q & A**



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