Demand Response in the PJM Synchronized Reserve Market: Experience and Prospects

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Ancillary Services

- Regulation - a automated response service that resources offer to provide fine tuning for power balance that is necessary for effective system frequency control
- Synchronzed Reserve – quick response service that resources offer to maintain grid reliability during system events (i.e. large generator trip or low Area Control Error)
Energy is Co-optimized with Regulation and Synchronized Reserve in Unit Dispatch Software

- DMT = Dispatcher Management Tool
- UDS = Unit Dispatch System
- EMS = Energy Management System

Diagram:
- Markets Database
- Settlement Database
- UDS
- DMT
- EMS
- Resource Owner

Connections:
- Bids / Offers
- Assignments
- Dispatch Instructions/Assignments
- Sync. Res. / Reg. Assignments
- State Estimator Solution
- Dispatch, Sync. Res., Regulation Signal
- Unit MW & Regulating Capability
Resource Dispatch in Real-time Operations

PJM generates dispatch Signal, synchronized reserve assignment and regulation signal

Generation Operation Center

Curtailment Service Provider

Response Total MW Spin and regulation
Unit Dispatch Instructions

Response Total MW Spin and regulation
Load Dispatch Instructions

Gen Unit

Gen Unit

Gen Unit

Gen Unit

Gen Unit

Flex. Load

Flex. Load
• Examples of Customer Response to provide synchronized reserve
  - **Industrials** – required more automated controls on production lines and processes
  - **Hospitals** – installed control systems on backup facilities and integrated them with building control system
  - **Universities** – Installed more advanced building control systems, also installed integration technology for building control systems to manage demand across multiple buildings
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Demand Resources Certified as Synchronized Reserve

As of December, 2008 the Market had 81 Active Registered DR Participants, some of these have multiple sites.

- **2006**: 116 MW Certified, 116 Maximum MW offered in single hour
- **2007**: 129 MW Certified, 129 Maximum MW offered in single hour
- **2008**: 410 MW Certified, 410 Maximum MW offered in single hour
Demand Side Response as Synchronized Reserve

DSR Participation in PJM Synchronized Reserve Markets

- Total Payments
- MWh Cleared
Synchronous Reserve Event Participation
10+Min Events, 2002 - Present

Generators

Demand Side Response

- Foodservice
- College/University
- Chemical
- Metalworks
- Manufacturing
- Hospital
- Stone/Cement
- Scrap Metal
- Pharmaceuticals
- Tools/Machinist
- Nursing Home
- Water Utility
- Recreational
- Business Services
- Telecommunications
- Waste Management
Mid-Atlantic Grid Interactive Car Consortium Demonstration Project

- Mid-Atlantic Grid Interactive Car Consortium (MAGICC) – electric companies, research institutes, and vehicle manufacturers
- **Over one year experience** with the MAGICC battery electric vehicle responding to the PJM regulation signal
AES grid-scale energy storage system

Operational Details

- Altairnano, Inc – Lithium Ion nano titanate battery
- Power: 1 MW for 15 minutes
- Usable Charge Range: 5% - 99%
- Energy: 300 kWh
- Efficiency: 90% round trip
Findings: RTO REG signal does not take full advantage of the capability of the resource
PJM proposed modified REG signaling should allow for very high service rate from limited energy resources.

Consistently net negative (with long durations in one direction) which fill or drain the battery.

Very balanced and could make a great signal for limited energy resources.

A PJM proposed, frequency focused, REG nearly as balanced as pure ACE.

**Performance**:
- **Model**: 52%
- **Actual**: 52%

**Performance**:
- **Model**: 92%
- **Actual**: Not available for test

**Performance**:
- **Model**: 93%
- **Actual**: TBD