Alcoa – Dynamic Demand Response
DOE Workshop – 10/25-10/26
Alcoa at a Glance

- Founded in 1888
- 200+ locations
- 31 countries
- $21.0 billion 2010 revenue
- Alcoa’s lost workday injury rate is 1/10 that of the average U.S. manufacturing workplace
- Award-winning sustainability leadership
- 120 years of aluminum technical leadership, including the original aluminum process

Number of Employees (2010)

<table>
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<tr>
<th>Region</th>
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<tbody>
<tr>
<td>U.S.</td>
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<tr>
<td>Europe</td>
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<td>Other Americas</td>
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<td>Pacific</td>
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59,000
Alcoa Energy Business

- Alcoa - A Major Consumer of Energy
  - Over 3000 MW’s of Load in US
  - Over 1400 MW’s of Generation in US (800 MW’s of Renewable)
  - 2/3 of Global Energy Demand is supplied through Renewable Energy

- The Only Supplier of Controllable Demand Response in MISO
  - 70 MW’s of Direct Load Control, 24 hrs a Day for over 2 years.
  - 75 MW’s of Interruptible Spinning Reserves for over a 1 ½ years.
  - Enabled by Advanced Meters and Integrated Controls
Alcoa’s Traditional Energy Demand Response

- Alcoa has many types of loads.
  - High Load Factor - Smelting
  - Block Load - Rolling
  - Traditional Industrial
  - Alcoa Loads in the US are nearly 3000 MW’s/hr at Peak

- Alcoa has a long history of Demand Response
  - Emergency Response
  - Load Shifting
  - Load Factor Optimization

![24 Hr Load Profile with Reliability Interruption](image)
Drivers for Expanded Demand Response

- Rising Energy Costs
  - Energy can be 40% of the cost of Aluminum Production
  - Global Competition

- Support for Grid Reliability (Less Reserves)
  - System Emergencies
  - Ancillary Services

- Integration of Intermittent Technologies
  - Wind
  - Solar

- Focus on Clean Energy Alternatives
  - Demand Response is a Clean Alternative

- Markets for Procurement of Energy and Ancillary Services
Direct Load Control
- Load Following
- Price Responsive Demand
- Emergency Response (10 min)

Directly Competitive in Market

Contingency Reserves (5 min)
- Regulation (4 sec)
- Planning Capacity
Key Enablers to Demand Response at Warrick

- **Advanced Metering**
  - Understanding Consumption
- **Data Availability**
  - Accessibility
  - Visualization
- **Integrated Control Systems**
  - Systems that Use the Data to Respond
- **Dynamic Business Models**
  - Co-Optimization of Markets and Business Objectives

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Warrick Performance Statistics in MISO Market

- Outstanding Performance!

- DRR Type II – Controllable Load
  - (providing Regulation, Spin, Energy)
  - 2011 – Available 284 Days (as of Oct. 12)
  - 2011 – (4) Failure to Respond of 6818 (1) hr Intervals
  - 2011 – (83) Excessive/Deficient of 81,742 (5) min Intervals
  - 2010 – Available 365 Days
  - 2010 – (123) Excessive/Deficient of 105,120 (5) min Intervals

- DRR Type I – Interruptible Load (providing Spin Reserves)
  - 2011 – Available 268 of 284 Days
  - 2011 – 36 Deployments (2 failures) – Avg Duration: 40 min.
  - 2010 – Available 317 of 317 Days
  - 2010 – 52 Deployments (1 failures) – Avg Duration: 41 min
Best Practice Sharing to Other Alcoa Locations

- Mt. Holly
  - Active Load Factor Optimization
  - Testing “Spin Reserves” and “Regulation”
  - Issues with Compensation and Dispatch Algorithms

- Massena
  - Active Load Factor Optimization
  - Issues with Compensation and Metering Requirements

- Intalco
  - Load Shifting and Load Factor Optimization

- Wenatchee
  - Interruptible Loads

- Alumar
  - Attempting to deploy spinning reserves and interruptible response.
Keys to Fitting Demand Response into the Grid

- **Accessibility to Markets and/or Traditional System Operations**
  - Loads Often Constrained by Local Utility
  - Utility Model Can Create Competing Objectives
  - State and Federal Involvement

- **Modeling of Demand Response**
  - Flexible Models to Capture Unique Characteristics
  - Generation has had a Century of Modeling
  - Integration of Production Priorities

- **Metering**
  - Investment Costs

- **Compensation**
  - Comparable Payment for Comparable Performance
  - Cost Recovery is a Necessity
MISO Modeling Issues

- MISO Dispatch Algorithm – Forces DR into Generator Mold
  - Will not allow Injection and Withdrawal from a single resource, but DR can do both.
  - Offers are Generator Centric
  - A model for DR is needed

- Regulation is a Symmetric Product
  - DR can provide much more Asymmetric Regulation

- No Incentives for Speed or Accuracy of Response
  - Current models constrain quicker response through capacity limitations
  - Regulation is ramp rate times 5 minutes
  - Spin Reserve is ramp rate times 10 minutes
MISO Modeling Issues

- **Single Value Pricing for Ancillary Services**
  - For DR, cost of 10 MW’s of regulation is different from cost of 20 MW’s of regulation.

- **Limitations on Interruptible participation in Spin – 10%**
  - Current constraints limit compensation on Interruptible Demand Response
  - Price separation for resources

- **No ability to limit the Maximum Daily Energy**
  - This parameter (if used during regulation) would provide valuable protection during regulation and spinning reserve deployments

- **Order 745 Issues – Net Benefits Test**
  - Current proposals and settlements would diminish DR participation
Key Learning's from Alcoa’s DR Experiences

**Stronger Economic Viability**
- Energy Cost Reduction
- Minimization of Market Volatility
- Economic Market Integration
- Ancillary Services Compensation

**Reliability Improvements**
- Reduced Customer Outages
- Increased Grid Stability

**Environmental Benefits**
- Alternative Supplier of Ancillary Services
- Potential for Total Ancillary Service Reduction
- Support Integration of Alternative Energy Sources
Thank you!

Alcoa can’t wait for tomorrow

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