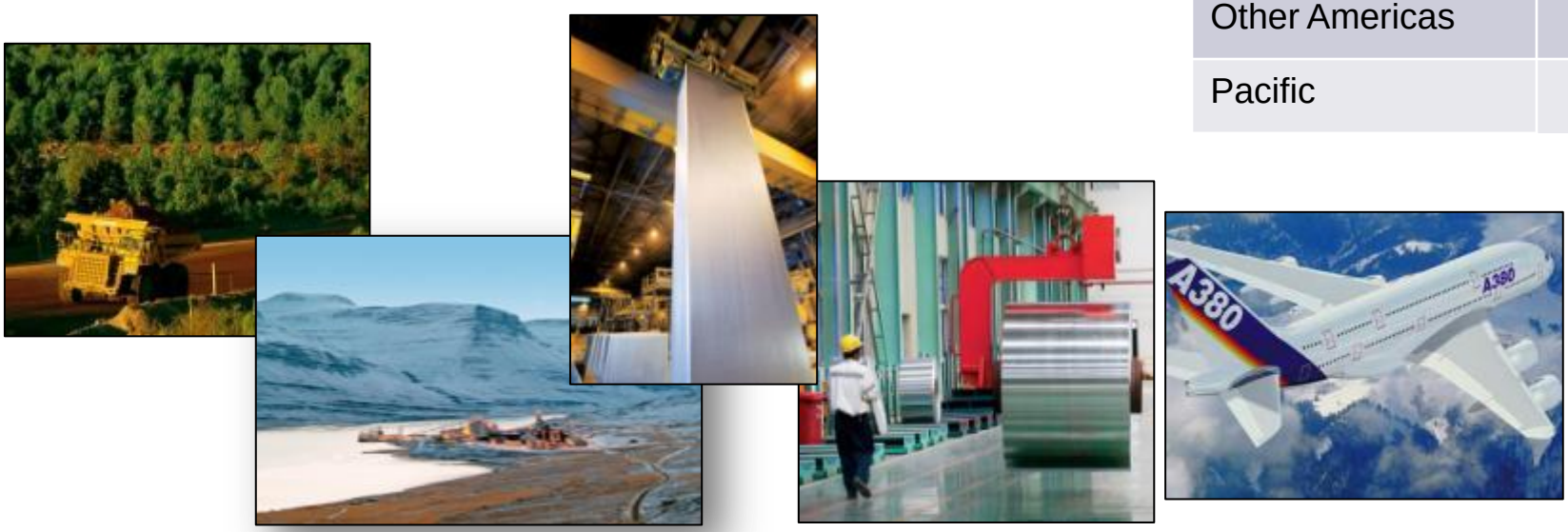
Alcoa – Dynamic Demand Response
DOE Workshop – 10/25-10/26

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)	
U.S.	24,000
Europe	17,000
Other Americas	11,000
Pacific	7,000
	59,000



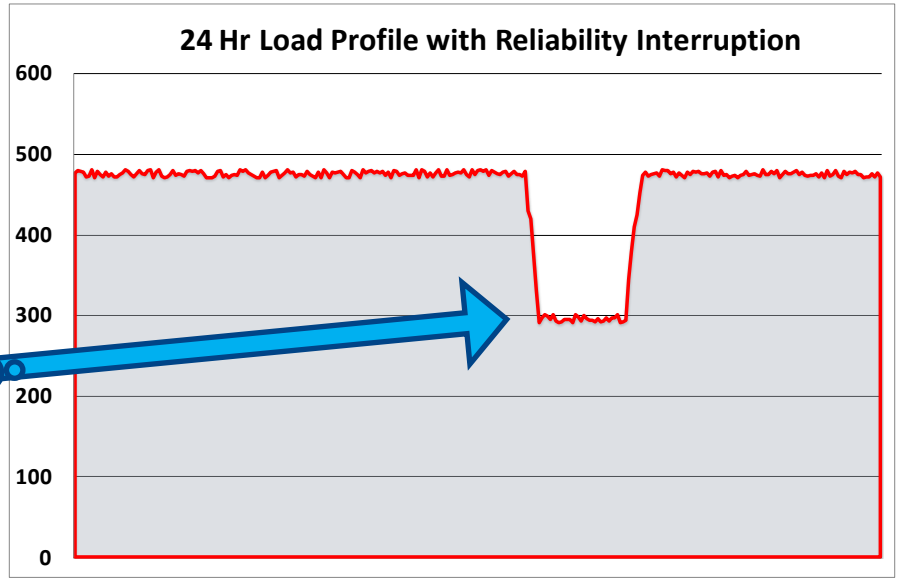
Alcoa Energy Business

- **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

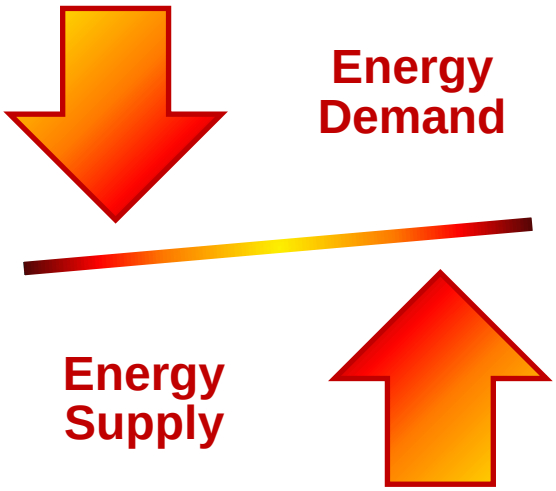
- **Alcoa has many types of loads.**
  - **High Load Factor - Smelting**
  - **Block Load - Rolling**
  - **Traditional Industrial**
  - **Alcoa Loads in the US are nearly 3000 MW's/hr at Peak**
- **Alcoa has a long history of Demand Response**
  - **Emergency Response**
  - **Load Shifting**
  - **Load Factor Optimization**

Traditional Load Shedding



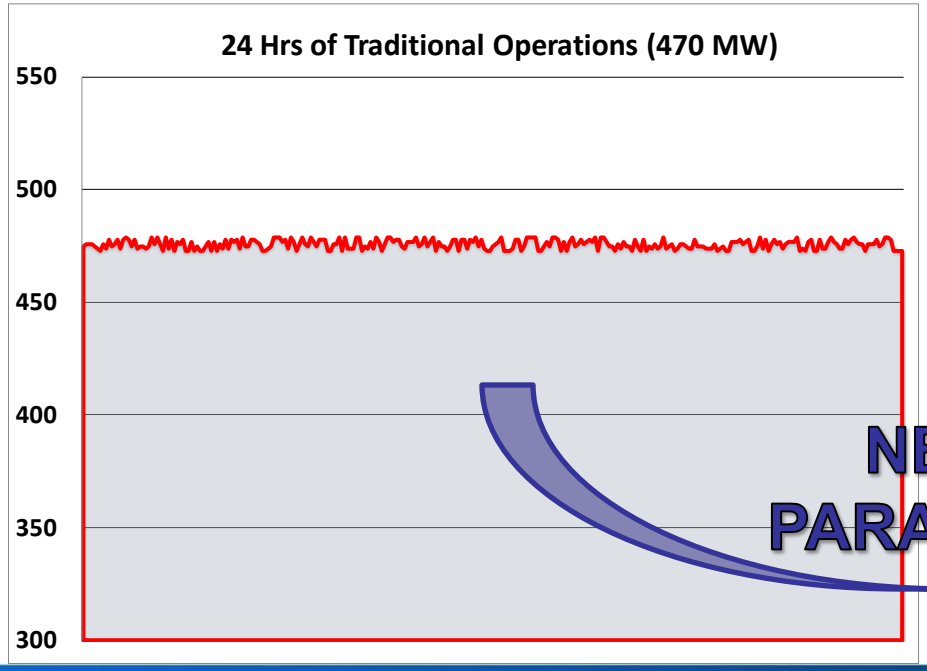
Drivers for Expanded Demand Response

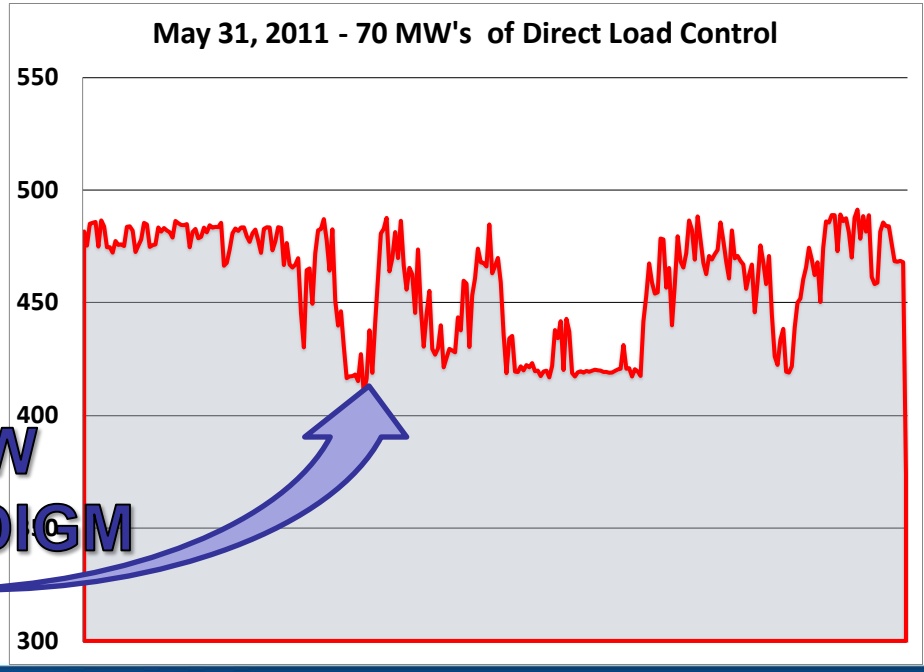
- **Rising Energy Costs**
  - **Energy can be 40% of the cost of Aluminum Production**
  - **Global Competition**
- **Support for Grid Reliability (Less Reserves)**
  - **System Emergencies**
  - **Ancillary Services**
- **Integration of Intermittent Technologies**
  - **Wind**
  - **Solar**
- **Focus on Clean Energy Alternatives**
  - **Demand Response is a Clean Alternative**
- **Markets for Procurement of Energy and Ancillary Services**



Demand Response Redefined at Warrick

- **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

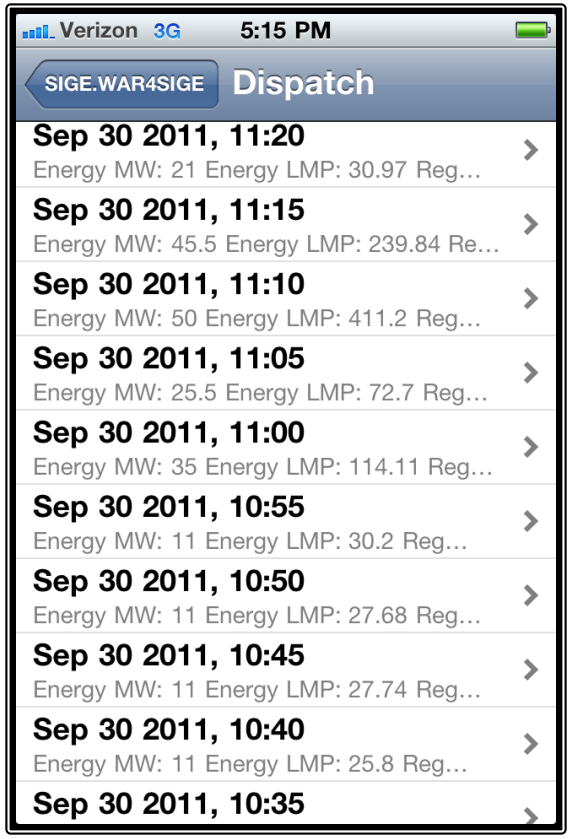




NEW PARADIGM

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**



Warrick Performance Statistics in MISO Market

- **Outstanding Performance!**

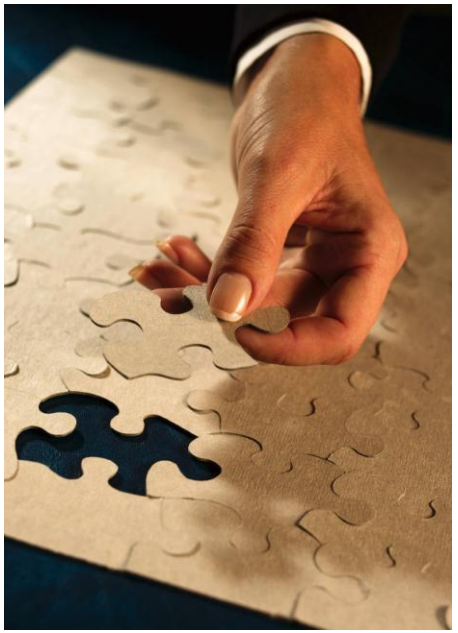
- **DRR Type II – Controllable Load**
  - **(providing Regulation, Spin, Energy)**
  - **2011 – Available 284 Days (as of Oct. 12)**
  - **2011 – (4) Failure to Respond of 6818 (1) hr Intervals**
  - **2011 – (83) Excessive/Deficient of 81,742 (5) min Intervals**
  - **2010 – Available 365 Days**
  -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

Questions?

Thank you!

Alcoa can't wait for tomorrow

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