Technical Assistance to the New England Demand Response Initiative (NEDRI)

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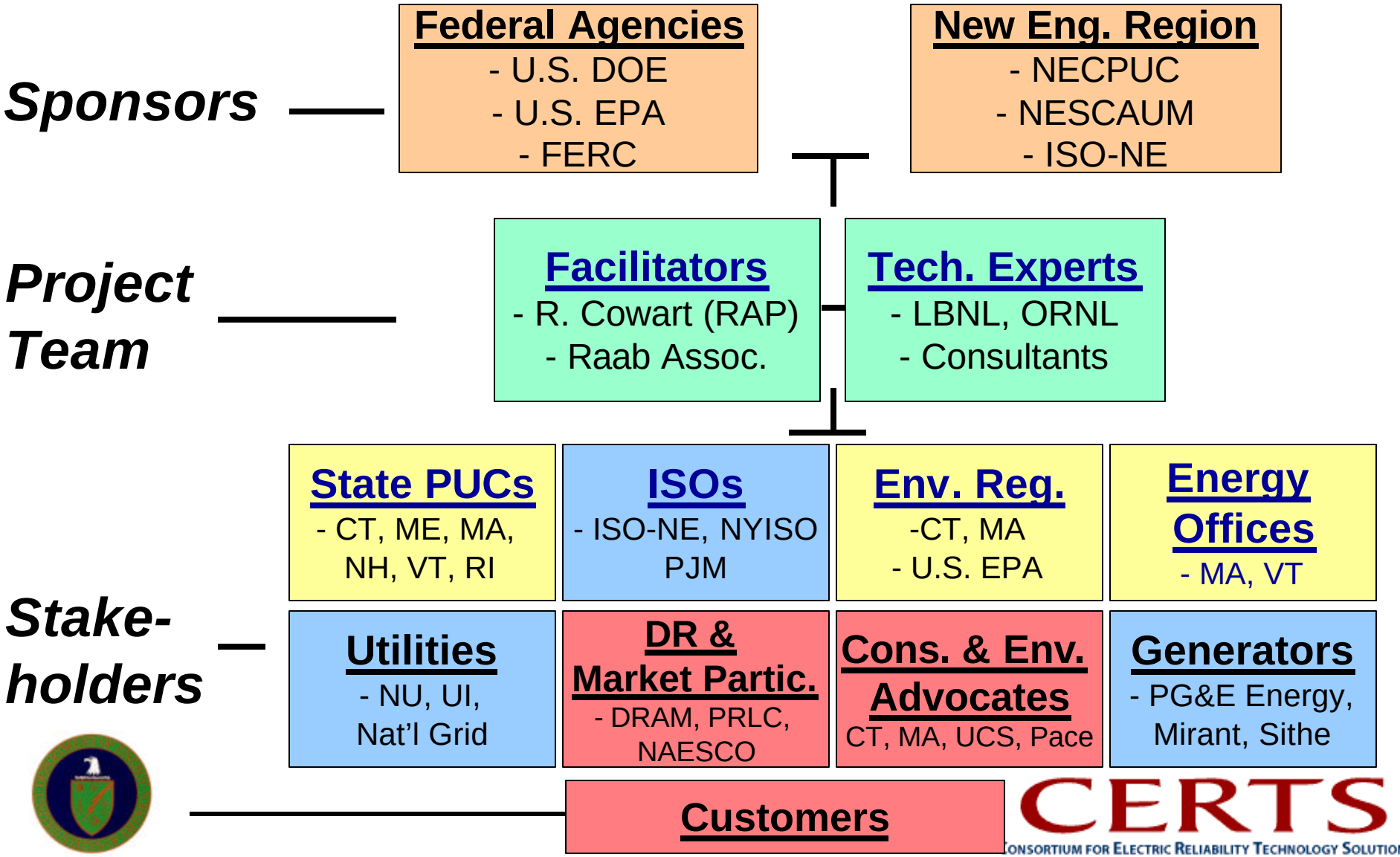
Project Objectives

- **Identify short-term and long-term demand response opportunities in New England**
- **Identify barriers at wholesale and retail markets and regulation**
- **Propose consensus-based, coordinated policies and programs for the region**
  - For ISO-NE, and to recommend to FERC
  - Recommendations for state PUCs and environmental regulators
- **Support viable business models for Demand Response**

Key Stakeholders and their Involvement



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NEDRI's Broad View of Demand Response Resources

- "Include all intentional modifications to electric consumption patterns of customers that are intended to modify the timing or quantity (including both the level of instantaneous demand and consumption) of customer demand on the power system"
- Dimensions of DR:
  - How called: Dispatchable, Scheduled, Deployable
  - Availability: few hours, up to many years
  - Nature of customer's response:
    - efficiency & conservation
    - short-term load curtailment or shift
    - increase in onsite generation

Restructuring does not resolve barriers to DR Resources

- *Break-up of the utility franchise*
  - *Who is responsible for EE and LM?*
- *Distribution companies – retain throughput incentive*
- *Supply-only bidding at wholesale*
- *Default service plans (averaged rates) blunt wholesale mkt. price signals to customers*
- *Load profiling blunts incentives to retailers*
- *Reliability rules and practices that exclude DR resources*

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NEDRI Final Report: Dimensions of Demand Response

- *Regional Demand Response Programs*
- Retail Pricing and Advanced Metering
- Energy Efficiency as long-term Demand Response Resource
- *Opportunities for Load Participation in Contingency Reserve Markets*
- DR Resources and Power Delivery System
  - transmission congestion relief, prices and expansion plans

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Regional DR Programs: What do Customers Want?

- **Focus Group Results:**
  - Timely and certain payments for performance
  - Relatively certain stream of benefits in order to make "business case" for investment
  - Easy to enroll and participate ("Low hassle factor")
  - DR Enabling technology that can be used to manage energy costs
  - Customized, tailored service offerings
  - Minimal Downside risks (e.g., performance penalties)

ISO-NE 2003 Regional Demand Response Programs

	Reliability	Price
Large C/I Customers	Real-Time Demand Response (RT-DRP) ➢30-Minute notice ➢2-Hour notice	Real-Time Price Response Program
Groups of Smaller Customers	Real-Time Profile Response Program	

➢ Day-ahead market DR program: under development

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Regional DR Programs: NEDRI Recommendations

1. **Strengthen the Real-Time DR Program**
   - Higher minimum floor payments for load curtailments
   - Lower entry barriers for DR Providers (e.g. drop $5000 participation fee)
   - Increase program stability: Longer-term commitment (3 years with option to extend)
   - Offer location-based capacity payments to enrolled customers

Regional DR Programs: NEDRI Recommendations

2. Strengthen the Day-Ahead DR Program

- Permit smaller bidding increments
- Permit standing offers; don't require daily bids
- Equal bid ceilings for supply and demand-side bids

➢ **Status**

- FERC requires implementation of price-driven Day-Ahead DR Program
- Program development underway (summer 2004)

NEDRI Recommendations: Financial Support for Regional DR Programs (cont)

3. **Provide location-based capacity credits to DR resources**
4. **Provide adequate resources and cost recovery to DR programs**
5. **Evaluate and improve DR programs**
   - **Conduct independent evaluation of DR program**
   - **Enhance effectiveness of DR Working Group**
6. **Ratepayer funding to overcome customer market barriers to and increase participation in DR programs**

- **Performance-based metering and telemetry to reduce unnecessary costs**

NEDRI Recommendations: Environmental Policies for Regional DR Programs (cont)

- **Key Issue: Increased use of "dirty" back-up generators**

7. Monitor & Limit Environmental Impacts of DR Programs

- Air regulators should adopt output-based, technology neutral standards for onsite generators

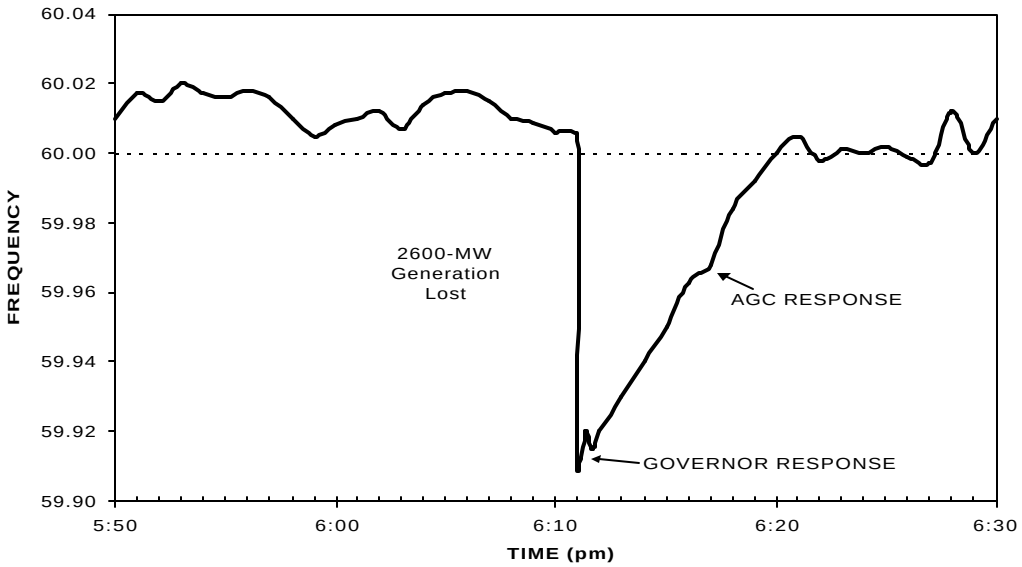
8. Dist. Generation: Customer-sited generation that is "clean" and "behind the meter" should be eligible to be treated as DR Resource

Load Participation in Contingency Reserves Markets

- Essential idea: Spinning, supplemental, and replacement reserves to meet power system contingencies can be provided by supply-side or load resources
- Reserves are needed to:
  - Balance real-time generation and load
  - Manage power flows across transmission facilities
- Challenges for DR resources:
  - System operators need to control and monitor real-time status and performance
  - Individual loads are small – resources need to be aggregated
  - Is the resource pool big enough to matter?
  - Can the resource be dispatched for sufficient duration?
  - Tradition: current rules tailored to supply-side resources

Load Participation in Contingency Reserves Markets: Background

- **Power System Reliability Events Are Fast, Infrequent and Relatively Short.**



- **Loads can provide *Contingency Reserve services, given their characteristics***
  - Fast response
  - Fast deployment
  - Redundancy
  - Distributed throughout the power system
  - Shorter interruptions than in other DR programs
  - Can complement energy management and price response
  - Only looking for a small percentage of load to respond

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Loads that are potentially good candidates to provide Contingency Reserves

- Storage
  - product (excess production capacity)
  - water, liquid, or gas pumping
  - thermal
- Control capability
- Require little or no advanced notification; rapid response to curtail (including communications time)
- Ability to quickly restore load
- Sufficient aggregate size
- Loads with acceptable standby and deployment costs

Load Participation in Contingency Reserves Markets: Recommendations

- **ISO-NE should develop markets for all three contingency-reserve services ASAP**
- **Launch a market potential study and pilot programs to demonstrate the potential for small (and large) loads to provide contingency reserves**
- **NPCC should ensure that reliability rules and requirements for contingency reserves markets are technology- neutral and performance-based**
- **Review metering and telemetry requirements; consider less frequent (and costly) data recording and reporting requirements for loads**

Significance: Impacts of NEDRI

- Regional Demand Response Programs
  - ISO-NE filed and FERC adopted NEDRI Recommendations
  - Enrollment doubled in Summer 2003 vs 2002 (450 customers with ~400 MW vs. 221 customers with ~185 MW)
  - RT-DRP produced significant response on Aug. 15 (~90 MW average of load curtailed in CT over 10 hours)
  - ISO-NE developed M&V protocols for non-interval metered customers; filed and approved by FERC
- ISO-NE issued “all resources” RFP for up to 500 MW of reliability enhancements in SW CT
- States
  - VT Senate – reviewing legislation to adopt some NEDRI recommendations
  - CT & MA – air quality recommendations being considered
  - Regional appliance standards – various states

Significance: What if NEDRI Recommendations were aggressively implemented?

	Mid-Term (2007)	Long-Term (2015)
ISO-NE Peak Demand Forecast (MW)	**26,258**	**29,768**
Energy Efficiency Total	**500**	**2,450**
Building Codes	*0*	*700*
Appliance Standards	*500*	*1,750*
Enhanced SBC Funding	*?*	*?*
Short-Term DR Total	**220-440**	**440-1,100**
Emergency Programs	*200-400*	*400-900*
Market Programs	*20-40*	*40-200*
Load as Contingency Reserve	**10-25**	**60-300**
Dynamic Pricing	**50-200**	**200-750**

- Energy efficiency could offset 30-50% of incremental load growth
- DR and pricing could provide additional 300-1800 MW of resources

Source: LBNL estimates (Goldman and Barbose)

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Deliverables

- **Technical Reports**
  - Final NEDRI Report: “Dimensions of Demand Response: Capturing Customer-based Resources in New England’s Power System and Markets” (July 2003)
  - Framing Paper: Goldman, “Price-Responsive Load Programs” (April 2002)
  - Technical Memo: Goldman, “Regional DR Program Recommendations”
  - Background Paper: Hirst and Kirby, “Opportunities for Demand Participation in New England Contingency-Reserve Markets” (January 2003).
  - Scoping Paper: Kirby & Hirst, “Technical Issues related to Retail Load Provision of Ancillary Services” (February 2003)
  - Technical Memo: Goldman, “Contingency Reserves Recommendations”

- **Presentation and Briefings to NEDRI Stakeholder Meetings**
  - Regional Demand Response Programs (Sept, Oct, Nov, Dec. 2002; March 2003)
  - Load Participation in Contingency Reserves Markets (March and May 2003)

Background Slides

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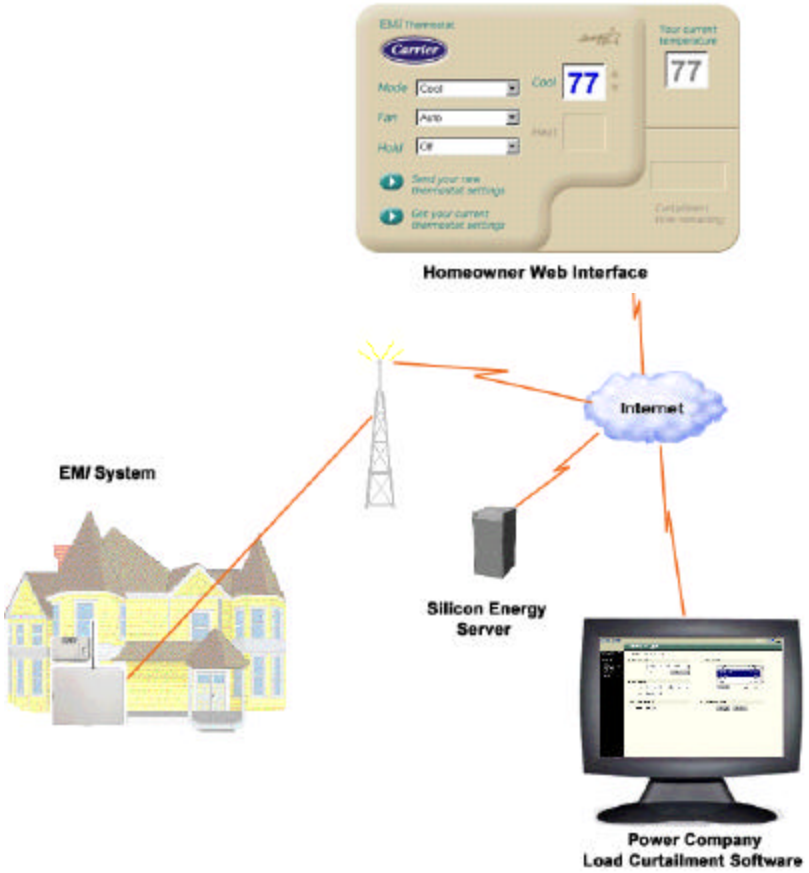
Barriers to Demand Response

- Wholesale market
  - Supply-only bidding
  - Load profiling by pools and RTOs
  - Reliability rules and practices excluding demand-side resources
- Retail market
  - Averaged rates and default service plans block wholesale market price signals
  - Rate designs for Utilities promote throughput
  - Metering traditions, costs and standards

One Example: Spinning Reserve From Residential and Small Commercial Thermostats

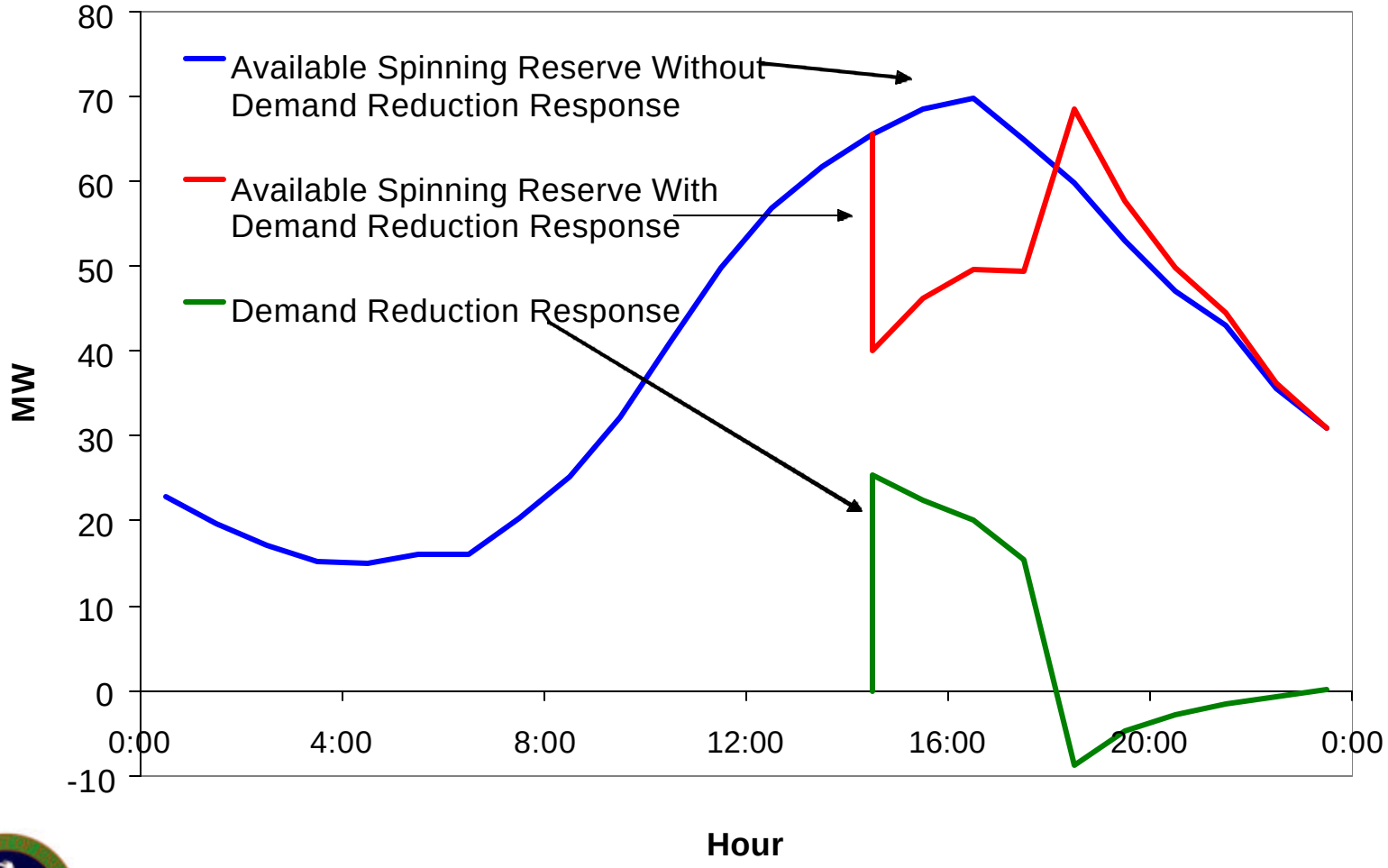
- Existing Carrier ComfortChoice technology for peak reduction
- Faster than generation for spinning reserve
- Spinning reserve capability ~3x peak reduction
- Significant monitoring in place



Communications and Control

- Designed for multi-hour peak reduction
- Deployment signal <90 seconds
- Verification delayed to protect paging system
- Grouping by location, type, or any other criteria
- Customer override allowed for peak shaving, not for spinning reserve
- Control can be duty cycle, set point, or turn off
- Monitors temperature, run time, communications
- Customer remote monitoring and control web interface

Can Provide Spinning Reserve While Providing Peak Reduction



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Metering and Communications Requirements

- Givens:
  - Payment must be tied to actual response
  - Deployment signals have to be fast
- One SCADA monitoring system currently performs three functions
  - Continuous readiness monitoring
  - Real-time event monitoring
  - Performance monitoring
- How much monitoring is required?
  - Statistical resources may not need the individual real-time monitoring that deterministic resources need
    - Redundancy may be better than observability.
    - A 5% error in total load forecast can be a problem. A 5% error in reserve response may not be.
  - Performance monitoring can be slower
  - What information does the system operator really require in real-time?

Communications Requirements Are Asymmetric (This is a Big Benefit)

- System-to-load communications are typically broadcast
  - Resource need – MW of response desired
  - Price
  - Deployment – respond *Now!*
- Load-to-system communications are typically individual
  - Capabilities and price offer
  - Performance monitoring – conceptually can be slower
  - Aggregator may help

Service Definitions Are Critical

- Most generators do not care if they run for 30 minutes or 8 hours
  - May have minimum run times
  - May have emissions limits
- A load may be able to respond for 10-30 minutes but not 2 hours
  - Can re-arm immediately if not used frequently
- Response capability matches spinning contingency reserve much better than demand relief