



# Demand Response and Ancillary Services

*September 2008*

# Agenda

The purpose of this presentation is to offer insight into the mechanics of demand response resource participation in several deregulated markets

1. Overview of EnerNOC's DR participation in ISO and RTO markets
2. Summary of different DR product types available in several ISO and RTO regions
3. Detailed look at programs offered in PJM, highlighting in particular:
  - Capacity / emergency
  - Economic / energy
  - Ancillary services
4. Summary of themes that emerge from the various Eastern DR programs

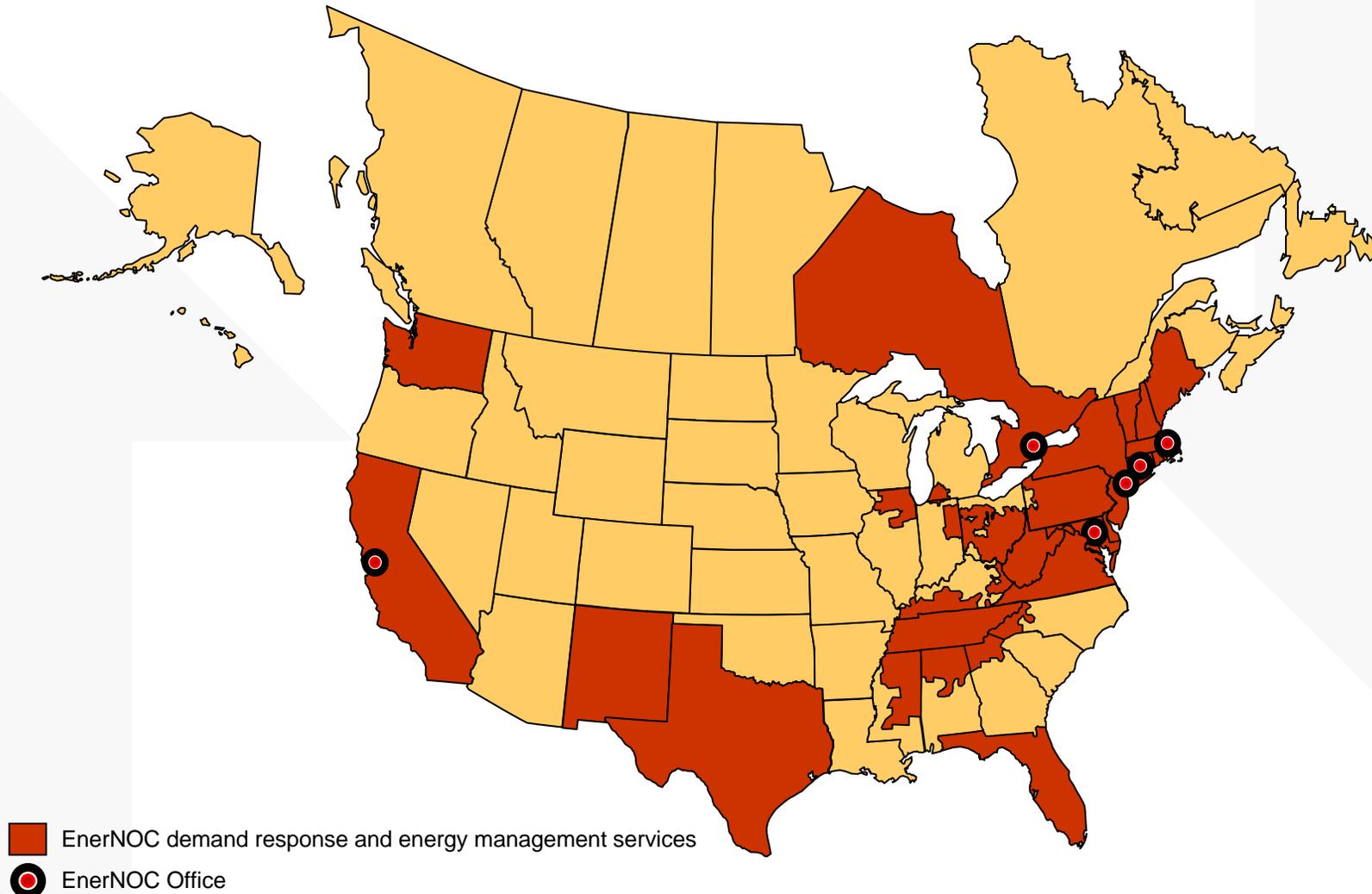
# EnerNOC's business



- EnerNOC provides technology-enabled commercial and industrial demand response resources across North America in both regulated and restructured markets
- As of 6/30: **1600+ MW under management from 3000+ sites**
- Offers full “turnkey” demand response solutions for utilities and grid operators – auditing, engineering, permitting, financing, metering, sales, installation, data and payment reconciliation, maintenance
- In addition to demand response, EnerNOC offers a suite of energy management solutions in selected markets, including energy efficiency and procurement
- Founded in 2001 – headquartered in Boston; 300+ employees; publicly traded (ENOC)

# EnerNOC and Demand Response

EnerNOC manages demand response resources in nearly every open ISO or RTO market, and within each of the various program options for each ISO or RTO

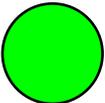
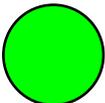
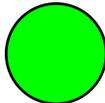
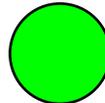
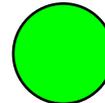
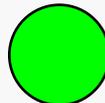
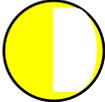
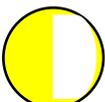
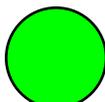
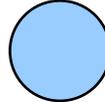
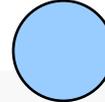
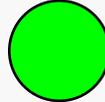
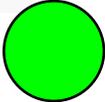
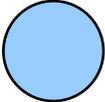
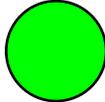
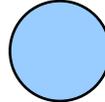
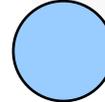
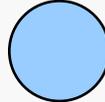


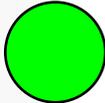
## Overview of EnerNOC Capabilities and Experience with Demand Response as Ancillary Services

- EnerNOC has extensive experience with demand response programs that provide **fully automated, sub-10-minute dispatch** of firm capacity through load reductions.
- EnerNOC was the first entity to enroll demand response resources in PJM's Synchronized Reserves Market (SRM); currently EnerNOC represents approximately **50 MW** of demand response resources in the SRM.
- EnerNOC is also a participant in ISO New England's Demand Response Reserves Pilot (DRRP) program, and has a contract with Public Service Company of New Mexico (PNM) for up to **30 MW** of load reduction capacity, all dispatchable in 10 minutes or less.
- Dispatch options include SCADA infrastructure, email, or PowerTalk (new EnerNOC application based on streaming XML protocols) – all functionality is available on a 24/7/365 basis.

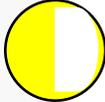
# National Program Summary – Open Markets

The different characteristics of each ISO and RTO demand response product drive different levels of participation

	New England	New York	PJM	Ontario	California	ERCOT
Capacity						
Ancillary Services						
Energy						

 = Full program, robust participation

 = Full program, limited participation

 = Pilot or emerging program

# PJM – Demand Response Program Overview



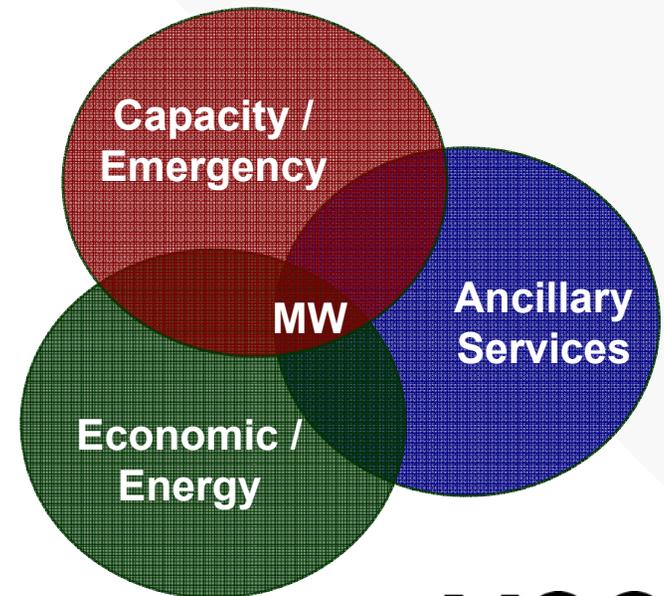
Program Name	Emergency Load Response	Economic Load Response	Synchronized Reserves Market
<b>Territory</b>	Mid-Atlantic & parts of Mid-West, including: PA, NJ, DE, MD, DC, IL, OH, TN, VA, WV		
<b>Demand Response Types</b>	Curtailment and permitted generation		
<b>Capacity Payments</b>	Yes; varies by zone & year	No	Yes; based on “available” hours
<b>Energy (Event) Payment</b>	Yes		
<b>Program Period</b>	Compliance required June – September	Year-round	Year-round
<b>Program Hours</b>	12 PM – 8 PM	At customer’s discretion; 24 hours / 7 days per week	
<b>Maximum Events</b>	10 per year, up to 60 hours	N/A	
<b>Event Notification</b>	2 hours	1 hour / day-ahead	10 minutes
<b>Response Duration</b>	Up to 8 hours	At customers discretion	Average is ~15 minutes; 30 minutes per event
<b>Event History</b>	2007: 1 event; 2006: 2 events; 2005: 2 events	N/A	~25 events/yr
<b>Testing Requirement</b>	None	None	None
<b>Technology Requirement</b>	Hourly interval metering at gen or meter		1-minute interval metering, SCADA response at gen or meter

# DR Product Compatibility in PJM Market Structure

A single MW of DR can participate in each of the different PJM programs, allowing PJM to maximize value from DR resources

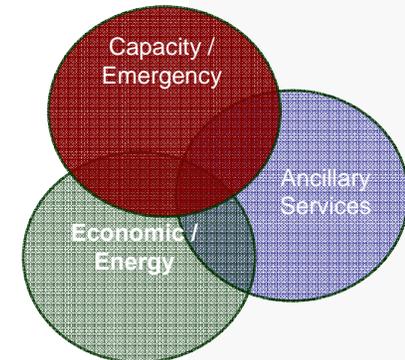
Program Name	Emergency Load Response Program	Economic Load Response Program	Synchronized Reserves Market
Market Used to Procure	Reliability Pricing Model (RPM), capacity market	Day-ahead and real-time energy markets	Synchronized reserves market
Procurement / Commitment Period	Three-year forward capacity auction, committed for full power year	Offered and cleared on hourly basis (day-ahead), ; dispatched voluntarily (real-time)	Hourly ancillary services market, committed ~75 minutes prior to operating hour

- Compatibility is based on structure of market, and focused on preventing “double-dipping:”
  - If emergency event declared (2 hrs lead), must un-nominate SR resource; “over-rides” economic event
  - If committed to day-ahead energy market, cannot also commit to reserves market
  - If committed to reserves market, cannot commit to day-ahead or real-time markets



# Emergency Load Response Program

The Emergency Program serves as PJM's "last line of defense", and is a key component of the PJM capacity market

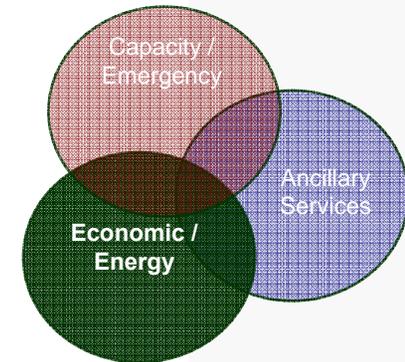


- **MW Enrolled:** 4,500 MW
- **Program compensation:**
  - Capacity price: \$1.24 - 5.50/kW-month (based on location, for 2008/9), determined via auction
  - Energy price: up to \$1,000/MWh (based on offer)
- **M&V Approach:**
  - One of several baselines (e.g., high 5 of 10)
  - Optional day-of adjustment
- **Telemetry Requirements:**
  - At a minimum, hourly interval data
  - Aggregator must submit data 60 days after event month
- **Triggers:** Steps 1 (long-lead) and 2 (short-lead) of Real-Time Emergency Procedures

For the 2008/9 Delivery Year,  
3.4% of PJM capacity needs were  
met by Demand Response

# Economic Load Response Program

The Economic Program comes in two flavors (day-ahead and real-time), and integrates DR into the PJM energy markets

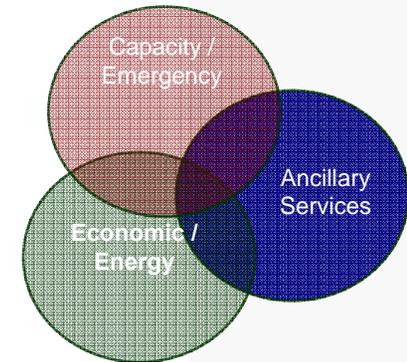


- **MW Enrolled:** 4,525 MW
- **Program Compensation:**
  - Capacity price: N/A
  - Energy price: up to \$1,000/MWh
- **M&V Approach:**
  - High 4 of 5 baseline
  - Optional day-of adjustment
- **Telemetry Requirements:**
  - At a minimum, hourly interval data
  - Aggregator must submit data 60 days after event
- **Triggers:**
  - Based on clearing of day-ahead market (~5:00 PM)
  - Voluntary dispatch in real time (set by customer)

In 2007, the Brattle Group estimated that economic resources save PJM ratepayers up to \$26MM in energy costs and \$73MM in capacity charges annually

# Synchronized Reserves Market

PJM allows DR to provide ancillary services, including both synchronized reserves and regulation



- **MW Enrolled**: between 70 – 110 MW
- **Program Compensation**:
  - Capacity price: hourly market, avg. of \$7-9/MW
  - Energy price: based on real-time LMP
- **M&V Approach**: difference between pre- and intra-event load
- **Telemetry Requirements**:
  - Revenue-grade one-minute interval data (+/-1% tolerance)
  - Aggregator must submit data within 24 business hours of event
- **Triggers**: Low Area Control Error, unit trip, reactive transfers, etc..

A 2008 report by the PJM Market Monitor indicates that SRM prices are lower when all reserves MW are provided by DR

## Summary and Themes

Several consistent themes emerge from PJM; these themes are echoed in other deregulated markets, such as ISO-NE and NYISO:

- If designed appropriately, **different types of DR programs can compatibly co-exist, maximizing the value of a single DR MW to the grid**
- Telemetry requirements for DR programs need to balance several often-competing aims:
  - Participation for aggregators is **simple, consistent, and straightforward**
  - Integrates with existing system architecture
  - Provides **sufficient visibility** to grid operators
- Since DR typically can respond for fewer hours/year, **providing appropriate capacity prices is the key to maximizing participation**

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