Demand Response: An Underutilized Capacity Resource Whose Time is Now

March 2, 2006
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What is Demand Response?

- Customers reducing their demand for electricity from the grid in response to:
  - High wholesale electricity prices or
  - System resource capacity needs or
  - System reliability events
- Can be achieved by curtailment or self-generation (backup generators)
- Customers receive payments for performance
The “NOC” in EnerNOC stands for Network Operations Center. EnerNOC enables existing assets with inexpensive, scalable technology to accomplish significant and guaranteed reductions in demand.
EnerNOC Overview
EnerNOC is the leading technology-enabled, C&I-focused total energy management solutions provider

- **Proven and growing track record** - Over 200 MW’s of demand response capacity managed at more than 500 customer sites. Over 500 MW’s of peak demand currently monitored by PowerTrak®


- **Significant and growing market** - Currently serving:
  - ISO New England (Certified IBCS and Demand Response Provider)
  - NYISO (Responsible Interface Party)
  - PJM (Emergency Demand Response Provider)
  - California ISO markets (Certified Demand Reserves Partnership Provider)
  - SCE, National Grid, NStar

- **Distinguished technology** - Provide 24/7, real-time metering and web-based device monitoring and control through open architecture technology that leverages customers’ existing assets

- **Significant resources**
  - Strong balance sheet and impressive financial track record
  - Deep management team experience in energy and technology management – 50 employees with more than 60 engineering and management degrees
## Notable Customers
EnerNOC has secured marquee customers in its Total Energy Management program territories

<table>
<thead>
<tr>
<th>Large Industrial And Utilities</th>
<th>XEROX</th>
<th>DRESSER-RAND</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Office and High Tech</td>
<td>SBC</td>
<td>THE HARTFORD</td>
</tr>
<tr>
<td>Education</td>
<td>WESTERN CONNECTICUT STATE UNIVERSITY</td>
<td>HARVARD BUSINESS SCHOOL</td>
</tr>
<tr>
<td>Food Sales and Storage</td>
<td>Pathmark</td>
<td>Hannaford</td>
</tr>
<tr>
<td>Government</td>
<td>Stanford Health System</td>
<td>NEW YORK HOSPITAL</td>
</tr>
<tr>
<td>Healthcare</td>
<td>GREENWICH HOSPITAL</td>
<td>HALL-BROOKE BEHAVIORAL HEALTH SERVICES</td>
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<tr>
<td>Light Industrial</td>
<td>Boehringer Ingelheim</td>
<td>SPATTECH</td>
</tr>
<tr>
<td>Lodging and Resorts</td>
<td>WESTIN HOTELS &amp; RESORTS</td>
<td>THE NEW YORKER HOTEL</td>
</tr>
</tbody>
</table>
EnerNOC Overview: 7/27/05 Event Performance: Generation and Curtailment

University provider combines generation with load curtailment to reduce more than 1.7 MW from the electrical grid.

Provider Summary
- Commitment: 1,450 kW
- Performance: 1,727 kW
EnerNOC Overview: 7/27/05 Event Performance: Parallel Processing

Communications provider simultaneously transfers 50 facilities to backup generators, totaling over 12 MW.

Notification 1:00 PM
Event Start 1:30 PM
Program End 6:00 PM
Voluntary Extension 7:15 PM

Baseline
Stacked Meter Demand
Commitment: 12,050 kW

Performance: 12,980 kW

Provider Summary
• Sites: 50
• Commitment: 12,050 kW
• Performance:
  13,418 kW (non-coincident)
  12,980 kW (coincident)
EnerNOC Overview: 7/27/05 Event Performance: Curtailment

University provider curtails more than 400 kW of load at five individual sites.

Provider Summary
- Sites: 5
- Commitment: 370 kW
- Performance: 424 kW (non-coincident) 416 kW (coincident)

Baselines and Load Curtailment
- Stacked Meter Demand
- Notification 1:00 PM
- Event Start 1:30 PM
- Event End 6:00 PM
- Voluntary Extension 7:15 PM

Commitment: 370 kW

Performance: 416 kW
EnerNOC Overview

EnerNOC is developing a national reputation as the company that addresses needs of utilities and ISOs/RTOs by making demand response reliable and successful.

Pat Wood presents at U.S. National Town Meeting on Demand Response on June 21, 2005...

Demand Response: Making it Work for Customers

Pat Wood III, Chairman
Federal Energy Regulatory Commission

National Town Meeting on Demand Response
June 21, 2005

Success Story - ISO New England

Load curtailment provides needed capacity

EnerNOC’s Capacity Came Online Fast and Held for the Duration

Committed Capacity

11:30 am – within 30 minutes, EnerNOC had reduced 18.9 MW from the New England end.

Event Start

Event End

Source: EnerNOC

...and singles out EnerNOC as a national success story for demand response
DR as a Capacity Alternative

Demand response with EnerNOC delivers numerous benefits.

- Strengthens a PUC’s and a utility’s leadership role in addressing the peak electricity capacity shortfalls and in reducing emissions
- Demonstrates the economic and operational viability of demand response as a reliable, verifiable, and economic resource for meeting peak load needs
- Compliments existing energy efficiency programs, and serves as a catalyst for further energy management and efficiency measures
- Enables effective engagement of C&I customers in real-time market participation and taps into a sizeable capacity resource
- Strengthens a PUC’s and a utility’s brand and identity as innovators
DR Capacity Alternative: Capacity on Demand

EnerNOC offers a completely outsourced solution. The complexities of administering and participating in a demand response program are entirely simplified for utilities and end-use customers. Our approach has three key characteristics:

1. Market Analysis
   - Define DR benefits and goals
   - Identify comparable DR programs
   - Catalog end-user asset inventory
   - Survey end-user interest
   - Identify current and potential regulatory barriers
   - Define DR program MW goal

   Business Case for DR and Associated Capacity Plans

2. Program Design and Integration
   - Define end-user incentive structure
   - Target electrical loads by end-user type
   - Identify and develop partner relationships
   - Develop end-user contract/tariff
   - Develop program marketing plan
   - Develop response management and technology integration plan
   - Develop regulatory buy-in plan

   Utility-Specific Program Plan and Integration Guide

3. Program Implementation and Tracking
   - Secure regulatory approval if applicable
   - Integrate DR and resource planning technology
   - Market program
   - Sign up end-users to contract/tariff
   - Test program with end-users
   - Manage DR events
   - Conduct program benefit analysis

Megawatts!
## DR Capacity Alternative: Capacity on Demand

The following table summarizes key aspects of a program concept and is offered as a starting point for discussion.

<table>
<thead>
<tr>
<th>ASPECT</th>
<th>VALUE</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Size</td>
<td>100 MW</td>
<td>Large enough to retire a large peaker</td>
</tr>
<tr>
<td>Price</td>
<td>$10 per kW per month</td>
<td>Will enable customer adoption, and provide a guaranteed product at a cost equivalent to or less than a new peaking plant</td>
</tr>
<tr>
<td>Term</td>
<td>4 to 6 years</td>
<td>Long enough to attract end-user participation</td>
</tr>
<tr>
<td>In Service Date</td>
<td>Within 3 months of contract signature</td>
<td>Firm ramp-up schedules, with goal of bringing as much capacity online in year one and all capacity online by 18-24 months</td>
</tr>
<tr>
<td>End User Assets</td>
<td>EnerNOC directly controls customers’ HVAC systems, lighting systems, process equipment, pumps, other energy consuming devices, and backup generators when permitted and appropriate</td>
<td>EnerNOC’s technology optimizes asset performance and gives customers immediate access to their energy consumption patterns. EnerNOC’s customers typically initiate further energy efficiency initiatives once they recognize the benefits of demand response</td>
</tr>
<tr>
<td>Event Window</td>
<td>12:00 pm to 6:00 pm on non-holiday weekdays, to be defined by utility, system operator, and EnerNOC</td>
<td>Window parallels system peak</td>
</tr>
<tr>
<td>Event Trigger</td>
<td>Reliability events and/or peak demand hours, TBD by the utility, system operator, and EnerNOC</td>
<td>DR resources will provide capacity during reliability events and allow retirement of dirty, out of favor peak plants or obviate need for new peak plant build outs</td>
</tr>
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Demand Response Impact Potential

Demand Response provides a better solution to meeting peak demand than the traditional solution of over-building generation.

US Generating Capacity: 948 GW

US Summer Peak Demand: 697 GW

Source: EIA Electric Power Annual 2003
Demand Response Impact Potential

EnerNOC reduces peak demand associated with ~1% of annual electricity consumption. Nationwide, DR could provide 95 GW with a replacement value of ~$28 billion.

Illustrative Load Duration Curve for 1,000 MW’s of Electricity in the US
Demand Response Impact Potential

A few hours of demand response provide substantial peak load reduction.

Peak Load Drop Potential

Based on CT 2004 load duration curve
Demand Response Myths

- Demand response is slow and insignificant – it will never provide enough capacity to address grid issues
- Demand response is not reliable
- Demand response is not functionally equivalent to generation
- Demand response payments have to be uniform within ISO territories
- Demand response will fully mitigate energy market price spikes
- Demand response is not an environmentally friendly solution
Demand Response Market Realities
Demand response is ready for primetime because it is:

- **Fast and significant** – EnerNOC enabled 40 sites in less than six weeks and is on track to enable well over 100 MW in Southwest Connecticut alone; these sites can be dispatched within minutes.

- **Precise** – Demand response capacity can be brought online exactly where it is needed when it is needed.

- **Verifiable and accountable** – EnerNOC captures 5-minute interval data, providing direct visibility into asset performance; EnerNOC accepts penalties for non-performance; system operators can rely on us.

- **Economical** – Demand response capacity is very cost effective compared to alternatives, and customers commit when the price is right, but Demand Response is not a panacea for all market challenges.

- **Environmentally friendly** – Many customers curtail electricity usage during events; others use backup generators (BUGs), and U.S. EPA studies show that demand response can reduce air emissions, even when diesel-fueled BUGs are used.
### Load and Technical Analysis
- Conduct facility walkthrough
  - Identify curtailable loads
  - Identify backup generator potential
  - Identify existing metering systems to integrate and save money
- Interview facility engineering and operations staff to identify customer sensitivities
- Develop technical solution options
- Summarize load analysis, present options for load control and program involvement, and present economic potential

### Enable and Enroll Facility
- Design technical solution
- Procure required technology (e.g., metering, relays, controls)
- Install (or integrate with existing) metering, controls, and communication
- Test and troubleshoot technical solution
- Initiate monitoring and begin metering loads
- Apply for, administer, and secure eligible cost reimbursements
- Register as customer’s Assets
- Aggregate customer loads as applicable
- Enroll assets into each DR program

### Program Management
- Begin collecting data
- Research, file, and renew all required city and state permits for program participation
- Maintain all required records
- Enroll load in daily/monthly markets to maximize potential benefit while minimizing risk
- Present real-time meter data to system operator for verification and to customer for reporting
- Monitor loads continuously and adjust enrollments accordingly
- Reconcile data and collect and disburse program payments
- Manage any program disputes and changes for customer

### Event Management
- Notify customers in advance of potential events
- Notify customers during day of event of event “window” and requirements
- Curtail load/initiate backup generator operation as required
- Monitor, meter, and adjust performance according to enrolled load
- Notify customers of event completion and restore normal operations
- Provide event and load reports accordingly
- Continually ensure operational integrity of technical solution

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**EnerNOC Examples and Experience: Solution Overview**

EnerNOC’s offering is a complete solution.
EnerNOC Examples and Experience: Demand Response Audit

EnerNOC’s four-part evaluation of a facility’s energy use and operating flexibility identifies opportunities for how demand response can be implemented, energy usage can be reduced or rescheduled, and peak demand limited.

1. Interview
2. Site Survey
3. Technical and Financial Analysis
4. Report and Presentation
EnerNOC Examples and Experience
Backup Generators Provide Significant “Negawatts”

Profile of Generator Customer During 8-20-04 ISO-New England Test

(kW)
7:00 8:00 9:00 10:00 11:00 12:00 1:00 2:00 3:00 4:00 5:00
EnerNOC Examples and Experience

EnerNOC’s deploys industry-specific solutions that maximize the customer’s contribution and return without risk to business continuity.

Supermarket 24 Hour Load Profile and EnerNOC Demand Response Application

- ISO Calls 7 Hour “Event” Starting at 11:00 a.m.
- EnerNOC Remotely Curtails/Generates
- EnerNOC Automatically Communicates to All Stores
- 20 kW from Backup Generator
- 20 kW from Store AC or Air Handler
- 30 kW from 1/3 Lights
- EnerNOC Restores Automatically
EnerNOC Examples and Experience
Who Says Load Reduction Isn’t For Real?

Profile of Load Reduction Customer During 8-20-04 ISO-New England Test

(kW)

7:00 8:00 9:00 10:00 11:00 12:00 1:00 2:00 3:00 4:00 5:00 6:00
EnerNOC Examples and Experience
Demand Response Can Make a Difference