TVA EnerNOC Demand Response Program

Updated  Q1 2018
The Enel Group Worldwide

A multinational power company and leading integrated player in the world’s power and gas markets

Overview

- Second largest global utility by revenue
- More than 50 years of experience
- Global leader in renewable energy generation
- #20 on Fortune’s Change the World List
- May 2017: Launched e-Solutions, new business unit focused on value added services
- August 2017: Acquired EnerNOC to build on EnerNOC’s position as a leader in B2B energy solutions

World Class Team and Resources

- US $83.91 / EUR €70.1 B in revenue
- More than 63,000 employees operating in 31 countries across 5 continents
- Net installed capacity of more than 82 GW in electricity and gas
- Global leadership in renewables with 36 GW in consolidated renewables capacity
EnerNOC, an Enel Group Company

A global leader in demand response and pioneer of energy intelligence software and services

Proven Client Track Record
- 50+ DR programs in 10 countries
  - 4,000+ MWs of curtailable load
- 1,100+ software subscription customers
- More than US $1B in customer payments/savings to date
- Streaming data from +14,000 enterprise sites
- Managing 1M bills annually with UBM

Full Value and Technology Offering
- Energy intelligence platform and applications
- Combines technology, professional services, and market access
- More than US$200M invested in to date technology
- 24x7x365 Network Operations Center & customer support

World Class Team and Resources
- US $404M revenue in 2016
- US $98M cash and cash equivalents on balance sheet
- More than 1,000 employees in offices across 10 countries
Intro to Demand Response
More than 10% of grid infrastructure costs are spent to meet peak demand that occurs less than 1% of the time.

Building a new power plant for that 1% of the time is incredibly expensive.

Demand response is a fast and cost-effective way to meet peak electric demand.
How Demand Response Works

When the electric grid needs resources, EnerNOC “dispatches” its network of resources, and thousands of facilities across nearly every industry reduce their electricity consumption.
Benefits of Demand Response

- Earn Payments to Subsidize Tight Budgets
- Operational Reliability & Advance Warning
- Strengthen the Grid & Serve Your Community
- Support Environmental Sustainability
How Demand Response Dispatches Work

- **Notify:** When an event is called, we immediately notify your facility contacts via phone, text and/or email.
- **Respond:** Your facility responds by curtailing load manually or automatically.
- **Restore:** When the event is over, operations are returned to normal levels.
Maximize Dispatch Performance

EnerNOC drives bottom line impact through revenue assurance and maximization.

The value in demand response is realized through sound execution.

- We work with you to design an energy reduction strategy based on your energy assets and operations.
- We provide personalized coaching from our experienced team during a dispatch.
TVA-EnerNOC Demand Response Program

Delivered more than $35 million in savings to participating organizations

By-the-Numbers

- Service Territory: 80,000 square miles
- Participating LPCs: 118 (of 154)
- Peak Demand: 33,482 MW
- Sites: 1,300 facilities
- Performance: >99%
# TVA-EnerNOC Demand Response

## Territory
Tennessee, parts of Kentucky, North Carolina, Georgia, Alabama, Mississippi, and Virginia

## Demand Response Types
Curtailment and permitted generation

## Payments
<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity Payments</td>
<td>(for being on stand-by): $24/kW-yr</td>
</tr>
<tr>
<td>Energy Payments</td>
<td>(for dispatch performance): heat rate x gas index, currently $40-50/MWh $225/MWh or more for emergency energy</td>
</tr>
</tbody>
</table>

## Costs
No up-front, out of pocket costs to participate

## Program Period & Hours
<table>
<thead>
<tr>
<th>Season</th>
<th>Period</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td>Apr – Oct</td>
<td>12:00 PM – 8:00 PM CT</td>
</tr>
<tr>
<td>Winter</td>
<td>Nov - Mar</td>
<td>5:00 AM – 1:00 PM CT</td>
</tr>
</tbody>
</table>

## Dispatch Notification
30 minutes

## Response Duration
2 – 8 hours

## Maximum Dispatches
1 event per day; no more than 2 dispatches in 2 consecutive business days 6 events per month; 40 economic hours per year

## Annual Dispatch Frequency
8 – 12 dispatches on average

## Testing Requirement
One acceptance test required prior to program enrollment
BUGs are Back: Enroll your Diesel Generator

Qualified diesel generators can be participate in DR…if it meets any of the criteria below

**Commenced construction before June 12, 2006 (RICE NESHAP)**
- Engine < 300 hp
- Engine rated Tier 2 or Tier 3

**Commenced construction on or after June 12, 2006 (NSPS)**
- Engine rated Tier 2 or Tier 3 (if manufactured before 2011)
- Engine rated Tier 1 (if manufactured between 4/1/06 and 12/31/10)

- Engine rated Tier 4, or Tier 4i (regardless of construction date)
## TVA Demand Response Dispatch History

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of DR Events</th>
<th>Avg. Duration (Hrs.)</th>
<th>Max Duration (Hrs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>5</td>
<td>3.4</td>
<td>4</td>
</tr>
<tr>
<td>2012</td>
<td>4</td>
<td>3.2</td>
<td>4</td>
</tr>
<tr>
<td>2013</td>
<td>11</td>
<td>3.6</td>
<td>4</td>
</tr>
<tr>
<td>2014*</td>
<td>11</td>
<td>3.5</td>
<td>6</td>
</tr>
<tr>
<td>2015</td>
<td>8</td>
<td>3.5</td>
<td>8</td>
</tr>
<tr>
<td>2016</td>
<td>8</td>
<td>3.6</td>
<td>5</td>
</tr>
<tr>
<td>2017</td>
<td>6</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>53</td>
<td>3.5</td>
<td>8</td>
</tr>
</tbody>
</table>

*Includes 2 voluntary dispatches of 7 hours total*
When Can You Expect a Dispatch

>50% of dispatches occur in Jun-Sept; or on a Tuesday or Thursday
The Value of Real-time Energy Data
Real-time DR Performance

The information you need to perform your best during DR events

- View and manage DR performance data in real-time to maximize revenue.
- Track all active DR registrations, performance, contact information and energy reduction plans.
- Dispatch coaching and 24x7x365 support from EnerNOC to help you meet your curtailment goals.

Easily monitor your dispatch performance
Payment Tracking

Quantify the value DR performance brings to your organization

- View earned revenue and payment history online, on demand.
- Connect your DR participation to revenue earned.
- Track detailed earning by site, program, or custom date range.

Detailed earnings and payment info at your fingertips
View and export your earnings data 24x7x365
Energy Profiling: Make the Most of your Interval Data

Intuitive way to add more sites and data feeds such as usage

Customize the time range and your data granularity - down to 5-minute intervals
Make the Most of your Interval Data

**Lower Peak Demand:** Proactively manage your peak demand, 15-40% of your electric bill

- Analyze where and when peaks occur to avoid costly demand charges.
- Identify phantom loads to prevent energy waste during non-production hours.
Make the Most of your Interval Data

Optimize Site Performance: Identify underperforming sites and achieve continuous energy savings

- Identify efficiency opportunities.
- Track changes over time to ensure savings persist after efficiency measures have been implemented.

Over $16,000 in annual savings
Make the Most of your Interval Data

Protect Your Equipment: Avoid costly maintenance and extend the lifespan of your equipment

- Zoom into your data to spot.
- Track changes over time to ensure savings persist after efficiency measures have been implemented.
Case Studies
A Snapshot of Our Expertise

Water Treatment Facilities

- **EnerNOC Experience**
  - 235 MW of DR Capacity
  - +400 Customers

- **Typical DR Participation Strategies**
  - Reduce pump usage temporarily in part or full: Influent, RAS and WASS, Digester Mixing, Heating
  - Curtail ultraviolet lighting and air-handling fans
  - Transfer load to permitted back-up generation

- **Just a few of our customers**
Customer Spotlight: Eastern Municipal Water District

It's very expensive to build new electrical generation facilities, and it's definitely not as expensive to curtail energy and avoid problems that affect the broader community.

Demand response is a key strategy that helps us curtail energy use—without any impact on service. It makes real sense for us.”

Key Results & Benefits

- $100,000 in DR payments annually
- No-risk, no-penalty participation

Water District Works with EnerNOC to Reduce Significant Electrical Load

<table>
<thead>
<tr>
<th>Industry</th>
<th>Geography</th>
<th>Annual Energy Spend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water District</td>
<td>Southern California</td>
<td>$10 million</td>
</tr>
</tbody>
</table>

https://www.enernoc.com/sites/default/files/media/pdf/case-studies/P14134_CS_emwd.pdf
Customer Spotlight: Lodge Cast Iron

We may be making the same product we made 118 years ago, but we’re continually looking to incorporate new technologies in our business.

By using EnerNOC’s software in conjunction with our own in-house monitoring, we’ve saved almost 7.5M kWh - a reduction that could power 1,125 average size homes per month.

Manufacturer cuts $1M annual energy budget with EnerNOC

Key Results & Benefits

- $130,000 in DR payments annually
- $2.3M total savings.
- Visibility into real cost of consumption.

Industry
Manufacturing

Geography
South Pittsburg, TN

Annual Energy Spend
$2.9 million

https://www.enernoc.com/sites/default/files/media/pdf/case-studies/P14054_CS_Lodge.pdf
Customer Spotlight: MGM Industries

Manufacturer Cuts Costs and Saves Jobs with EnerNOC

During the busy times, power optimization was not on our radar screen. Now every dollar saved helps us save jobs. We don’t run any equipment we don’t have to run. And we’ve become very conservative, taking a hard look at every expense. Total annual cost savings, thanks to EnerNOC’s energy intelligence software, total more than $30,000.”

Industry
Manufacturing

Geography
Henderson, TN

Annual Energy Spend
<$250,000

Key Results & Benefits

- $12,000 in DR payments annually
- >$30,000 in annual energy cost reductions
- Bottom-line benefits that help MGM thrive in a challenging economy.
- Detailed insights into key energy-consuming equipment.
Customer Spotlight: U.S. Silica

With rising energy costs, a difficult economic climate, and a duty to be environmentally responsible, the TVA-EnerNOC Demand Response program gives us the chance to do something good for the community, the environment, and for our business.

Mineral supplier protects its community without affecting its operations

Industry: Mining
Geography: Jackson, TN
Annual Energy Spend: $500,000

Key Results & Benefits

- $30,000 in DR payments annually
- >$30,000 in annual energy cost reductions
- Bottom-line benefits that help MGM thrive in a challenging economy.
- Detailed insights into key energy-consuming equipment.

https://www.enernoc.com/sites/default/files/media/pdf/case-studies/P14055_cs_us-silica.pdf
Q&A
Thank you!

Andrew Geshwiler, Business Development Manager II
615-300-7942
ageshwiler@enernoc.com
Our NOC and Advanced Technology

Delivering unparalleled visibility, our Network Operations Center is staffed 24x7x365 to monitor potential event triggers throughout the program season, track event performance, and provide coaching during events.
Enablement Timeline

EnerNOC’s DR enablement process is designed to be fast, cost-effective and scalable with an emphasis on customer satisfaction and support.
<table>
<thead>
<tr>
<th>Year</th>
<th>Day of Week</th>
<th>Date</th>
<th>Start Time (CST)</th>
<th>End Time (CST)</th>
<th>Duration (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>Monday</td>
<td>6-Jan</td>
<td>8:00 AM</td>
<td>1:00 PM</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>7-Jan</td>
<td>5:00 AM</td>
<td>11:00 PM</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>28-Jan</td>
<td>6:00 AM</td>
<td>10:00 AM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Wednesday</td>
<td>29-Jan</td>
<td>6:00 AM</td>
<td>10:00 AM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>4-Mar</td>
<td>5:00 AM</td>
<td>8:00 AM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Monday</td>
<td>16-Jun</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Friday</td>
<td>14-Nov</td>
<td>6:00 AM</td>
<td>8:00 AM</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>18-Nov</td>
<td>6:00 AM</td>
<td>9:00 AM</td>
<td>3</td>
</tr>
<tr>
<td>2015</td>
<td>Friday</td>
<td>19-Nov</td>
<td>6:00 AM</td>
<td>8:00 AM</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>5-May</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>7-May</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>28-Jul</td>
<td>12:00 PM</td>
<td>8:00 PM</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>4-Aug</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>11-Aug</td>
<td>3:30 PM</td>
<td>5:30 PM</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>8-Sep</td>
<td>3:35 PM</td>
<td>5:35 PM</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Tuesday</td>
<td>6-Oct</td>
<td>4:40 PM</td>
<td>7:40 PM</td>
<td>3</td>
</tr>
<tr>
<td>2016</td>
<td>Wednesday</td>
<td>10-Feb</td>
<td>5:00 AM</td>
<td>9:00 AM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>23-Jun</td>
<td>1:00 PM</td>
<td>6:00 PM</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Monday</td>
<td>18-Jul</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Monday</td>
<td>25-Jul</td>
<td>1:00 PM</td>
<td>5:00 PM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Monday</td>
<td>1-Aug</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>25-Aug</td>
<td>3:00 PM</td>
<td>6:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>22-Sep</td>
<td>2:00 PM</td>
<td>5:00 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Friday</td>
<td>23-Sep</td>
<td>1:00 PM</td>
<td>5:00 PM</td>
<td>4</td>
</tr>
<tr>
<td>2017</td>
<td>Wednesday</td>
<td>15-Mar</td>
<td>5:00 AM</td>
<td>9:00 AM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>16-Mar</td>
<td>6:00 AM</td>
<td>8:00 AM</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>18-May</td>
<td>3:05 PM</td>
<td>6:05 PM</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>13-Jul</td>
<td>2:00 PM</td>
<td>6:00 PM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Thursday</td>
<td>20-Jul</td>
<td>2:00 PM</td>
<td>6:00 PM</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Friday</td>
<td>22-Sep</td>
<td>1:00 PM</td>
<td>5:00 PM</td>
<td>4</td>
</tr>
</tbody>
</table>

31 events have been called in last four years
Opportunities to Optimize Earnings
Take Advantage of the 30-Minute Ramp Period

A quick response to dispatches means more in DR earnings

There is no limit to how much your site can earn in energy payments during the 30-minute ramp period at the start of each dispatch!

<table>
<thead>
<tr>
<th>Dispatch Hours</th>
<th>Committed (kW)</th>
<th>Performance – with Ramp (kW)</th>
<th>Performance – No Ramp (kW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-min ramp</td>
<td>N/A</td>
<td>229</td>
<td>0</td>
</tr>
<tr>
<td>12:00 PM</td>
<td>600</td>
<td>633</td>
<td>633</td>
</tr>
<tr>
<td>1:00 PM</td>
<td>600</td>
<td>641</td>
<td>641</td>
</tr>
<tr>
<td>2:00 PM</td>
<td>600</td>
<td>592</td>
<td>592</td>
</tr>
<tr>
<td>3:00 PM</td>
<td>600</td>
<td>429</td>
<td>429</td>
</tr>
<tr>
<td>Total (kW)</td>
<td>2,400</td>
<td>2,524</td>
<td>2,295</td>
</tr>
<tr>
<td>Performance</td>
<td></td>
<td>105.2%</td>
<td>95.6%</td>
</tr>
</tbody>
</table>