SMARTER WAYS OF MANAGING ELECTRICAL SUPPLY

Ross Fraser, Senior Advisor, EnerNOC Australia

Melbourne Forum, Wednesday 7 December, 2011
EnerNOC’s demand response footprint

- United Kingdom
- Australia and New Zealand

- EnerNOC demand response
- EnerNOC office
Community concerns about high electricity prices and security of supply

HARM TO COMMERCIAL & INDUSTRIAL BUSINESSES
- Large price rises from Climate Change initiatives
- Impact on competitiveness and exports

HARM TO LOW INCOME FAMILIES
- Already serious concerns by Social Welfare groups
- Further flow through of costs from above
- Further infrastructure costs - growing peaks

ELECTRICITY IS AN ESSENTIAL SERVICE
- Total loss of supply has massive impacts
- No compensation for loss of supply – market earns $24Bn pa
- And no ability to deal with the issues
What has been happening in the NEM?

Average 40 hours Maximum

- Cal Year
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- 2007
- 2008
- 2009
- 2010

2200MW (or $2.2Bn) used for less than 40 hours pa costs us ~10% of our "Bill"
Example of Wholesale Market Price Volatility

Example: RRP($) each half hour

Peak prices above $300 / MWh represented >25% of the annual wholesale energy cost

Opportunities for DR (but no mechanism)

Hedges & Reserve cost additional $10/MWh (average)

$300/MWh

Average wholesale cost ~$40/MWh

WHOLESALE PRICE OF ELECTRICITY


0 1000 2000 3000 4000 5000 6000 7000 8000

RRP ($)
## Cost of Energy Components

### NEM Total Retail Electricity Costs (ex GST and C Tax)

### Summary of Cost Components (averaged across all sectors)

<table>
<thead>
<tr>
<th>Components</th>
<th>Subcomponents</th>
<th>Retail Cost $Bn pa</th>
<th>% of Annual &quot;Bill&quot;</th>
<th>Current situation</th>
<th>Demand Response Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td>Wholesale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&lt;$300/MWh</td>
<td>$ 18.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Wholesale</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt;$300/MWh</td>
<td>$ 2.0</td>
<td>8.3%</td>
<td>Cannot respond</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Hedges, prudentials, etc</td>
<td>$ 1.8</td>
<td>7.5%</td>
<td>Possible opportunity</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>Estimated cost of Reserve</td>
<td>$ 0.5</td>
<td>2.1%</td>
<td>Denied opportunity</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Networks</strong></td>
<td>To service 8720 hours pa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>To service peak 40 hours pa</td>
<td>$ 1.9</td>
<td>7.9%</td>
<td>Some improvement coming</td>
<td>Yes</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Admin etc</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td>$ 24.0</td>
<td>25.8%</td>
<td>$6.2Bn pa</td>
<td>$2Bn pa</td>
</tr>
</tbody>
</table>

(EUAA 2004)
Are we meeting the National Electricity Objective?

The National Electricity Objective

To promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to –

(a) price, quality, safety, reliability, and security of supply of electricity; and
(b) the reliability, safety and security of the national electricity system.

Red font and underlines are by presenter

Answer to efficiency: No!
At least 3000MW of built assets already exist

Why build more supply side for short peaks and reserve when >3000MW is

- Already available
- Electricity users willing to provide Demand Response
  - it won’t harm electricity users
  - they get paid for their participation, and
  - they do not suffer production or sales losses
- Results in major benefits to Australia
- Not able to work in NEM without changes

EnerNOC and others such as EUAA and EEC are on an Advisory Panel to the AEMC’s DSP Review Stage 3
Demand Response Model

Similar in all electricity markets

- BANKS
  - Hedge contracts
- ELECTRICITY RETAILERS
- MARKET & SYSTEM OPERATORS
- GENERATORS
- ELECTRICITY NETWORKS
- EnerNOC DR Facility

An EnerNOC Company

- Financial & Market
- Physical Network
- Demand Response

Millions of electricity Customers
Four Applications for Demand Response

- Network Support
- Capex Deferral and Outage Protection
- Retail Price Response (in Energy Only Markets to de-risk exposure to high prices)
- Reserve Capacity (where DR replaces Peaking Generation for the last 40 hours of maximum demand)
- Ancillary Services
  - Frequency Control, Load Following, Balancing Services, etc

EnerNOC’s Energy Management Applications

**Demand SMART**

- Enables utilities to implement cost-effective DR programs for their C&I customers
- Real-time visibility into energy consumption data allows C&I users to optimise event performance and identify inefficiencies in consumption patterns

**Efficiency SMART**

- Commissioning
  - Delivers 8-12% energy savings through the analysis of building management system data, primarily through low-cost and no-cost operational energy efficiency measures
- Insight
  - Provides large, multi-site organizations with direct visibility into energy usage, energy spend, and “hidden” savings opportunities
- Services
  - Wide range of services including industrial EE implementation, energy engineering, energy project design, audits, and other utility program management services.

**Carbon SMART**

- Enables C&I users to measure, track, and manage GHG emissions to support environmental initiatives and to comply with mandatory or voluntary reporting standards
Demand Response (Peak Load Management)

- Limit of generation or network capacity
- Reduce/shift demand during peaks
Energy Efficiency Reduces Overall Demand

- Reduce/shift demand during peaks
- Limit of generation or network capacity
Building and Managing the DR Resource

By assembling a portfolio of diverse customers, a DR service provider can provide a firm resource to each of its utility customers that has the operational characteristics of a peaking power plant.

Customer capabilities

Utility and grid operator needs

Value of Aggregation of DR

- Available on a seasonal basis
- Available for a limited number of events
- Available for a limited event duration
- No Restrictions
Examples of EnerNOC’s “Capacity Providers”

<table>
<thead>
<tr>
<th>Commercial Office and High Tech</th>
<th>Education</th>
<th>Food Sales &amp; Storage</th>
<th>Government</th>
<th>Healthcare</th>
<th>Light Industrial</th>
<th>Lodging &amp; Resorts</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBM Level 3</td>
<td>Adelphi University</td>
<td>Whole Foods</td>
<td>Pathmark</td>
<td>Stanford Health System</td>
<td>General Electric</td>
<td>HUHotels &amp; Resorts</td>
</tr>
<tr>
<td>NYMEX</td>
<td>Babson</td>
<td>Shaws</td>
<td>Pathmark</td>
<td>Greenwich Hospital</td>
<td>Unilever</td>
<td>Hilton</td>
</tr>
<tr>
<td>Vornado Realty Trust</td>
<td>Western Connecticut University</td>
<td>Price Chopper</td>
<td>Pathmark</td>
<td>LGBT Healthcare</td>
<td>Boehringer Ingelheim</td>
<td>Comfort Inn &amp; Suites</td>
</tr>
<tr>
<td>ESPN</td>
<td>Cal Poly</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>Hall-Brooke Behavioral Health Services</td>
<td>DuPont</td>
<td>Hyatt</td>
</tr>
<tr>
<td>at&amp;t</td>
<td>Trinity College</td>
<td>Stop &amp; Shop</td>
<td>Pathmark</td>
<td>Bradley Memorial Hospital</td>
<td>Pfizer</td>
<td>DoubleTree</td>
</tr>
<tr>
<td>Adobe</td>
<td>Johns Hopkins University</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>Magnacare</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>Cablevision</td>
<td>Fairfield University</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>SunAmerica</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>Morgan Stanley</td>
<td>Saint Joseph College</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>St. Vincent's</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>Cushman &amp; Wakefield</td>
<td>Temple University</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>SUNY Upstate Medical Center</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>RCN</td>
<td>Tufts</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>St. Vincent's</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>NuHorizons Electronics Core</td>
<td>Hofstra University</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>SUNY Upstate Medical Center</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>Pitney Bowes</td>
<td>Olin College</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>St. Vincent's</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
<tr>
<td>CSU</td>
<td>The California State University</td>
<td>Shaw's</td>
<td>Pathmark</td>
<td>SUNY Upstate Medical Center</td>
<td>Xerox</td>
<td>Holiday Inn</td>
</tr>
</tbody>
</table>
The EnerNOC Technology Platform
What’s an ESS?

ESS – EnerNOC Site Server
- It is the general term used to refer to the equipment installed at a Site.
- It is not specific to any one kind of equipment
- Some sites may require multiple ESS’ because of multiple metering/control points that are impossible to connect to 1 ESS.

The ESS MONITORS and CONTROLS
- At the bare minimum, and ESS monitors kWh either as consumption from the Grid, or output from a Generator
- Every ESS at least Monitors something.
- The simplest ESS counts “pulses” from an electric meter and PowerTrak downloads those pulse counts and converts them to (Average) Kilowatts
- An ESS can control almost any part of a site’s electrical system by opening/closing relays – Lighting, HVAC, Generators and Transfer Switches, process equipment
A Full-Control ESS

- Cube Relay
- Modbus and Power Wires
- Modbus Communications
- 240VAC Power
- UPS
- ADAM Relay Module
- Control Wires
- 240VAC -> 24VDC Power Supply
- Pulse Inputs
- iLon
- Power Supply
Applying a Robust Technology Platform

EnerNOC has built a highly-scalable technology platform, based on two-way communication of real-time data, providing a foundation for consistent and reliable resource performance.

EnerNOC Site Server (ESS)

At customers sites, EnerNOC installs an ESS, a gateway device that establishes communication with our network and provides near-real time visibility into end-user energy consumption.

The ESS also allows the NOC to remotely curtail loads in order to deliver demand response capacity.

Energy Network Operations Center

Our two NOCs, staffed 24x7x365, feature advanced technology and specialized staff to ensure that load reductions happen quickly, efficiently, and consistently for both the utility and end users.

DemandSMART

EnerNOC’s web-based energy management platform monitors energy consumption and enables end-user load control.

DemandSMART also provides end-users with a web portal, and utilities with the ability to view load reductions during demand response events.
## Consistent Performance

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Performance</th>
<th>Number of Events</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>103 %</td>
<td>34</td>
</tr>
<tr>
<td>2007</td>
<td>103 %</td>
<td>119</td>
</tr>
<tr>
<td>2008</td>
<td>102 %</td>
<td>102</td>
</tr>
<tr>
<td>2009</td>
<td>107 %</td>
<td>132</td>
</tr>
<tr>
<td>2010</td>
<td>101%</td>
<td>221</td>
</tr>
</tbody>
</table>

### Key Drivers
- Technology platform enables **automated dispatch** of multiple events simultaneously, with **real-time visibility** into performance.
- End-use loads are **continuously monitored** to ensure capacity availability.
- Each site’s capabilities is **thoroughly tested** prior to event dispatch, including acceptance tests and notification tests.
- The composition of the “**portfolio**” ensures reliable delivery.
24/7 Real-Time Visibility with DR
The Value of a Demand Response Service Provider

EnerNOC program features

- Guaranteed performance to utility, while shielding businesses from under-performance penalties
- Utilities can contribute employee knowledge and customer relationships, while letting EnerNOC staff and manage the resource
- Free equipment and customized curtailment plans increase market penetration
- No new tariff required: One contract with aggregator
- Utility controls branding and messaging
- Dedicated sales and operations staff in territory
### DR adds value to Energy Efficiency

(Case Study)

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**Case Study to show benefits of EE plus DSR programs**

(Large Industrial Business)

Add DSR Revenues into the business case

Discount for cash savings

<table>
<thead>
<tr>
<th>Recommended change</th>
<th>Cost of change ($)</th>
<th>Savings from energy efficiency (pa)</th>
<th>Payback without DSR (years)</th>
<th>Savings from EE plus DSR revenue (pa)</th>
<th>Payback with DSR (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity and gas monitoring and management program</td>
<td>$2,500</td>
<td>$50,053</td>
<td>0.1</td>
<td>$50,053</td>
<td>0.1</td>
</tr>
<tr>
<td>Automated daylight sensing control of lighting - Fibre Board</td>
<td>$5,000</td>
<td>$16,148</td>
<td>0.3</td>
<td>$16,148</td>
<td>0.3</td>
</tr>
<tr>
<td>Replace ancillary area high bay MH lights with fluoro high bay sensor lights</td>
<td>$11,200</td>
<td>$2,762</td>
<td>4.6</td>
<td>$12,762</td>
<td>0.9</td>
</tr>
<tr>
<td>Replace high bay MH lights with fluorescent high bay sensor lights</td>
<td>$224,000</td>
<td>$42,490</td>
<td>6.3</td>
<td>$42,490</td>
<td>6.3</td>
</tr>
<tr>
<td>Investigate installation of light timers and sensors in periodic use areas</td>
<td>$42,500</td>
<td>$3,471</td>
<td>19.4</td>
<td>$3,471</td>
<td>19.4</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td><strong>$285,200</strong></td>
<td><strong>$114,924</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Reference: Data for Case Study from Genesis Now
About EnerNOC

❖ Proven Customer Track Record
  – 4,750 customers across 11,150 sites with 7,000 MW’s of demand response capacity in North America, Europe, Australia, and New Zealand
  – 99% customer retention rate
  – Highest industry customer satisfaction rating
  – Over $390 million in customer payments/savings to date
  – Simple, risk-free commercial agreements

❖ Full Value and Technology Offering
  – Energy management application platform addresses demand and supply-side
  – Combine technology, managed services, and market access
  – More than $100 million invested to date in technology
  – 24/7/365 Network Operations Center, real-time metering and web-based monitoring

❖ World-Class Team and Resources
  – 600 employees and growing fast – multiple “top places to work” awards
  – Publicly traded on the U.S. NASDAQ (ENOC)
  – Over $75 million in cash on balance sheet