



Integrating Energy Efficiency and Demand Response

Colorado Utility Efficiency Exchange
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Thanks to . . .

- **Peak Load Management Alliance (PLMA)**
 - www.peaklma.com
 - Fall conference in Austin, TX – October 27-28, 2008
- **Energy Insights**
 - www.energy-insights.com

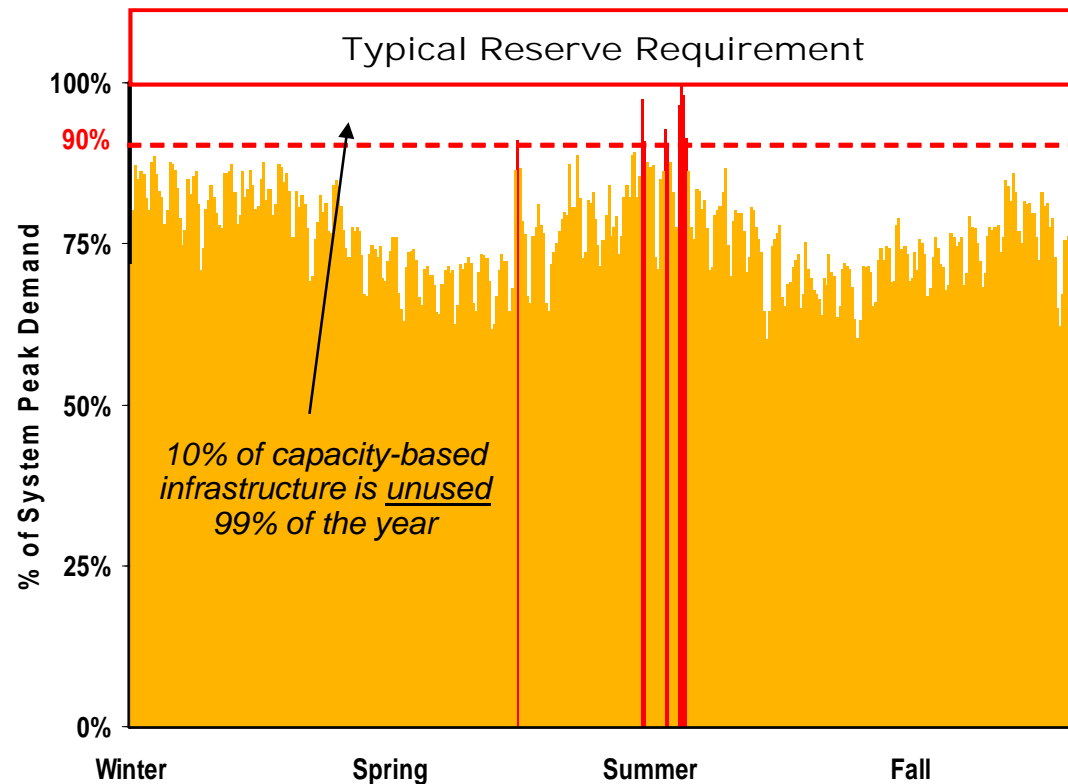
Demand response in an energy efficient world . . .



*“Let’s face it: you and this organization
have never been a good fit.”*

Drivers for demand response

- For many utility systems, **80 to 90 hours of the year** account for up to 10% of peak demand.
- And another 10% (or more) of system peak demand must be put in place as **operating and planning reserves** to ensure system reliability.

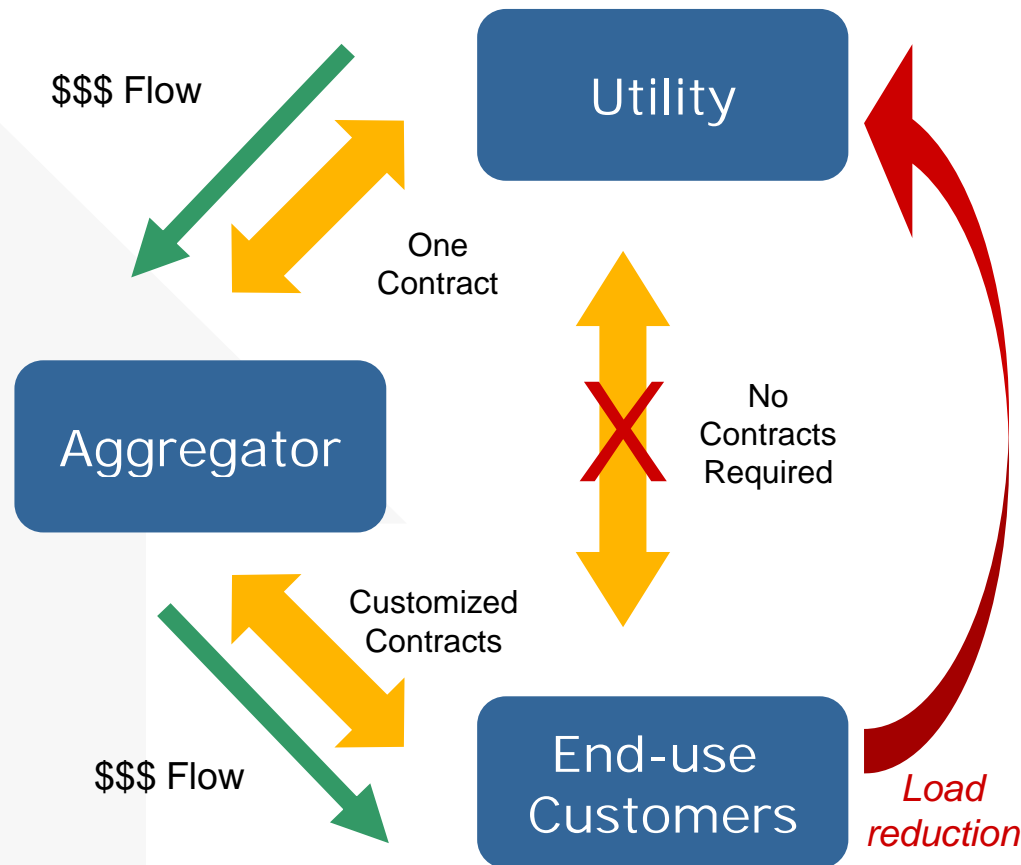


EnerNOC's business



- EnerNOC provides technology-enabled **commercial and industrial demand response** resources across North America, to utilities and grid operators, in both regulated and restructured markets.
- Offerings include demand response resources for both emergency and economic dispatch, as well as ancillary services (synchronized reserves).
- 310+ employees; publicly traded on NASDAQ (ENOC).
- Piloting energy efficiency services with some customers.

The aggregator business model



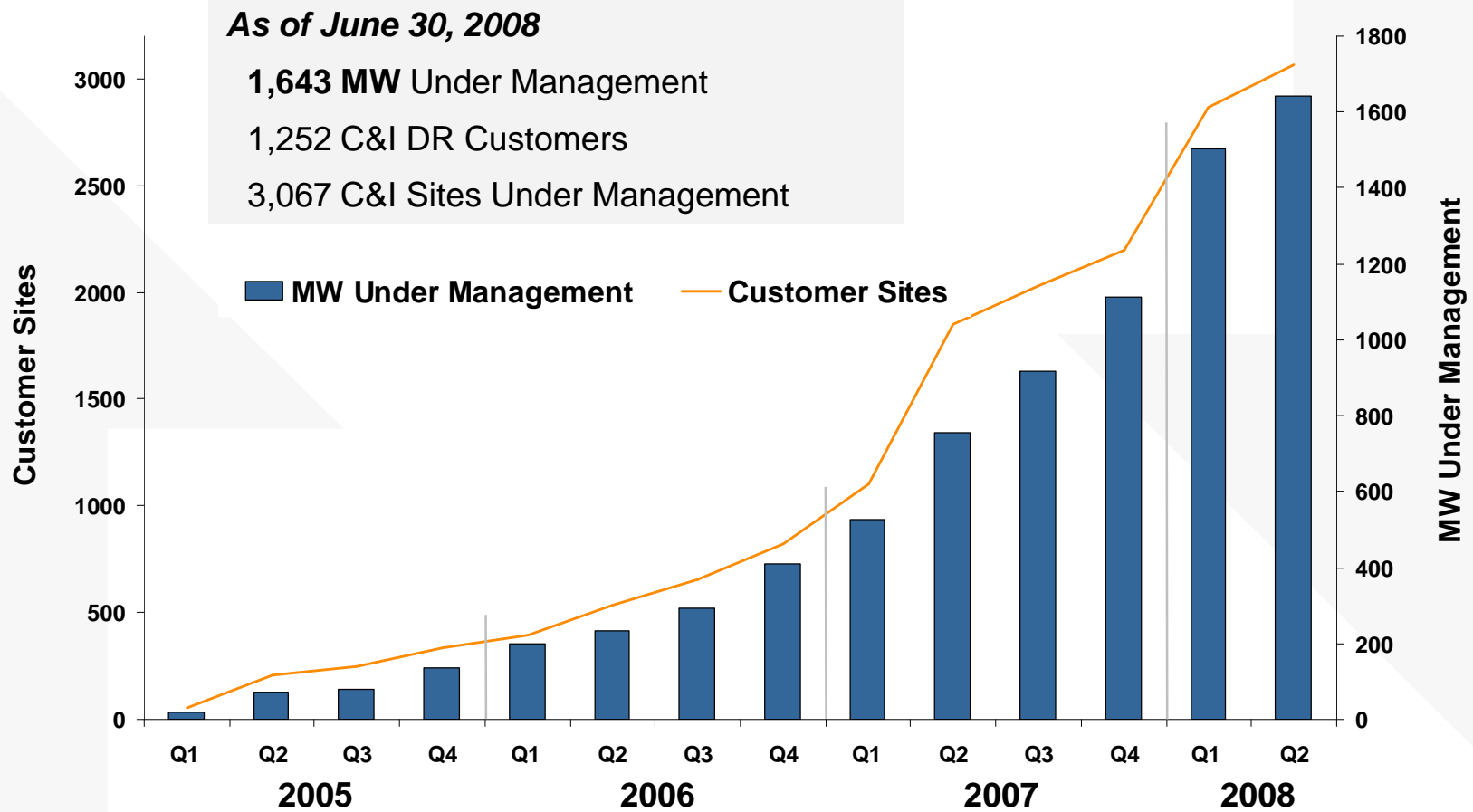
- Customized curtailment plans (and contracts) increase market penetration
- No new tariff required
- Utility can control branding, messaging
- Aggregator **guarantees performance** to utility, while shielding businesses from all penalties for under-performance

EnerNOC's load reduction "providers"

Relationships with national accounts can facilitate rapid deployment of demand response in new geographic areas.

Commercial Office and High Tech	
Education	
Food Sales and Storage	
Government	
Healthcare	
Industrial	
Lodging and Resorts	

Building a 1.6 GW “virtual power plant”



EnerNOC's technology



Network Operations Center (NOC)

The NOC features automated DR capabilities to ensure that load reduction happens quickly, efficiently, and consistently for both utility and end-user.

NOC operators lead event management processes and coach underperformers to improve performance.



EnerNOC Site Server (ESS)

The ESS sends near real-time 5-minute interval data directly from sites in our network to the NOC.

The ESS transfers data to PowerTrak® and ensures that EnerNOC is always capturing site consumption data.

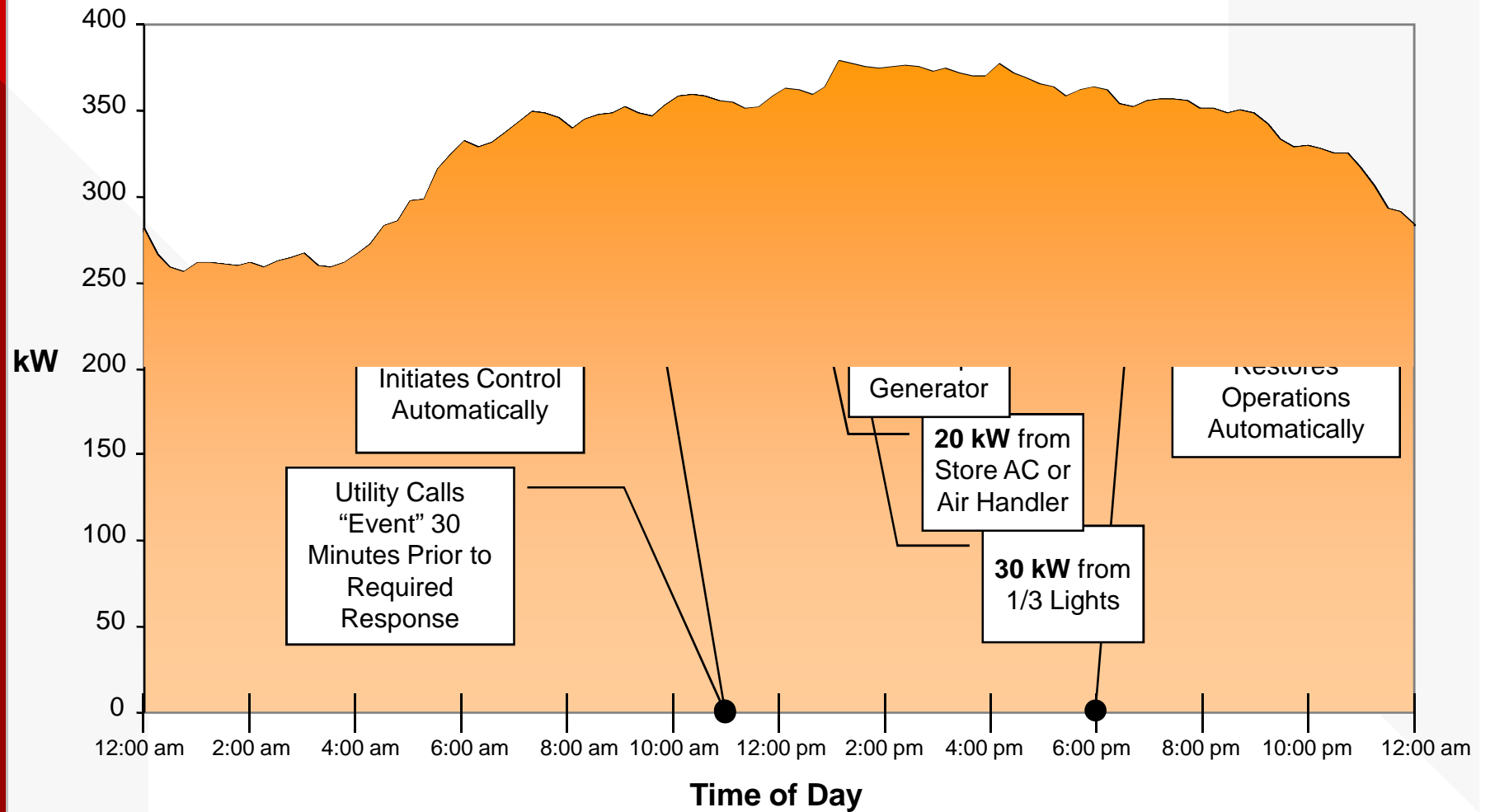


PowerTrak®

EnerNOC's energy management platform, PowerTrak®, collects and presents energy consumption data for NOC use and analysis.

PowerTrak enables two-way communication quickly and accurately between EnerNOC and the utility and EnerNOC and the customer.

Prototypical DR "event" at supermarket site



Definitions

- **Energy Efficiency** (EE) involves permanent load reduction across all hours of use.
- **Peak Load Management** (PLM) is a reduction of energy use during on-peak hours, or a shift in use to off-peak hours.
- **Demand Response** (DR) is a temporary load reduction during specific hours – usually coinciding with high system demand or high wholesale prices, or system emergencies.

Key program characteristics

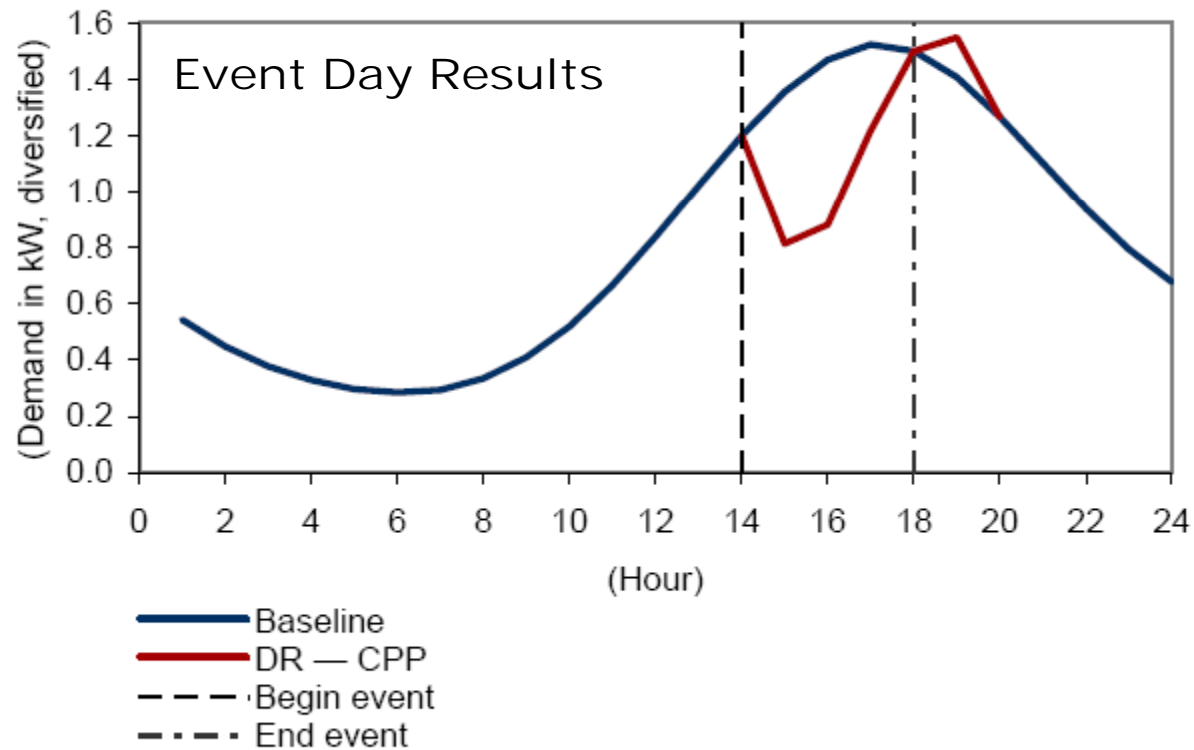
	Energy Efficiency	Peak Load Management	Demand Response
Load reduction	Permanent reduction	Permanent reduction during on-peak hours or load shifting to off-peak hours	Temporary reduction (with some load shifting possible)
Hours affected	Up to 8,760 hours per year	Perhaps 1,000 hours per year, depending on system load shape	50 to 100 hours per year; 10 to 15 days per year
Effect on customer value, comfort, or output	None, if properly implemented	Depends on application	Customer receives incentives to compensate for reduction

Where things stand . . .

- Utilities typically develop and manage DR and EE programs independently – often in different parts of the organization
 - DR is a dispatchable resource, EE is a “customer program”
 - Very different M&V considerations
- “Silos” can lead to inefficiencies
 - Technicians may be sent to homes to install programmable thermostats or load control switches for DR, but not to look for potential EE savings at same time
 - In worst case, third-party DR providers have disincentives to encourage EE
- Customers get confused
 - How to choose between growing number of “energy savings programs” that might include DR, TOU, renewable energy, equipment rebates, etc.?

Residential examples: Customer #1 (DR only)

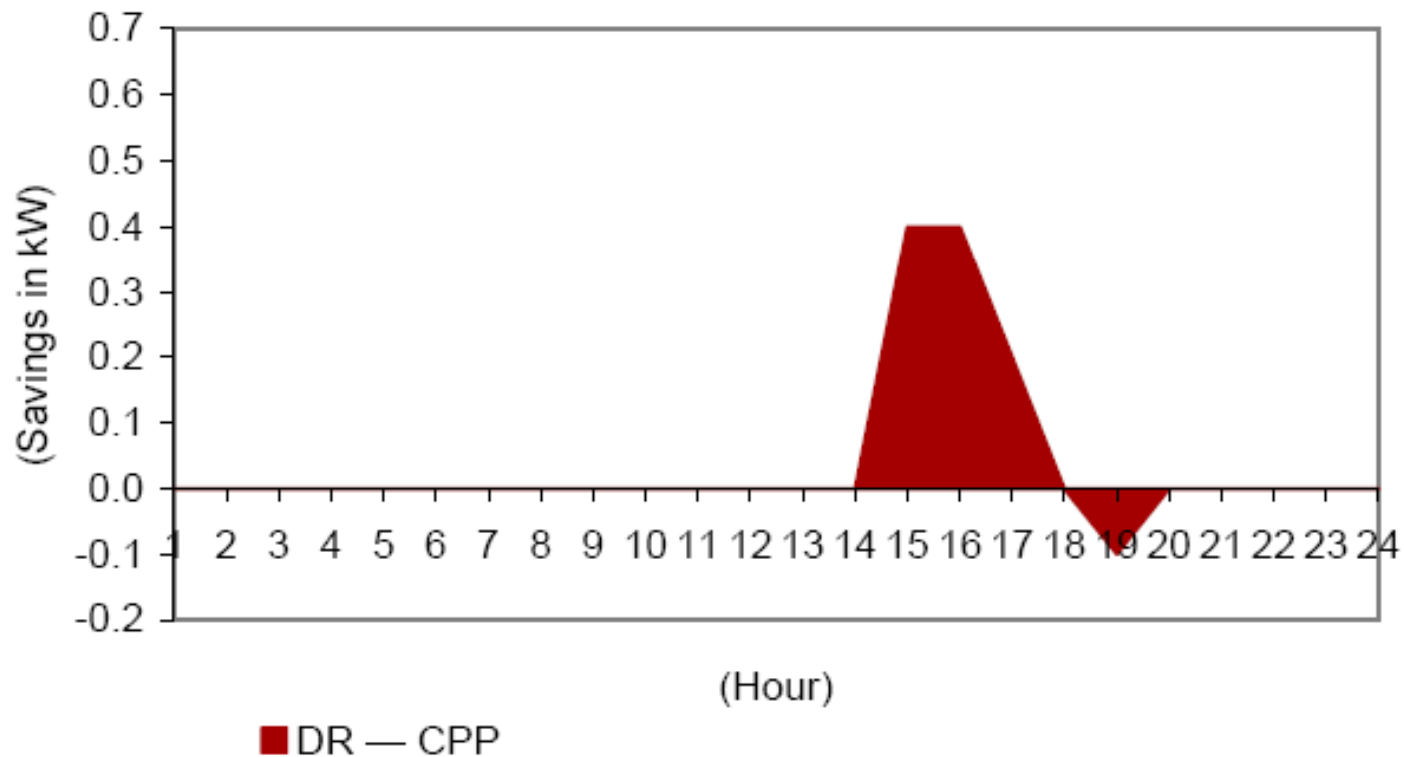
- Customer signs up for a critical peak pricing (CPP) rate, and receives a programmable communicating thermostat as part of the program.
- The thermostat is remotely controlled by the utility during CPP events.



Source: Energy Insights, 2007

Energy savings – Customer #1 (DR only)

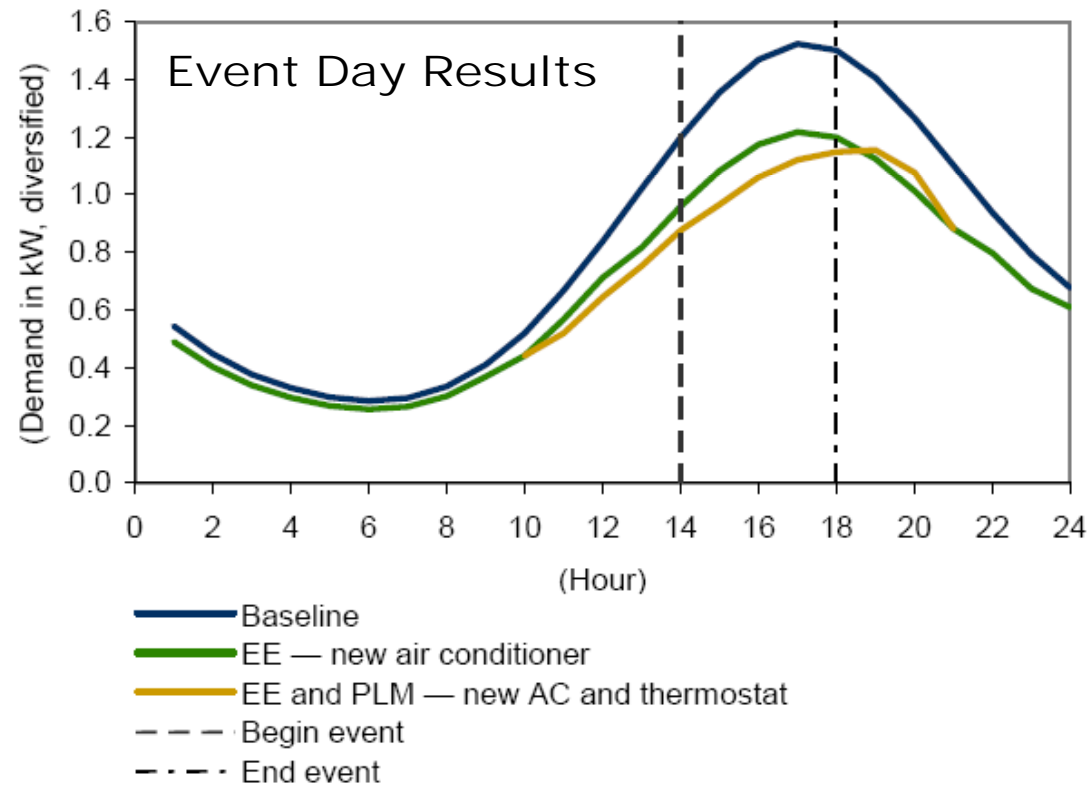
Customer reduces energy use by 27% during the event, with a small snapback effect when the thermostat resumes the lower, nonevent setting.



Source: Energy Insights, 2007

Residential examples: Customer #2 (EE and PLM)

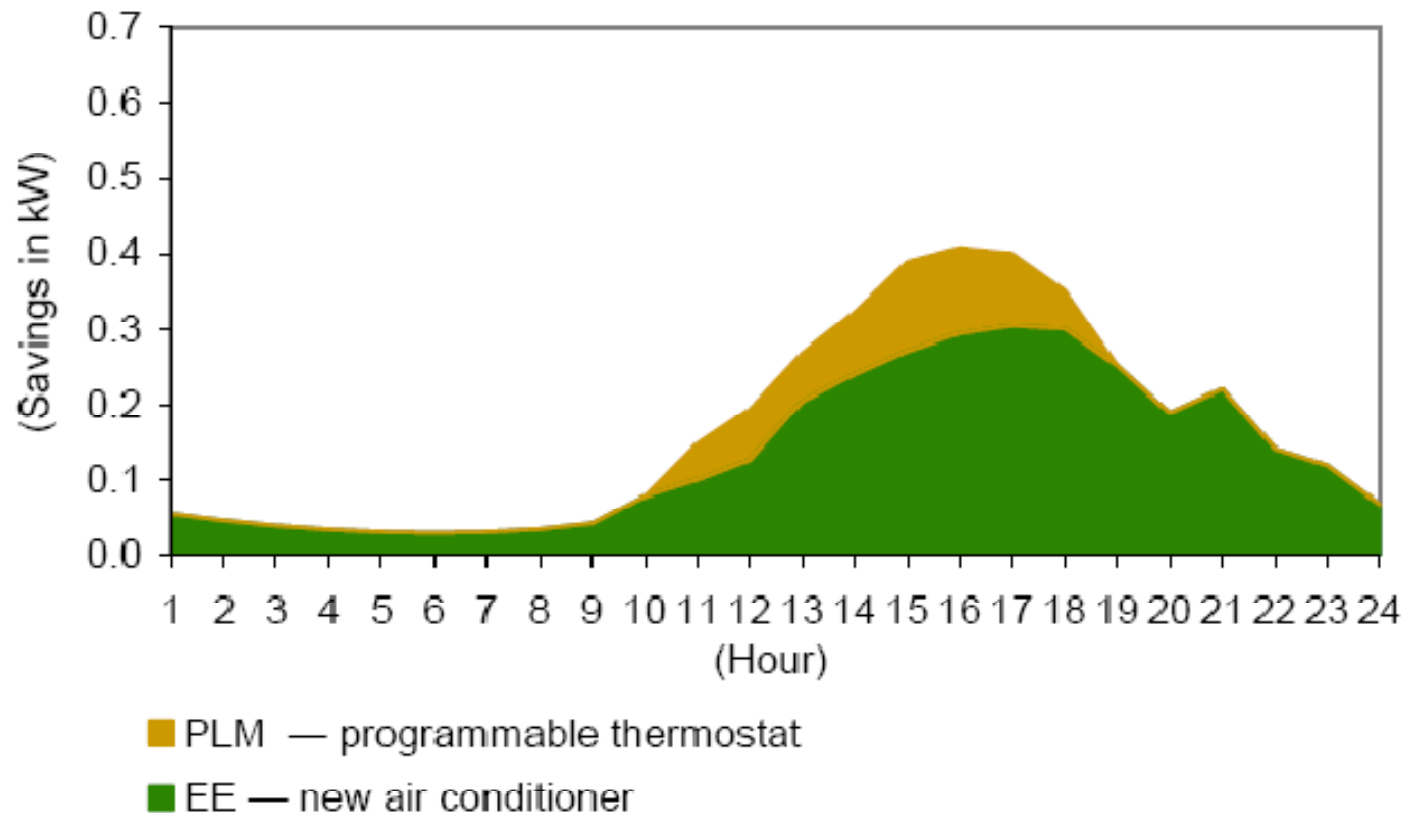
- Customer uses an online energy analysis tool on the utility's website, and takes specific actions, including:
 - purchasing a high-efficiency air conditioner to replace a 15-year-old unit
 - installing a programmable thermostat and increasing the thermostat setting during on-peak periods



Source: Energy Insights, 2007

Energy savings – Customer #2 (EE and PLM)

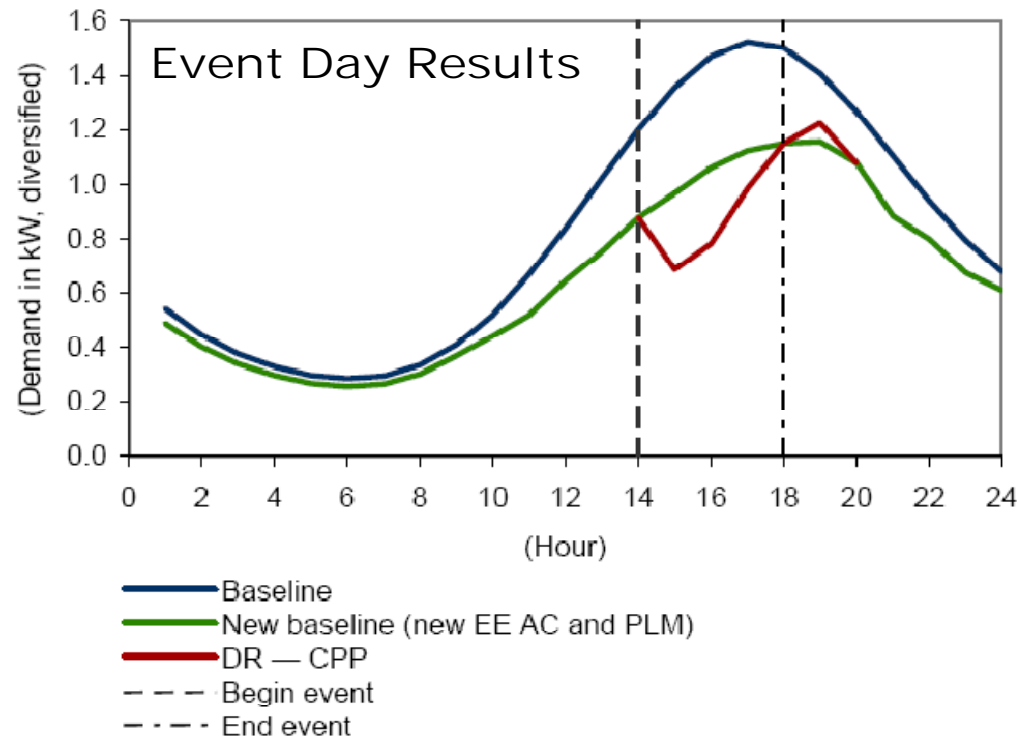
Compared with customer #1, customer #2 reduces the same amount of peak demand, but saves more energy across all hours that the air conditioner is on.



Source: Energy Insights, 2007

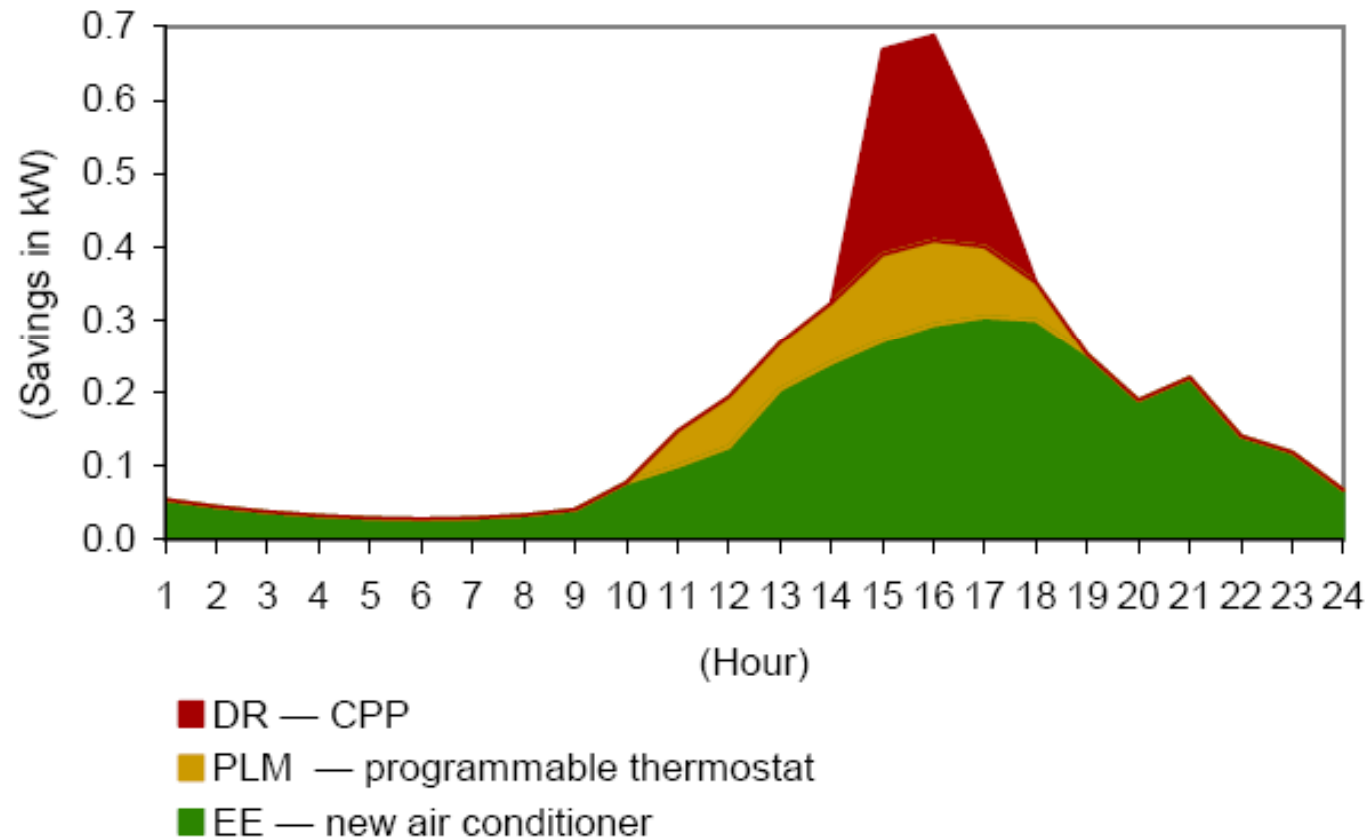
Residential examples: Customer #3 (EE, PLM, and DR)

- Customer combines the actions of the previous two customers:
 - installing a high-efficiency air conditioner
 - installing a programmable thermostat and increasing the thermostat setting during on-peak periods
 - participating in the utility's CPP program that automatically adjusts the thermostat a few degrees during events



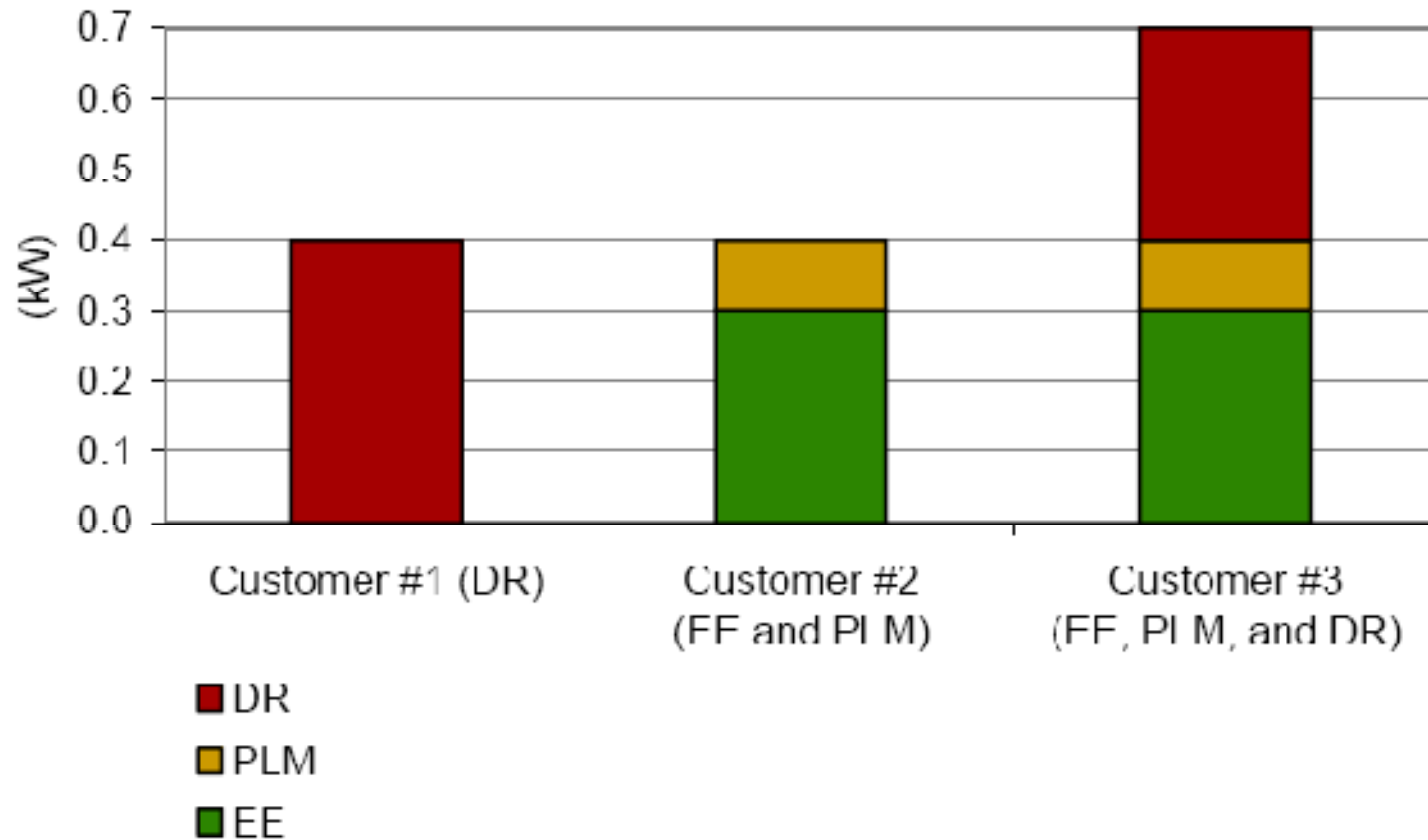
Energy savings – Customer #3 (EE, PLM, and DR)

Overall savings are less than the sum of the savings for customers #1 and #2, since the DR impact is reduced.



Source: Energy Insights, 2007

Peak savings summary by type of customer



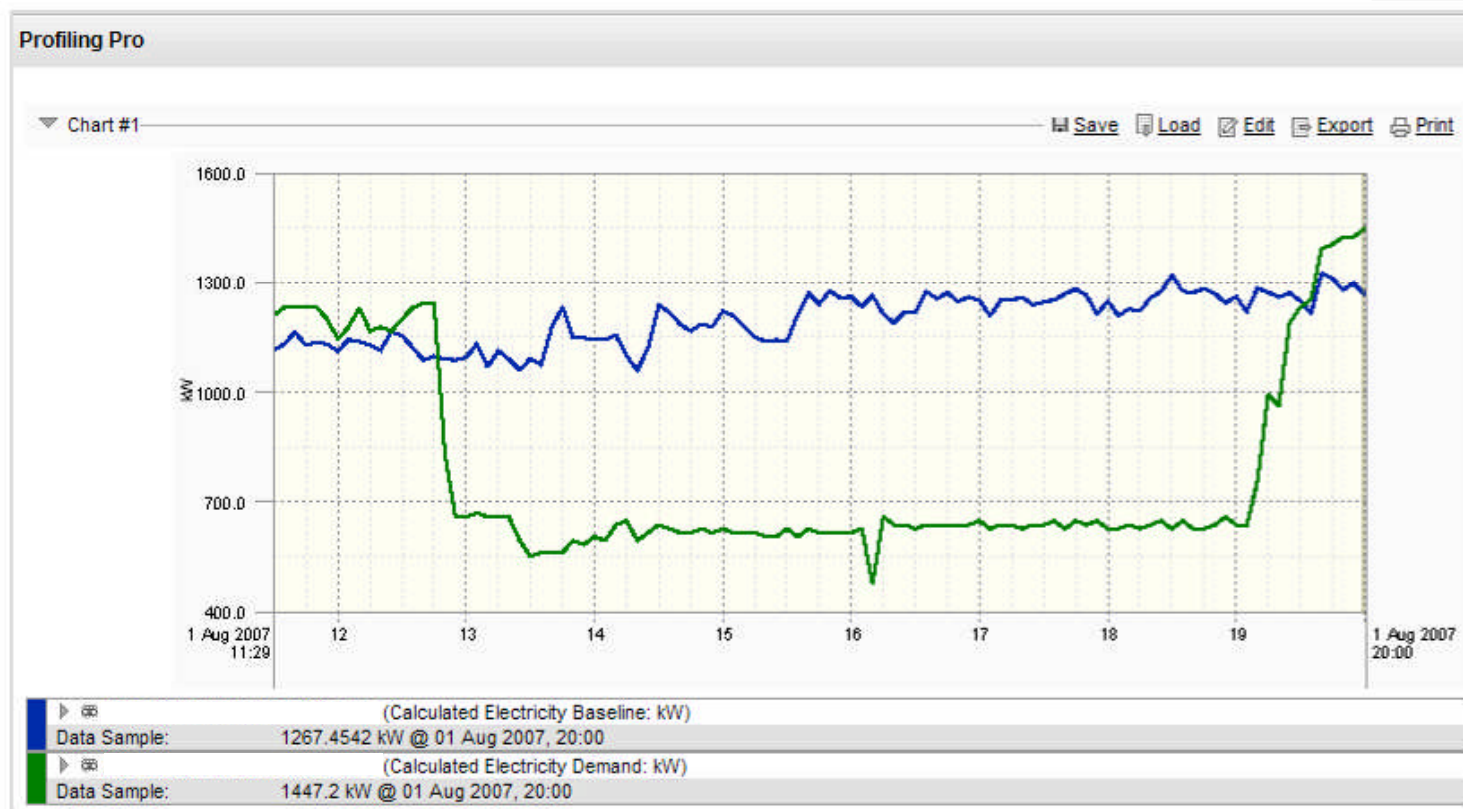
Source: Energy Insights, 2007

Demand response: a “gateway drug” to energy efficiency?

- Increase awareness
- Leverage the “audit”
- Use the revenue stream
- Take advantage of information through analytics

Integrating DR and EE for commercial customers

Demand response program participation typically increases energy awareness by providing visibility into real-time energy usage – savings of 1 to 2 % (or more) are typical.



Integrating DR and EE for commercial customers

- During demand response “audit,” technicians can also identify opportunities for energy efficiency improvements.
- Frequently, a thorough review of control strategies (to implement DR) uncovers operational issues such as improper settings, overrides, etc.
- Need to make sure incentives are aligned, especially when using third parties for implementation.

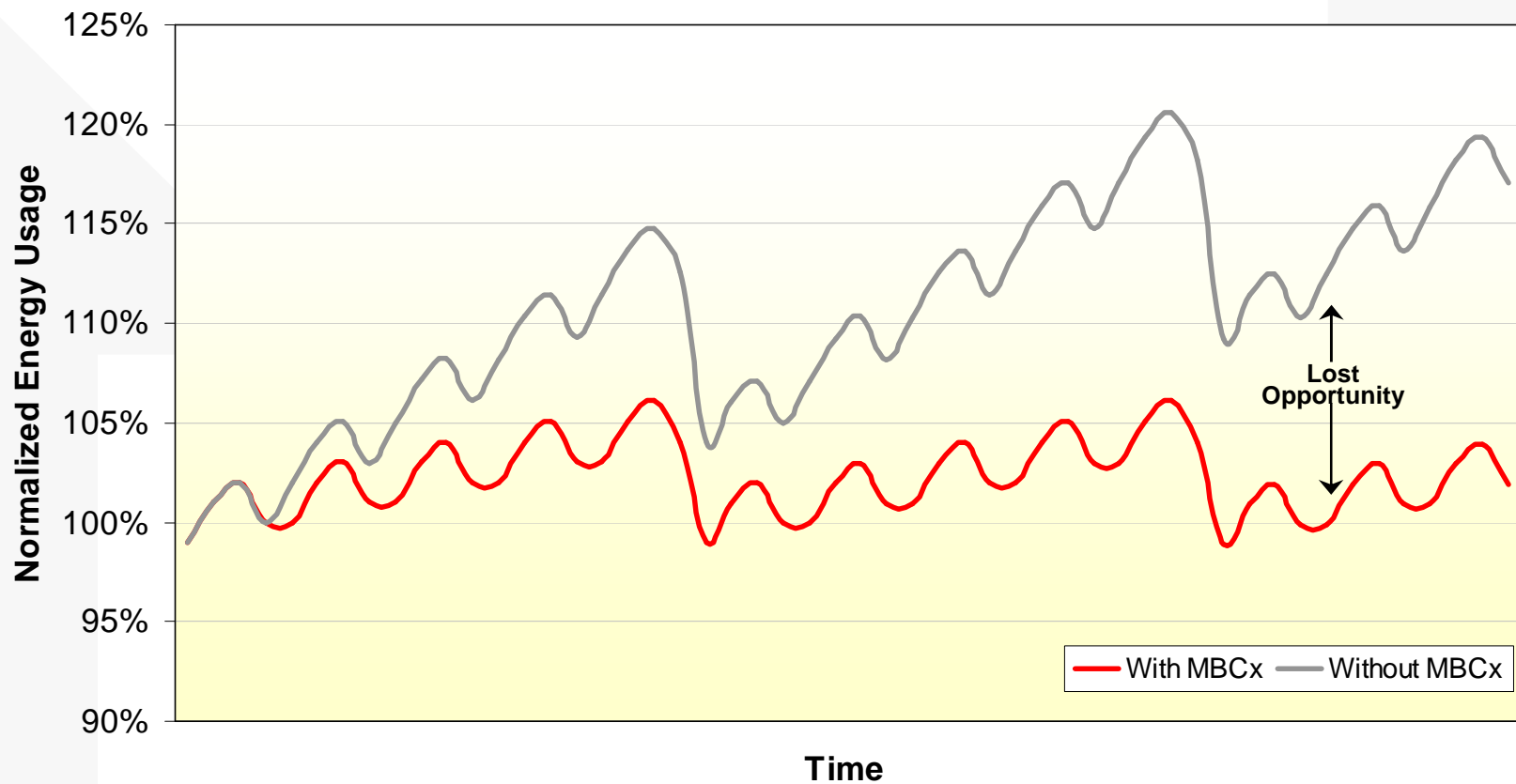


Integrating DR and EE for commercial customers

- Demand response can create a significant “revenue stream” that can be used by the customer to finance energy efficiency investments.
- One idea: utility can “match” DR incentive funds when used for EE
 - Small business customer could get **\$1,000/year** for demand response program participation for **four years**, **OR** an up-front **\$5,000 payment** for qualifying EE capital investments (in addition to other applicable incentives)
- Could new energy-efficient equipment be provided in lieu of DR incentives?
 - *“Let us raise your thermostat a few times a year, and we’ll give you a new high-efficiency A/C system for 50% off.”*

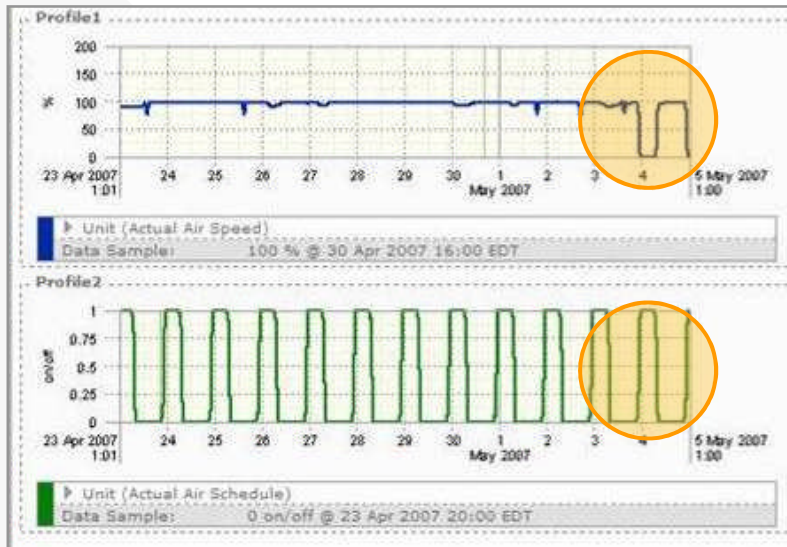
Integrating DR and EE for commercial customers: Monitoring Based Commissioning (MBCx)

Like a continuous tune-up for your car . . .



Monitoring Based Commissioning (MBCx)

A **technology-based** offering designed to help **optimize** the way buildings operate, measure the impact of key **energy** and **environmental** decisions, and optimize occupant **comfort**.

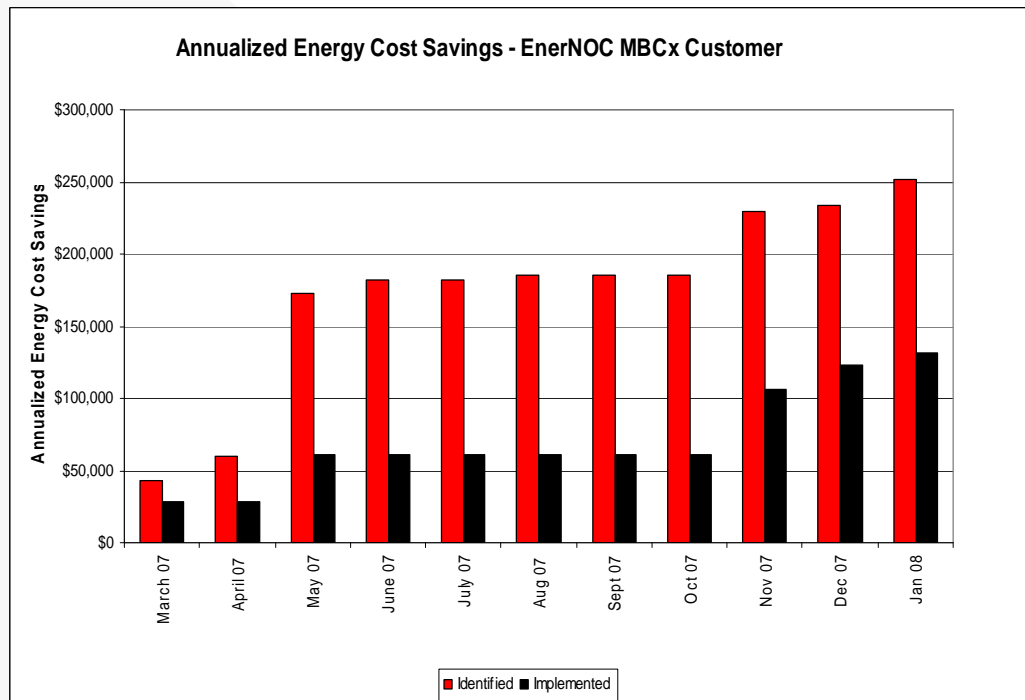


PowerTrak screen shot, showing how the application is used to identify and address energy efficiency issues.

- Provide actionable recommendations for energy efficiency
- Prioritize facility maintenance and repair activities
- Benchmark buildings and compare them to others
- Plan for capital equipment upgrades
- Document emission footprint and track environmental impacts

Case study – Western Connecticut State University

- Buildings include 283,000 square feet: classrooms, library, student center, administration building, etc.
- EnerNOC monitoring hundreds of datapoints continuously through existing BMS system and new submetering
- Two campuses, totaling ~25 buildings, \$2.5MM energy spend; more than \$275K in annual savings identified in the first twelve months of monitoring



The chart shows the growth in energy cost savings from MBCx for WCSU.

The red bars illustrate the annualized energy savings identified, and the black bars indicate the savings resulting from measures implemented.

Thoughts to consider

- ◉ Integrating EE and DR programs has advantages, but also adds **significant complexity** in allocating costs and benefits.
- ◉ Identify key system objectives and **prioritize programs** accordingly.
- ◉ Focus on **customer needs** – use portfolio of programs as a “toolkit” and customize to meet specific situations.
- ◉ Measurement & verification (and defining **accurate baselines**) is critical – need to avoid any “double counting” when calculating program impacts.



Questions?



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