Killer Apps for the Smart Grid
Demand Response and Monitoring Based Commissioning of Buildings
April 22nd, 2009
“Time present and time past are both perhaps present in time future, and time future contained in time past.”

-T. S. Eliot
I admit it, “Smart Grid” is a buzz word

- Google search this morning yields:
  - 2.7 M sites relating to Smart Grid
  - 2,456 news stories

- Frequency of searches have increased 10 fold in the last year, and 100 fold since 2007

*Usage index* = # of times term is searched in a week relative to average number of times term was searched each week during the period

Source: Google Trends
Oh, and “killer apps” seem to be getting a lot of attention too

- Almost certainly NOT driven solely by Smart Grid interest

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Source: Google Trends
“Smart Grid” means “Smart Meters”, right?
It’s not just residential!

2007 Electricity Data

Who really cares about “killer apps” anyway?
So, Smart Grid Killer Apps are services and products that...

1) Provide value to businesses and consumers,

2) Are enabled by Smart Grid monitoring and data infrastructures, and

3) In turn, drive rapid development of those infrastructures
What is so important about Demand Response?

Average Load Duration Curve for 1,000 MW of Electricity in the US

<1% of kWh represents nearly $3 billion in capital expenditures annually
How does the Smart Grid enable Demand Response?

Building-to-Grid integration promises…

• Real time energy data
• Technology-based Demand Response
• System level monitoring
• Sub-meter based management
• Automatic Operational Energy Efficiency
• Two-way energy Data
• Dynamic Pricing

Available today in Smart Buildings
Demand response works best when customers do not have to make on-the-spot decisions

- Notify
  - Customers need to be made aware of the situation

- Curtail
  - Ideally, load is shed remotely, but some on-site decision making and action may be required

- Monitor
  - Real-time monitoring increases the delivered resource

- Restore
  - Customers need a feedback loop to know how they did
Name That Industry! Customer #1

Average Performance: 2,131 kW (271.8%)
Name That Industry! Customer #2

Average Performance: 345 kW (107.9%)
Name That Industry! Customer #3

Peak Performance: 425 kW; 5:35 PM

Average Performance: 380 kW (87.9%)
And when you add it all together…
By the way, once you’re monitoring the building anyway, you can start to deliver additional value.
How does MBCx leverage the Smart Grid?

End-Use Devices

Monitoring

Network

Applications & Results

EnerNOC Site Server

Building Management System

[TCP/IP]

Broadband Narrowband Wireless

EnerNOC BMS Gateway

PowerTrak®
What the Smart Grid can see…

VAV boxes are often hunting undetected by facility managers unless someone is walking around and hears or feels it.

In this example, the properly operating VAV-Box had an annual savings of $360 and 12-mTons of CO₂ avoidance, but was typical for 40 VAV-Boxes.

The estimated replacement cost of the controller and actuator is about $500 with a total deferred cost of $20,000.

**Savings Category:** No Cost

**Action Recommended:** This and several other VAV-Boxes, ~40%, were found to be in this condition and in a building that was still under warranty! The contractor was brought back in to fix all identified VAV-Boxes.
WCSU faced common energy management challenges, all of which were budget-busting.

- **Energy Costs**: CT energy prices spiked by 40% in 2006, busting the budget.
- **Scope**: Two campuses with 25 buildings for a total of 283,000 square feet.
- **Lack of Visibility**: No site-specific reporting of energy use/profile to perform building-to-building or year-to-year comparisons.
- **Lack of Integration**: Disparate systems monitoring building energy usage, no integrated platform.
- **Lack of Support**: University understaffed, so a “detailed evaluation” of the BMS not a priority. Shrinking budget, capital expenditures hard to justify.

Ideal Opportunity for Monitoring-Based Commissioning
WCSU – MBCx Operational Cost Savings (All Fuels)

Cumulative Implementation Rate = 62%

WCSU identified over $275,000 in annualized energy savings – 13% of annual spend. (Currently at 18%)

WCSU implemented measures with an actual M&V savings of nearly $110,000 with an annual run rate of $170,000 – 8% of annual spend.
WCSU Results

To date, WCSU has saved nearly 200K THM and 900 MWh since the inception of the agreement.

WCSU efforts earned the Energy Project Award from the New England chapter of the Association of Energy Engineers.

There was no capital outlay on the part of WCSU – services were paid through deductions from Demand Response payments.
Where do we go from here?

- Submetering of tenants
- MBCx for other customer types
- Dynamic DR
- Web or kiosk-based displays
- Outage detection
- Dynamic pricing services
- Premium power services
- Hybrid/EV participation in real-time markets
- MBCx for the grid
- Smart appliances
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