

# Helping Facilities Professionals Make Smarter Decisions

# BUILDINGS

April 30, 2012  
www.buildings.com

## Curbing the Energy Curve

An inch-deep, mile-wide strategy carries energy management across the portfolio of Duke Realty

By Chris Curtland

In order to realize significant energy savings, you need to take your energy pulse and then strengthen and monitor it – but it's difficult to manage energy when you only have 12 data points a year from utility bills.

Gathering energy baselines across a portfolio is a unique challenge, but it doesn't necessarily require outside consultants or fancy equipment. Attaining profiles can start simply with interval data taken every 15 minutes from a smart or shadow meter – because 35,000 data points per year open up a lot more opportunity.

"This technique can be quickly deployed across the portfolio instead of focusing on one building and gives us tremendous leverage," says Paul Quinn, strategic execution officer of Duke Realty, a publicly traded REIT.

Quinn has implemented energy management strategies across 122 of the firm's 300+ office buildings utilizing an inch-deep, mile-wide philosophy. It entails drawing energy curves that graph kW and occupancy, then applying an analytics package to them.

"When people hear that term – 'analytics' – it seems big, complicated, and expensive. Some vendors want to come in, track thousands of points, and run hundreds of rules, but you'll get overwhelmed trying to do all that at once. Just start simple. Get a good, robust framework that will let you expand over time," Quinn says. "For us, it's more important to get breadth and commonality than it is to drill down a foot."

Once you have the sketch of the curve, you can begin shaping it, lowering its height, and monitoring any shifts from normal. These five steps will ensure your energy pulse isn't left to flatline.

### 1) Gather Data and Draw the Curve

The seeds of Quinn's strategy were planted about five years ago by shadowing utility meters at Duke Realty's office buildings. The data was graphed into energy profiles.

"We took these kilowatt demand curves and tried to teach people how to distinguish good shapes from bad ones. However, their analysis across different markets wasn't consistent," Quinn explains. "That led us to look for an analytics package that could interpret all the data and automatically identify opportunities for savings."

When selecting among the plethora of analytics packages available, Quinn and the firm decided that having the ability to write their own rules for the program was important. Some systems require the rules to be written by the provider, Quinn explains, and he has since determined that the SkySpark package was the right decision. It also has a simple, intuitive user interface that allows technicians to easily see what energy-saving opportunities the program has identified.

Duke Realty employed the package almost two years ago, starting with just two data points – kilowatt readings every 15 minutes and occupancy.

"With only those two measures, we identified a major aspect of the energy problem," he says.

### 2) Correct the Curve's Shape

Having taken the energy baseline, the next step is to steady it.

"Using the data points, we wrote just six total rules that analyze the shape of the curve in the context of occupancy," Quinn explains. "They identified low- or no-cost opportunities to correct poor start-up and shut-down sequences, which are a huge issue and offer the biggest bang for the buck."

A proper demand curve should show a clear start and end that corresponds to when the building is occupied. It shouldn't have any unusual spikes. Common issues identified by the package include:

“ For portfolios, it's more important to get breadth and commonality than it is to drill down a foot. ”

– Paul Quinn, Strategic Execution Officer, Duke Realty



- The building starting early or late
- The building running late
- The building experiencing peak load outside of occupancy
- Choppy energy profile (equipment cycling)
- Peak load within 5% of annual peak

"It's really a matter of fine-tuning your building schedules and sequences," Quinn explains. "That's where the rubber meets the road."

Even a building being off schedule by 30 minutes or a momentary spike in energy (when all systems come on at once, setting a demand threshold) can have significant impact on usage and cost, Quinn explains.

### 3) Lower the Curve's Height

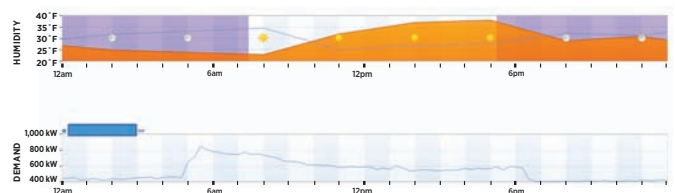
Quinn's inch-deep, mile-wide strategy allows Duke Realty to take on flexible, incremental retrofits. Once the mile is laid out, Quinn can decide when it's appropriate to drill down another inch.

"The next opportunity is lowering the height of the curve, which depends on individual loads on the meter," explains Quinn. "That requires looking at different pieces of equipment, and then you're really starting to go deeper into the building."

Quinn has begun collecting data points on each terminal piece of equipment: VAV air handlers and heat pumps with DDC controls. Only a few additional points were collected and combined with about a dozen additional rules. Doing so has already identified the following problems affecting energy usage or tenant comfort:

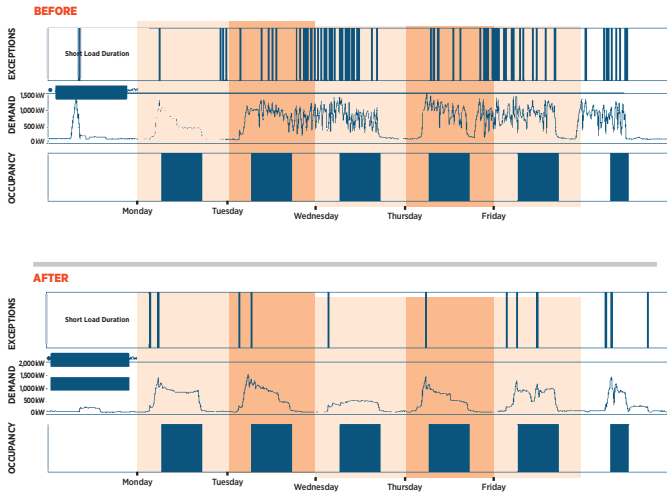
- Bad temperature sensors
- Missing night setbacks

#### CORRECTING THE ENERGY CURVE



The first step in curbing your energy curve is making sure that your demand syncs up with occupancy. Outside weather patterns are helpful for identifying load requirements. Once the curve is synced up, you can start lowering its height and monitoring drifts.

## IDENTIFYING SHORT CYCLING WITH ANALYTICS



The analytics package Duke Realty uses does all the heavy lifting. No technician or employee is required to interpret the choppy curves, because exceptions (or alerts) are displayed on the top bar. For example, the system will report if there is an unusual spike outside of the blue occupancy zones or if there are more spikes than should be expected.

- Not reaching setpoints
- Conditioning past the setpoint
- Short cycling
- Not reaching airflow
- Excess after hours demand for conditioning
- After hours space temperature unchanged

“Those extra measures caused the building to light up like a Christmas tree. There are more issues than you would believe,” Quinn explains. “It would be labor intensive and difficult to find them with traditional techniques. With analytics, they jump right out at you.”

Finding inefficient units and fixing or replacing them brings that energy curve down, and the next goal is to apply analytics to cooling towers, boilers, heat exchangers, and rooftop units, Quinn says.

“It’s all about finding more opportunities,” he adds.

### 4) Monitor Drifts from the Curve

Duke Realty enlists a half-time-equivalent employee who interacts with reports from the program and communicates those to technicians in the field. Once the curve is optimized and lowered, it’s important to manage slides from optimum performance.



“Some vendors want to track thousands of points and run hundreds of rules, but you’ll get overwhelmed doing that. Start simple. Get a robust framework that will let you expand over time.”

— Paul Quinn, Strategic Execution Officer, Duke Realty

## OPERATIONAL SAVINGS FROM ANALYTICS

MEASUREMENT	2006	2010	2012
Office Square Feet Per Technician	189,000	229,000	252,000
Card Access Cost	\$25	\$0-10	Limited self-service
Diagnostic & Alarming Maturity	Inconsistent	Standard	Analytics
Metering Strategy	Minimal	Manual analysis	Continuous commissioning

After systems were standardized on a common platform, Duke Realty began seeing operational savings in addition to energy savings. For example, the firm now has the ability to grant, deny, or change system access on its own, thereby avoiding charges. Also, advanced metering stimulates commissioning and recommissioning processes.

“If somebody overrides a system and then doesn’t take that override off, we want to catch that as quickly as possible so that it doesn’t stay on for any extended period of time,” Quinn explains. “The analytics package lets you do that because you get alarms or exceptions every time something is outside of parameters.”

The system doesn’t require a technician – either at the central location or in the field – to actively look for problems because any disturbance is automatically alerted via the interface.

“We look at these exceptions on a weekly basis. In that time frame we find a number of opportunities, and typically they are very low-hanging fruit,” Quinn explains. “Usually it’s something around the start-up or shut-down schedule or other kinds of setpoints that can simply be reconfigured and don’t require additional capital.”

Quinn has also identified when a building hits an annual peak usage or is within 5% of that mark. “At that point, we can call the field, asked what’s changed in the building, and see if something can be shaved to lower demand charges,” he says.

### 5) Drill Down Deeper

The next step is to strengthen your pulse. Duke Realty still has about 200 office buildings in its portfolio that aren’t equipped with metering or modern control systems, and the plan is to incorporate those incrementally.

“We have a company policy that says any new construction or retrofit must include this technology,” Quinn says. “So at this point, as buildings justify system replacements – typically because of age or breakdown – then those buildings will come onto the analytics platform.”

Duke Realty’s system also helps during the commissioning process, Quinn says.

“A contractor will only sample 10 or 20% of VAV units in a building and if they’re working correctly, he assumes all the others are. With analytics, we can look at every single unit and tell the contractor which ones aren’t working while he’s still in the building,” explains Quinn. “From a recommissioning perspective, if we have a tenant turn over and there’s a major finish work and reconfiguration done in a space, we will pay more attention to the analytics after that to make sure we don’t have any balance issues.”

Additionally, the package helps Quinn turn an eye toward the future. Right now, Duke is investigating more centralized control.

“Facilities personnel are very busy and it’s hard for them to make time for more analytical and proactive tasks. Today, the analytics system does all the heavy lifting and identifies opportunities. Then we rely on the field to make those changes,” Quinn explains. “We’re experimenting with a model where we can make those adjustments directly from our central location. It takes one more point of resistance out of the process.”

Quinn is pleased with how analytics has streamlined the firm’s energy management intelligence. It has enabled the firm to lay its mile-wide framework and expand flexibly and incrementally over time.

“Start with something simple,” he says. “Then go an inch deeper.”

Chris Curtland [christopher.curtland@buildings.com](mailto:christopher.curtland@buildings.com) is assistant editor of BUILDINGS.

Reprinted with permission from Buildings.com, April 30, 2013. © On the web at [www.buildings.com](http://www.buildings.com).  
© Stamats Business Media. All Rights Reserved. Foster Printing Service: 866-879-9144, [www.marketingreprints.com](http://www.marketingreprints.com).

**SkyFoundry**

[www.skyfoundry.com](http://www.skyfoundry.com)