

Minding The Grid: Empowering Utility Management With M2M Technology

Fifteen degrees Fahrenheit is cold.

In the natural gas business, 15degrees F is the equivalent of August at midday for an electric company: primetime. It's when even the most frugal extra-sweater-wearer is likely to turn up the thermostat, and the collective result of this can be a strain on a utility's infrastructure and a vast drain of its resources.

[National Grid](#) anticipates all of this. The former Keyspan (it was purchased by London-based National Grid in 2007 and branding officially switched this May) is the largest distributor of natural gas in the northeastern United States. It serves 2.6 million gas customers in New York, Massachusetts and New Hampshire, as well as 3.4 million electric customers in the same states plus Rhode Island.



National Grid considers the weather, studies customers' previous usage, anticipates future use and then places its enormous orders for natural gas at negotiated rates and in long-term contracts. Nonetheless, a bad storm or an extended cold front could put the company in a position of needing to quickly purchase more gas on the spot market.

"The last thing you want to do is buy gas on the coldest day of the year. That's when it's normally most expensive," says Bruce Maida, Manager of Dual-Fuel Engineering at National Grid. "You want to plan your buying."

Since embracing an innovative machine-to-machine ([M2M](#)) technology, National Grid is able to avoid the pinches that once came with spikes in demand, and is able to plan its purchases more effectively than ever. So effectively, in fact, that the resultant savings during a severe winter could be enough to pay for a complete M2M rollout in a single heating season.

Dual-fuel boilers have long been a part of National Grid's ability to meet customer demand. The boilers are capable of running on one of two types of fuel -- for instance oil and natural gas -- and can be automatically switched from one to the other. Hospitals and other government-regulated buildings use dual-fuel equipment to meet safety regulations that require the presence of a backup fuel source.

Since 1964, National Grid has offered a special Temperature Controlled (TC) rate to large commercial, industrial and multi-family customers with dual-fuel boilers. As part of the deal, these

customers agree to switch their heating fuel from gas to oil when the temperature falls to 15 degrees F.

Knowing that on the coldest nights its largest customers would switch to oil enabled National Grid to offset the need to purchase or maintain the gas capacity for those times. However, there were nights when customers would continue to use gas -- a mistake that wouldn't be discovered until the morning.

The old system combined various types of technologies that over the years became difficult to service and replace. It operated over pager frequencies that, eventually, no longer will be supported.

"It was a mix-and-match of pager systems that we used for the fuel switching and automatic meter reading systems through telephone lines that were not real time. They came in on a scheduled call-in," says Maida.

In 2004, for the sake of gas system integrity more than anything else, Maida proposed developing a system that could replace the TC boiler room controls and the automatic meter-reading equipment with a single device. The proposal was born of a confidence that the system could handle primetime amounts of gas surging through it without suffering a collapse.

This system would be a state-of-the-art Web-based application for monitoring and control that could also provide reports and data to better predict and control gas purchasing as well.

Maida designed a system and put out a request for proposal (RFP). Seven firms responded and National Grid Beta-tested the products of four of them, installing five units from each company for the duration of a winter. In the end, only three fulfilled the needs of the RFP, and only one could meet it at an excellent rate: M2M Communications, a five-year-old, employee-owned company based in Boise, Idaho.

Opening Communications

M2M, in the simplest terms, enables a machine to relay information about itself to another machine (or device) that can then communicate that information to people.

For example, a soda machine with M2M technology in its guts can be instructed to email a delivery driver when it's low on A&W Root Beer, thereby reducing machine downtime and saving the driver unnecessary visits. A blood diagnostic machine can be made to text a technician when it's not calibrating perfectly -- a subtlety likely to go undetected by a nurse or physician. And a water spigot acres-deep in a soybean field can prompt a voice message to a farmer's cell phone saying it's stuck

in the mud.

Early incarnations of M2M relied on satellite networks at considerable costs, but today communications can be less expensively handled via cellular and WiFi networks.

Falling costs, as well as the technology's seemingly unlimited usefulness, are helping drive its prolific growth. Research firm Berg Insight predicts the number of mobile network connections used for M2M communications will grow from 37.5 million in 2007 to 186 million in 2012, and Alexander Resources expects the number of M2M connections to outnumber mobile phones in North America, Western Europe and Japan by 2012.

The market is rich with players, from network equipment providers (such as Nokia and Sony Ericsson) to application developers, mobile networks and Internet datacenters.

M2M Communications is a complete M2M solutions provider, which means it offers designed and manufactured M2M hardware, corresponding application software, Web site development and hosting, cellular or satellite airtime (it is a VAR with AT&T) and technical support defined by service level agreements. It will also sell portions of its solution, such as its field-tested hardware and its NOC (network operations center) service, which is the component that communicates via text message, email or voicemail.

Mark Sams, Senior Software Developer with M2M Communications, says a lot of factors are encouraging M2M growth, including fuel prices. "Any kind of alternative to having to drive your vehicle somewhere becomes real attractive," says Sams. "Fuel costs are now exceeding the labor costs for companies, which I think is the first time in history that that's ever been the case."

The growth of M2M is also coinciding with a mass greening of big business. "These kinds of products allow the customer to be eco-friendly by not having to drive to various locations to monitor or observe equipment," says Sams. "They can just sit at their desks and pull it up on a web page and see how things are doing. If something does need attention, they can better prioritize and schedule when it is that they visit that equipment."

Working with Maida's specs and prototype designs, M2M Communications customized a complete solution for National Grid. When the devices were ready for installation, an engineer from M2M Communications spent time in Long Island and New York City conducting hands-on training sessions. Maida, who directed both sessions, trains new technicians and manages the program.

Today, five full-time dual-fuel technicians support the M2M installations, working toward getting an M2M installed for all 5,000 customers signed on for the TC rate. When installing a device in a boiler room, the technician launches the M2M Communications application on a Palm handheld and follows step-by-step instructions. The application can also test cellular signal strength (consider the

location of most boilers) to determine whether an external antenna is needed.

"Now we have the ability to get customers efficiently off the system at 15€," says Maida. "When we buy gas, we buy gas for our TC customers up to 15€. Once it goes below 15€, the quicker we get these customers [switched over to oil], and the more efficiently we switch them over, the less possibility there is that the gas we purchased isn't enough to support the load of our customers."

Knowing it can enforce TC rates and avoid spot market purchases is no small relief. Sams explains, "When you're talking about as much gas as those guys are talking about -- it can be 10s of million of dollars a day."

With the M2M Communications technology in place in the boiler rooms, it was simple to add additional logic to the hardware that now allows National Grid to measure the quantities of gas each customer uses.

Every hour the device sends an update to the National Grid servers; the hourly numbers are then totaled to generate a meter reading. Through an online portal, the numbers can be viewed and devices can be given new instructions if necessary. This portal also gives National Grid the capability to retrieve real-time data, status alarms and confirmation of control actions from sites.

"The obvious benefit is you don't need a meter reader to visit the site," says Maida. "But also, the reads are very accurate and are automatically delivered via an FTP file into our billing system with 99% efficiency. This efficiency in billing has a positive effect on cash flow and customer satisfaction."

Maida says the company is also looking into providing real-time consumption information to customers. This would help them improve their energy management by enabling them to see when their equipment needs servicing. Says Maida, "It's about setting them up for the long term."

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