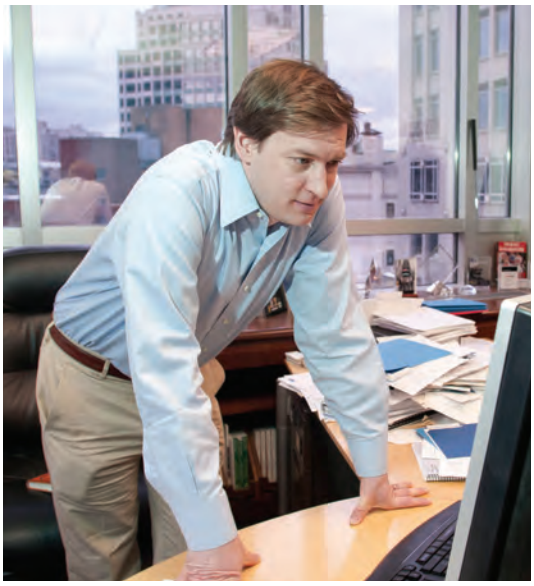
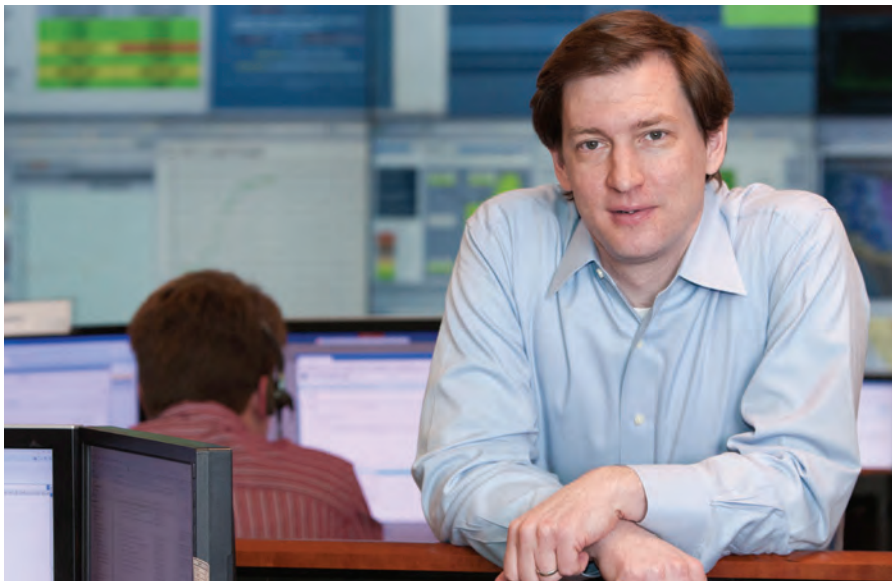
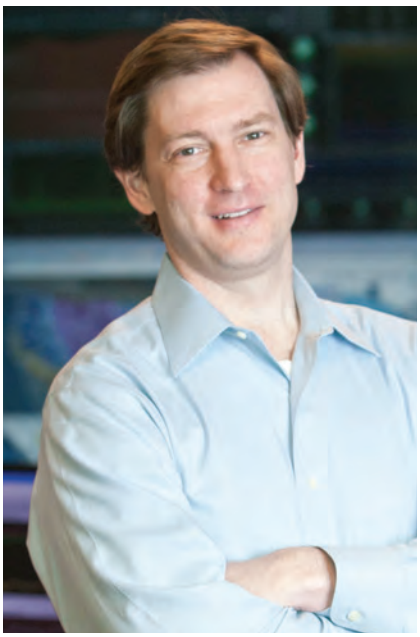




POWERSWITCH: ALUM BREWSTER TRANSFORMING HOW WE USE ENERGY

by Erica Rowell



Photos by Judy Rolfe

FORGET ABOUT BUILDING IT. IF YOU DON'T BUILD IT, THEY WILL COME—**AND WHISK YOUR ENERGY NEEDS TOWARD THE SMART-GRID FUTURE.**

The "it" is a new power plant. And the "they" refers to **David Brewster** MEM'98 and EnerNOC, short for Energy Network Operations Center, a firm in the business of selling *negawatts* (instead of *mega*watts) to utilities. "With a push of a button from our network operations center, we can reduce unnecessary consumption," says Brewster, who co-founded the company in 2001. "That ability to actually control demand on the network creates a dispatchable resource that creates a lot more efficiency in the market."

A quick visit to a stormy Thursday in the Northeast provides a real-world example. On June 24, 2010, amid powerful thunderstorms ravaging Maine and New Hampshire and a tornado ripping through Bridgeport, Conn., two major power plants failed. Grid operators signaled Brewster's team, and EnerNOC's control room kicked into gear, sending electricity reduction orders to area customers. In response, hundreds of sites tripped the switch on their reduction plans, dimming lighting, shutting down processing lines, tweaking HVAC settings and so forth. In all, 380 megawatts of electricity were collectively pulled off the grid for two and a half hours. The wattage delivery, in the words of EnerNOC co-founder **Tim Healy**, was "the equivalent capacity of roughly three peaking power plants."

It's an innovative solution to one of our biggest energy problems—namely, the need to build more power plants to accommodate our ever-growing appetite for energy. Instead of tapping backup plants when demand for electricity outstrips supply, utilities tap EnerNOC, whose customer sites cut nonessential electricity usage on demand.

While a price-based version of this system has been around for decades (interruptible tariffs allow utilities to incentivize customers by offering lower rates for reductions during peak-demand times), that less technological practice does not guarantee affordable real-time data communication or adequate automation to allow for smooth curtailment. EnerNOC's technology-based solution does—while delivering a suite of complementary energy-management tools for even more reductions and added pollution cuts.

It's nothing short of a quiet energy revolution.

THE VIRTUAL POWER PLANT

For all the high-tech, 21st century tools EnerNOC employs to update an aging electricity delivery system designed for the 20th century, the company's big hurdles are more psychological—one might even say evangelical—than technological. In turning on its head the way the industry has worked for more than a century, EnerNOC's main challenge, says Brewster, is persuading utilities it's a viable resource.

"Our heavy lift is getting utilities to agree to do this," he says, "and getting regulators—the public service commissions, the public utility commissions in each state—to actually pay for it."

That challenge is diminishing over time, thanks to a proven track record and mounting success stories. A customer base of about 100 grid operators and utilities that spans three countries (the United States, Canada and England) doesn't hurt either, especially when it includes such heavy-hitters as ISO New England, New York ISO and PJM Interconnection, as well as Pacific Gas and Electric Company, Salt River Project and Southern California Edison Company.

Last year EnerNOC signed its biggest industry contract ever with the Tennessee Valley Authority.

"Most people look at TVA as a pretty risk-averse, low-cost electricity territory, so I think it raised a lot of eyebrows when the industry saw TVA sign a 560-megawatt contract with EnerNOC to deploy demand response," said Brewster.

If signing up utilities can be challenging, finding end-user sites is a "no-brainer." The reason is simple: the utilities pay EnerNOC to be a resource and to reduce demand, and EnerNOC shares those payments with its end users.

When signing up those end users, EnerNOC looks for industrial, commercial and institutional heavyweights who typically draw a lot of energy. Simulating a power plant and building capacity require a lot of negawatts. And so size is the common denominator among its diverse list of customers who include well-known brands (AT&T, General Electric, Pfizer, Albertson's, Shop Rite, Stop & Shop), hospitals (Stamford Hospital, Greenwich Hospital, UMass Memorial Health Care), universities (University of San Diego), and governments (Maine, Vermont, Boston, Connecticut), among many others. Take Connecticut's heft, for example. The state's 700 megawatts of demand response capacity within a 7,000-megawatt system peak mean that within minutes of notice, about 10 percent of the system's demand can be made to disappear.

Paying end users to be smarter about electricity use while helping them save on energy costs is a big selling point for EnerNOC, Brewster says, but the benefits do not stop there.

UNLOCKING A POWERFUL DATA STREAM

EnerNOC's home page keeps a running tally of the dollars it has helped its customers save. At the time this magazine went to print, those savings altogether had reached $320 million and counting. Demand response is responsible for a big chunk of those savings, and what allows for the rest is the technology behind demand response.

That technology, the EnerNOC Site Server, is housed in an unassuming cabinet at the customer's site that easily blends into boxes typical of an electric room. But the information it holds is anything but typical of what's available

to the average American corporation.

The box is the gateway connection between the site's energy resources and EnerNOC; it reads and records a host of detailed energy information, from voltage and current to power levels and power quality, and sends all that data to EnerNOC's control room, where, says Brewster, "our special sauce is located—the software to manage thousands of distributed energy resources and to do it in a centralized, secure fashion."

While the software allows for near-immediate, sometimes even automated energy curtailment, its powerful data stream unlocks a world of information to end users. Suddenly, says Brewster, these sophisticated commercial office properties, industrial facilities and universities, who are used to getting their bills 30 days after the fact and not understanding the line items on them, are seeing real-time energy data. They can log in and see minute by minute exactly how much energy they're consuming, why and where. And that can be ground-shifting.

Says Brewster, "That then opens their eyes to, 'hey, why am I getting a peak demand at 6:00 in the morning? It's because I come in and turn on all my chillers at the same time. Or how much is this actually costing me. Or, you know what, I'm finding out that our chess club is coming into this building and turning on the lights and then leaving them running, and so we're wasting all this electricity.' So we start driving energy efficiency and getting customers much more attuned about how they consume electricity."

With this valuable data in hand, EnerNOC can then work with their customers to reduce energy consumption all the time (not just during peak periods), to monitor and start reducing greenhouse gas emissions and to help them consider and go about procuring renewables.

"Our vision is to be not a one-trick pony," says Brewster. "Our trick is to become an overall total energy management partner for these commercial and industrial facilities, so we're helping them think about all their energy decision-making."

PAVING THE WAY TO A CLEAN ENERGY FUTURE

Brewster has seen the future of energy and it is clean and bright. It is monitored and metered. It is dispatchable and digital. It is interconnected and smart. It is slowly starting to roll out.

"In the smart grid," says Brewster, "there's going to be the infrastructure layer, all these meters and the copper and the sensors. And then there's going to be the application layers, the analytics driving energy efficiency with the data. And we are very much in the application layer."

EnerNOC is to the smart grid what applications like eBay, Google and Yahoo are to the hardware network of switches and routers and fiber known as the Internet.

It's not a far cry from what Brewster and Healy originally had in mind but it's a different model.

"Our initial vision was that we were going to build the data communications network to link together all these distributed generation assets, these fuel cells and micro-turbines, and we were going to do the remote diagnostics and the metering and verification work," says Brewster, who adds that in that vision, the customer would have had to pay them.

"On further investigation over the course of a year or so, we came upon the concept of demand response," Brewster continues, explaining, "We could do everything we were thinking of doing, but we could do it behind a meter. We didn't need to interconnect to the grid, we could actually not only use distributed generation, but we could actually do curtailment of demand, energy efficiency, and get paid as if we were selling power back to the grid."

Before building his virtual power plant, Brewster studied the economics and policy of energy at Duke's Nicholas School — a "great building block" for his work now, he says, in which a core focus is government and regulatory affairs. (Brewster is now a member of the Nicholas School's Board of Visitors.)

"I think Duke is just so well positioned for building energy leaders of the future," he says, "because it has such good undergraduate and graduate programs in the environment, in business, in policy and also in engineering, which are sort of the four pillars of the industry. And there's such good cross-pollinization and ability to take classes across those institutions."

Brewster, who as EnerNOC's president approaches the business from an environmental angle, met CEO Healy, whose approach is more entrepreneurial, at Dartmouth's Tuck School, where they both received their MBA.

In the decade since the two men took their company from a limited liability company to a corporation traded on the NASDAQ, Brewster and Healy have built up a network of some 8,000 sites and a demand capacity of five gigawatts—the equivalent of several large nuclear power stations.

The idea, says Brewster, is to keep growing their network of virtual power plants—adding more negawatts to the grid, cutting costs and reducing emissions, and ultimately fashioning, he hopes, the "killer app" of the smart grid.

Erica Rowell is managing editor of Dean Chameides' blog, TheGreenGrok.com. She is based in New York City.

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On Video

David Brewster talks about the future of energy

nicholas.duke.edu/davidbrewster