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Active Energy Management: the Next CTO Mandate

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Welcome to summer in the 21st century: heat waves, brownouts and rolling blackouts are a fact of life these days. Far more than mere annoyances, they also take a heavy toll on business operations.

According to the smart grid watchdog Jesse Berst, power interruptions and disturbances [cost the U.S. electricity consumer](#) at least \$79 billion per year, and a single recent rolling blackout caused an estimated \$75m in losses in Silicon Valley alone.

As the effects of global warming are increasingly felt, business is going to have to comprehensively address the volatility of the electricity grid, as a way to ensure a steady energy supply and minimize the impact of price fluctuations, as well as a response to increasing customer demands for greater environmental stewardship. CTOs sit right smack in the middle of this discussion because they hold the reins to the technologies being used that consume a certain amount of power from the grid every time they're used, and it's usually peak power that gets consumed.

"Customers are beginning to think about information life cycle management -- not only in terms of where data should reside -- but also power consumption," says Rich Lechner, IBM's vice president of IT Optimization. He added that, on a recent sojourn to Europe, he regularly heard that customers also increasingly want to know just how green their IT services really are.

That's yet another reason CTOs need to think hard about how they're handling their peak power consumption. And most global technology companies are already seeing a need to incorporate a discipline they're calling 'active power management' or 'active energy management' into their businesses.

In IBM's case, says Lechner, "Customers are considering energy efficiency in all aspects of the datacenter and a new discipline around active energy management is emerging in addition to the traditional concerns of security, availability and performance."

It's just not enough anymore to sell a technology solution to your customers. Whether it's higher processing capacity, or more efficient air conditioning, customers also want to see they've contributed to lessening environmental impact in their bill. They already know it's possible to improve a building's energy performance and reduce electricity usage while

lowering the bill; they know there's a difference between "clean" and "dirty" power generation; they also know the ancillary benefit they're aiming for: a reduction of greenhouse gas emissions. No matter what the product, it needs to come with a built-in global warming response.

Active energy management is as much a way to help reduce greenhouse gas emissions, as it is a sign of the fundamental shift that's taken place in how we handle electricity as a commodity. We place more importance on energy security in the wake of Hurricane Katrina, 9/11 and climate change than ever before, and companies are looking at ways to optimize grid efficiency and power consumption. "Electricity has to be used when it's



Ice Energy's Ice Bear 50 system installed atop a fitness center.

generated, and that particular attribute, or deficiency, has led to gross or perverse consequences," said Frank Ramirez, CEO of Ice Energy. Ramirez's company manufactures ice-storage air conditioning technology that provides cooling from off-peak generated power.

"In lighting, for instance, we've done a great job to reduce energy that's being consumed. Cooling, however, is one area where the market has failed," Ramirez said. "It's failed miserably because many of the technologies are still the

technologies of the '20s, '30s and '40s. We can definitely do a lot better than we are currently doing."

Ramirez says that the U.S. utility infrastructure lies fallow as much as 50 percent of the time, driven largely by temperature spikes. "We have a utility infrastructure that's been grossly overbuilt to service what amounts to a few hundred hours per year of peak demand." His counter to more peaking plants is to take advantage of the utility infrastructure in off-peak hours.

The built-in inefficiencies of our utility infrastructure mean that energy during peak hours costs substantially more than energy during off-peak hours. When demand spikes, utility companies often turn on their most-polluting energy generators to kick in the needed power, and in doing so, those polluting generators dump their waste into the atmosphere. However, if you could generate power off-peak, and store it -- then you can use it during peak at far better prices, with more efficiency, *and* less harm to the ozone layer.

That's where companies like Ice Energy, Calmac, IBM, Baltimore Aircoil and others come in: they are addressing the fundamental fact that electricity, as a commodity, is the only commodity in the world that can't be economically and efficiently stored. Their thermal storage and cooling technologies may be just what the doctor ordered. And what do they use for storage and cooling? Ice, of course.

The Technology Behind Thermal Storage (and Cooling) Solutions

Ice is what's behind a lot of thermal cooling solutions, or eutectic salts, just as really cold water is behind some liquid cooling solutions. The less energy it takes to cool the refrigerant used to cool off data center servers, your computer and mine, offices, schools,

hospitals, malls, manufacturing plants as well as homes, the lower the energy bill.

In the U.S., thermal energy storage is often used for cooling storage since summer air conditioning, for example, is responsible for a lot of peak grid load. If you can cool off the refrigerant you're using at night with less expensive energy for use during the day, you can decrease your overall grid energy consumption, thereby reducing your electricity bill, and ultimately use cleaner energy on a consistent basis.

"Think of it as a giant ice-cube for your data center," Lechner says of IBM's cooling solution. "It's a stored cooling solution that allows you to store the cooling in the off-peak hours and during peak hours -- when you need the cooling capacity -- discharge the solution at a much lower temperature, therefore using less energy from the grid at peak."

The advantages of air conditioning with thermal storage are pretty clear. Add to this that you're not using imported fuel at night to cool your refrigerant, and not adding to the usual emissions output associated with producing power for air conditioners from inefficient "peaker" plants, and ultimately what you end up with is needing fewer power plants to do the job.

"Storage creates much better economic values from economic resources," notes Mark MacCracken, Calmac's CEO. "I mean, wind blowing at night is competing against 2 cent power, but if you have storage you can store that wind energy, and now you're competing with 12 cent power."

"You shouldn't overlook the potential for storage efficiency," says Lechner. "Through storage virtualization, we often see customers increase their storage utilization rate by 24-35 points -- and what that equates to is fewer devices." Not to mention less of an impact on the grid.

Calmac a company that offers large-scale thermal energy storage solutions to its clients, has been in the market for years. The company has weathered the ups and downs brought on by deregulation, and MacCracken says load factors are getting a lot worse, which means load factoring has to move a lot higher -- and soon -- on the agendas of CTOs everywhere.

The good news for CTOs is that it's shocking how simple such thermal cooling and storage solutions really are, and how effectively they serve to reduce CO2 and NOX emissions. Frank Ramirez, Ice Energy's CEO, says, "By storing energy at night, our technology reduces CO2 by 40% and NOX by 57%. That just falls out of not generating during the peak."

"It's easy to make a load factor better," notes MacCracken. "Storage is the way you balance your energy supply and demand. But in the electric grid, we have not done that, mainly because storing electrons is very expensive. But storing what those electrons are needed for is very easy; you just store it in the form of ice or chilled water." He added that 40 percent of a company's peak demand then comes from the creation of cooling the night before. Lechner believes there will be a new discipline emerging around management of a data center for power efficiency, where more thoughtful workload and lifecycle management, including use of different energy storage aspects, is

needed. He foresees customers wanting to out-task power management, noting, "the tools are there for clients who want to [do this]."

IBM's strategy to exploit liquid cooling solutions in and outside of the data center entails a couple of layers, the first being the implementation of their Rear Door Heat Exchanger, a device which mounts directly back onto the rack of servers, reducing heat exhaust by as much as 50 or 60 percent. The second IBM solution is their Data Center Stored Cooling Solution, which provides a 40-50 percent overall efficiency of the cooling system at the data center level.



IBM's Heat eXchanger circulates chilled water from data center air-conditioning systems.

These solutions are part of IBM's "Cool Blue Portfolio" -- technologies across their hardware and software portfolio ranging from processor to system level design. It includes such things as ventilation, calibrated vector cooling, which allows for more efficient movement of air through the server, liquid cooling technologies, virtualization, and the ability to actively manage power.

Lechner, MacCracken and Ramirez all believe the demand for storage will grow radically. Clearly, technologies that can help normalize temperature affects or volatility in the system are extremely valuable and getting even more valuable by the minute.

Customers Are Still Gauging the Possibilities

Lechner says that one key hot button for IBM is just helping clients understand and assess exactly where they're at and what they need. "I think that many clients if you would ask them how green are you today or how efficient are you today, wouldn't be able to give you an answer. So assessment is the first step. And companies need help looking at the big picture." He added that their assessments help clients address the problem from end to end, in a way that improves the overall utilization of a company's assets.

Helping companies look at the issue of power and cooling in a data center end to end are virtualization technologies and power management incentive programs, at least to some degree, both intended to provide a more collaborative, dynamic and accessible platform for power management, especially to those companies who still are struggling to understand how to even begin to address the issue of power management internally.

To help such companies address this problem, IBM will be launching an energy efficiency incentive finder portal next month sometime. However, neither Ramirez nor MacCracken find some of the various incentive schemes very powerful long-term. MacCracken said to me, "...they are still incentive-izing with money from the money just in energy savings. And I would rather see NO rebates than rebates in a focused way, because that takes focus away from demand reduction."

Getting Started and Calculating the ROI

Ice Energy cites that one Ice Bear cools up to 150,000 square feet. Each unit retails for \$10,500, plus installation fees. Ice Energy charged FiberLok \$17,200 to install two free trial systems, but the investment paid for itself in 287 days.

Says Calmac's MacCracken, "It doesn't have to cost any more if it's new construction you're talking about, though it may, but not necessarily. In retrofit situations, it does cost a little more, and you normally have to wait until something else has to be changed out in the building -- for example, taking chillers that are 20 years old out." MacCracken says payback for such a move is usually in the three-year range, and something that he finds a lot of companies taking advantage of during retrofits of their buildings. Calmac currently



Calmac's IceBank Ice Storage System

includes Morgan Stanley, Credit Suisse and Bank of America as clients, which makes a certain sense: these are all organizations suck a ton of energy, and place a premium on maintaining data integrity and power redundancy should systems fail. With such enormous data networks and serious security concerns, the finance sector is a prime target territory for thermal energy storage technology vendors like Calmac.

Calmac sold its first thermal storage system, the Ice Bank, in 1980. Ice storage was growing very nicely until deregulation hit and the industry hit a dry spell. ASHRAE Refrigeration Committee Member and Center Director for the University of Wisconsin-Madison's HVAC&R Center Dr. Doug Reindl told me he watched deregulation pretty much dry up the Center's thermal storage studies for a while.

Things have since improved. Just look at what's happening in the industry: Calmac's CEO MacCracken cited projects with the Bank of America in Manhattan, Goldman Sachs and a couple of other large financial institutions. With a long history in the business, the company already has distribution through partners such as American Standard and Trane.

Ice Energy just closed a nice Series A round as well, and their rollout to the City of Victorville, California is going well. Victorville is installing Ice Bears on every city-owned building, and just this month, the city has ordered 10 more machines. The results speak for themselves: the 31 units Victorville ordered helped permanently reduce peak demand by 231 kilowatts and, due to higher efficiency, save more than 100,000 kilowatt-hours annually.

What the Future Holds for Energy Management

Ramirez believes micro-grid management is in the future. "Instead of looking at each individual building as a standalone player, there will need to be an evolution in technologies that enable a micro-grid a system to balance itself." He explains that, because of inefficiencies in how most companies operate their buildings -- lights on with no people in the room, flat screens that don't go to sleep -- a lot of energy is being consumed for no real purpose.

He estimates that for every kilowatt in energy that is saved, there are about three kilowatts

that have to be generated. "The question is, how can we as a system understand that managing the resource without the intervention of a human being to do so will enable us to save a significant amount of energy without any loss in comfort or security and without impairing reliability in our businesses?"

That, in a nutshell, is the challenge and promise of the thermal cooling and storage market. You can expect to hear a lot more about it in the near future.

[Lara Abrams-Melman](#) is a Silicon Valley-based consultant to (mostly) technology companies on strategy and business development issues . She has spent almost five years researching companies in the cleantech space and considers herself an advocate of sustainability and clean technologies. Her website is [LaraAbrams.com](#).

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