

Can The Internet Save The Planet?

Solar arrays and wind farms grab all the green technology attention, but the Internet is quietly providing ways to save energy.

By Richard Martin, [InformationWeek](#)

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Last October, environmentally conscious Netheads everywhere got some excellent news. The pervasive use of broadband Internet connections and the tools and practices they enable could reduce greenhouse gas emissions by some 1 billion tons over the next decade, according to the American Consumer Institute. Widespread adoption of broadband in the United States alone would cut energy use by the equivalent of 11% of annual oil imports, the group says.

Clearly, though, when it comes to energy use, the Web is both a crusader and a culprit. Server farms and data centers burn mountains of CO₂, much of it to keep machines cool. But now a new crop of companies and thinkers is trying to make the Internet "carbon neutral" and find ways to use Web-based technologies to reduce worldwide energy consumption through "demand-response" schemes that give energy consumers more direct control over their energy use.

Internet-enabled capabilities like telecommuting, e-commerce, teleconferencing, and distance learning that have been around for decades are expected to play an increasing role in cutting energy consumption--reducing air travel and the need for warehouses, trips to the mall, and even malls themselves. The American Consumer Institute projects that telecommuting alone will cut CO₂ emissions by more than a half million tons over the next decade (see table, above). Overall, the Internet economy could help reduce growth in greenhouse gas output by 67% over the next several years, the study says, citing data from the Lawrence Berkeley National Lab.

"The future Internet represents an incredible business opportunity for researchers and corporations," says Bill St. Arnaud, senior director of advanced networks at Canarie, a nonprofit group focused on advanced Internet development in Canada. "It will allow them to deploy new economic models and create marketing opportunities where they will make profits by reducing CO₂ emissions."

St. Arnaud believes that Internet companies can slow global warming in two ways: by reducing the energy use of the routers and servers that make up the Internet's backbone, and by "bits-and-bandwidth for carbon" trading schemes that would provide incentives for individuals and companies to reduce their carbon footprints in return for free or reduced-rate broadband connections or downloadable music and films.

St. Arnaud isn't the only Internet luminary turning attention to how the Net and Web technologies can help the environment. Legendary Silicon Valley investors like John Doerr of

Kleiner Perkins and Vinod Khosla, who made their fortunes from Internet-based technology, are now focused on slowing global warming, channeling billions of dollars into technologies such as solar power and wind farms. And Google has said it will build a series of renewable-energy plants that will produce a total of 1 gigawatt more cheaply than coal. That's enough to power a city the size of San Francisco, and the project is likely to cost a few billion dollars.

Couple the potential of Internet-related technologies with these investment engines and the optimists among us might foresee a significant dent in the energy crisis. But such pronouncements mask the inconvenient truth that the Internet hogs a great deal of power, particularly for big server farms on Google- and Amazon-like scales. Power consumption by data centers doubled between 2000 and 2005, according to Jonathan Koomey, a staff scientist at Lawrence Berkeley National Lab, and while the total amount of electricity used by the Web infrastructure is small--about 1.5% of all U.S. electricity consumption in 2006, according to the Environmental Protection Agency--it's one of the fastest-growing sectors. (It doesn't help that Google co-founder Larry Page released about 1.5 million tons of CO₂ flying 600 friends on private jets to his wedding on a Caribbean island.)

What's more, the Internet-related energy-reduction schemes that St. Arnaud and others envision, which involve disseminating information that will help people and companies reduce CO₂ emission growth, overlook the more direct and powerful ways that companies are using the Internet to actively reduce energy use.

Many of these more commonsensical plans revolve around the emerging demand-response industry, which matches electricity consumption to supply in real time. They use the Internet to do what it does best: enable IT managers and "chief carbon officers" to act on more accurate and timely data on energy consumption, prices, and supplies to control myriad devices over the network.

In other words, while Google snags headlines for equipping its Mountain View, Calif., campus with a huge solar array, the real work of using the Web to slow global climate change is going on in less celebrated locales, like the Boston offices of demand-response and energy-management provider EnerNOC.

MARKET-DRIVEN

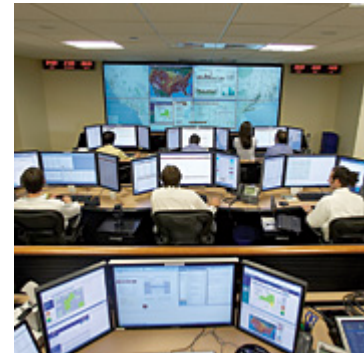
EnerNOC, which stands for "Energy Network Operations Center," was founded in 2001 by a pair of energy-business veterans and graduates of Dartmouth's Tuck School of Business. It's based on a simple principle: Companies should respond to market signals in the energy business just as they do in their own core industries.

The company wants end users "to be much more engaged and participatory in electricity markets," says co-founder David Brewster. "We're getting users for the first time to respond to high wholesale prices or reliability events on the grid."

A handful of utilities across the country in recent years have provided incentives for customers to cut power usage during times of peak demand. But most businesses have largely been passive energy consumers with little incentive or capacity to respond to events in electricity markets.

Now companies like EnerNOC are making this a viable option by tracking price fluctuations and grid events like power shortages, spikes in demand, and brownouts and helping customers respond to them in real time.

The technology is likewise simple: EnerNOC installs a gateway software device at the customer's premises (a data center, grocery store, warehouse, or manufacturing facility) that gives it 24-hour, real-time connectivity and control over the customer's energy assets. Based on preset rules, when peak demand hits, the price of electricity skyrockets, or a rolling brownout occurs, EnerNOC's automated program reduces power consumption, powering down lights and other nonessential power-consuming devices within minutes. In addition to saving money on the power they don't use during a peak-demand event, EnerNOC customers get a rebate from their utility for participating in the program, and they receive additional compensation based on how well they perform during a specific event.



EnerNOC's network operations center injects real-time thinking into electricity markets

EnerNOC gets paid a monthly stand-by fee, plus an energy-savings premium tied to the number of kilowatt-hours it saves the customer. The customer's happy because it makes money from an otherwise idle asset, excess energy demand; the utility's happy because it can more effectively handle peak demand periods and provide power to urgent-use customers willing to pay a premium during those times.

"Today's electricity supply is very inefficient," points out Brewster. Utilities build power plants and the transmission lines to meet periods of peak demand, but those spikes happen infrequently—10% of the oversupply of infrastructure is there to cover peaks that occur less than 1% of the time. "We have billions of dollars [in generation capacity] that sits idle 99% of the time," Brewster says. By monitoring and reducing demand during those anomalies, the EnerNOC system can flatten the peaks and create a more regular demand curve.

As of September, EnerNOC had more than 2,000 customer sites across the country. One customer is telecom interconnection provider Telx, which maintains sizable co-location centers that hook up with service providers' networks. Telx benefits from a secondary EnerNOC service: selling excess power back to its grid when it tests its backup generators across the country.

"They can actually run those generators when we do our cycles and provide power back to the grid," says Hunter Newby, Telx's chief strategy officer. Telx expects to generate several thousand dollars in the coming year thanks to EnerNOC's service, according to VP of operations Michael Terlizzi.

SAAS APPROACH

What's striking about EnerNOC's service is that it's so sensible: Energy savings can be achieved in friction-free ways, just by paying attention. That's the business model behind the emissions management platform at Canadian software-as-a-service provider Carbonetworks.

Carbonetworks was founded in 2005, but its CNX software platform was in development for about six years before that. The Web-based tool is aimed at C-level executives who want to treat their carbon emissions as a vital contributor to their companies' bottom lines.

"We provide an executive-level view of what a company's emissions footprint looks like in terms of both assets and liabilities," says co-founder and CEO Michael Meehan, who spent a decade in software development and is also the founder of online climate-change information source the Climate Resource.

In practice, CNX is a series of real-time Web-based dashboards that give a company a site-by-site breakdown of carbon emissions plus options for an emissions strategy that reduces energy use and carbon production while minimizing costs and maximizing returns. "We'll present the CFO or CTO with all types of options, one of which might be to look at investing in carbon-offset projects," explains Meehan. "The software will do the calculations and run the algorithms, to tell you which offsets you qualify for and how much they'll cost over time."

The final step is using the Internet to match "emitters" with validated carbon-offset providers such as SGS, 3C, and Blue Source. They deal in tradable emission credits from sources engaged in activities that lower CO₂ production, like reforestation projects and solar energy providers. Emitters can buy credits to offset their emissions.

Going Down

Reductions in greenhouse gases from various online activities

	CURRENT ANNUAL SAVINGS (MILLIONS OF TONS)	FORECAST 10-YEAR INCREMENTAL SAVINGS (MILLIONS OF TONS)
Telecommuting	134.7	568.2
E-commerce	37.5	206.3
Teleconferencing	36.3	199.8
Replacement of mail, CDs, publications with online equivalents	9.8	67.2

Data: American Consumer Institute

Carbon offsets have gotten plenty of bad press over the last few years, with many experts calling them "greenwashing" or Band-Aids to cover up wasteful energy practices with clever marketing. But the value of offsets already makes Carbonetworks' service attractive, Meehan says, and the advent of mandatory carbon caps--now a virtual certainty with the United States' acquiescence to

controls at the Bali global warming summit in December--will create an active carbon-trading market that CNX users can capitalize on.

Since starting out with a handful of companies on the network three years ago, Carbonetworks now has around 3,500 customers, many in the energy sector, such as oil and gas producers, and is adding five or so per week.

"There's a lot of tire-kickers out there now," Meehan says, but in the last year the emissions-control industry has turned a corner. "The threat of government regulation is really what got things going in the carbon management space, especially in the energy sector," he says. "But a lot of companies were still sitting on the fence."

Now the threat of regulation is being paired with incentives. "Companies see there's a huge carrot out there," Meehan says. By using CNX to attach a dollar figure to its emissions, he says, a forward-looking company could save 60% or more in energy costs per year without adding significantly to its bottom-line expenses.

While interest in CNX and other emissions management platforms is mostly coming from energy producers and other major-league greenhouse gas emitters, other industries are sure to follow, Meehan says. "Once the pieces are in play and a good management system is in place, the next step is monetization of those assets."

BLACK ARTS

"Monetization of assets"--there's a phrase seldom associated with global warming. At its most elemental level, that's the alchemy that Web-based technology can provide the energy-monitoring and carbon-emissions sector: the transformation of presumed liabilities (greenhouse gases) into potentially tradable commodities (carbon debits and credits).

"This is the inflection point," says Bob Gohn, VP of marketing at wireless-mesh silicon vendor Ember. "The energy management area is growing rapidly, and we're seeing very significant growth as a company--we're doubling chip shipments quarter to quarter."

Spun out of an MIT research team in 2000, Ember operates in the online energy management space, making semiconductors and software for ZigBee networks, the powerful short-range wireless technology used, for example, in sensor networks for demand-response systems. Ember-powered networks are finding applications in advanced metering infrastructure, residential load-control devices to regulate energy demand, and wireless controls for building automation.

The success of companies like Ember provides a clear signal that Web-based energy management is a niche market rapidly going mainstream. "In recent years energy management has become the killer app driving deployment of sensors and control-point networks," Gohn says.

Silver Spring Networks, which makes wireless transceivers that are embedded in energy and water meters, is seeing that sort of demand. Such meters until recently were standalone devices

waiting for a once-a-month reading. Now they supply hourly or even minute-by-minute energy-usage data to utilities and customers.

Utility grids, CEO Scott Lang says, "are some of the largest, most complex networks in the world"--yet they're still being read by guys with clipboards walking around in back yards. "To link them up we identified one standard: IP. The same kind of approach that makes the Internet work is going to make this work."

In a nutshell, that's how the entire Web-based energy management sector is becoming one of the fastest-growing segments of IT: by bringing the power of open standards and open networks to the problems of energy distribution, demand, and efficiency.

Given the simplicity of many of these concepts--Hey, how about linking up electrical meters?--the question is, Why has it taken this long for them to edge into the mainstream?

One answer is security. The Hollywood scenario of an attacker gaining access to power-grid control systems is a real fear for public utilities. Then there's the era of cheap fossil fuel that we've just exited. When oil was less than 30 bucks a gallon, who cared? There's also the fact that the energy-producing sectors have been relatively IT averse. Drilling, refining, and distributing petroleum and coal is messy, both physically and politically, and meshed wireless sensor networks (to cite one example) haven't been top of mind, to say the least.

Finally, there's Moore's Law. Only recently have the wireless technologies, the silicon, and the networking standards become widespread and economical enough to drive this latest phase of the Internet's evolution.

"Energy companies have been doing things in a very similar fashion for their first 100 years," says Silver Spring's Lang. "But now there's this convergence of devices that can talk and radio frequency technologies and processing power. It's going to revolutionize the system."

"It's all about giving people tools to understand what's going on and taking action," says Martin Flusberg, founder of Nexus Energy Software, a unit of Esco Technologies, which provides utilities with Web-based tools that customers and businesses can use to monitor and reduce their energy consumption.

Another Internet revolution--and this one just might help save the planet.

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