

UTILITIES: The new local power plant just might be *your* house

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WHEAT RIDGE, Colo. -- The next power plant in your town might just be your neighbor's house, or yours.

The National Renewable Energy Laboratory and Habitat for Humanity built a home here in this Denver suburb that generates enough electricity for its occupants and then some, having provided about 3,600 kilowatt-hours to the power grid since October 2005. The excess power is about a third of the electricity that an average household uses every year and enough to fuel an electric vehicle for 13,500 miles.

About 30 miles away, Eric Doub, owner of EcoFutures Building in Boulder, lives in a house heated and powered entirely by solar energy, on balance. After adding more solar panels, Doub said his house will provide more than 400 kilowatt-hours a month to the power company in summer and be almost demand-neutral this winter. It has produced enough excess electricity this past year to drive an electric car about 4,000 miles, worth about \$485 in gas.

That's not all. Doub has designed another house that would generate a whopping 25,858 kilowatts -- 80 to 150 percent more electricity than it would consume. "It's going to be a power plant," he said.



Eric Doub, founder of EcoFutures Building Inc., shows the \$8.45 check he received from his utility, Xcel Energy, for the power his solar panels provided to the grid for one year based on one month's meter reading. Photo by Katherine Ling.

While a solar-powered house generates little electricity compared to an old-fashioned power plant -- a 500-megawatt plant sells about 3.9 billion kilowatt-hours per year -- many experts see what they call "distributed generation" adding up eventually to a substantial U.S. energy source. The possibilities have a few electric utilities eyeing houses, commercial buildings and industrial complexes as future energy generators.

Last month, Southern California Edison began installing solar panels on leased commercial roof space as part of a plan to install 250 megawatts of solar panels across 2 square miles of roofs in the next five years.

North Carolina-based Duke Energy is also pursuing a \$100 million pilot program that would place solar panels on 850 houses, schools, buildings and lots for a total of 16 megawatts of generation capacity. Owen Smith, managing director of Duke's renewable energy and carbon strategy, said the utility is just trying to get ahead of what it believes could be a trend.

"We think distributed generation is something that will take hold en masse," Smith said. "Distributed generation is something that is going to be more and more important going forward."

Jon Wellinghoff, a member of the Federal Energy Regulatory Commission, said that while large, central power plants will be important for at least another 50 years, distributed generation has to play a role as electricity demand rises and climate regulations are imposed to curb emissions of heat-trapping greenhouse gases.

"It is absolutely essential if we are going to have an intelligent grid operating at its optimal efficiency," Wellinghoff said in an interview. "That is the amazing thing about distributed generation resources: It can provide not only benefits to the consumers but the entire grid."

Distributed generation's small size -- usually less than 20 megawatts -- enables it to quickly power up or down to meet the variability in utility loads. It can also support reliability in the case of power disruptions, as it depends on transmission over shorter distances, as opposed to the long lines to central power plants that prove vulnerable in hurricanes and other natural disasters.

Not all utilities or energy regulators are open to tapping large amounts of distributed generation, which includes solar panels, microturbines, combined heat and power, and engines that run on traditional fuel or "opportunity fuels" such as wood chips, old tires and landfills, and even storage devices like plug-in electric vehicles.

Critics say too many sources producing intermittent power will make it hard to balance the load on transmission lines. It would also cause problems for utilities' balance sheets. State regulations almost uniformly require utilities' rates to be based on the amount of power they sell and on the company's assets: power plants and the transmission and distribution system.

Moreover, critics say, integrating large numbers of distributed generators will require the development of a digitalized "smart grid," whose deployment is still in its infancy, to handle two-way communications between the utility and multiple power sources.

But Wellinghoff said such issues can and should be addressed now.

"If a utility company tells you it is hard and expensive, I think it is because they are conservative and don't want to change and don't see [distributed generation] as a business model," Wellinghoff said. "Their business model is building the \$7 billion nuclear plant rather than retrofitting millions of customers' homes for \$700 million."

Inertia and an 80-year-old utility regulatory structure constrict markets for distributed generation, said Kurt Yeager, executive director of the Galvin Electricity Initiative, an organization campaigning to modernize the grid using microgrids based on distributed generation to create reliable and efficient "perfect power."

"It largely boils down to ... having the policy environment amenable to first serve the consumers -- recognize and reward consumers, and also rewarding the utility," Yeager said.

Once a niche, now mainstream

State renewable energy standards, policies and incentives have pushed distributed generation from being backup or supplemental electricity for consumers to being a more dominant power source. The Energy Information Administration predicts that distributed generation could go from less than 5 gigawatts of the power sector's generating capacity to about 19 gigawatts in 2020, or about 5 percent of total capacity, although some experts say much more is possible.

Xcel Energy's Colorado solar rebate program, which provides up to \$4.50 per watt of capacity, was certainly an important factor in Doub's decision to go solar, as well as for the more than 1,000 Colorado residents who have purchased solar panels since the program started.

Xcel's rebate program was prompted by the passing by Colorado voters of a state renewable portfolio standard that requires utilities to generate or purchase enough renewable energy to supply 20 percent of their retail electricity sales by 2020.

Colorado also has a law known as "net metering" that allows distributed generation to interconnect with the grid and allows the owner to offset any electricity that is consumed against the excess electricity the building produces, as well as paying the owner once a year for extra electricity produced in a one-month snapshot.

Despite the incentives for residential distributed generation, much of the growth in distributed generation capacity will be through industrial combined heat and power. But experts say improvements in technology, drops in cost and potential future technology -- such as plug-in electric vehicles -- should make distributed generation much more accessible for individual consumers and small businesses.

But installing distributed generation still carries a substantial up-front cost. Doub's 8.84-kilowatt-capacity solar panels, for example, cost about \$31,000 after all of the rebates (see sidebar).

But utilities and policymakers are stepping in to help with up-front installation costs for consumers as companies face renewable energy requirements, limits on greenhouse gas emissions and skyrocketing costs for building baseload power plants.

New Jersey's major utility, Public Service Enterprise Group Inc. (PSE&G), will provide about \$105 million in loans for customers to install 30 megawatts of solar power over the next two years. Arizona Public Service Co. has partnered with the Sacramento-based nonprofit Electric and Gas Industries Association to offer \$50,000 loans with relatively low interest rates for customers to install solar panels.

Many public utilities and states -- notably, New York, Oregon, Massachusetts and Florida -- also offer loan programs on top of tax relief and incentives.

Utilities get involved

The market is expected to grow if the federal government mandates curbs on greenhouse gases and places a price on carbon.

Such a move would make distributed generation worth more than the energy it produces -- as it would also generate renewable energy credits in an emissions cap-and-trade system.

While a single household would be unlikely to sell its renewable energy credits alone, a company that owned and managed a significant number of solar panels could aggregate enough to have a legitimate block of credits to peddle.

Such prospects have new companies and a few utilities stepping up to be owners and operators of distributed generation.

Duke Energy, for example, decided to own and operate all the solar panels in its \$100 million pilot program. The utility will pay for installation and "rent" the rooftops and land to locate the solar panels on rather than implement a loan or incentive program. Homeowners would continue to purchase power from the utility, as opposed to tapping into the installed solar panel system.

Duke's Smith said the company wants to own the solar installations to get experience and have a key role in determining how distributed generation is deployed in meeting North Carolina's renewable energy and solar targets. The program will let Duke get experience and data on distributed generation that will help in discussions about renewable energy programs, he said.

"If utilities have concerns, it makes a lot of sense ... to get involved and be in the forefront, rather than waiting for it to happen to you without direct involvement," Smith said.

'Possible for the average Joe'

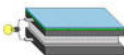





But Duke and Southern California Edison are among the few utilities trying this model, leaving a potentially large market for third-party installation and managers.

A third party can purchase the expensive equipment and install and maintain the system, working out an agreement with the property owner to provide discounted power for the building and sell the excess power back to the grid.

"It makes it more possible for the average Joe," the Galvin initiative's Yeager said.

The third party becomes similar to an independent power producer, helping consumers and utilities, as well, Yeager argued. He said it would be healthier to have competition on the consumer side of the meter to provide more reliable service and to free up utilities' attention and financing to tackle expensive projects like transmission and distribution.

There are already a few examples of third-party managers. Hewlett Packard Co. has an agreement with SunPower Corp. that it estimates will save the company about \$750,000 a year. Wal-Mart Stores Inc. has similar arrangements with SunPower, BP Solar and SunEdison LLC for some of its stores, and Whole Foods and Kohl's have deals with SunEdison. Honeywell International Inc. has provided similar "energy service agreements" to facilities of various sizes in Oregon.

Photovoltaic	
Description: Solar cells convert sunlight directly into electricity in the form of direct current.	
Capacity: Less than 1 kilowatt to 100 kW	
Cost: \$6,000 to \$10,000 per kW installed	
Location: Buildings, open spaces	
Emissions: None	
Efficiency: 5 to 15 percent	
Wind systems	
Description: A turbine rotates in the wind, turning the generator that produces electricity.	
Capacity: A few kilowatts to 5 megawatts	
Cost: \$2,500 to \$3,500 per kW	
Location: Open spaces	
Emissions: None	
Efficiency: 20 to 50 percent	
Combined heat and power	
Description: Captures excess from electricity generation to heat water with additional power or thermal heat.	
Capacity: A few kilowatts to 25 MW	
Cost: \$700 to \$20,000 per kW depending on technology used with	
Location: Buildings with generator	
Emissions: Depends on generator technology	
Efficiency: 50 to 90 percent	
Microturbines	
Description: A modified turbocharger that runs on traditional fuel, landfill gas, other.	
Capacity: 25 to 500 kW	
Cost: \$700 to \$1,100 per kW	
Location: Buildings, transportation	
Emissions: Low NOx	
Efficiency: 20 to 30 percent (with heat recovery)	
Combustion turbines	
Description: A traditional engine that runs on oil, gas or a combination.	
Capacity: 500 kW to 25 MW	
Cost: \$300 to \$1,000 per kW	
Location: Utility backup power	
Emissions: NOx	
Efficiency: 20 to 45 percent	
Reciprocating engines	
Description: A traditional engine that runs on gas, biogas or diesel.	
Capacity: 5 kW to 7 MW	
Cost: \$300 to \$900 per kW	
Location: Industrial, residential	
Emissions: NOx, CO	
Efficiency: 25 to 45 percent	
* Additional up-and-coming distributed generation resources include energy storage, stirling engines and hybrid systems. Data courtesy of the California Energy Commission and the Electric Power Research Institute.	

But there are few states where third parties can offer these services. Many states treat third-party managers as utilities, discouraging or even prohibiting them from operating -- regulations that FERC's Wellinghoff calls "ridiculous."

"We need to look at all these models and remove the regulatory barriers that prevent any particular model to be put in place," he said.

Wellinghoff and Yeager say the problem must be fixed by legislatures and regulators soon so that installation of distributed generation can be accelerated.

"If we are going to have a smart grid and perfect power that doesn't fail, consumer distributed generation is an essential part of that," Yeager said. With a concerted effort by regulators and policymakers, he said, distributed generation could be "really paying dividends" within as little as two years.

Oregon regulators recently took a big step toward that goal when they ruled that "energy service agreements" do not make participants public utilities under Oregon law.

But Oregon's move may be an exception, as Wellinghoff acknowledges that new distributed generation policies will take some time to "filter through the system" of state regulators.

"There is a big learning curve," he said. "State regulators have a lot of work to do and are inundated with a lot of information, and it is something they haven't had a lot of time to focus on."

But Wellinghoff said excuses only go so far.

"I think we are making this all too complicated," Wellinghoff said. "The technology is all out there, and we somehow need to free all this up and allow customers to acquire it on their own, or for the utility to provide it."
