Solar technology could give consumers the power to get off the grid

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In the more than 130 years since Thomas Edison released the electric light bulb on the world, households have more or less gotten electricity one way. Build a power plant, string power lines in all directions until you've connected as many homes and businesses as possible, repeat.

But in a nondescript white brick house a few miles outside downtown Houston, there is no need for a distant power plant spinning on a steady burn of coal or maybe radioactive uranium.

One moment the lights and home appliances are humming along like those in any building. Then, for a fraction of a second, the lights dim and the room goes quiet. Joe Coffey, an engineer with NRG Energy who spends his days testing out devices like portable solar panels and water heaters you put on your roof, has cut the house off from the power grid.

Only, the air conditioner is still running, as are the lights. In place of the grid - or the standard gasoline-powered backup generator - is a battery array in the garage and solar panels on the roof. On the patio, where the grill should be, sits what is essentially a 5-foot-tall miniature power plant hooked into the natural gas line.

"A lot of this stuff, it's going to be years before it can be delivered to customers cost-effectively. But it's like anything. There's going to be early adopters, and we want to be ready," Coffey said.

The U.S. by and large runs on a network of more than 7,300 power

plants, including 1970s-era coal plants, wind farms in West Texas, the Hoover Dam, nuclear reactors and more. The facilities are large and often away from population centers, each supporting on average 20,000 customers across millions of miles of power lines.

But what if each of those 146 million U.S. electric customers could generate his or her own electricity?

Historically, generating electricity was expensive, and there were cost savings in size. But with the advent of new technology - known as "distributed generation" within the industry - the prospect of cost-effectively generating electricity at home is moving beyond the realm of science fiction.

Solar panels, for a long time so grossly expensive only hard-core environmentalists would buy them, are now being mass-produced in China. With government incentives, solar power can now compete with the power grid in 10 states, according to analysis by NRG.

And then there are home battery systems, potentially upending the need for a constant flow of electricity from the grid. Tesla founder Elon Musk is building a battery factory in Nevada so large he calls it a "gigafactory." Fuel cells, which can be powered by hydrogen, natural gas and other substances, are no longer just for space missions. They're finding their way into talking points of forward-looking CEOs.

"Distributed generation is already in California. It's not the future; it's real," said Michael Webber, deputy director of the Energy Institute at the University of Texas. "Instead of building large power plants, we'll install solar panels and battery systems. It's not today, but 10 years from now it will be."

SOLAR HEATING UP

Locales including Germany, Hawaii, California and Arizona have been inundated with rooftop solar systems, prompted by a combination of high power prices and generous subsidies for renewable energy.

If predictions hold true that solar panels are only going to get cheaper, that same growth trajectory is expected to spread across the U.S.

Right now solar power represents about 2 percent of the nation's electrical capacity, both through rooftop installations and utility-scale farms.

If current growth rates continue, by 2025 there should be 90 gigawatts of solar power in the U.S. - more than 8 percent of current capacity - according to the financial services firm UBS. That will hold even if the U.S. government lets the solar tax credit expire next year.

Batteries and fuel cells remain firmly stuck in the development phase, with no clear timeline for mass adoption. But were one of those technologies to prove cost-effective, homes and businesses could quickly be generating their own electricity.

Texas' grid operator, the Electric Reliability Council of Texas, is not taking the potential for a shift away from the grid lightly. After watching the sudden onslaught of solar in other states, the agency launched a study to determine what steps it could take to prepare, said Paul Wattles, a senior analyst at ERCOT.

"Other than Austin and San Antonio, we haven't had the strong incentive programs that encouraged a massive adoption rate," he said. "But the price of (solar panels) is so low, it's approaching the point where we're going to start seeing massive adoption rates."

THE POWER OF GREEN

Environmentally speaking, this is all good news. Power plants, particularly those that burn coal, are responsible for more than 30 percent of U.S. greenhouse gas emissions.

At a Dallas-area IKEA, planners have cut demand on the grid by covering the store's roof in solar panels - about two football fields' worth.

The almost one-gigawatt system is one of the largest in Texas and supplies about 20 percent of the store's energy demands, as throngs of customers a day go in and out to shop for Poang chairs and Caja tablecloths.

"If you go back to 2010, we've cut our energy costs by 35 percent," said Tim Smythe, operations manager at the store. "That's everything: the solar system, switching to LED light bulbs, automating our temperature and lighting to use less power when the store is closed."

In the U.S., electricity is a $377 billion-a-year industry, employing hundreds of thousands of people.

Already the boom in solar panels is cutting into traditional sales, along with a housing stock that is vastly better insulated and more efficient than it was just a decade ago. Since peaking in 2007, electricity sales have fallen by 1 percent, according to the U.S. Energy Information Administration.

Oncor, Texas' largest transmission company, warned investors in its annual report this year, "to the extent self-generation facilities become a more cost-effective option for certain customers, our revenues could be materially reduced."

By and large, the sentiment within the industry is that while distributed

generation will cut into profits, it is far from the game changer some have made it out to be. The government regulators who run the power grid must ensure a stable electrical supply. Any change to the grid and the markets upon which electricity contracts are traded would probably be rolled out slowly and cautiously, Webber said.

BRANCHING OUT

Already, the power industry is lobbying in statehouses across the country to reduce the rate they pay for their customers' excess solar power, to better account for the cost of maintaining the grid.

"This is going to be negative headwind to power prices for the foreseeable future. But let's not overemphasize this," said Julien Dumoulin-Smith, an energy analyst with UBS.

Not everyone in the power sector anticipates a modest shift.

In a letter to investors last year, NRG Energy CEO David Crane warned that not only was distributed generation growing but the day was coming when homeowners and businesses would generate "most of the electricity they consume on the premises."

Already, NRG is branching out in an "if you can't beat 'em, join 'em" strategy. It created a new Home division last year that will not only install solar panels on your roof and a vehicle charging station in your garage, it will sell you a device to charge your tablet while sitting in the bleachers of your child's soccer game.

A house outside downtown Houston serves as a lab in which to test new products. Touring the facility recently, NRG retail president Elizabeth Killinger said that while revenues for the new venture were modest, she expected one day they would help mitigate the anticipated drop in power

sales.

"We can help make the complex simple. Sure, we might sell less power, but at the end of the day the customer is going to use less anyway. Someone's going to help them," she said.

SUN IS RISING

In some parts of the world, rooftop solar installations have become so prevalent they're already forcing a rethinking of how electricity is transmitted.

In Hawaii, which has some of the highest electricity rates in the world, there are so many solar systems that the local utility warns it is losing its ability to maintain the delicate harmony of electricity generation and demand across the grid. Last year, Hawaiian Electric Co. announced it was in negotiations to build utility-scale batteries in hopes of easing the strain.

In Arizona, utilities have complained the high rates they are required to pay their customers for their unused solar power - combined with the loss in sales - are threatening to send them into what some have termed a "utility death spiral."

It's too early for any such issues to have arisen in Texas, said Wattles, the ERCOT analyst.

With no state subsidy and the decision on what to pay for distributed power left to the companies, Texas has one of the lowest per-capita rates of solar in the country. But with so many sunny days, developers continue to watch the state as the next big market.

Among the early leaders, Adam Stetson, with Austin-based PSW Homes,

is selling what he calls "sustainable" houses for which one of the primary selling points is a rooftop solar system capable of supplying about 40 percent of a household's daily electricity needs.

So far, PSW only has four homes built in Dallas. With seven housing developments in development across the city, Stetson says more than 270 homes should eventually get built.

Assuming they use the standard size, that should work out to around 3,200 solar panels.