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INNOVATIVE POWER SOLUTIONS IN THE OFFING

Schenectady Capital Region companies work to revolutionize world's electric system

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The nation's electric grid is groaning, for a lot of reasons, in part because there's too much power and too little transmission capacity. Jodi Reeves might have part of the solution, and the SuperPower Inc. materials scientist holds a strip of it in her hand.

The future looks like audiotape, except it's stiffer and made from exotic stuff like yttrium barium copper oxide. And when chilled to a brisk 90 Kelvin -- about minus 298 Fahrenheit -- something amazing happens: It becomes a perfect conductor of electricity -- a superconductor.

And that superconducting tape can carry three to five times the electricity that a typical high-voltage line can haul in the same space because power lines shed some electricity in the form of heat. Superconducting lines are far more efficient.

That sounds pretty good, considering that a lack of transmission capacity may have played a role in the massive blackout 10 days ago. That devastating power outage will lead to months of investigations, calls to action and demands for answers.

But superconducting power lines are no quick fix. Nor are some of the alternatives to conventional power generation under development. Among them: personal fuel cells that can slough some of the electricity-generating burden off power plants; homes that can heat and cool themselves using solar energy; nuclear power plants that both generate electricity and create hydrogen -- a potential power source itself.

Someday, though, all those things could help keep the power flowing to your toaster.

The electric grid is a century-old idea -- and it's ripe for change. And there are people and companies around the Capital Region working on what may come next.

Two weeks ago, they were just technology wonks. Since the blackout, two local companies -- Plug Power Inc. and Intermagnetics General Corp., SuperPower's parent -- have been put into heavy rotation on cable news shows.

Their message: From power sources to transmission lines to more efficient devices, the power system is evolving. Now, we draw power from big, distant generators. Tomorrow, we may not.

``The grid is a wonderful thing. ... Having said that -- what is a new paradigm?" said Sanjay

Correa, technology leader at General Electric Co.'s Niskayuna Global Research center.

GE's presence here for more than a century has long been the driver behind this area's energy involvement. It is a major backer of Plug Power; Intermagnetics is a spinoff; so is Mechanical Technology Inc., which is working on a tiny fuel cell for portable electronics.

All those companies are figuring out the possible directions the nation's energy grid will go, which requires several assumptions.

First is that our energy needs will continue to grow.

At the same time, people don't like to live next to big power plants or near the transmission lines that carry power from one place to another.

But don't expect everyone to drop off the grid. Our power will not be beamed to us from the moon (big energy rays would have the unfortunate side effect of roasting things in their path, like airplanes.)

And scrapping power plants isn't much of an option, either. Take solar power: Using today's technology, it would take 42 million square acres of solar panels -- an area equal to New York, Vermont and New Hampshire -- to replace the nation's energy needs, said Pete Sheehan, executive director of the North American Board of Certified Energy Practitioners in Clifton Park.

So we've got this grid, and we're going to live with it. But it will be improved. Politicians will go on about the existing one being ``antiquated,'' or being of Third World quality, as former energy secretary and current New Mexico Gov. Bill Richardson famously quipped.

Many who know the grid consider statements like that to be nonsense.

``Have you spent any time in a Third World country?'' asked Jack Valentine, who trains people in the workings of the electricity market for the New York Independent System Operator. ``In a Third World country, you're thankful when you have power in the afternoon.''

The NYISO, which monitors the state's electricity market, issued a call for change earlier this year. Not only is more generation needed to meet demand, the group argued, but so is more transmission. Over the past three years, crowded power lines have cost New Yorkers $2.75 billion.

Today's system is largely made up of large power plants connected to large power lines that carry energy to smaller and smaller power lines until it reaches its destination.

With more power plants coming online, and transmission capacity stymied -- the last major line built in the state was energized more than a decade ago -- superconductors can help. They can carry more power through existing corridors without new towers that cut through hundreds of back yards.

And they're not far off. SuperPower expects to break ground on a test run of cable next year. The $26 million project, partially financed by the Energy Department, should be energized in 2005.

So the grid will endure.

Another big assumption is that carbon dioxide created by burning fossil fuels is not good for the environment. So future power sources must be clean.

Paul Grant, a science fellow at the Electric Power Research Institute in Palo Alto, Calif., predicts a SuperGrid. That's a superconducting backbone supported by nuclear power. Nuclear power plants, he argues, are clean and far safer than people think. Solar? Wind? They're ugly, he says, and take up too much space.

Nuclear, he argues, can be put underground, to protect from terrorist attacks. And it can generate hydrogen as a byproduct, which can cool those superconducting lines and be tapped at substations to power fuel-cell vehicles.

Of course, it's expensive: $1 trillion over 50 to 100 years.

The feds will have to lead the way, Grant and others say. If we're going to keep the economy strong, we can't have glitches that put 50 million people in the dark.

The government financed the Erie Canal, the transcontinental railroad and interstate highways. And the government just might have to cover this, too. ``Energy,'' Grant said, ``is the backbone of the economy.''

Even if the grid gets more attention, Grant and others don't expect it to handle all the heavy lifting. Smaller power sources, installed right where they're needed, are expected to play a major role in the future.

``Do we want an SUV grid? Or do we want a hybrid car?'' asked Anna Dyson, an assistant professor of architecture at Rensselaer Polytechnic Institute working on a solar-energy solution. ``We need new solutions. And using our old solutions is the path to disaster.''

Dyson's project would put dozens of lenses on windows in commercial buildings to collect sunlight for use in heating and cooling. Those lenses, made of translucent plastic, would also deflect harsh rays, helping keep down cooling costs.

Such a solution, which produces electricity independent of the grid, is known as distributed generation.

Getting away from a centralized grid has history on its side.

``I think if you look at the big networks -- telephone, data, entertainment -- and if you go back to when I was a kid, there were three networks, there was one telephone company, there were a handful of gigantic computers,'' said George McNamee, chairman of investment banking firm First Albany Cos. Inc. and investor in both Mechanical Technology Inc. and Plug Power Inc., two of the Capital Region's alternative-energy players.

But while efficiency was first gained by making those networks larger, gains eventually come by making them smaller.

Think of the Internet, which isn't governed by a few big computers but is an aggregate of all its players.

Plug Power is already selling fuel cells, which convert hydrogen to electricity using a chemical process. Heat and water vapor are the only byproducts. A $15,000 unit introduced earlier this year is meant to provide hydrogen-generated backup power to sites such as cellular-telephone towers. Greg Silvestri, the company's chief operating officer, sees his offering as part of a range

of new technologies that can reduce dependence on big power plants.

``When you look out at a time period measured in decades, as opposed to years, I have a high degree of confidence there's going to be a multipart solution,'' Silvestri said.

The earliest wide-scale use of distributed generation will likely be in places where the power grid was never adopted in the first place: remote areas or developing nations.

Consider cellphones. In some parts of the world that never had telephone service, cellular antennas eliminated the need for costly infrastructure such as central stations and wires. As a result, many people made their first call on a cellphone.

And many people, Plug officials expect, will see their first light generated by a fuel cell.

``Economics will continue to dictate that some people are better served by centralized generation,'' he said. ``In areas that don't have the grid in the future, distributed generation will be tough to beat.''

Reducing consumption, too, is part of the recipe. At RPI, the school's Lighting Research Center is working on several possibilities, including a way for utilities to dim users' lights automatically with a remote command and solid-state lighting, such as light emitting diodes, that require less energy than incandescent bulbs.

GE, which is involved in everything from lighting to more efficient generators, has projects on its drawing board that could take a decade to hit the market. Correa, the energy-technology team leader in Niskayuna, talks of taking his crew to the Schenectady Museum, where some of the electric revolution's earliest ideas are displayed.

And he asks them: What are you working on that's revolutionary enough to make its way into this museum? FACTS:Powerful potential While some search for clues to what happened in the blackout of 2003, others are concentrating on what's next. This power grid of ours, based on a century-old concept, isn't likely going anywhere anytime in our lives. But changes are coming of. Distributed generation: Big, centralized power plants will likely be part of our future. But producing electricity where it is used a -- known as distributed generation -- might have a major role. Buildings might be connected to both the grid and to another source such as solar, fuel cells or wind energy. Or a user may have on-site generation alone. The Grid: The network of high-voltage power cables strung across the country might be reinforced with superconductors, exotic metals that can conduct electricity with no resistance when cooled to mind-numbing temperatures. Superconductors can carry three to five times the amount of energy of a comparably sized aluminum cable. That's not all they can carry: Some surmise that nuclear power plants will generate not only the electricity for those cables but also hydrogen. That could be used not only to cool the superconductors but also to operate hydrogen-powered vehicles and other devices. Home: It's not just about how electricity is made -- use is important, too. Energy-saving technologies such as giant sheets of glowing plastic could one day replace the incandescent bulb. And buildings that breathe, using solar power to heat or cool, could also reduce the strain on our energy supply. Source: Times Union