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Big and smart: energy-reaping windmills

By Scott Kirsner

Standing on top of a hill in central Massachusetts, Jonathan Fitch is surrounded by a grove of eight tall white windmills. He regards them like someone eager to trade in an old car.

The windmills were installed in 1984 so the town of Princeton would receive at least a small fraction of its power from a nonpolluting source. But three of the windmills are broken, a result of direct hits by lightning, and their manufacturer has gone out of business.

Fitch, general manager of the Princeton Municipal Light Department, is planning to upgrade his wind farm. The town-owned utility is overseeing a $4 million project to replace the eight older windmills with two gargantuan modern ones. The current system generates enough electricity for about 1 percent of the town's 1,450 households; the new one, expected to be in place next year, is to satisfy roughly 40 percent of the town's appetite for power.

The modern windmills — often called wind turbines — are quieter and more reliable, and they generate more power at a lower cost. Unlike the older ones in Princeton, they are outfitted with dozens of sensors and connected to a network that allows them to be monitored remotely, from a PC or laptop.

"The efficiency of the turbines has gone up about 5 percent every year," said Philipp Andres, a vice president at the American subsidiary of the Danish company Vestas Wind Systems, the world's largest manufacturer of wind turbines.

Perhaps most important, modern wind turbines are bigger, a fact provoking controversy almost everywhere utilities have proposed to put them up — most notably off Cape Cod, Massachusetts, where a developer hopes to build the first U.S. offshore wind farm, using turbines that will rise 426 feet, or 130 meters, from the water.

Utilities and independent developers are nonetheless moving ahead with plans to increase older installations' generating capacity and establish new wind farms. Michael O'Sullivan, a senior vice president at FPL Energy, the biggest U.S. operator of wind farms, said that 2003 "will probably be the second-biggest year in the industry's history, in terms of adding capacity," exceeded only by 2001.

The independence afforded by wind power is only partial. "You can't rely on it every day," Fitch said. "You have to have some backup contract in place."

Moreover, wind power does not necessarily prevent large-scale blackouts, like the one in the U.S. Northeast this month, because the turbines themselves generally need a voltage supply to operate. While Fitch expects the more modern turbines to provide the town with modest savings in energy costs — perhaps $90,000 a year compared with other sources — the environmental considerations are the main attraction.

The power generated by Princeton's aging wind turbines has actually cost more than electricity from other sources, Fitch said, but the new technology changes that equation. Wind turbines now rely on an electronic nervous system that allows them to predict the force and direction of the wind up to 24 hours in advance, and adjust the orientation of the rotor and even the pitch of each individual blade in order to wring the maximum energy out of a passing breeze.

Electricity is generated at the top of the windmills, in a boxlike structure called the nacelle, to which the rotors are attached. "The rotors can be as large as the wingspan of a 747," said Jim Lyons of GE Wind Energy, the biggest U.S. maker of turbines. At the bottom of the tower that supports the nacelle and rotor is a cylindrical space housing the computers that collect data from throughout the turbine. The collection of computers is known as a Scada system, for Supervisory Control and Data Acquisition.

The Scada system can supply 200 or more pieces of data related to the turbine's operation, Lyons said. Information about higher-than-normal vibration levels or oil temperature can alert a wind farm's staff to problems before they cause disruption. Typically, the wind turbines are connected by fiber-optic cable to a control center. Many problems can be solved remotely, but staff members must climb up through the tower to the nacelle on occasion.

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