Future Power

Wind: Feast or Famine

Wind, ultimately driven by sun-warmed air, is just another way of collecting solar energy, but it works on cloudy days. One afternoon I stood in a field near Denmark's west coast under a sky so dark and heavy it would have put my own solar panels into a coma. But right above me clean power was being cranked out by the megawatt. A blade longer than an airplane wing turned slowly in a strong south breeze. It was a wind turbine.

The turbine's lazy sweep was misleading. Each time one of the three 130-foot (40-meter) blades swung past, it hissed as it sliced the air. Tip speed can be well over 100 miles (160 kilometers) an hour. This single tower was capable of producing two megawatts, almost half the entire output of the Leipzig solar farm.

In Denmark, turning blades are always on the horizon, in small or large groups, like spokes of wheels rolling toward a strange new world. Denmark's total installed wind power is now more than 3,000 megawatts—about 20 percent of the nation's electrical needs. All over Europe generous incentives designed to reduce carbon emissions and wean economies from oil and coal have led to a wind boom. The continent leads the world in wind power, with almost 35,000 megawatts, equivalent to 35 large coal-fired power plants. North America, even though it has huge potential for wind energy, remains a distant second, with just over 7,000 megawatts. With the exception of hydroelectric power—which has been driving machines for centuries but has little room to grow in developed countries—wind is currently the biggest success story in renewable energy.

"When I started in 1987, I spent a lot of time sitting in farmers' houses until midnight talking to the neighbors, just selling one turbine," says Hans Buus. He's director of project development for a Danish energy company called Elsam. "I would not have been able to imagine the level it is today."

He means not only the number of turbines but also their sheer size. In Germany I saw a fiberglass-and-steel prototype that stands 600 feet (200 meters) tall, has blades 200 feet (60 meters) long, and can generate five megawatts. It's not just a monument to engineering but also an effort to overcome some new obstacles to wind power development.

One is aesthetic. England's Lake District is a spectacular landscape of bracken-clad hills and secluded valleys, mostly protected as a national park. But on a ridge just outside the park, though not outside the magnificence, 27 towers are planned, each as big as the two-megawatt machine in Denmark. Many locals are protesting. "This is a high-quality landscape," says one. "They shouldn't be putting those things in here."

Danes seem to like turbines more than the British, perhaps because many Danish turbines belong to cooperatives of local residents. It's harder to say "not in my backyard" if the thing in your backyard helps pay for your house. But environmental opposition is not the only trouble facing

wind development. Across Europe many of the windiest sites are already occupied. So the five-megawatt German machine is designed to help take wind power away from the scenery and out to abundant new sites at sea.

Many coastlines have broad areas of shallow continental shelf where the wind blows more steadily than on land and where, as one wind expert puts it, "the seagulls don't vote." (Real voters, however, sometimes still object to the sight of towers on the horizon.) It costs more to build and maintain turbines offshore than on land, but an underwater foundation for a five-megawatt tower is cheaper per megawatt than a smaller foundation. Hence the German giant.

There are other challenges. Like sailboats, wind turbines can be becalmed for days. To keep the grid humming, other sources, such as coal-fired power plants, have to stand ready to take up the slack. But when a strong wind dumps power into the grid, the other generators have to be turned down, and plants that burn fuel are not quickly adjustable. A wind-power bonanza can become a glut. Denmark, for example, is sometimes forced to unload power at uneconomic rates to neighbors like Norway and Germany.

What's needed for wind as well as solar is a way to store a large energy surplus. Technology already exists to turn it into fuels such as hydrogen or ethanol or harness it to compress air or spin flywheels, banking energy that can later churn out electricity. But most systems are still decades from becoming economically feasible.

On the plus side, both wind and solar can provide what's called distributed energy: They can make power on a small scale near the user. You can't have a private coal plant, but you can have your own windmill, with batteries for calm days. The more houses or communities make their own wind power, the smaller and cheaper central power plants and transmission lines can be.

In Europe's big push toward wind power, the turbines keep growing. But in Flagstaff, Arizona, Southwest Windpower makes turbines with blades you can pick up in one hand. The company has sold about 60,000 of the little turbines, most of them for off-grid homes, sailboats, and remote sites like lighthouses and weather stations. At 400 watts apiece they can't power more than a few lights.

But David Calley, Southwest's president, whose father built his first wind turbine out of washing machine parts, is testing a new product he calls an energy appliance. It will stand on a tower as tall as a telephone pole, produce up to two kilowatts in a moderate wind, and come with all the electronics needed to plug it into the house.

Many U.S. utilities are required to pay for power that individuals put back into the grid, so anyone in a relatively breezy place could pop up the energy appliance in the yard, use the power when it's needed, and feed it back into the grid when it's not. Except for the heavy loads of heating and air-conditioning, this setup could reduce a home's annual power bill to near zero. If, as Calley hopes, he can ultimately sell the energy appliance for under $3,000, it would pay for itself with energy savings within a few years.

Somewhere in this mix of the grand and the personal, there may be big numbers in wind too.