

A Price Controller For Business And Home

Small businesses seem, at first blush, to be ideal candidates for taking advantage of a relatively maintenance-free renewable resource like wind.

By Lyn Corum

The business owner, however, who wants to install a small wind turbine must have geography on his side—something that rural landowners, ranchers, and telecommunications operators who dominate sales, have in abundance. He must have open-minded permitting officials on his side as well.

Small wind turbines range in size from 400 watts to 250 kW, and they usually need to be located on at least one acre of land. Most small businesses are located in urban landscapes where they don't have the luxury of large acreages. Furthermore, they have to do battle before planning commissions that are uneducated about wind power. Robert Preus, owner of Newberg, OR-based Abundant Renewable Energy, hopes the US will follow Europe's lead. He said changes are already occurring there and noted that recent studies indicate small wind system sales are expected to increase in England over the next 15 years.

If the small business owner wants the wind turbine to supply more than 20% or 30% of his power, he must buy a German-made turbine. While American companies manufacture 90% of small wind turbines installed in the U.S., the mid-size turbine, 100 kW up to 600 kW, is no longer produced by American companies, which have shifted to the larger utility-scale machines.

For example, among the nine key small wind turbine manufacturers, Bergey Windpower builds the very popular 10-kW turbine usually installed on ranches and farms. Southwest Windpower manufactures several models ranging from 400 watts to 3 kW for off-grid homes and isolated telecommunications applications. Abundant Renewable Energy now builds a 2.5-kW unit designed for low wind speeds. Lorax Energy Systems is the North American distributor for the German company Fuhrlander AG, which manufactures wind turbines ranging in size from 25 kW to 2.5 MW.

Also slowing the development of small wind turbine sales in the US is the lack of federal tax credits—which have not been made available to small wind turbines since 1985, according to the American Wind Energy Association.

Most of the business owners interviewed for this story forged new territory when they sought permits in their cities or counties. There are no standardized zoning ordinances in most of the country. California is the only state with a law, passed in 2001, that requires most cities and counties to allow wind turbines on towers of at least 65 feet on property of one acre or more.

Yet, experience demonstrates that a successfully operating wind turbine can pay for itself in six or seven years, and owners can enjoy free electricity for the remainder of the turbine's 25-to-30-year life span. Here are the stories.

Iowa City on Cutting Edge

Tom Hurd has been interested in renewable power forever, he says, and got a masters degree in energy conservation from Iowa State. In 2003, when he built a new office building on a 3-acre lot in Mason City, IA, for his architecture and design business, Spatial Designs, he wanted to show that it could be done with energy-efficient alternate design, a wind and solar energy system, and a FEMA-rated tornado center.

While he waited for Mason City planners to review his permit application, Hurd researched US-manufactured turbines but found

the African Wind Power turbine supplied by Abundant Renewable Energy was what he needed. These turbines could perform very well at 12 mph, typical for Mason City winds in summer months. During the winter, winds are typically at 13 or 14 mph. While all turbine blades start moving at 6 or 7 mph, the typical turbine doesn't start performing well until they reach 24 or 25 mph, which was much higher than the typical wind speeds in the Mason City area.

(Robert Preus, owner of Abundant Renewable Energy, said that because of shifting exchange rates and quality control problems he no longer supplies African Wind Power turbines. Instead, he now builds a more efficient 2.5-kW machine that runs at low wind speeds with a break-even point at 5 mph. He said his company has a commitment to low wind performance.)



Hurd's lobbying finally paid off in 2004 when the city council approved an ordinance allowing small wind turbines within in Mason City as long as they were to be installed lots at least half an acre in size. After granting Hurd his permit, the city council imposed a moratorium on wind systems to study the matter, and in February 2006 it revised the ordinance to specify that wind turbine towers must be set back from property lines at least 110% of their height.

Hurd installed a 1-kW wind turbine in September 2004 and installed a second, 1.6-kW turbine in May 2005, both on 35-foot towers. He had installed a 2.8-kW photovoltaic solar system earlier when the building was constructed. The two turbines cost about \$25,000 and the solar system about \$15,000.

Among other things, a lack of federal tax credits has slowed the development of small wind turbine sales in the U.S.

Hurd couldn't find a contractor to install the turbines, so while he was waiting for his permit he researched how to install them himself. He did so with the help of a couple of employees and an electrician who completed the electrical hookup.

The wind turbines and the solar system continuously charge batteries. Two Outback Power inverters rated at 7,200 watts convert DC power to AC, and have an automatic switchover to utility power. Hurd said the inverter checks the battery voltage every six seconds and buys utility power in six-second intervals when battery power is drained.

Hurd said he discussed net metering with his utility, but it wanted another piece of equipment and a fee of \$1,000. Since his goal was to be independent of the grid he chose not to put money into net metering. Once he made the decision to use the utility for backup power only and not sell back, the utility was not concerned about the installation.

The combined wind/solar system provides the building with about 90% of the electricity it needs and satisfies about 40% of its heating needs, thereby displacing natural gas heating. Hurd said he saves approximately \$250 each month on utility bills. His electric bill in February 2006 was \$50. He acknowledged that the reduced utility bills also reflect the efficiency of the sustainably built office building.

As a result of this experience, Hurd created a new business opportunity for himself and is lining up industrial clients who are talking about installing 250-kW systems on 150-foot towers. His advice to do-it-yourselfers: There are a lot of ways to get in trouble. He does not recommend it for the guy off the street.

Tricia Sandahl, a planner with Mason City said she has received one application from the owner of a storage business since the moratorium was lifted, and two residents have expressed interest.

She said wind turbines can be installed in any part of the city, but residents will have difficulty because of the set-back requirement.

Wind Turbine Joins Microturbines

Harbec Plastics Inc., a manufacturing company founded in 1977 in Ontario, NY, incorporated environmental responsibility into its corporate philosophy 10 years ago. It specializes in engineering prototypes, precision tooling, and complex injection molded parts. Founder and president Bob Bechtold is intent on eventually operating his company on 100% renewable power by going at it one step at a time. He began by installing 25 30-kW Capstone microturbines over five years ago, then installing a 250-kW wind turbine three years ago.

Bechtold is now involved in setting up a biodiesel production company. He has already converted two of the microturbines to operate on biodiesel fuel. If the economics work out he will convert half of the microturbines to operate on the same fuel. This newest thrust is due largely to the increase in natural gas prices, he said.

Planning for the wind turbine took many years. "I schlepped the whole world," and had the turbines lined up, Bechtold said. But by

the time he got the financing in place, the manufacturer had gone out of business. He found German-made Fuhrländer, the one provider of the 250-kW size machine, through Lorax Energy Systems, headquartered in Webster, NY. Why this size turbine? "We could not find a bank that would finance a larger machine," Bechtold said.

That related to the lack of a true net metering law in the state of New York. It will allow him to sell back 10 kW at 1.9 cents/kWh, but is not enough income to justify a larger machine in the eyes of a bank. Choosing not to make the effort of selling back, the company instead gives power back to the utility on the weekends. His business operates 24 hours, five days a week. During that time, the wind turbine produces 20% of the business's total energy needs, between 300,000 and 350,000 kWh annually, saving Harbec about \$50,000 a year, at a wholesale cost of about 5.5 cents/kWh, Bechtold calculates.

"One thing the onsite wind turbine does is offer an opportunity for owners to predict costs two decades into the future," Bechtold said. As soon as net metering comes to New York, he intends to buy a 1-MW turbine, greatly increasing the onsite electricity supply for the company.

Permitting offered another challenge. Bechtold had to get a variance because the turbine tower, at 130 feet, was above the standard height. He made a presentation to the Ontario planning board, which "put him through hoops for several months." Bechtold got the variance only after presenting the board with engineering data. "I wore them down with the truth," he said.

Lorax Energy Systems installed the wind turbine and tower in about a week, with help of two Fuhrländer factory technicians and a number of Harbec employees. Bechtold reported that the company elected to do its own maintenance on the wind turbine. In its three years of operation, it has received a total of 20 to 30 hours of maintenance, including checking the brakes' hydraulic system and fluid levels.

The wind turbine, installed between the building and the highway, produces no noise whatsoever, Bechtold said, and he has seen no dead birds under the turbine.



The increased natural-gas prices have affected how the microturbines are operated. Five years ago, the turbines produced all the power Harbec needed. When the price of natural gas tripled, the turbines were no longer cost-effective, Bechtold said. So he switched tactics to make the thermal requirement drive the microturbine load. During summer months when the microturbines' exhaust heat is used for air conditioning, they operate about 50% of the time. During winter months, the load drops to 15%. The exhaust heat is sent through a heat exchanger to heat hot water for the building's radiant in-floor heating systems and forced air systems.

Now, with the wind turbine operating, Harbec purchases between 30% and 60% of its electricity from the grid. It pays 11 cents per kWh for green power, Bechtold said.

First Wind Turbine in Boston

The original motivation for installing the 100-kW wind turbine was for education and training, Martin Aikens admitted. The International Brotherhood of Electrical Workers Local 103 has a strategic interest in getting its members jobs, and Aikens sees great potential for job creation in the renewables field.

A business agent at IBEW 103, Aikens was already sold on renewable power. He had a small solar system installed on his house, and IBEW had already installed a 5.4-kW solar photovoltaic system on the roof of its Apprenticeship Training Facility in February 2002.

Aikens took his idea for a small wind turbine to his boss, business manager Michael Monahan, in early 2004. Monahan's response, sensing a political situation down the road, was "Let's get the mayor involved." This was easily arranged since Monahan had sat on the Mayor's green buildings committee for a year. The presentation to the mayor and staff went well and staff recommended that since this would be the first wind turbine in Boston, Monahan and Aikens needed to get the neighbors involved.

Of the three or four neighborhood groups, the Clam Point Civic Association of



Dorchester was the largest. Aikens met with the group several times, educating them about the project. He told them, “Before I go forward and pull the permit, I need your support.”

Other than the one man who hated the idea because he thought the wind turbine was ugly, turbine noise was the only issue that worried the neighbors. The proposed location of the wind turbine—and where it sits now—was 175 feet from the highway, 400 feet from the street and 400 feet from the nearest houses.

The issue disappeared after Aikens did a noise study. The results surprised the neighbors—they could not believe how noisy their neighborhood already was. If it did make any noise, the wind turbine could not be heard over the din, which included a train passing regularly along the nearby tracks.

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But the construction permit was denied because there were no regulations for wind turbines, so Aikens immediately appealed his application to the Zoning Board of Appeals in January 2005. At the hearing, the local university, neighbors, and environmental groups all supported his plan. When the board president asked for opposing testimony, there was none. “In that case, we’ll have to approve it,” he concluded.

In September 2004, once the neighbors were on his side and before he got his permit, Aikens ordered the turbine from Fuhrländer. Delivery took place eight months after the order was received, primarily because it was manufactured to US electrical standards, which differs on Hertz and volts, for example, from European standards.

In most of the U.S., there are no standardized ordinances regarding wind generators.

Aikens tried to get an American turbine but both General Electric and Vestas stopped manufacturing the smaller sizes, he said. The 100-kW size was important so that if it fell it wouldn’t reach the highway, 175 feet away. He was successful in obtaining a \$260,000 grant from Massachusetts Technology Collaborative to defray construction costs.

Morrison Berkshire, a Massachusetts company, manufactured the tower and foundation and Massachusetts Electrical Company installed the tower and wind turbine. Installation went like clockwork, Aikens said. The turbine began operating toward the end of May 2005.

There has been a learning curve involved in operating the wind turbine. Speed had to be adjusted to take advantage of the steady winds in the area. Light House Electric maintains the turbine, which amounts to retorquing all the nuts and bolts once a year.

Combined, the wind turbine and solar systems have reduced energy costs between 25% and 30%, Aikens reported. The IBEW is receiving further income by selling green tags to the Massachusetts Energy Consumers Alliance.

As for training, the wind turbine is now part of the energy curriculum in IBEW’s apprenticeship program. “Within the next two to three years, we will have 200 full-time jobs for electrical workers,” he predicted. As evidence, he cited two solar PV manufacturing plants in Boston that have quadrupled production in the past two years. Currently, however, they are shipping the product to Japan and Germany where the demand is greater. “One of my contractors is looking for 40 kW of panels,” he said, but the manufacturer will ship in four months—not one month. “This stuff should be available off-the-shelf,” he exclaimed.

Power for Orchids

Larry Johnston, the owner of Rio Mojave Orchids, installed a 10-kW Bergrey wind turbine on his 33-acre ranch in San Bernardino County, Calif., 4 1/2 years ago to provide power, not only for his two small greenhouses where he grows orchids, but for his ranch house, a multi-use building, and two mobile homes as well. The \$27,000 installation has almost paid for itself, with the help of a \$13,500 rebate from the State of California. Monthly utility bills have been \$500 to \$700 lower in summer months and \$300 lower in winter months. No bill has been more than \$200, and some bills have been as low as \$40, reducing his utility cost by two-thirds.

Three years ago, he installed another 10-kW wind turbine to power a new large greenhouse and work building. But those buildings are still being built, so that turbine has not been operating. Once it is, he will transfer the power connection for the two

small greenhouses and the mobile homes to the second turbine. Operating the two wind turbines, which are about 500 feet apart, should cut his utility bills to near zero.

Thanks to net metering, Johnston pays his Southern California Edison bill once a year, although he gets monthly statements. The power he doesn't use goes back into the grid, and the bill is reconciled at the end of the year.

Johnston's ranch is located in an unincorporated, hot and windy portion of San Bernardino County east of Los Angeles. His contractor, Joe Guasti, pulled the required permits. While the county has strict permitting requirements for wind turbines, Johnston says, cities in the area have restrictive codes, including height set-backs and tower height in relation to neighbors' property lines. The county's requirement, on the other hand, was limited to tower height, 60 feet in the case of his first turbine. By the time he installed the second turbine, height limits had risen to 80 feet. Recent code changes limit tower height to amount of acreage. If land exceeds five acres, for example, the tower can be 120 feet high.

Like other owners, Johnston reports the turbine requires almost no maintenance. He's been told to check the cables holding the tower in place once a year to make sure they remain tight. Two weeks ago he thought he would need to lubricate a hinge on the tail when it started squeaking. However, by the time contractor Joe Guasti checked it, the squeak was gone. Guasti theorized the wind had cleaned away dust causing the squeak.

When asked if neighbors had complained of noise, Johnston replied, "What noise?" Actually, that wasn't quite true. When winds reach 60 mph, he has heard some noise for about 30 seconds. As for dead birds, he has seen none under the turbine. However, live birds do like to nest in the tail assembly, he exclaimed.

What NOT to Do

Dick Considine, owner of Superior Sod, couldn't get his 10-kW wind turbine to operate properly for the three years it was operating. "I never got more than \$21 a month in savings," he said, adding, "I knew it had to work, but I couldn't get anybody to fix it." His other major complaint was that it was as loud as could be and people over a mile away complained of the noise.

The wind turbine was installed on an 80-foot tilt-up guyed tower that was reclaimed from a nearby windfarm project when obsolete wind turbines originally installed in the 1980s were replaced. It was net metered into Southern California Edison's distribution system. The rebate from the California Energy Commission went to the dealer who reduced his sale price.

After three years of off-and-on operation, Considine tore down the wind turbine and tower in August 2005. The Authorized Bergey dealer that installed it had gone bankrupt and Considine hired three different contractors to repair it over those three years, paying each \$2,000 to \$3,000 to replace or add parts. Considine had paid \$32,000 originally, and put out \$8,000 in repair bills, before he gave up.

There is a lesson to be learned here. Considine has an 800-acre farm and business that produces premium variety sod for landscapers and homeowners in Southern California. When he bought the wind turbine, he thought it was a good thing. There also were several residential installations operating in the Tehachapi area. But he was too busy with his business to become familiar with the wind turbine and could not explain what was wrong with it. Nor did he contact the manufacturer directly.

In contrast, the other business owners interviewed for this story were highly motivated. They spent not weeks, but years researching the wind turbine they wanted and either installed the it themselves or had a vested interest in understanding the details of its installation and its operation.

Michael Bergey of Bergey Windpower does not believe Considine's wind turbine wasn't working. Considine did not request service under Bergey's five-year warranty offered on all its units. Bergey suggested the turbine didn't perform because the wind resource was very low in the immediate area in which the turbine was located. He also said the system had an older blade technology that will make noise in high winds when it is not loaded.

Looking Ahead

Bergey remains upbeat about the future for small wind power, as long as oil stays over \$50 a barrel! As for its current state, he said the industry is small and undercapitalized and has limited marketing and outreach. Promotion appears to be limited to word of mouth. He thinks it will take a federal tax credit to stimulate the market in general and grow it from its current status as a cottage industry.



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Topics: Utility
