A Second Wind

The idea of generating electricity using the wind appeals to many, but the reality is that wind systems demand the most planning, labor, and maintenance of any home-scale renewable electricity system. Homeowners and installers don't always get it right the first time, and there are lessons to be learned when they don't.

by Ian Woofenden

In May 2001, Don and Bev Grim approached Randy Brooks of Brooks Solar—they were interested in a wind-electric system for their home in Peshastin, a small town in central Washington. They wanted to participate in the Sustainable Natural Alternative Power (SNAP) incentive program in the Chelan County Public Utility District service area, which would pay up to $1.50 per kilowatt-hour for green electricity.

Randy and his crew were familiar with SNAP after having installed a Bergey Excel wind turbine to help June and Charlie Nichols reap the program's benefits (see "Betting the Farm" in *HP96*). But Randy was relatively new to wind generator siting, and the available wind maps at the time were not terribly useful. He suggested to Don and Bev that they install a meteorological (met) tower to gather wind data, but they were not interested in the added expense ($5,000 to $15,000) or time required. Don and Bev were convinced that the site was windy, and Randy observed the topography and was inclined to agree.

Ian Woofenden

The tower and turbine at its original site in Chelan County, Washington.

Courtesy Randy Brooks (2)

Inset, top: The forms, rebar, and rebar supports. Inset, bottom: The finished tower footing.

Courtesy Randy Brooks

The turbine was assembled on the tower, then lifted onto the base by a crane.

Off the Drawing Board

The wind installation moved from concept to project over the next few years, with the concrete footing poured in May 2002, and the 100-foot tower and Bergey Excel turbine installed in October 2002. Randy was joined by Bill Hoffer in prepping the site, and by his western Washington crew of Kelly Keilwitz, Rose Woofenden, and yours truly for the tower assembly and crane installation.

Courtesy Don Richmond (4)

Once it was confirmed that a lack of wind was the culprit causing low energy output, the system was disassembled and loaded onto a flatbed trailer for transport to a new site.

We left the Grims' home confident that we'd set them up with a productive system. The turbine went online and began to sell electricity to the Chelan County PUD, with a dedication ceremony in July attended by utility officials, local politicians, and other interested people from the area. Don and Bev received their first check for anticipated green tag earnings.

After helping with an installation, I always look forward to hearing from the contractor and homeowner about how the system is performing, but the first reports in this case were discouraging. After three months, only about 100 kWh had been produced. The full first year of data was even more disheartening: The Grims' turbine had only generated about 500 kWh, or an average of less than 1.4 kWh per day.

At first, we wondered if there was a performance issue with the turbine, and there had been some glitches with the inverter. But the anemometer that had been installed on the tower told of a more permanent problem. The average wind speed reported was very low—less than 6 mph in those first three months. We hoped that the initial period was an anomaly and that the overall average would be much higher. But after 15 months, our fears were confirmed by a wind-speed average of only 4.3 mph. According to the turbine manufacturer's projections, with an 8 mph average, the turbine would have produced about 3,000 kWh per year; a 12 mph average would have produced 11,000 kWh per year.

What happened? The owners' eagerness coupled with a lack of solid resource data led to a waste of time, effort, and 48 cubic yards of concrete in the ground, and about $55,000 spent. While external appearances and anecdotal observation seemed to indicate a good wind site, the reality of low wind speeds and poor turbine production proved otherwise.

Seven years later, the wind maps available are considerably better, and would likely have helped avoid this situation. The free mapping database from AWS Truewind (see Access) indicates a mean average of only 4.8 mph at a 60-meter (197 foot) height at the site—much lower than the 8 to 14 mph suggested for a viable system.

The truck, with tower and turbine ready for transport.

After almost four years, Don and Bev concluded that they had made a poor investment, and advertised the machine and tower for sale. The concrete weighs more than 70 tons, so reusing it in another location was out of the question, but Don and Bev hope to use it as a level surface for a future PV array.

Have Site, Need Turbine

In March 2008, RE engineer Randy Richmond contacted me. His family had purchased property in Ellensburg, Washington, with the express purpose of installing a wind generator, and he was looking for recommendations. I mentioned the Grim turbine, so the two Randys got together to inspect the system. They negotiated a very reasonable price for the complete system, and Randy Brooks put the wheels in motion to move it.

While Randy Richmond worked with local authorities for permission to site the turbine on his vacation property, Randy Brooks gathered his de-installation crew. In early June, we attached a crane, unbolted the tower from the foundation, and tipped the whole thing over. Turbine blades, tail, and then generator were removed and stowed, leaving us with a bare tower.

Brooks had arranged for a flatbed semi trailer to haul the tower and turbine 40 miles to Ellensburg. We decided to partially disassemble the tower into five 20-foot sections. This strategy worked well, and we nested the sections on the semi, with the turbine strapped down on the back end. All then headed south, leaving a bare concrete slab at the Grim property.

The turbine and tower are reassembled and hoisted at the new site—one with a considerably better wind resource.

Courtesy Don Richmond (5)

Relocation & Reinstallation

Randy Richmond and his wife Melissa had multiple reasons for purchasing their weekend cabin in eastern Washington, but their primary motivation was a site for a wind-electric system.

This site clearly had a better wind resource than the Grim site. There are two commercial wind farms nearby, and the wind maps show a 14.5 mph average wind speed (at 197 feet) in their neighborhood. The landscape is largely treeless, and neighbors complain of consistently strong winds. While no on-site anemometry was done, data from nearby sources, including a commercial wind energy company, confirmed our initial observation and verified the wind maps.

When the semi and crane arrived on site, we unloaded the sections and preassembled the tower near the new foundation site. We opted to only assemble the tower without the turbine, getting a head start on the future installation. The installation was scheduled to be resumed a few months later, to give Richmond time to prepare the site. In June, the tower site was excavated, forms were built, and rebar was set in 38 cubic yards of concrete. Richmond also fine-tuned the electrical and monitoring systems for the turbine, including wind monitoring equipment, radio antennas, and a Web cam. Provisions were included for selling space on the tower to local agencies and companies needing radio transmitters and receivers.

The crew gathered to resume installation of the wind system in late August. Richmond had done much of the work already, including routing the transmission cables, both underground and on the tower. We quickly finished up the remaining odds and ends before the crane rolled onto the site. This was the sixth Bergey Excel that our crew had installed in seven years, so we worked like a fairly well-oiled machine.

The crane lifted the tower so we could prop it up for room to install the turbine. We then lifted the turbine head and bolted it to the tower, followed by the tail and new, next-generation blades. The blade upgrade led to some head-scratching over the installation hardware and a field modification to make the nose cone fit properly. Meanwhile, with transmission wires secured, furling cable attached, and damper completed, we were ready to lift.

Once the tower and turbine were up, we ran ground wires to the ground rods, and performed electrical and furling tests on the turbine. We left the turbine running unloaded, an acceptable condition for this particular model.

Once final electrical approval was received from state authorities and the utility in October 2008, the system began to produce electricity. In its first 86 days of operation, the

Courtesy Randy Brooks

Proud new owners of the relocated wind-electric system.

The turbine and tower, at their new home on the range.

Ian Woofenden

Courtesy Randy Richmond

The installation crew.

system has produced 2,047 kWh, or an average of 23.8 kWh per day, a far cry from the low performance at the Grim site. Average wind speed at 33 feet was 8 mph in the fall of 2008, and, Randy estimates, probably 1 to 2 mph higher at the turbine hub.

The Richmonds are earning a 12-cent per kWh state incentive payment for their wind energy. The incentive has a $2,000 per year cap, which Randy hopes to reach. The electricity produced also offsets the energy consumption of the cabin on the property, further improving the payback.

Lessons Learned

Seven years after his initial meeting with Don and Bev Grim, Randy Brooks has more experience with wind site assessment and system installation. His experience with the Grims leads him to be "much more conservative with wind resource estimates."

Wind systems aren't for everyone, or for every site. In fact, truly good wind sites are not all that common. Wind turbines should be installed well above (at least 30 feet) anything within 500 feet of the tallest obstacle, and taller towers are always better. And as the Grims learned, even adequate tower height cannot overcome a site with a poor wind resource.

It's fortunate for all involved, and for the renewable energy community, that Don and Bev realized their mistake and moved on. This gave Randy and Melissa an affordable opportunity to tap into wind energy. And it put a poorly producing turbine into a new environment where it can now earn its keep.

Access

Ian Woofenden (ian.woofenden@homepower.com) enjoys moonlighting on the Brooks Solar crew, which has provided many rewarding wind installation experiences.

AWS True Wind • www.awstruewind.com • Online wind maps

Bergey WindPower Co. • www.bergey.com

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