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SMALL TURBINE COLUMN:

Determining the Cost of Electricity

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Following up to last month's column, Size Matters!—which urges readers to beware of "technology-breakthrough" wind turbines marketed on the Internet that promise to produce more power than their size would likely allow—the other frequent question I often hear about all of the turbines that are being sold on the Internet revolves around the projected cost of electricity touted by many of these Web sites. It is not unusual to see claims for the cost of electricity from many of these products in the single digits. Given that, according to the Department of Energy, the average cost of residential electricity in the US is $0.11/kWh, claims of single digit kilowatt-hour cost are very appealing to prospective customers.

Instead of taking the Web site's claim for the cost of electricity that their latest and greatest product will deliver to your house, it might be wise to do your own math. I'm not accusing these companies of fraud, but many are wildly enthusiastic about the performance and subsequent cost effectiveness of their products. The savvy consumer would certainly ask questions about the claims made concerning other kinds of products, so why not do the same for the wind turbine you are interested in buying and operating for the next 20 or so years? I'd think that it's the responsibility of all the companies selling wind turbines to help potential customers determine their cost effectiveness. After all, if you want to sell me something that will make me "run faster and jump higher," isn't it reasonable to ask how fast and how high?

The AWEA Small Wind Performance and Safety Standard

The first thing I suggest that potential customers ask of any small wind company is if their turbines will meet the AWEA Small Wind Turbine Performance and Safety Standard (Standard) that is in process of development. A committee of small wind industry stakeholders has worked for the better part of five years to develop this Standard. At the time of this writing, the draft has been floated to the public by AWEA, which is helping coordinate the development of the Standard. The committee is reviewing and incorporating comments into the document as appropriate. I hope that by early summer we will have a final Standard that companies can test their turbines to.

The Standard sets benchmarks and criteria that turbines must meet in order to be certified by an independent agency. Currently, one such certifying organization, the Small Wind Certification Council (SWCC), is up and running, just waiting for the onslaught of applications from small turbine manufacturers. The SWCC will review the test results submitted by manufacturers for their products and either certify the products or send the company back to do more homework.

SWCC certification, per the AWEA Standard, will cover small turbine reliability, rated output, annual energy output performance, and sound and safety compliance. This certification is being driven by the state public benefit renewable energy programs, which want assurance that the equipment they are funding with utility ratepayer dollars will actually do what the manufacturer claims, and subsequently that grant money for such systems is being spent wisely. This is an idea that is long overdue.

Relative to claims of the cost of electricity (COE), many manufacturers calculate the COE based on a 20 year or so life expectancy. One big question is, will the turbine actually last at least 20 years? Some established products out there will meet that life time, but not all. The biggest unknowns are the latest and greatest "technology breakthroughs"--e.g., designs engineered on the back of an envelope and being sold with little if any testing. While certification by the SWCC certainly will not guarantee a 20-year life, it will go a long way beyond what is the current warranty out there on many of these products, which is essentially "trust me."

Uh huh.

Annual Energy Output

Obviously, (or at least I hope this would be obvious) annual energy output (AEO) is the important number that potential buyers are interested in. However, until we have test results certified by the SWCC, we can only depend on what the manufacturers tell us about their products. But sourcing reliable or reasonable AEOs for some of these products is nearly impossible.

Manufacturers' AEO estimates for some products reflect reality, more or less. As there are always going to be unknowns with any renewable energy installation, some leeway is understandable. So if a turbine performs in the ball park of what the manufacturer estimates, say give or take 10%, I'd be satisfied. Since the manufacturer cannot evaluate every customer's site, hopefully their installers have been trained to do wind site assessments and how to use the AEO estimating tools provided by the turbine manufacturers they are representing.

However, thorough and accurate site assessments and AEO estimates are not necessarily done by all installers, nor do site assessments or AEO estimates necessarily reflect reality. Some manufacturers that operate on the Web do not hesitate to quote AEOs for their products, with no real idea of what will actually be produced by their product at that site. It is not unusual to see claims touted like, "This turbine will generate 2000kWh/year at a 12 mph wind site." What the customer latches onto is the AEO estimate (2000 kWh/year), not the qualifying wind speed (at 12 mph average annual wind speed at hub height). And invariably in these situations, neither the potential customer nor the manufacturer have any idea at all what the actual average annual wind speed is at the site. In such Internet sales situations, no one ever actually qualifies the site as

even suitable for a wind turbine, let alone what the wind speed might actually be. But that never seems to dampen some Internet companies' enthusiasm for quoting turbine outputs.

One of the most egregious examples of this is a Savonious rotor "urban turbine" that was recently installed by a utility as a demonstration project near Madison, Wis. The media, quoting the manufacturer and its turbine specifications, reported that the turbine would power 2-3 average homes. Since the average home consumes about 1000 kWh/month, it would be reasonable for a reader to conclude that this particular small wind device would generate 24,000 to as much as 36,000 kWh per year. At a cost of $40,000 installed, any reader would conclude that this system is a bargain—where do we sign up?

In this case, however, the utility has been documenting and reporting kilowatt-hours generated. In the interceding six months since the turbine has been commissioned, it has generated a paltry 37 kWh, and has seen no down time for repairs. And this has been during the windy winter and spring seasons in Madison. Extrapolating this performance to one year, it is not unreasonable to calculate that this particular turbine will generate all of 74 kWh per year, or a capacity factor of 0.0008% (read: eight ten thousandths of one percent). At an average cost of $0.12/kWh, this $40,000 wind turbine has a payback of a mere 4,504 years. We're approaching the half life of some radioactive elements! And the extrapolated cost of electricity (COE) for this Internet wonder over the presumed 20-year life of the turbine? $27.03/kWh. As they say, "Your mileage may vary."

Is it any wonder why the public would get cynical about the cost effectiveness of small wind turbines if this is all they saw reported by the media?

Another example brought to my attention is a Web-based manufacturer's statement that, "When the wind is blowing only 7-10 miles per hour, [the manufacturer's wind turbine] can charge a battery storage system that will meet all the electrical needs of your home." All your electrical needs for only $35,000, plus installation and other extraneous costs—
this for a product for which there is no other data or information to back up the purported performance claim. Simply nothing.

If anyone out there is interested in buying one of these turbines, please contact me. I have some swampland to sell you.

So, what to do?

Until the AWEA Standard is in place and the SWCC is certifying performance and reliability, buyers need to be diligent in getting firm answers about the wind system of interest. Your research list must include the following tasks and points of awareness:

- Get a reasonable determination of the average annual wind speed for the intended site at hub height. The best and cheapest way to do this is to hire a trained wind site assessor to give you an independent evaluation of your site, its wind potential, and the energy that can be generated there. At $500 or so, this may be your best investment in a wind system.

- If you are not willing to retain the services of such a person, then you need to monitor the site for a reasonable enough length of time to determine at least a ball park idea of what the wind resource is. This can only be done by mounting the anemometer at the location and height of your proposed system. Do not depend on the manufacturer, the one entity that has a stake in the outcome of the assessment, to determine your wind resource. For rooftop or urban turbine installations, their guestimates are little more than sticking a wet finger in air and declaring the site suitable for a wind turbine. Unfortunately, this is done all too often, and the gullible and those who want to believe simply swallow the bait.
- Remember that the output of a turbine is roughly proportional to the cube of the annual average wind speed. Going from an 8 mile-per-hour average annual wind to a 10-mph annual average nearly doubles the AEO, and subsequently cuts the cost of electricity in half. COE for a small wind turbine is far more sensitive to the wind speed at the site than the initial cost of the turbine, a fact lost on most consumers.
- Keep in mind that the cost of a wind system is not just the wind turbine. A wind system has a long list of equipment and services that need to be purchased after you take the turbine out of its crate. Nevertheless, prices quoted often are for the turbine only, and do not include the costs for the tower, wiring and other electrical work and components, concrete, shipping, labor, permits, or sales tax—all of which can easily add up to several times the cost of the turbine, or more. And don't forget operation and maintenance and occasional repair costs. So far, the only "maintenance free" wind turbines I have seen are disposable, not repairable. All of these systems need at least annual inspections by a trained service person.
- By all means, insist on third-party test reports that meet the intent of the AWEA Standard and will qualify for review by the SWCC. Even though the AWEA Standard is still a draft at this time, any serious manufacturer of small wind equipment knows about the Standard, and has begun the process of testing their equipment. If your chosen equipment supplier has no idea what the Standard is about, find another manufacturer.

And finally, listen, listen, listen. All too often I hear people say that the manufacturer claimed a certain AEO at a certain wind speed, but the turbine ends up underperforming. Digging for details reveals that the purchasers invariably have no idea at all what their average annual wind speed is, or even the proper tower height for their site. They just took the bait residing on the Internet. Your best investment may turn out not to be the turbine, but the wind site assessment you hired a trained person to do. While many people are reticent to spend dollars on such assessments, think of the consequences. Would you rather spend $500 to qualify your site, or $40,000 or more to monitor the site with the wind turbine you bought, only to find out that you have a poor wind site?

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[Editors Note: The opinions expressed in this column are those of the author and may not reflect those of AWEA staff or board.]