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SMALL TURBINE COLUMN:

Rooftop-Mounted Wind Turbines

--Mick Sagrillo, Sagrillo Power & Light

Wind turbines seem to be on the public's mind lately. The production tax credit was recently reauthorized by Congress, bringing press attention to numerous wind farm projects that have been on hold for the past few years. Many utilities are offering green pricing programs, with the green electricity most often coming from wind farms. While there is no connection to electricity, skyrocketing gasoline prices also have people thinking about alternatives to fossil fuels.

On the heels of all of this attention is increasing interest in rooftop wind turbines for homes or office building applications. The concept of a roof mounted wind turbine has wide public appeal. Generally, people are averse to climbing. But standing on your roof doesn't seem like climbing, especially when compared to scaling a 120-foot tower. Anyone who has stood on a roof knows that the wind is stronger there than on the ground, so roofs seem like a good alternative to towers. And if you don't have a tower to install, along with the cost of the machinery to dig the foundation, concrete for the foundation, and crane costs to install the tower and wind turbine, it appears as though you could easily save more than half the price of a wind system by eliminating the tower.

In addition to those reasons, companies are beginning to market rooftop-mounted wind turbines with their own rationales. Phrases such as "easy to install," "easy to permit," and "aesthetically pleasing compared to a tower" are making their way into sales literature. The epitome of these arguments is that rooftop wind turbines "don't require a tower for blade clearance."

Placing wind turbines on roofs may make them easier to install, but it creates a new set of problems and takes the wind turbine out of the best wind resource.

One problem with rooftop-mounted turbines is that roofs are not designed to support them. Wind turbines experience considerable lateral thrust as the wind is captured by the rotating blades. Towers and their foundations are designed specifically to accommodate those forces. In addition, a resonant frequency develops from the electrical generator that is conveyed to the structure the turbine is mounted on, which can turn into a deafening sound inside the structure. Even if you could isolate the structure from this vibrating frequency, buildings are simply not designed to accommodate the dynamic loads that a wind turbine places on the tower it is mounted to.

Most importantly, the wind resource that exists on rooftops is not as steady as that which can be found on a tall tower, away from structures. This is the basic physics of fluid dynamics.

Wind turbines are not mounted on towers "for blade clearance." If that were the case, your residential wind turbine with a ten-foot blade would only need a tower slightly taller than ten feet. Well, maybe fifteen feet so that the rotating blades will not kill your dog. Why, then, are wind turbines mounted on such tall towers?

Wind speed increases as you move away from the surface of the earth. The surface of the earth causes considerable friction on the air masses moving across it, which reduces wind speed. This zone of friction begins to diminish above 60-feet over completely open ground. This concept is critically important for wind turbines because the output of a wind turbine is proportional to the cube of the wind speed. For example, increasing wind speed from the eight miles per hour (mph) we often see at ground level to 11 mph at 60 feet increases output by 130%!

It would seem as though tall buildings would therefore be an ideal location to mount a wind turbine. However, obstacles like buildings will cause turbulent air flow around them. This zone of turbulence can extend to twice the height of the obstacle, and about 20 times downwind from the obstacle. Turbulence not only reduces the wind's speed, but the constantly shifting direction of turbulent winds puts considerable strain on a device like a wind turbine. A good way to visualize turbulence is to watch a flag on top on a building versus one in an exposed field on a flag pole. All of these stresses due to turbulence will increase wear and tear on the wind turbine, resulting in increased maintenance and significantly reduced life.

All of this said, there may indeed be isolated and unusual situations or locations where a rooftop wind turbine may perform as hoped. However, the engineering required to model the building and surrounding obstacles so that the wind speed and turbulence are understood would likely far exceed the dollars saved on the tower and its installation.

Notwithstanding these issues, the popular press repeatedly gives coverage to some new "inventor" who is going to buck the conventional wisdom that wind turbines belong on towers. While they may spin, rooftop-mount wind turbines rarely, if ever, live up to the hype about their cost savings and output. If the turbine doesn't generate any electricity, it really doesn't matter how much was saved by eliminating the tower.

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