

A Sustainable Environment: Our Obligation to Protect God's Gift

by
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Be Careful in Selecting a Wind Turbine

If you are reading this article, I am sure you are aware of two major environmental issues, that of climate change and the limited availability of fossil fuels. One of the answers to both reducing carbon dioxide emissions to the atmosphere and a renewable energy source is wind energy. I have been a big proponent of wind energy for quite a few years, but for the past year or so, the adoption of this alternative energy source has become very popular. The installed wind capacity grew 78% in 2008 and it is expected to grow thirty-fold in the next five years.

Besides categorizing wind turbines by size, they are also identified by type, whether they are designed with a horizontal axis or a vertical axis. The large wind turbines with three rotor blades that you see as part of a wind farm in the countryside have a horizontal axis. This is by far the most common wind turbine. However, you may have also seen a wind turbine resembling an egg beater on the roof of a building or at the top of a mast. Some of these vertical axis wind turbines are known either as Savonius or Darrieus, both introduced in the 1920s. While they are attractive and functional, they are not very efficient.

An example of vertical wind turbine on a 24-foot mast is manufactured by Windside and was installed last year at Madison Gas and Electric in Fitchburg, Wisconsin. This turbine, rated at 10 kilowatts at wind speeds of 35 mph, costs \$40,000. During the first six months of operation, it generated 37 kilowatt-hours which can be extrapolated to produce 1480 kwh in 20 years. If the value of the electricity is \$0.12/kwh, the payback for this wind turbine would be about 4500 years.



Another example of a vertical axis wind turbine is that designed by Aerotecture, a Chicago-based company. Several of these have been installed in the Chicago area including eight 1-KW units at the edge of the roof of a Mercy Housing building on the near-north side of the city. These units were actually installed on their sides so that any wind blowing against the building will be forced over the roof and thus spin the turbines to generate electricity. At a total cost of \$150,000, these units are expected to save \$1,500 per year for a payback of 100 years. Why would anyone invest money to generate electricity with a 100-year payback? Worst of all, it does not appear that these wind turbines will generate as much power as expected.



In general, these roof- or ground-mounted vertical axis wind turbines are not adequately efficient to be a good investment. The primary reason is that they are installed too close to the ground. It is a well known fact that the wind speed increases with height, and the power generated by the wind is proportional to the cube of the wind speed. For example, the power generated at 20 mph is eight times as much as that of 10 mph. ($20/10 = 2$ and $2 \times 2 \times 2 = 8$) If you install these wind turbines on top of a very tall building, then there is the problem with turbulence. If the turbines happen to operate extremely well, then there will likely be a problem with vibrations to the building.

Another example of very inefficient vertical-axis wind turbines can be seen on the first-floor roof of an extension of Pepsico's office building at the corner of Monroe and Jefferson in downtown Chicago. These units are very close to the ground and surrounded by tall buildings. I am not sure why anyone would expect them to work.

Vertical axis wind turbines really indicate that the owner has a concern for the environment, but they are more artistic than functional. You might say they are a good example of "green washing".