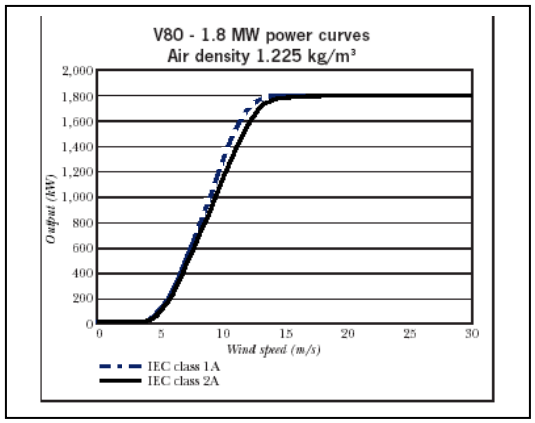
MCCR Windpower FAQ #7:

Do certain turbines work better than others at specific sites?

It is true that some turbines will produce more power than others on a given site. One of the primary reasons for this can be found in what's called the power curve of the turbine in question. The power curve for a turbine is a graph that shows the power output of the turbine for each value of wind speed (assuming a specific air density, and a couple of other factors). An example of two power curves is shown below. (These happen to be for two variants of the Vestas V80 turbine and were taken from the company's on-line brochure.)



You see from these power curves that below some specific wind speed (the "cut-in speed"), the turbines produce no power. Also, above some particular wind speed (the "rated speed"), the power output becomes constant, and equal to the nameplate rating of the turbines (1800 kilowatts, or 1.8 megawatts, in this case). Above the rated speed, faster winds don't lead to more power. That's because the components of the turbine have maximum ratings that can't be exceeded, and the turbine limits its own output to protect itself. There is also a "cut-out" or "stop" wind speed. If the wind exceeds that speed, the mechanical loads on the turbine become too great, and it shuts down, again to protect itself from damage.

Ideally, a wind farm designer would choose a turbine for a site such that the wind speed on that site is as close as possible to the rated speed for that turbine, for as much of the time as possible. That way, the maximum amount of energy would be extracted from the wind on that site. Since this rated speed is different for different turbines, you will find that some turbines do work better than others on some sites.

How does one go about selecting the best turbine for a site? First, one must have reliable wind speed data for the site. The more data you have (that is, the longer the period of data collection on the site), the better. These data are used to develop a statistical picture of the wind resource on the site, which can be compared to the power curve and used to predict the amount of energy a turbine would produce on that site. If measured data are not available, it's possible to approximately predict the statistics of the wind on a site, but this is far less accurate. Once wind data and a set of power curves are available, then a designer can predict the energy production from each candidate turbine for that site and choose the one that produces the most. Of course, factors such as cost and ease of installation play a role as well.

In addition to the fact that differences in design give rise to different power curves, it is also true that different system designs cause different impacts on the power grid. This phenomenon was discussed in FAQ #4, and the interested reader is referred there for more details.

For additional information or resources, or to submit an FAQ, contact Dr. Michael Ropp, Electrical Engineering Department, South Dakota State University, Brookings, SD, 57007-2220, michael_ropp@sdstate.edu.