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## **MCCR Windpower FAQ #4:**

### **Does windpower “make sense” technically?**

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For purposes of this FAQ, we will concentrate on large, utility-scale wind development. Usually, when people ask this question, they are concerned about two issues: nondispatchability and effects on the power grid. Let's consider each of these, bearing in mind that the discussion must be highly simplified to fit into a one-page discussion.

An electric power generator that can produce any amount of power up to its rated capacity on command is called “dispatchable”. Fossil fuel-based generation is dispatchable: if more power is required, one can turn up the fuel supply to meet the demand. Since wind turbines use the wind as their “fuel”, they are called “nondispatchable”: their output depends partly on uncontrollable factors.

Clearly, this is not a desirable property, but how much of a limitation is it? Nondispatchability is really not a problem for electric utilities--from their standpoint, most electric loads are nondispatchable. Wind turbines can be regarded as negative loads, and thus the same techniques can be used to design the power system to handle them.

However, there is another implication of the above discussion: windpower cannot truly replace dispatchable generation. Without large-scale storage, the dispatchable generation must be capable of supplying the entire electrical load at all times. Since the wind turbines are considered a part of this “load”, the dispatchable generators must be sized to meet the maximum load, which will occur when the wind is not blowing.

To understand other effects of wind turbines on the power grid, a bit of Power Systems 101 is required. First, power systems actually supply two types of power, called “real” and “reactive”. Real power is the power that makes lights glow and motors turn; it does the real work, and is what we pay for. Reactive power supports the magnetic

fields in the motors and charges up the elements of the power system so that the voltage is where it should be. Reactive power does not turn your meter, so you don't pay for it directly. Wind turbines send real power back onto the utility lines, but many large turbines require significant amounts of reactive power. Thus, the utility has to pay for the real power while still burning coal to supply the reactive power. Also, if a turbine draws too much reactive power from one part of a power system, the voltage there can drop, resulting in possible equipment malfunction or damage. Fortunately, there are several techniques that can overcome this problem. Some wind turbines use power converters that supply almost all of their reactive power; in other situations, utility equipment can be installed to supply additional reactive power.

Another worry of utilities is the problem of what is called “harmonics”. Harmonics are signals injected onto power lines that are at frequencies other than the 60 Hz our equipment is used to. Wind turbines can inject harmonics, and can cause other equipment, such as transformers, to inject harmonics. This problem is also solvable. Care must be taken to use only turbines that produce high-quality power, and to study the power system for susceptibility to harmonic problems before turbine installation.

Although there are other, more complex concerns, the bottom line is that most technical challenges involved with windpower are solvable, given proper resources and engineering effort.

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