Wind Power

Types of Wind Power

There are three basic scales (sizes) of wind power technology: Large-scale wind turbines (often called "utility scale wind" turbines), which are used for both large wind farms and to provide power for large facilities such as schools and factories; "small scale wind power" which are used to power homes, small boats, etc, and; "medium scale wind power" which provide remote power at installations such as radio transmitters. The ranges of power output for these turbines are roughly (here, kw means "kilowatts", MW means "megawatts"):

- Utility Scale Wind Power: 660 kw – 4000 kw (4 MW). Typical size is 1.5 MW.
- Medium Scale Wind Power: 10 kw – 200 kw.
- Small Scale Wind Power: 400 watts – 10 kw

How it works: Wind turbines work by using blades, called "rotors" (not propellers!) which are pushed around by moving air to convert the wind's kinetic energy into mechanical torque, which is then used to turn a generator.

Large-Scale New Mexico Wind Power Example: Below is a picture of wind farm in New Mexico using large-scale wind turbines. This wind farm is located 20 miles northeast of Fort Sumner, New Mexico. It has 137 wind turbines, each of which has a maximum output of 1.5 million watts, and produces enough power each year for about 98,000 homes. It cost about $200 million, and offsets (avoids) about half a million tons of carbon dioxide emissions per year.

Utility-scale Wind Turbines are Incredibly Large and Powerful: A utility scale wind turbine is an amazing machine. Typical turbines are over 200 feet tall, and have rotor blades longer than 100 feet (see photo below). A utility-scale wind turbine is like "a 747 on a stick!"

Environmental Benefits: A single utility-scale turbine can prevent 500 or more tons of coal from being burned each year, which prevents 2000 to 3000 tons of carbon dioxide emissions per year! They also save several acre-feet of water per year.

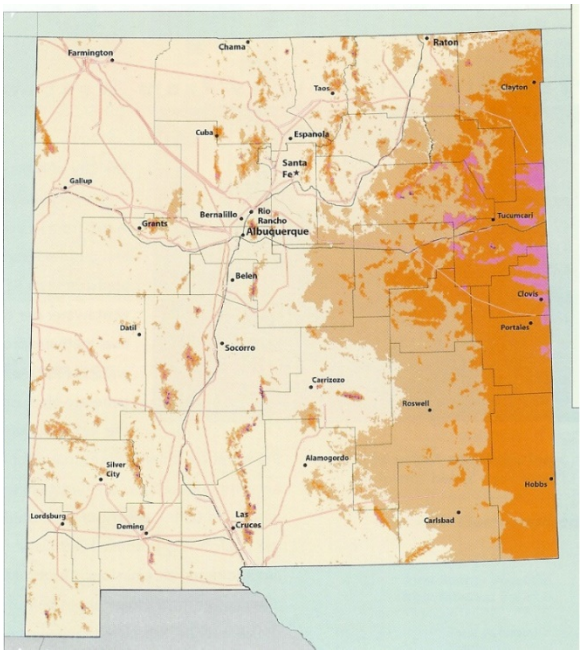
Rural/Agricultural Siting of Wind Power: Note that the wind farm pictured on the previous page is on rangeland in New Mexico. This land is also used for ranching. In general, wind farms mix very well with agriculture: The farmers or ranchers can still work the land, but make money from the wind. They can make several thousand dollars per year per turbine! Below is a photograph of some happy ranchers (the two men wearing cowboy hats and not white helmets!) showing visitors around a new wind farm in the making. Note the incredible size of the wind turbine "rotor" in the background:

Smaller Scale Wind Power Example: At right is a photo of a small wind turbine attached to a home. This house also has a PV system, which can be seen to the lower right.

This is a typical kind of arrangement: Small wind power and PV go together very well, *because the wind often blows when the Sun doesn't shine very much.* This shows how different kinds of renewable energy technology can *complement* each other.

Where the Good Wind is in New Mexico

As the map at right shows, the good wind power sites in New Mexico are located in the Eastern Plains area of New Mexico (the darker areas of the map), where the land is fairly flat and the wind is relatively unobstructed. The map also shows that good wind sites are also located in many mountainous regions. Although this is true, such regions are often valued for their scenery as well, and so may not be as appropriate for wind development.



How much wind resource is there: The practical (developable) wind power resource of the United States is at least several times larger than the electrical energy needs of the US. New Mexico has enough to power our state five or more times over.

Cost of Wind Power

The wholesale cost of large-scale wind power today is roughly competitive with new coal-fired power generation – about 4 cents per kilowatt-hour (without federal subsidies included), and definitely less than natural gas-fired generation. For this reason many utilities are now adding wind farms to their power generation assets, and many states are requiring that utilities obtain a significant fraction of their power from wind generation

Smaller scale wind power is roughly competitive with retail electricity costs, and will likely become much cheaper soon. Because smaller scale wind power is generally used on-site to offset or replace retail electricity supply, it is also competitive.

Intermittency/Energy Storage Issues

The wind doesn't blow all the time, even at very good wind power sites. This means that wind power must either be used instantly when its generated, or stored (like power from a PV panel!). Right now there is not a lot of energy storage potential for the big electric power grids, so wind power is generally used instantly. This creates some limitations, because it's not easy to change the output of large power plants very quickly when the wind power output changes quickly or unpredictably.

Many power utilities, however, have a relatively large amount of smaller natural-gas fired power generation, and these plants *can* change their output relatively quickly, and so these utilities are adding lots of wind power today as result.

Smaller wind turbines are generally used to charge batteries, and so are completely associated with energy storage.

In the future, wind power may become a major source of energy for transportation. For example, wind power is an ideal potential source of cheap clean electricity for making hydrogen, which can be used to power hydrogen cars.

Problems with Birds

Some claim that wind turbines kill many birds. It has been found that this is only true if a wind farm is improperly located, for example on a migratory pathway. Only one or two wind farms were not carefully located in the US (for example, a wind farm at Altamont Pass in California, which was the first big US wind farm). Nowadays, new wind farms are usually sited very carefully, and usually with the involvement of the Audubon Association and other bird groups.