

Worldwide Wind Power Installations

Using the wind to generate clean, efficient and “cheap” electricity has been the dream of many people and industries for at least 100 years. However, until very recently the ability to achieve these three goals was elusive, mainly because fossil fuels were so plentiful and relatively inexpensive. Now with the threat of “global warming” along with the attendant pollution caused by the burning of fossil fuels, renewable energy technologies are making inroads into providing commercially attractive power sources.

While solar power is a great choice for localized electricity generation, wind power is certainly the choice for grid-based power generation. Modern wind generators, and the wind farms that host them, can provide large cities like San Francisco and even entire rural states with sufficient power to operate homes and businesses, alike.



It has been correctly claimed that if our mid-western states like North and South Dakota were to build mega-wind farms this flat, barren and constantly windy territory could become the “Saudi Arabia of the United States” in terms of grid-based wind energy generation.

For sometime now countries such as Germany, Spain and Denmark (in order of the percentage of use of wind power) have supplemented their existing fossil and nuclear power generation by the use of wind power. The United States is behind in similar programs; however, it is on a course to catch up at some point in the near future. We will briefly explore these and other examples of wind power usage beginning with the primary types of wind turbines in use today.

Wind Energy Technologies

While old-fashioned windmills are still seen in many rural areas for pumping water, modern wind turbines are divided into two major categories: horizontal axis turbines (HAWT) and vertical axis turbines (VAWT).

Horizontal axis turbines like the one pictured above are the most common turbine configuration used today. They consist of a tall tower atop which sits a fan-like rotor

that faces into or away from the wind. Most horizontal axis turbines built today have two or three blades, although some have fewer or more blades. The newer, larger and more powerful horizontal axis turbines have blades that are longer than the wings of a 747-jet airliner! Plus, they are the most efficient in terms of energy production, to date.

Vertical axis turbines fall into two major categories: Savonius and Darrieus, however neither turbine type is in wide use today. The Darrieus turbine was invented in France in the 1920s. Often described as looking like an eggbeater, this vertical axis turbine has vertical blades that rotate into and out of the wind. Using aerodynamic lift, these turbines can capture more energy than drag devices like the Savonius which offer no lift due to their flat blade structure.



The basic “theoretical” advantages of a vertical axis machine are that the generator and gearbox can be placed on the ground and, thus, do not require a tower. Plus, you do not need a mechanism to turn the blades into the wind as you do with a horizontal axis machine. That said, the disadvantages of a Darrieus turbine far outweigh its advantages. First of all, wind speeds are much lower and more turbulent close to the ground so the overall power generating efficiency is not very impressive. Plus this type of turbine needs a push to get started and must also have a wide network of guy wires to hold it in place, which occupy valuable farm land that can’t be used for grazing or planting. Finally, when the main bearings or other parts need maintenance the whole machine must be torn down. That’s why the Darrieus turbine pictured here has been out of service for many years, rusting away on a hill above the St. Lawrence Seaway in Canada.



First invented in Finland, the Savonius turbine is S-shaped if viewed from above. This drag-type VAWT turns relatively slowly, but yields a high torque. It is useful for grinding grain, pumping water, and many other tasks, but its slow rotational speeds are not good for generating electricity.

Some practical electrical applications for Savonius wind turbines still exist, however, like the one pictured here on the left. When there is a need for a small amount of electricity and solar panels are not practical due to climate or lots of trees, etc. a home-built Savonius wind turbine will do nicely. This one in

particular provides the user with enough electrical power to open and close a gate to the driveway entrance as well as power safety lights.

Wind Farms

There are many today who think of harvesting the wind as if it were a crop. In reality, wind is like a crop since it has value to the wind farmer who cultivates it as well as to the consumer he services with the electricity the wind farm generates. Unlike edible crops, however, the wind crop does not need to be tilled, fertilized or sprayed with pesticide to grow healthy and strong. At the same time there is inherent risk in establishing and maintaining an economically healthy wind farm. Here are some examples of new and potentially successful wind farms.

Native American Wind Farms



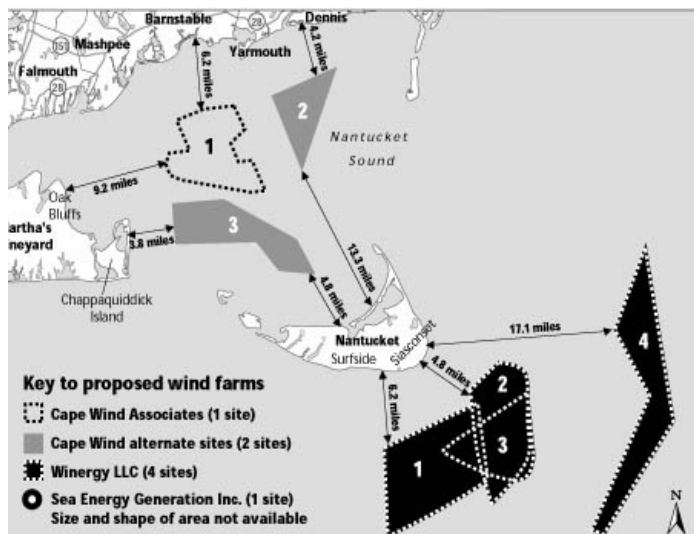
The Rosebud Sioux Tribe Wind Turbine Project is the first large-scale Native American-owned and operated wind turbine in the country. It is located on the Rosebud Sioux reservation in south-central South Dakota. The project had been stalled as funding and energy sales issues were addressed, but with a long term contract with **NativeEnergy**, complementing a long term sales option retained by the Tribe for a portion of the wind turbine, the Rosebud Sioux Tribe has now proceeded with final construction financing and has placed the first turbine order. If successful, many more turbines will be constructed and put into operation.

Wind Farms as a Tourist Attraction

“Windmill Tours” of Palm Springs, California has hit upon a unique and fun way to learn about wind power. As the ad says ...“Travel through a forest of towering windmills on electric-powered vehicles. Feel the energy as the giant blades WHOOSH overhead. Your skilled guide will take you inside this working wind farm comprised of turbines modernized to efficiently contribute to a cleaner and safer environment. As you travel along the 90-minute adventure, you realize the environmentally friendly power propelling experience was created by the air you are breathing”.



Wind Farms At Sea – United States



One of the more unique and controversial newly planned wind farms will be located on our East Coast off Nantucket Island, which is near Cape Cod, Massachusetts. Cape Wind Associates of Boston has proposed building the country's first offshore wind farm in Nantucket Sound. The 130 wind turbines are to be placed in a 24-square-mile area on Horseshoe Shoal, and some of the 417-foot tall turbines would be visible from Nantucket, Martha's

Vineyard and various points along the Cape's south coast from Mashpee to Dennis. As popular as these areas are to the summer vacation tourist trade, let alone the local year-round residents, it will be interesting to see if this plan succeeds in the long run.

Wind Farms at Sea – Denmark



In the summer months of 2002 the world's largest offshore wind farm on the Danish west coast was built and put into operation. The sea-based wind farm is sited 14 to 20 kilometers into the North Sea, west of Blåvands Huk, and represents the first phase of a large-scale Danish effort to produce non-polluting electricity from these offshore wind turbines. The "Horns Rev" project, as it is called, has a total capacity of 4000 megawatts and must be established in full before 2030.

Historically, wind power capacity has been developed on land, but it has become increasingly difficult to obtain the required permits for turbine sites. With its available coastline, interest has been directed toward coastal areas with shallow water depths

between 15 and 50 feet that have the possibility of locating the turbines far enough away from the coast that they are visually neutral, something the Nantucket Sound project is criticized for ignoring.

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