HIDDEN POWER

TURBINES

What methods are used to spin turbines and make electricity?

Question & Answer Fact Sheet

What is a turbine?

A turbine is a fan-like device in which a moving flow (liquid or gas) acts on the blades of a rotor to produce rotational motion. This rotational motion is then available to provide power for the operation of various devices (a common example being an electrical generator).

How do turbines create electricity?

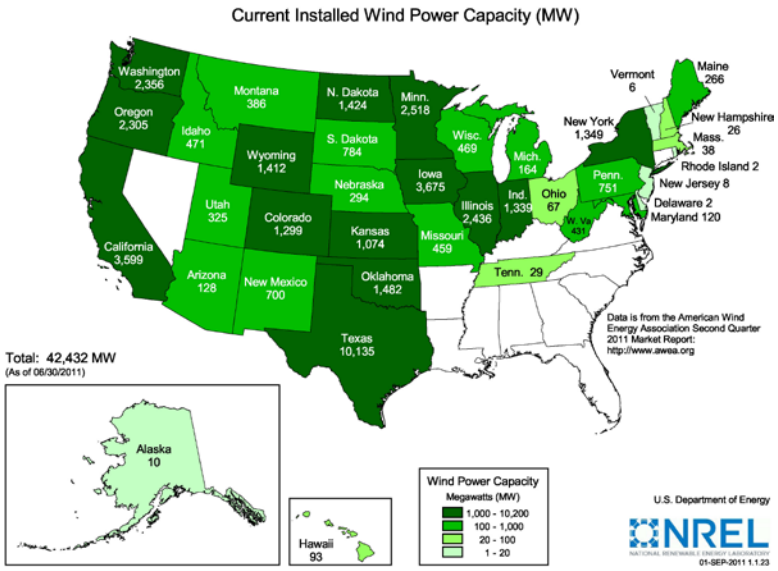
Electricity and magnetism are inherently related to one another in a symbiotic partnership. Any change or movement by one of these fields generates natural forces that cause a predictable and immediate change or movement by the other. Therefore, the movement of a spinning magnetic field (caused by attaching a strong electro-magnet to the shaft of a turbine) generates an instant flow of electrons (i.e. electricity) within nearby stationary coils of metal wire.

Steam Turbines

When water is heated into a gas, the molecules of the gas (steam) take up more space than the liquid water did, creating high temperatures and pressure within the gas volume. The energy in this expansion is used to push the blades of the turbine, causing rotational motion of the hub and shaft. This shaft is connected to an electric generator that creates the electricity we use.

Wind Turbines

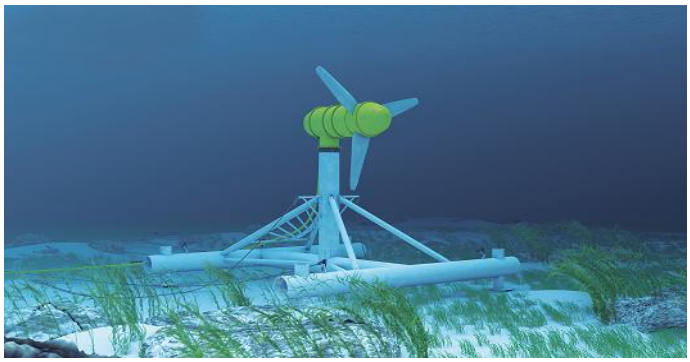
There are two primary types of wind turbines being used commercially to supply grid power to populated areas. The first type is the Horizontal-Axis-Wind-Turbine (HAWT) and the second type is the Vertical-Axis-Wind-Turbine (VAWT). Like the names imply, the HAWT rotates about a horizontal axis (like an airplane propeller), while the VAWT rotates about a vertical axis (like a blender or helicopter). Modern wind turbines are approaching capacities of 10 Mega-Watts (MW) per device. The total wind power in the United States as of June 2011 is over 42,000 MW, which is enough electrical power for over 11 million households. The cost of wind power is now on the order of 3 cents per kilowatt-hour, making it one of the world's most economical sources of power. Texas is the largest producer of wind energy in the United States, followed by Iowa and California.



Hydrokinetic Turbines

Water has been used for many centuries to generate power. The conventional source of hydro-power in the United States is created by controlling the flow of water through large water turbines, often at dam sites. Some of the largest hydro-electric dam sites in the U.S. are the Grand Coulee Dam (Washington State) and the famous Hoover Dam (Nevada). The Hoover Dam supplies enough electricity to serve nearly 500,000 households per year. Most of the large dam sites in the United States have already been utilized for electric power generation, so it is unlikely that this source of energy will expand in the future.

Researchers and companies are now looking at ocean resources to supply electricity to coastal areas. There are two types of ocean-based turbine devices. Some turbine devices are being used in Tidal flow regions along the shorelines. These tidal currents typically ebb and flow in different directions throughout the days of the year. To maximize the potential electrical capacity in Tidal regions, turbine designs that can operate in both directions (forward and aft) are being used. Large turbine devices (on the order of the size of modern wind turbines) are being considered for deep-water ocean current regions. Ocean currents typically flow in one direction and at near constant speed throughout the year. Unlike wind and tidal turbine environments, where the wind or tides slow down and change directions frequently, ocean current turbines can operate almost continuously throughout the year, utilizing a large fraction of the energy capacity available. Some unique design challenges of ocean turbine devices are the ability to resist corrosion and the accumulation of biomatter, and to handle the large forces generated by the water.



(Courtesy: Steven Willits)