

Wind Turbines

Presented by:

Terry L. Schaf

Southern Solar & Electric, Inc.



Wind Turbine Definition

- A **wind turbine** is a device that converts kinetic energy from the wind into mechanical energy. If the mechanical energy is used to produce electricity, the device may be called a **wind generator** or **wind charger**. If the mechanical energy is used to drive machinery, such as for grinding grain or pumping water, the device is called a windmill or wind pump.

HISTORY OF THE WIND TURBINE

- Windmills were first seen in Persia about 500AD and were used to pump water and grind grain. They were later adapted in Europe, particularly The Netherlands and Denmark from 1300 to present. Between 1850 and 1970, over six million wind machines were sold for use in the United States, primarily used to pump water, and later to provide electricity in rural areas.

TODAY'S WIND TURBINES

- Developed for over a millennium, today's wind turbines are manufactured in a range of vertical and horizontal axis types. The smallest turbines are used for applications such as battery charging or auxiliary power on sailing boats; while large grid-connected arrays of turbines are becoming an increasingly large source of commercial electric power.

DIFFERENT TYPES OF TURBINES

- There are actually **two distinct types of wind turbines** that are currently in production, with several other varieties also theorized. **The two main categories of wind turbines are vertical axis wind turbines and horizontal axis wind turbines.** Although these two different types of wind turbines work using relatively similar methods, there are key differences in how they function as well. Along with these two major categorizations there are also many different kinds of wind turbines that exist to operate in unique conditions.

USES OF WIND TURBINES

- From **500 AD** to present: windmills primarily used to pump water and grind grain. **From 1888**: first use of windmills to produce electricity. During the **1920s**: Airfoil blade design borrowed from aviation increases efficiency versus fan blades. **From 1970 to present**: Sporadic state and federal funding in the U.S. improve technology and wind farms are created from Maine to California; Texas today produces the most electricity from wind power.

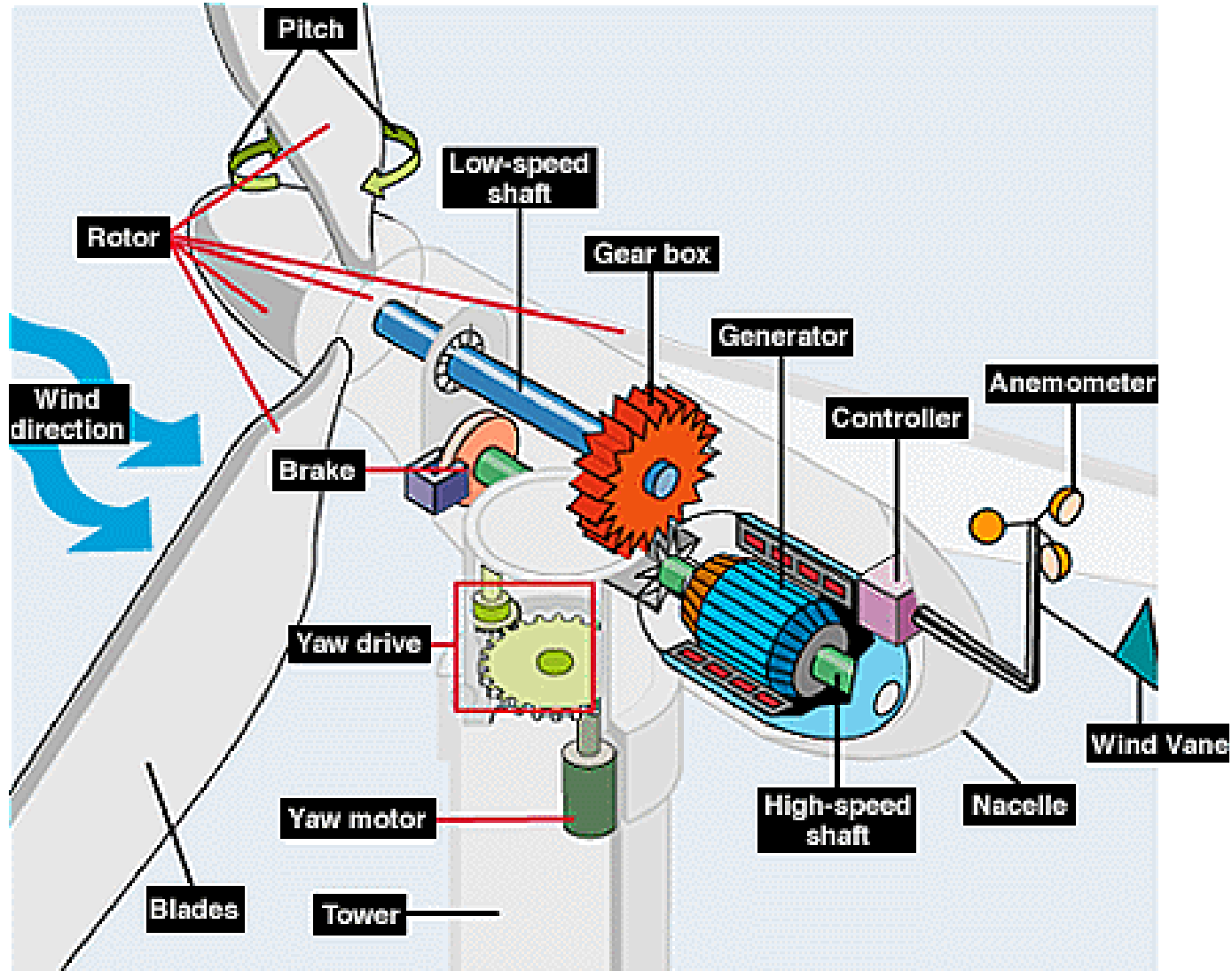
HORIZONTAL AXIS WIND TURBINES

- **Horizontal axis wind turbines are by far the more prevalent type of wind turbine in use today and historically speaking.** Windmills, for example, use a horizontal axis wind turbine to power themselves, as do most modern wind-farm turbines. **Horizontal axis wind turbines work by facing propeller blades into the wind on a horizontal rotor shaft.** The action of the wind causes the blades to spin, much like a pinwheel. The blades are fixed and are connected to the rotor shaft, which rotates with them in the wind. The motion of this rotor shaft can then be used to do work of some kind or, in more modern applications, to generate electricity.

Horizontal axis

- Horizontal-axis wind turbines (HAWT) have the main rotor shaft and electrical generator at the top of a tower, and must be pointed into the wind. Small turbines are pointed by a simple wind vane, while large turbines generally use a wind sensor coupled with a servo motor. Most have a gearbox, which turns the slow rotation of the blades into a quicker rotation that is more suitable to drive an electrical generator.

Components of a horizontal-axis wind turbine



Offshore wind farm using 5MW turbines
[REpower](#) 5M in the [North Sea](#) off [Belgium](#)



VERTICAL AXIS WIND TURBINES

- **Vertical axis turbines work on very similar principles to horizontal axis wind turbines, but with several key distinctions.** To begin with, the rotor shaft of a vertical wind turbine is arranged in a vertical fashion, with the wind-catching blades arranged around the rotor shaft. **Vertical axis wind turbines do not need to be facing into the wind to work** because the blades are arranged uniformly around the rotor shaft and can catch the wind from any direction. The blades catch the wind, spinning the entire apparatus in a circular motion. The energy created by this kinetic effect can then be used to either do work or to create electrical energy.

Vertical axis design

- [Vertical-axis wind turbines](#) (or VAWTs) have the main rotor shaft arranged vertically. Key advantages of this arrangement are that the turbine does not need to be pointed into the wind to be effective. This is an advantage on sites where the wind direction is highly variable, for example when integrated into buildings.

VERTICAL AXIS WIND TURBINE



The VAWT 5000 is a unique, Vertical Axis Wind Turbine (VAWT).



300w-10kw Vertical Axis Wind Turbine



Mag-Wind Vertical Axis Turbine for your Home



Presentation by:

Terry L. Schaf

Southern Solar Electric, Inc.

469 McQuiston Road

Brighton, TN 38011

(901)219-7462