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ORIGINAL ARTICLE

Windmill: The New Era Of Energy

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Abstract:

A windmill is a machine which converts the energy of wind into rotational energy by means of vanes called sails or blades. The history of wind power shows a general evolution from the use of simple, light devices driven by aerodynamic drag forces; to heavy, material-intensive drag devices; to the increased use of light, material-efficient aerodynamic lift devices in the modern era. Modern wind turbines fall into two basic groups 1) horizontal-axis variety 2) vertical-axis design. There are certain advantages and disadvantages of Windmills

KEYWORD:

Windmill, history of wind power, horizontal-axis variety, vertical-axis design, advantages and disadvantages.

INTRODUCTION

A windmill is a machine which converts the energy of wind into rotational energy by means of vanes called sails or blades. Originally windmills were developed for milling grain for food production. In the course of history the windmill was adapted to many other industrial uses. An important non-milling use is to pump water, either for land drainage or to extract groundwater with wind pumps. Windmills used for generating electricity are commonly known as wind turbines.

HISTORY OF WINDMILLS

The history of wind power shows a general evolution from the use of simple, light devices driven by aerodynamic drag forces; to heavy, material-intensive drag devices; to the increased use of light, material-efficient aerodynamic lift devices in the modern era. The earliest known use of wind power, of course, is the sail boat, and this technology had an important impact on the later development of sail-type windmills.

The first windmills were developed to automate the tasks of grain-grinding and water-pumping and the earliest-known design is the vertical axis system developed in Persia about 500-900 A.D.

Grain grinding was the first documented wind mill application and was very straightforward. The grinding stone was affixed to the same vertical shaft. The mill machinery was commonly enclosed in a building, which also featured a wall or shield to block the incoming wind from slowing the side of the drag-type rotor that advanced toward the wind.

While the belief that the windmill was invented in China more than 2000 years ago is widespread and may be accurate, the earliest actual documentation of a Chinese windmill was in 1219 A.D. by the Chinese statesman Yehlu Chhu-Tshai. Here also, the primary applications were apparently grain grinding and water pumping.

Daniel Halladay in 1854 designed the first commercially successful new windmill in the New World. His windmill had a self-governing design. This means that it automatically turned to face changing wind directions and that it automatically controlled its own speed of operation.

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Mechanical used by Halladay's had four wooden blades which swiveled to provide varying pitch in order to regulate operating speed. Later he devised wheels comprised of "sections" of thin wooden blades which could pivot in order to control surface exposed to the wind and thus regulate wheel speed. Windmills of this design were called sectional wheel windmills.

Halladay invented his first successful self-governing windmill in Connecticut, U.S.A., and his company manufactured them there from 1854 to 1863.

The earliest major competitor for Daniel Halladay's pioneer windmills were the Eclipse windmills invented by 1867 by the Reverend Leonard H. Wheeler. A missionary among the Ojibway Indians of Wisconsin, Wheeler and his son devised a windmill for use at their mission station. Instead of having a wheel comprised of pivoting sections, their wind machine had a "solid" wheel in which the wheel components were rigidly fastened together.

Up to this time, all windmills in North America were built from wood, with some iron and steel parts holding the wooden components together. As early as the 1870s, however, all-metal windmills were introduced, but at first they were not especially popular. People believed that they were easily broken and difficult to repair. In time, however, the use of steel and iron for windmills increased so that by the beginning of the twentieth century the majority of windmills built were made from metal.

The use of metal allowed windmill manufacturers to create wind wheels containing curved blades. Curved blades were much more efficient that the older-style thin, flat wooden blades. The use of curved blades also permitted introduction of back-gearing to windmills. Back-geared windmills typically had wheels which revolved two or three times for each stroke of a pump, and this allowed the steel windmills to begin turning in much lighter winds than were necessary for the less efficient wooden-wheel mills. By the 1940s, iron and steel had completely supplanted wood as a construction material for windmills as manufactured in North America.

Since 1982 the Windmillers' Gazette has chronicled water-pumping windmills as used in North America and around the world. Its articles have documented evolution of technology and applications in the manufacture, distribution, and use of these devices, which by the thousands continue to employ the free power of the wind to serve humans. Wherever you are in the world, if you are interested in wind power utilization, you will enjoy reading the quarterly Windmillers' Gazette.

How windmill work

Wind is a form of solar energy and is a result of the uneven heating of the atmosphere by the sun, the irregularities of the earth's surface, and the rotation of the earth. Wind flow patterns and speeds vary greatly across the United States and are modified by bodies of water, vegetation, and differences in terrain. Humans use this wind flow, or motion energy, for many purposes: sailing, flying a kite, and even generating electricity.

The terms wind energy or wind power describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. This mechanical power can be used for specific tasks (such as grinding grain or pumping water) or a generator can convert this mechanical power into electricity.

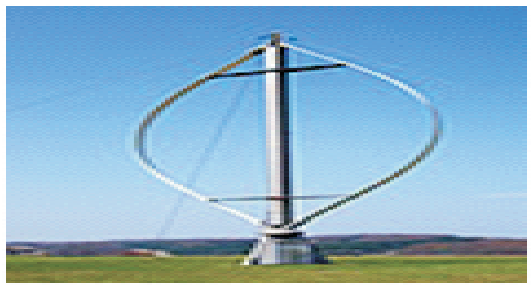
A wind turbine works the opposite of a fan. Instead of using electricity to make wind, like a fan, wind turbines use wind to make electricity. The wind turns the blades, which spin a shaft, which connects to a generator and makes electricity. View the wind turbine animation to see how a wind turbine works or take a look inside.

TYPES OF WIND TURBINES

Modern wind turbines fall into two basic groups

horizontal-axis variety

vertical-axis design



Horizontal-axis wind turbines typically either have two or three blades. These three-bladed wind turbines are operated "upwind," with the blades facing into the wind.

ADVANTAGES OF WINDMILLS

1.Wind is free and now we have technology to capture it and convert it into electricity.
2.Wind energy is renewable (sustainable), which means it will never run out. Since some places are windier than others the careful placement of wind farms will help to maximize the energy potential from wind and also minimize negative impacts. Wind turbines can be set up in rural areas to serve customers that may be difficult to serve through traditional means.
3.Electricity created using wind energy do not produce any green house gases and therefore do not pollute the environment.
4.Wind mills are tall structures and can be installed on a small piece of land. Therefore, space is not as much an issue in generating wind energy.
5.Depending on people's aesthetic sense, this can be an advantage and disadvantage. Many people love pictures of windmills, wind farms, and turbines in creating an exciting landscape but others feel differently.
6.People and places that are off grid (no power supply from the traditional power companies) can still have access to electricity by installing this renewable energy source and creating their own electricity.
7.On the same note, renewable energy technologies can really be a game-changer in developing countries where people just do not access to traditional electricity due to poor infrastructure.
8.The growth of wind energy is creating new jobs. The wind turbines need to be manufactured and set up and maintained. Also, the energy produced may be used to run businesses, which can create jobs.

DISADVANTAGES OF WINDMILLS

1.Wind is intermittent and does not always materialize when electricity is needed, so wind energy is not a totally reliable source of energy. But a combination of solar, hydroelectric and wind power can provide a totally reliable supply of renewable energy
2.Although free, wind energy generation depends on the fact if wind is flowing. That is something we can't control and the strength of wind can vary during different times of the day or during seasons. This creates a problem specifically if the wind turbine is not connected to the traditional grid. One might have to invest in batteries to store the wind electricity to be used during the time when there is low or no wind supply. It is also the place where one can supplement their energy withsolar energy OR geothermal energy.
3. This one comes down to individual preference in terms of landscape and can be an advantage or disadvantage. A lot of people feel that rural areas (and countryside) should be left alone and not be spoiled by installing man-made structures to maintain the natural beauty. People are on both sides of this debate so it is totally up to you how you feel about it.
4.Another disadvantage is thenoisethese structures generate (specially the big ones). In fact, many people have noted that when they have a wind turbine installed close to their house, it feels like living close to a busy road with lots of traffic.
5.Although once installed, the electricity produced by this renewable energy technology produces no pollution but the production of wind turbines does contribute to industrial pollution. Some people argue that the trade off is totally worth the long-term outcomes of having zero carbon footprints.
6.Electricity produced by this alternative energy source can now power a lot of houses. The biggest on-shore turbine produces enough electricity to power more than 800 homes. However, that still doesn't compare to electricity supplied by traditional grids that power thousands of homes.

7.The cost of wind turbines installation have gone done significantly in the past 10 decades, still the initial investment is higher than traditional electricity grids. One can take advantagefederal tax credits ANDstate incentivesto lower the installation cost but will still need to have a long term view of this renewable energy installment.
8.The higher initial investment than fossil fuel generators makes it hard to compete on a cost basis at least in the short run. Wind energy production may have to compete with other uses for the land ,which may be seen as higher value use.

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