

How Wind Turbines Work

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Wind turbines offer part of the solution to the world's renewable energy sourced electricity needs, and in some countries currently represents over 10% of the electricity supply. It's all a part of the battle to reduce global warming induced climate change and to reduce our reliance on fossil fuels.

Wind and solar energy connection

It's important to understand that wind is actually a form of solar energy - so by saying that a wind turbine harnesses solar power isn't totally incorrect. Wind is a phenomenon that occurs caused by the uneven heating of the Earth's surface in combination with the spinning of the planet on its axis.

Turbine design

A wind turbine, instead of operating like a fan in your home that uses electricity to create wind, uses wind to create electricity. The blades of the turbine are shaped in such a way that wind causes them to rotate, which spins a low speed shaft with a gear at the end which is connected to another smaller gear on a high speed shaft that runs through a generator. The generator creates electricity.

Turbine size and output

Wind turbines for commercial electricity production usual range from 100 kilowatts to 5 megawatts. At the time of writing, the largest wind turbine in the world had a rotor diameter of 126 m (390 feet) and the potential to generate enough electricity for 5000 households.

A wind turbine for home use has rotors between 8 and 25 feet in diameter and usually has the potential to generate between a few hundred watts and 6 kilowatts of electricity.

For every kilowatt hour of electricity produced by wind energy or other green means, approximately 1.5 pounds of carbon is prevented from going into the atmosphere if that electricity had been sourced from coal fired power plants. Carbon dioxide is a major contributor to global warming induced climate change.

Wind speeds needed

A wind turbine usually needs wind speeds of around 10 miles an hour (16kmh) to start generating electricity and optimum wind speed for large turbines is approximately 30 miles per hour ; so they aren't really an option if you're located in an area where winds are usually light and variable, although some models are now being produced that can generate electricity with as little as 5 mile per hour wind speeds.

Wind speed usually increases with height and where there are no natural or man-made obstructions and this why you'll often see them on hilltops or perhaps in the middle of wheat fields. The wind energy industry has been beneficial for many farmers. The farmers can still crop their land, with little interference, and also generate an income from allowing the turbines on their property.

The blades of a wind turbine rotate at a rate of between 10 to 50 revolutions per minute. In a situation where wind speeds are excessive, for example if there's a gale, the turbine automatically shuts down to prevent damage.

Turbine lifespan

The lifespan of a modern turbine is pegged at around 20-25 years, but they aren't totally maintenance free. As they contain moving components, some parts will need to be replaced during their working life.

Environmental impact

Wind turbines aren't overly noisy - mechanical noise is minimum these days and you'll mostly hear the "swoosh" of the blades passing the tower. Of course, if you're living close to a large wind farm, it could present some noise issues. Most countries have regulations regarding the placement of wind farms in relation to residential areas.

Wind turbines are created from fiberglass, plastics, aluminum, copper, steel and various other metals. Many turbine parts are recyclable.

Wind farms do have an impact on birds - there have been recorded cases of birds being killed by rotor blades when they fly into them. Today, most countries choose a location for a wind farm in relation to bird migratory patterns.

Key Issues For Future Of Wind Energy In Spain

ScienceDaily (Sep. 7, 2009)

"Nowadays, wind farms supply around 12% of the electric energy produced in Spain, but by 2030 this could rise to 30%", says José Luis Bernal, of the Department of Electric Engineering of the University of Zaragoza and co-author of a study published recently in the journal Energy Policy.

Favorable winds for employment

In 2008, wind energy provided around 104,000 jobs in the European Union, according to a report, also published in Energy Policy, by Maria Isabel Blanco, from the University of Alcalá (UAH) in Madrid, and Glória Rodrigues, from the European Wind Energy Association (EWEA). "This is an increase of 226% in comparison to 2003", the authors say.

The study shows that generation of this energy provides direct employment for 38,000 people in Germany, 20,500 in Spain and 17,000 in Denmark, the three major producing countries in the EU. Manufacturers of turbines and their components account for the largest number of jobs created, which are taken mostly by men (who account for 78%), as is generally the case in industrial production chains.

The report, based on a survey carried out among the leading companies in the sector, shows that a new market linked to wind energy is arising in Europe, with France, Italy, Ireland and Portugal also playing an active role. However, despite these dynamic developments, there is "a lack of specialists, project managers, engineers and operation and maintenance experts" for the wind farms. In order to resolve this situation, the study calls for measures to be put in place to educate workers and boost their mobility.

Name _____ Date _____

Wind Turbines

1. The use of wind turbines helps to reduce...
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2. How is natural wind created in the environment?
3. A wind turbine uses _____ to create _____.
4. Describe the steps that a turbine uses to create electricity.
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5. The largest wind turbine in the world can generate enough electricity for _____ households.
6. The use of wind energy prevents _____ from entering the atmosphere.
7. Describe the necessary wind speeds that a wind turbine needs to operate.
8. How do wind turbines positively impact the environment and negatively impact the environment?
9. Describe 2 reasons why wind energy is valuable in Spain.
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10. What do the European countries need in order to continue the use of wind turbines?
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Wind Turbines- Individual Quiz #1

1. (T or F) Wind turbines are negatively affecting farmers because the farmers are asked to sell their land for the construction of wind farms.
2. (T or F) Wind turbines cannot be used by an individual family to generate electricity for their individual home.
3. (T or F) Large wind turbines can generate the most electricity from 30mph winds.
4. (T or F) Spain predicts that by 2030 they could produce 30% of their electric energy from the use of wind turbines.
5. (T or F) Wind turbines provide many jobs because a lot of people are needed to constantly fix the broken turbines.
6. (T or F) When choosing a location for a wind farm, most countries consider the routes that birds use to migrate.
7. (T or F) The use of wind turbines creates electricity without releasing carbon into the atmosphere.
8. (T or F) European countries have plenty of experts, specialists, and managers for the production of wind energy. The problem is that the citizens are not willing to work for the wind turbine companies.
9. (T or F) Wind turbines are helpful to the environment because they reduce climate change due to global warming and they also reduce the use of fossil fuels.
10. (T or F) Wind turbines are built from recyclable materials.