

# WIND

## What is wind energy?

Wind energy is generated by harnessing the wind and is the world's fastest growing energy source. It's becoming more important for electricity companies to use wind energy as it's a renewable and free resource.

## How is electricity generated from wind?

Electricity companies harness wind energy with wind turbines. When the wind flows past the turbine's rotor blades, the blades turn and convert the wind energy into kinetic energy. This energy spins a rotor inside a generator where the kinetic energy is converted into electrical energy.

Once the wind energy is converted into electricity, the electricity flows through cables in the turbine, down the turbine tower to connect with the output from the other wind turbines in the wind farm before entering local electricity networks. The greater the wind speed, the more electrical energy generated.

You'll usually see more than one wind turbine working to generate electricity – this is called a wind farm. All the wind turbines in a wind farm work independently. The output of each turbine is combined before it enters a local electricity network or the National Grid

## What's inside a wind turbine?

Each wind turbine has four key parts:

**Foundation:** The foundation holds the turbine in place in the ground. A wind turbine has to

have a strong foundation to withstand strong winds and support the overall height and the length of the rotor blades.

**Tower:** Generation equipment is kept in the tower. The tower raises the blades and generation equipment high above the ground into the smoother, stronger wind currents. Access to the nacelle and rotor is through the tower.

**Nacelle:** The nacelle is the heart of the turbine, where the generator, gearbox and turbine drive train parts are held. The generator inside the nacelle is used to convert the wind energy into kinetic energy and then into electrical energy.

**Rotor:** Most wind turbines have three blades that are attached to the rotor. Blades in wind turbines are tested thoroughly to ensure that they will stand up to the most severe weather conditions.

## Are wind turbines safe to use?

Each wind turbine has an internal computer system that monitors the direction and speed of the wind, and allows it to automatically set itself to operate at a safe level. If there is any damage to the turbine due to overcapacity (wind speed and strength), the turbines shut down automatically.

## What are the advantages of wind energy?

The greatest benefit of using wind energy is



that it generates electricity without emitting greenhouse gases. Wind energy has little effect on the environment, this is because:

- wind energy is a renewable resource, so it can never run out
- there are no emissions when generating electricity from wind

Wind farms lessen the need for us to use fossil fuels to generate electricity, which helps to reduce greenhouse gas emissions.

### **What are the disadvantages of wind energy?**

Although wind energy is a great environmentally friendly option to generate electricity, a lot of turbines are needed in one place in order to generate power for communities to use. Some people think they have a negative visual impact on the landscape and are noisy.

### **How is wind energy used in New Zealand?**

Wind energy plays a useful role in energy generation for New Zealand. There are currently seven wind farms in operation in New Zealand. Combined, these wind farms have a capacity of 170MW, which will produce enough energy for about 75,000 average New Zealand households.



RENEWABLE ENERGY AT HAU NUI WIND FARM, WAIRARAPA  
SOURCE:GENESIS ENERGY

## ACTIVITIES

### ACTIVITY ONE

Divide the class into groups. Assign each group one of the seven wind farms in operation in New Zealand:

- Brooklyn, Wellington
- Gebbies Pass
- Hau Nui
- Southbridge
- Tararua
- Te Āpiti
- Te Rere Hau

Teacher displays a large map of New Zealand on the wall and labels the wind farms. Groups research their assigned wind farm, find out why the site was chosen, and present this back to the class. For example:

Hau Nui wind farm, southeast of Martinborough in the Wairarapa, is ideally located to capture the wind currents which are funneled and accelerated through the nearby Cook Strait and over the Rimutaka Ranges. The wind farm has 15 turbines and a capacity of 8.65MW which provides enough energy for around 4,200 homes in the Martinborough area and depending on demands and output, as far north as Greytown.

### ACTIVITY TWO WIND ENERGY QUIZ

Students answer the following questions:

- How long have wind turbines been available as an energy source?
- Before wind turbines were invented, how did people use wind to generate electricity?
- Why is wind energy a good choice for environmental management?
- What is kinetic energy?

### ACTIVITY THREE BUILD A MODEL WIND TURBINE

Here are some websites and publications showing how to build a model wind turbine:

- Make an Anemometer (Energy Quest - California Energy Commission).  
An activity that shows students how to make an anemometer which is a device that tells you how fast the wind is blowing.  
<http://www.energyquest.ca.gov/projects/anemometer.html>
- Make Your Own Wind Winch (Solar Schools)  
[http://www.solarschools.net/facts\\_and\\_figures/activities/make\\_your\\_own\\_wind\\_winch.pdf](http://www.solarschools.net/facts_and_figures/activities/make_your_own_wind_winch.pdf)
- Ministry of Education. (2004).  
Book 54: Windmills and Waterwheels.  
Building Science Concepts. Wellington: Learning Media.

## SUPPORTING RESOURCES

- New Zealand Wind Energy Association: [www.windenergy.org.nz](http://www.windenergy.org.nz)
- Ministry of Economic Development: [www.med.govt.nz](http://www.med.govt.nz)
- Energy Efficiency and Conservation Authority: [www.eeca.govt.nz](http://www.eeca.govt.nz)
- Genesis Energy: [genesisenergy.co.nz](http://genesisenergy.co.nz)

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