

EXPLORING WIND ENERGY

SCIENCE, TECHNOLOGY AND SOCIAL SCIENCE BASED ACTIVITIES FROM

NEW ZEALAND
WIND ENERGY



ASSOCIATION

www.windenergy.org.nz

THE IMPORTANCE OF ELECTRICITY?

Have students focus on the importance of electricity in our everyday lives. Brainstorm and list the household uses of electricity. Have them consider how different our lives would be if we didn't have electricity. How would life change?

- Have any students experienced a power-cut? What happens if the power goes off? Discuss experiences.
- Find out students' current understanding of electricity generation in New Zealand. What method do we use to produce most of our electricity (hydro)? Discuss other methods we use to produce electricity, **eg** wind, gas, diesel, geothermal, coal, biogas.

THE IMPORTANCE OF RENEWABLE RESOURCES

Introduce students to the idea that we produce electricity in New Zealand from renewable and non-renewable resources.

What is the difference between the two?

- Have students place the production methods we use into the two categories. Can the students come up with sound reasons why generating electricity from renewable resources (**ie** wind) is regarded as the best option for New Zealand? **eg**
 - New Zealand has a large supply of renewable resources: water; wind; solar; and geothermal resources. These resources don't run out
 - using renewable resources to generate electricity does not create as much pollution as fossil fuels
 - using our huge wind resources can smooth out any problems we have with other forms of generation.
- Have students 'guesstimate' the proportions of electricity generated from each resource (compare with statistics).

2007 ELECTRICITY GENERATION STATISTICS

HYDRO	= 55%
GEOTHERMAL	= 8%
WIND	= 2.5%
GAS/COAL/OIL	= 32%
OTHER	= 2.5% (eg, wood and biogas)

Share the above information with the students. Do they know that this year (2008) we are worried about electricity supply – especially over winter? What reasons can they give for this (we have low lake levels because of low rainfall)? Tell students that this also happened in 2001, 2003, 2006 and it will always be a problem in dry years. Introduce students to another problem we have – electricity demand is increasing by about 1.5% every year.

- What reasons can the students give for this? **eg**

Curriculum Links

Technology:

- Understanding how new technologies can change society in a positive way and improve its relationship to the environment.
- Developing an understanding of how wind turbines work in the context of generating electrical energy.

Science:

- Understanding that we must make the best use of our natural resources and 'do our best' for planet Earth.
- Gaining a basic understanding of the process of how we generate electricity – wind generation in particular.

Social Sciences

- Understanding how and why we need to make good decisions about access to and use of resources.

Links to The Arts, English, Maths

Best suited to Levels 2-4+

- increase in population, industry and electrical appliances such as heat pumps and plasma/LCD screens ...
- economic growth, **eg** new dairy factories.

SOLVING THESE PROBLEMS

Introduce the idea that even if we could always have full lakes, the increase in demand will always cause problems.

- Can the students suggest solutions for the problem? **eg**
 - cutting down on our use of electricity (efficiency)
 - generating more electricity.

Tell students that even if we make savings in the amount of energy we use, the demand is expected to increase by about 1.5% per year.

- Ask students what we must do to solve this problem, **eg**
 - we will have to generate more electricity.

Develop the idea that what we have to decide is in what ways we will generate this electricity. Remind students about the advantages of using renewable energy.

- Discuss the concept of an environmental footprint.
- Compare the environmental footprint of wind farms to other forms of generation such as large coal and gas stations. Remind the class that burning gas, coal and oil releases CO₂ into the atmosphere and that if we use a combination of wind and hydro, we can reduce the amount of CO₂ released – our carbon footprint.
- Tell students that though a wind farm can be spread over a large amount of land, it only takes up 1-3% of the site so most of the land remains in its existing state, **eg** can still be farmed.



A RENEWABLE RESOURCE

- Have students conduct a survey amongst families to find out their attitudes towards electricity generation, **eg**
 - *what generation combinations should we use?*
 - *is renewable more acceptable than non-renewable?*
 - *are they in favour of more wind generation? Give reasons.*
- Collate survey results and display in graphic form.
- How does wind energy rate in the survey? Are there any reservations about wind generation? **eg** noise, visual effects, killing of birds etc.

TUNING IN TO WIND GENERATION

Your school may be in an area of New Zealand that has a wind farm or there may even be a micro-generator in your district.

- In groups have students brainstorm and list all they know about electricity generation from wind, **eg**
 - *what generates the electricity?*
 - *what conditions are needed and where are they most likely to be found?*
 - *what is a wind farm? ...*
- Make a wall chart of all responses to be added to and/or altered and up-dated as the explorations continue.

TAKING A CRASH COURSE ON WIND GENERATION

- Introduce the idea that we need a special machine to generate electricity from wind and this is called a wind turbine.
- Encourage student speculation and simple explanations on:
 - *how a wind turbine works*
 - *where does the wind come from*
- In small groups, allow computer time for every student to take the 'Online Crash Course' on wind generation to find out how a wind turbine works and where the wind comes from (This could be set as a homework task for those with internet access at home). The crash course can be found at: www.windpower.org/en/kids/index.htm

WHAT HAVE WE FOUND OUT?

After online research, students should:

- *be able to name all of the parts that make up the physical structure of a wind turbine machine*
- *be able to explain in simple terms how the wind turbine generates electricity*
- *be able to name the different parts of the turbine and their purposes*
- *be able to explain in simple terms what happens in the nacelle to generate electricity*
- *be able to explain in simple terms how wind 'is made'.*

GROUP AND INDIVIDUAL ACTIVITIES

Select the Practical Activities section of the website www.windpower.org/en/kids/index.htm and have students complete some of the following projects:

- *Make a wind sock*
- *Make a kite*
- *Make a small turbine*
- *Study wind conditions*

LET'S FIND OUT MORE

- Have groups visit: www.windenergy.org.nz > Select Map of Windfarms in NZ. Answer the following:
 - *how many windfarms do we have?*
 - *how many turbines does each windfarm have?*
 - *locate windfarms using an atlas – what is the windfarm that is closest to your school*
 - *how many average households will all the windfarms combined produce enough electricity for? (145,000).*

Visit: www.windenergy.org.nz > **Select Resources for Teachers** and download and print out the Student Fact Sheet. Use as a shared reading/discussion activity or as individual or group research projects. Discuss/answer the following:

- Ensure students understand that electricity is generated by turbines and the type of resource (wind, water/hydro, gas ...) that turns the turbines is the name we give to that type of electricity generation.
- What is a wind farm and how suitable is New Zealand for wind farms? Identify further windy areas that would be suitable for constructing wind farms.
- Wind turbines need wind to operate. How do we try to make sure that some turbines are always generating electricity?
- How do wind turbines help us store more water in our hydro lakes when the wind is blowing strongly?
- Will we still use thermal generation in the future? Why?
- What percentage of our electricity do we now produce using wind generation?
- What other options for generating electricity may we have in the future?
- How noisy are wind farms and do they pose a problem for native bats and birds?
- How much of NZ's electricity could be generated by wind?
- Why will we need to produce more electricity?
- List the main environmental benefits of wind energy over other forms of electricity production.

CONCLUDING ACTIVITY

From all the information researched, have students write a report that promotes the use of wind energy in their local area and addresses people's concerns about birds, noise and visual impact.