CAPTURING THE ENERGY OF THE WIND

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Science, technology and social science explorations from …

Use the *Student Wind Energy Student Fact Sheet* in conjunction with this unit.
Download the pdf at: ***http://windenergy.org.nz/resources/resources/lessonplans***

new zealand wind energy association

HOW IMPORTANT IS ELECTRICITY?

- Can students identify the many different types of energy we use in our daily lives? *eg*
  - what energy source do we use to power our cars?
  - what energy source do we use to heat our water?
  - what energy source do we use to play sport?
- Have students focus on electricity as an energy source. How important do they think it is in our everyday lives? Brainstorm a list of ways we use electricity at home, in the community and at school. Can they think of any ways that businesses use electricity to produce goods or services they sell to us or export to other countries?
- Can the students imagine a world without electricity? Can they give any examples of what it would be like? Do they think it would be fair to say that '*we often take electricity for granted*'?

HOW DO WE PRODUCE ELECTRICITY?

- What is used to 'make' electricity? Do students know that electricity is produced by a generator? Introduce the idea that in New Zealand we use many different sources of energy to turn the generators that produce electricity. Can students identify these energy sources? Did they include: water, geothermal steam, gas, coal, oil, wind, waste?
- What do students think is meant when we describe our energy sources that make electricity as renewable and non renewable resources? Can students divide their identified energy sources into these two categories.
- Can students think of any reasons why it is good to generate our electricity from renewable resources? Have them 'guesstimate' the percentages of electricity we generate from both renewable and non renewable resources. Compare with percentages on the *Student Wind Energy Fact Sheet*.
- Were the students surprised that we generate such a large amount of electricity from renewable resources?

Indicative Curriculum Links and Learning Outcomes

Science. Physical World. Students will:
- gain an understanding of the many different sources that we use to produce electrical energy and the benefits to our planet of increasingly producing energy using renewable resources

Technology. Knowledge and Nature of Technology. Students will:
- gain an understanding of the process of producing energy by harnessing the power of the wind with wind turbines.
- understand that by using new technologies such as wind power we are taking positive steps in improving our relationship with the environment.

Social Sciences: Place and Environment.
- understanding how and why we need to make good decisions about access to and use of resources

Links to English, The Arts, Mathematics. Levels 2–4

- Did students know that New Zealand is one of the few countries in the world that generates most of its electricity from renewable energy (unlike Australia, UK and USA)?
- Data project *http://science.howstuffworks.com/electricity* for more information students will find useful.

COMPARING OUR ELECTRICITY OPTIONS

- Introduce the idea that all forms of electricity generation in New Zealand have some advantages and disadvantages. Through discussion, have students identify these, *eg*
  - *Wind*. It is free and renewable. Some times the wind doesn't blow or is too strong.
  - *Water-Hydro*. It is free and renewable but it depends on rain. Water is wanted for other uses, like irrigation.
  - *Geothermal*. Is free with fewer emissions than gas and coal.
  - *Gas and Coal*. Carbon dioxide emissions and changing costs, but the fuel can be stored for use when needed.
- Develop the idea that New Zealand is fortunate to have these options and to take advantage of all of their strengths and weaknesses we have to be able to make them work together to produce our electricity. Do students know that demand for electricity is changing all the time on every day and that generation has to be continually matched to demand? Can they think of reasons why demand falls or would rise? Can students think of what could happen if we don't manage these options and the demand for electricity well? *eg* we get blackouts.
- Did students know that planned wind farms are often opposed by people who are concerned about their effects? Have groups debate the following proposition. "When more power is needed in New Zealand a wind farm is the best option".

ONE OF THE MANY OPTIONS WE HAVE

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WHAT IS A WIND FARM?

- Do students know what a wind farm is? Why would it be called a wind farm? How many students have seen a wind turbine? What does the Student Fact Sheet tell us a wind farm is?
  How many students have visited a wind farm? Share experiences.
- Play the following videos about wind turbines and wind farms to the class. After playing each video, have students summarise the main points or ideas the video was trying to get across.

The Wind Business at:
www.thefutureschannel.com/dockets/science_technology/wind_farming

Energy 101 Wind Turbines at:
http://energy.gov/energysaver/articles/small-wind-electric-systems

Ocean Turbines off the Dutch Coast at:
http://videos.howstuffworks.com/discovery/6826-building-the-future-ocean-ic-wind-turbines-video.htm

A comprehensive selection of videos and animations and a quiz about wind power can be found at:***www.vestaselearning.com***

- Remind students that approximately 6% of our electricity is produced by wind farms. Did they know that our largest wind farm has 134 turbines and our smallest has 1 turbine.
- To find the closest wind farm to the school have students visit: *windenergy.org.nz/nz-wind-farms/nz-wind-farms*
- Locate these with an Atlas. Type in *Te Apiti Wind Farm, New Zealand* into Google Earth and fly to the wind farm.

TAKE A WIND TURBINES CRASH COURSE

- As a class or in groups, take the *Wind With Miller* crash course animation on wind turbines at:
  www.windpower.org/en/knowledge/wind_with_miller.html
  (Log in to this Danish Ministry of Environment and Ministry of Education site as a guest)
- Another simple animation on how a turbine works is at:
  www1.eere.energy.gov/wind/wind_animation.html
- After taking the animated course, have students compare the information given by Miller with the information under the 'All About Turbines' section of Wind Energy Student Fact Sheet.
- Give each group the task of preparing and presenting an illustrated presentation or multi choice quiz to the class on a turbine topic of their choice, *eg*
  - the parts of the turbine and the functions they perform.
  - how the turbine produces electricity and how much.
  - how the turbine is made to withstand strong winds.
  - what causes the wind to blow.

RESEARCH PROJECT AND ACTIVITIES

- As a shared reading exercise (or individual/groups) have students research and discuss the following from the Wind Energy Student Fact Sheet that can be downloaded at: ***http://windenergy.org.nz/resources/resources.lessonplans***
  - New Zealand's suitability for producing wind power and the percentage time that most turbines produce electricity.
  - the way that wind fits in with our hydro resources.
  - the protective mechanisms built into turbines.
  - reasons why we can't produce all our energy from wind.
  - identifying the benefits of wind farms and the benefits that renewable resources have over fossil fuels.
- Have students use the following website in conjunction with the Fact Sheet to find out how wind farms are carefully managed to have minimal environmental effects including birds, noise and visual impact.
  vestaselearning.com/explore/environmental-impact-of-wind-turbines

CONCLUDING ACTIVITIES

- Have students complete some of the following activities:
  - shoot a video that could be used to promote the use of wind power on environmental grounds.
  - write a report that promotes the use of wind energy in their local area and addresses peoples concerns birds, noise and visual impact.
  - conduct an investigation into other renewable sources of energy – bioenergy, geothermal energy, marine energy and solar energy. Have students identify both the pros and cons of each type and compare them to wind energy.
    www.eeca.govt.nz/efficient-and-renewable-energy/renewable-energy
  - contribute to a school/class website that promotes the use of renewable energy and includes interesting facts and links to websites on wind energy.
  - design a series of colourful posters, each promoting one positive message about the use of wind energy.
  - survey students, and families to find out how people feel about the visual effect of turbines. Write a radio advertisement, report or produce a video that promotes the visual appeal of wind turbines in a positive way.

GLOBAL WIND DAY 15 JUNE

Global Wind Day is a worldwide event that occurs annually on 15 June.

It is a day for discovering wind, its power and the possibilities it holds to change our world.

Find out more at:
globalwindday.org and ***windenergy.org.nz***