

Make a Wind Turbine

**Curriculum
Levels 3-4
Maths, Science**

Overview:

Investigate the power of wind through this STEM activity, where students make a model turbine and test out how it works!

Curriculum links:

LEARNING AREAS	ACHIEVEMENT OBJECTIVES	LEVELS	YEARS
Science: Nature of Science: Investigating in Science	Ask questions, find evidence, explore simple models and carry out appropriate investigations to develop simple explanations.	3-4	5-8
Physical world: Physical inquiry and physics concepts	Explore, describe and represent patterns and trends for everyday examples of physical phenomena... Identify and describe the effect of forces (non-contact and contact) on the motion of objects.	3-4	5-8
Science capabilities	Gather and interpret data, Use evidence, Engage with science	3-4	5-8
Maths: Statistics: statistical investigation	Gathering, sorting and displaying whole-number data and simple time series data to answer questions. Communicating findings using data displays.	3-4	5-8
Minor links: Technology			



Teacher information:

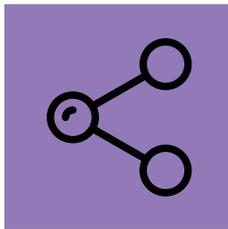
Learning sequence



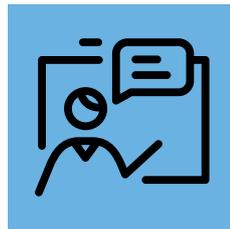
Introducing knowledge



Explore and investigate



Make and share



Reflect and extend



Make a difference

Learning intentions

Students are learning to:

- Understand how a wind turbine works
- Use a model wind turbine to investigate the effect of wind speed on turbines.

Success criteria

Students can:

- Describe how a wind turbine works
- Design a water wheel that uses the energy of water to move and reflect on the success of their design.

Resources needed and lesson preparation

You will need 3D printed model turbines or homemade wind turbine models for this activity.*

- Use the 'How to make a wind turbine' video, 3D printer files and step by step guide at <http://www.schoolgen.co.nz/make-and-play/maker-projects/make-a-wind-turbine/> to make your turbines. Ideally, make one turbine for each group of three.
- Equipment for making the turbine: Ruler or measuring tape, two wooden sticks (e.g. ice block sticks), scissors, sellotape, a kebab stick and a piece of flexible but firm material (e.g. thick paper/cardboard), sanding paper, and the 3D printed items.
- Worksheet or Google Doc 'Results for wind turbine investigation (page 5)' so that students can record their results and draw a bar graph of the outcome.

Vocabulary:

wind energy, turbine, hau, hau nui, renewable, spin, electricity, power, blades.

Background information and supporting resources

Wind is a renewable energy source which is abundant in some areas of New Zealand (especially high exposed hills). Wind farms are groups of wind turbines and in New Zealand wind farms generate around 5% of our country's electricity. They are the 4th largest electricity source in New Zealand behind hydroelectricity, geothermal and gas/coal thermal.

- Google slides presentation: Wind energy: https://docs.google.com/presentation/d/1epwO8f0KZapSLoivQQI6qYS8ZPzp_XSuetXoB_Ot3QE/edit#slide=id.g552d44ea45_0_185
- Find out about Genesis Energy's Hau Nui wind farm. (Hau Nui is te reo Maori for "Big Wind"): www.genesisenergy.co.nz/hau-nui-wind-farm

*If you don't have access to a 3D printer and would like to borrow the models to do this activity, please email schoolgen@genesisenergy.co.nz.

Learning experience suggestions

Note: These are suggestions only and teachers are encouraged to adjust the activity to suit the needs and interests of their students.



1. Introducing knowledge

Introduction:

Allow approximately

To introduce wind power and turbines, view the Google slides presentation: Wind energy: https://docs.google.com/presentation/d/1epwO8f0KZapSLoivQQl6qYS8ZPzp_XSuetXoB_Ot3QE/edit#slide=id.g552d44ea45_0_185

Discussion starters:

- Where does electricity come from?
- How does a wind turbine work? How does it make electricity?
- What are some issues with wind power?

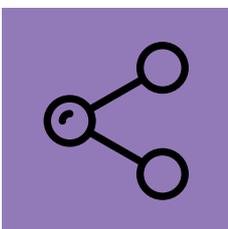


2. Explore and investigate

Allow approximately 20 minutes

Thinking like a scientist

What happens to a turbine as the wind blows it?
Does the wind speed make a difference to the spinning of the turbine?



3. Make and share

Allow approximately 15 minutes

Use the 'How to make a wind turbine' video, 3D printer files and step by step guide at <http://www.schoolgen.co.nz/make-and-play/maker-projects/make-a-wind-turbine/> to make your turbines. Ideally, make one turbine for each group of three.

Investigating wind power instructions

1. Set up your wind turbine on a table in an area without any breeze.
2. Make sure it is level and can spin easily.
3. Check that there is a dot on the top edge of the wind turbine: you are going to use this to count how many times the turbine spins around.
4. Measure 100 cm from the edge of the wind turbine and have the person blowing stand there. (Their mouth must be in line with the wind turbine i.e. they must blow directly at the blades and not from below or above.)
5. Without moving closer, the person needs to blow on the turbine.
6. Now count the number of times it spins from start to stop.
7. Record the number of spins and the distance in the results table below.
8. Repeat this for distances of 90 cm, 80 cm, 70 cm, 60 cm, 50 cm, 40 cm.

Hints for a smooth running activity

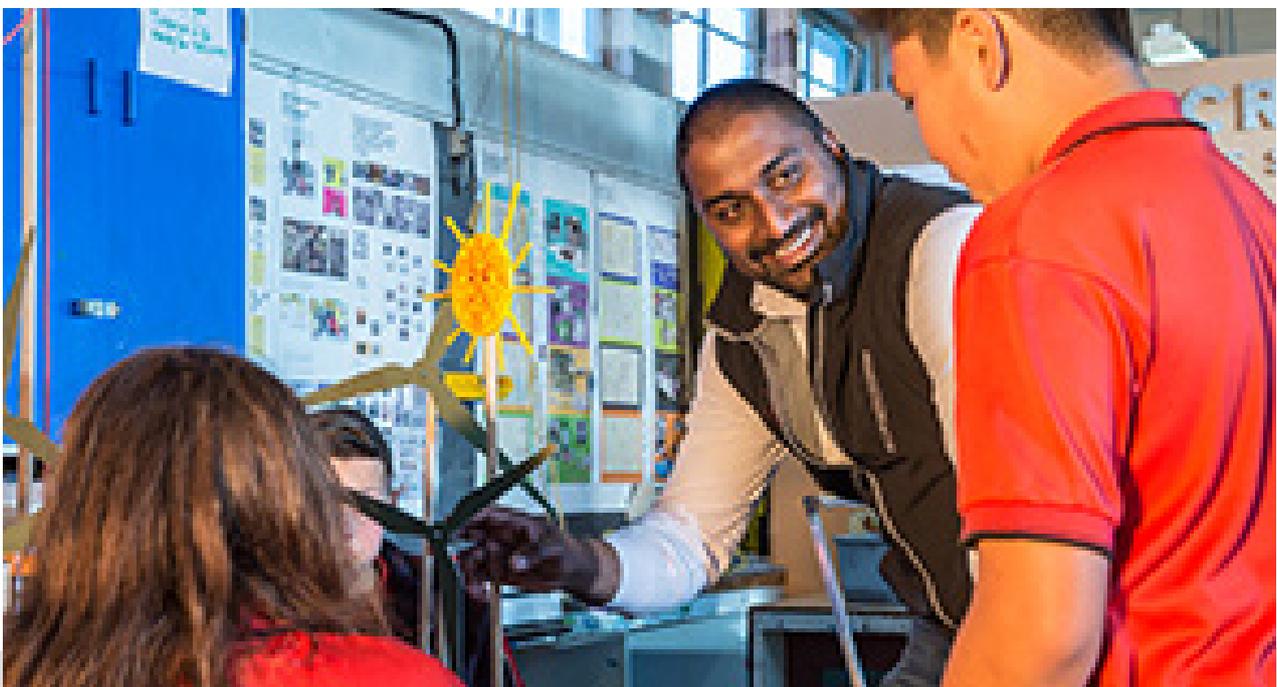
If you find it hard to count all the spins, then you might try to take a video of it spinning and then replay it.

It is easier to work in a group of 3, so one person can set the distance to the wind turbine, one person can do the puff, the other person can count the spins and record your result.

It is recommended that the students to put a marker dot on the top outer edge of the turbine. As the wind turbine turns, the students will count how many times this dot passes by where it started from.

They can take turns to blow (one breath allowed at a time) on the wind turbine from a series of decreasing distances starting at 100 cm down to 40 cm.

They need to count how many times it spins around. (Note: If the rotation speed is too fast to count then it could be videoed and then played back in slow motion for accurate counting.)



Results for wind turbine investigation

Number of turbine spins from 1 puff at different distances

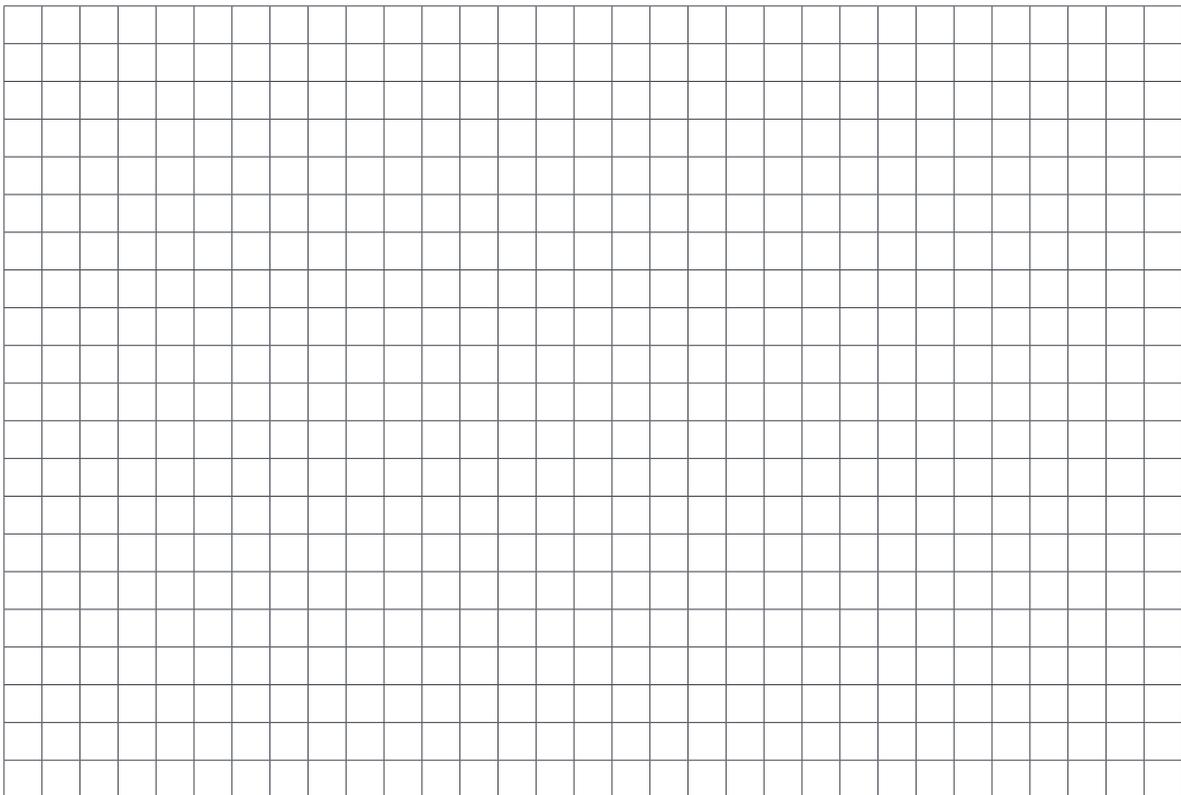
There are extra columns for each person in the group to have a turn at blowing (it is not a competition though!)

1. Table of results

Distance measured	Number of spins	Number of spins	Number of spins
10 cm			
20 cm			
30 cm			
40 cm			
50 cm			
60 cm			
70 cm			
80 cm			
90 cm			
100 cm			

2. Draw a bar graph of your results

Use the numbers you recorded in the table and make a bar graph of how many spins.



Google Docs version of this results sheet: https://docs.google.com/document/d/1c7YUtZzHdiaT8j26eyVRDQvuUxC5jEFrWYLH3_hNgws/edit?usp=sharing

Write a sentence or two to describe what you think the graph shows:



4. Reflect and extend

Allow approximately 10-20 minutes

Reflection questions

- a. Where does the energy in the wind come from?
- b. Where does the energy to make you breathe come from?
- c. In what way are breath and wind the same?
- d. In what way(s) are they different?
- e. What are large wind turbines used for?
- f. Where in New Zealand might you find really big wind turbines?
- g. Discuss with your friends if the wind will ever run out and explain your answer.



5. Make a difference

Allow approximately 15-30 minutes

How can we save energy and use the power of the wind to be more sustainable?

- Dry your clothes outside on a washing line (in the wind and sun) instead of in a clothes dryer
- Open your windows and doors on dry days to let the breeze through your home to keep it dry and healthy
- Close windows, fix any drafts and install insulation to keep your home warm in winter.