Lesson Plan: Discover wind energy

Year 7: Science & Maths

Lesson plan part 1

Materials

This activity is designed to be carried out in groups of two or three students. For your convenience the materials below can be loaned from the education team with enough materials for 15 groups.

Discover wind energy kit	**For student teams**	15 corks Approx. 300 toothpicks 50 sheets cardstock, aluminium foil, paper 30 lab goggles 15 protractors 15 roles of masking tape 15 pencils
	For two turbine testing stations	2 rulers 2 DC motors 2 rubber bands 2 pairs of alligator clips 2 multimeters 2 electric fans
Teacher resources	Discover wind energy student folio Discover wind energy map of Tasmania's windfarms	

Teacher preparation

- Email education@hydro.com.au to book the Discover wind energy kit that has the materials you will need for a class size of 30 students
- Print off student folios – one per student
- Students can work in pairs for this activity. Each pair of students will need:

Product	Quantity
Cork	1
Toothpicks	20
Choice of card stock, aluminium foil or paper.	3 sheets
Pencil	1
DC Motor	
Masking tape	1 roll
Scissors	1
Ruler	1
Protractor	1
Rubber band	2

Teacher preparation cont.

- Set up two turbine-testing stations in the classroom. Each station should have a fan and multimeter
- Assemble the motor and ruler as shown on the diagram in the kit
- Place the motor at the end of the ruler and attach it with rubber bands
- Attach the alligator clips to the metal tabs on the motor
- Follow instructions in the kit to attach the clips to the multimeter.

Discussion

Wind energy is driven by the sun. When the atmosphere is heated by the sun, it is done so in an irregular manner. This, along with the variations in the surface of the earth, bodies of water, and the rotation of the earth, influence wind patterns.

People have harnessed wind energy for thousands of years. For what reasons? To sail ships, grind grain, and pump water. Wind is the most widespread renewable energy source.

Today, modern wind turbines efficiently capture wind energy and use it to generate electricity. You may want to show students how wind turbines work (see link to parts of a wind turbine in references).

It begins with the transfer of energy from kinetic energy to mechanical energy as the wind moves the blades which move the parts of a generator. That energy is then transferred to electrical energy and transferred to where it is needed.

Method

1. **Hand out** student folios and **read** the story about life in Blustery Bay. Have students **discuss** with partners what life would be like with no electricity.
2. **Discuss** the advantages and disadvantages to harnessing wind energy through wind turbines.
3. **Divide** students into groups of two.
4. Have the groups **discuss** what they think could determine how much electricity a wind turbine could produce. Have them record their answers in their folios.
5. Provide a **demonstration** of how students can put their turbine hubs together. **Show** them a pre-built hub and go through steps briefly. There are images in their folios but a verbal and visual run-through adds to their level of understanding.
6. **Show** students the stations, how the fan and multimeters work and how to place their turbine hubs onto the end of the motors.

Method cont.

7. Have one person in each group gather the materials (materials listed in folios).
8. The instructions for the experiment are in the student folios. Groups will be moving at their own paces through the steps, and record the data as they go.
9. As groups work their way through the folios, they will be testing the blade angles, sizes, numbers and shapes.
10. Remind students that when measuring the voltage their turbines generate, the fans should:
    a. stay at a controlled distance away (approximately 30 cms – mark the spot on the table) and;
    b. be at a controlled speed (level 2 or 3 recommended). Students can record the voltage to the nearest hundredths.

Lesson plan part 2

Discussion

This part of the lesson will focus on students completing the trials of their turbine designs and completing their folio reports. Reflect on the intention of the lesson and encourage student's enthusiasm by engaging them in a wind energy challenge – which design will generate the most voltage?

Method

1) Set up the classroom with the testing stations and ensure each group has enough resources to continue building their wind turbines.
2) When each group has determined what turbine design is most efficient (designs may differ between groups), they will need to test them against each other.
3) Create a challenge - the group with the turbine that generates the most voltage wins.
4) Upon completing their trials, encourage students to design their best turbine and complete part two of their folios (except the reflection).
5) Gather the students as a class and have them test their **best** designs against each other.
6) You can extend the testing and have the fans further away or at a lower speed to see if turbine designs perform differently under distinct conditions.

Reflection

At the end of the testing, have a class discussion.

1. What variable (angle, size, number or shape), if evident, made the biggest difference in turbine performance?
2. Would this be reflected if built at a large scale?
3. What other factors could be altered to study the efficiency of the turbines?
   Answers could include the length of blade or the materials of the turbine – plastic, metal etc.
4. What is the most important thing that determines how much electricity can be generated with a wind turbine? *Wind consistency and speed in an area.*
5. Have the students explain which part of the system generated electricity. Which part transmitted electricity? Which part used electricity?

You may choose to have students answer the reflection questions in their folios, on their own or as part of a class discussion using the questions below.

1. How accurate do you think these tests were? Why?
2. How could these tests be more accurate in testing for design efficiency in turbines?
   The angle, number, size and shape of blade may not perform optimally on their own but in combination with each other. For example, when testing angles of blades, it would be more accurate to test angles against all other factors like number, sizes and shapes of blades. A certain angle might work well with a specific shape or size but not well with another shape or size. As mentioned earlier, different materials can alter performance of turbines as well.
3. How is wind power important to Tasmania? Use the included map of Tasmania and ask students if they are aware of wind farms in Tasmania.

4. Discuss why the wind farms are located in those areas. What are the challenges of having the wind farms in those locations? *They are far from urban centres where higher demands for electricity exist. More roads and transmission lines would be needed to access the remote areas. These sites might be sensitive habitats for wildlife.*
5. Are there benefits to having the wind farms so remote? *More ideal for those who do not enjoy the aesthetics or noise of wind turbines.*

References

Lesson adapted from the PBS Wind power lesson:
http://www.pbs.org/now/classroom/wind.html

Link to the parts of a wind turbine:
https://www.hydro.com.au/docs/default-source/community/education/year-6/ref-wind-turbine-labelled.pdf?sfvrsn=19e8a928_2

Note on Assessment

- Informal assessments – make notes on how each group works together. Can they follow instructions? Are they able to work independently and collaboratively?
- Formal assessment – use the student folios to determine whether the groups completed their work accurately and with all the measurements, including appropriate units. Did they provide thorough explanations in their written answers?