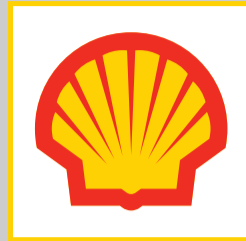# TEACHER'S GUIDE
Activity 17 - Witnessing Wind: Construct a Turbine

GETTING STARTED

Wind is a renewable energy source, which is available as long as the wind blows and the right tools are used. Using wind as energy is not a new concept. Colonists used windmills as an energy source to pump water, grind wheat and corn, and power the blades at sawmills. Through the years power lines replaced windmills but, the oil shortage of the 1970s created an interest in alternative energy sources and the windmill was reborn. In the early 1980s in California, state policies encouraged renewable energy sources, such as wind.

Wind energy offers many advantages.

- It is a clean energy source that does not pollute the environment.
- Wind is an abundant and a domestic source of energy.
- Wind energy is renewable
- Wind power can bring electrical power to remote areas that are inaccessible to conventional sources.

Wind energy also has disadvantages.

- Wind can be intermittent at times so backup sources of power are needed from traditional sources or alternative sources.
- Generating wind is usually more expensive than other alternative sources and requires a larger investment than some traditional energies.
- Large areas of land or water are needed for wind turbine towers causing potential aesthetic and wildlife concerns.
- Commercial scale wind turbines cost approximately $3-4 million dollars installed. The size needed to power a home might cost $50,000 -$80,000 (Source: **www.windustry.org/how_much_do_wind_turbines_cost**)

With your students or on your own, visit **energy-and-innovations/shell-wind energy.html** to learn more about what Shell is doing to expand wind power generation in the US.

Note: Be sure to read over the worksheet carefully before you distribute the activity to your class.

NATIONAL STANDARDS

Mathematics
Standard 1. Uses a variety of strategies in the problem-solving process
Standard 2. Understands and applies basic and advanced properties of the concepts of numbers
Standard 3. Uses basic and advanced procedures while performing the processes of computation

Physical Science
Standard 2. Understands Earth's composition and structure
Standard 9. Understands the sources and properties of energy

Technology
Standard 3. Understands the relationships among science, technology, society, and the individual Standard 4. Understands the nature of technological design Standard 5. Understands the nature and operation of systems Standard 6. Understands the nature and uses of different forms of technology

Skills
Making hypotheses, predicting, observing, collecting data, comparing, drawing conclusions

TIME CONSIDERATION

Preparation: 45 minutes

Activity: Two 50 minute periods

OBJECTIVE

To introduce students to wind power as an alternative energy source and to understand how a turbine's design and wind speed affect how much electricity is produced

SAFETY
Be sure that students wear safety goggles at all times and use care when handling the scissors, wire and motors.

MATERIALS
(Enough for groups of two to three students each)

- 2 speed fan or hair blower
- 1.5 v DC motor
- 0 – 5 v Voltmeter

- 100-ohm resistor
- insulated wire
- corks, paper clips, cardboard, glue

- tape, rubber bands
- toothpicks, scissors, rulers

Visit **www.shell.com/us/energizeyourfuture** with your students for more information on wind power and other forms of alternative energy.

EXPECTED RESULTS
Students should expect to find a relationship between wind speed and the output produced from the wind turbine. The greater the wind speed, the greater the output.

CHALLENGE ACTIVITY
Have students test their wind blade designs by changing the distance from their wind turbine and the wind source. Start at a distance of 50 cm and record the output, then move the wind turbine 10 cm closer and record the output. Repeat this process for 30, 20 and 10 cm. Graph the results and draw conclusions, and share the results with the rest of the class.

Students can construct a vertical wind turbine and then determine whether a vertical or horizontal wind machine is more efficient.