

## Wind Energy Lesson Plan

### Michigan Grade Level Content Expectations and Common Core State Standards

<i>3<sup>rd</sup> Grade</i>
<b>SCIENCE</b>
<p><b>Inquiry Analysis and Communication</b></p> <ul style="list-style-type: none"> <li>○ S.IA.03.12 Share ideas about science through purposeful conversation in collaborative groups</li> <li>○ S.IA.03.13 Communicate and present findings of observations and investigations</li> </ul> <p><b>Inquiry Process</b></p> <ul style="list-style-type: none"> <li>○ S.IP.03.11 Make purposeful observation of the natural world using the appropriate senses</li> <li>○ S.IP.03.12 Generate questions based on observations</li> </ul>
<b>ENGLISH LANGUAGE ARTS</b>
<p><b>Reading Standards for Informational Text (RI)</b> Integration of Knowledge and Ideas</p> <ul style="list-style-type: none"> <li>○ RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur).</li> </ul> <p><b>Writing Standards (W)</b> Research to Build and Present Knowledge</p> <ul style="list-style-type: none"> <li>○ W.3.8 Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories</li> </ul> <p><b>Speaking and Listening (SL)</b> Comprehension and Collaboration</p> <ul style="list-style-type: none"> <li>○ SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.</li> <li>○ SL.3.3 Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.</li> </ul> <p><b>Language (L)</b> Conventions of Standard English</p> <ul style="list-style-type: none"> <li>○ L.3.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.</li> </ul>
<b>Social Studies</b>
<p><b>Public Discourse, Decision Making and Citizens Involvement</b> P4.2 Citizen Involvement</p> <ul style="list-style-type: none"> <li>○ 3-P4.2.2 Participate in projects to help or inform others.</li> </ul>

**4<sup>th</sup> Grade****SCIENCE****Inquiry Analysis and Communication**

- S.IA.04.12 Share ideas about science through purposeful conversation in collaborative groups
- S.IA.04.13 Communicate and present findings of observations and investigations

**Reflection & Social Implication**

- S.RS.04.15 Use evidence when communicating scientific ideas

**ENGLISH LANGUAGE ARTS****Reading Standards for Informational Text (RI)**

## Integration of Knowledge and Ideas

- RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.

**Writing Standards (W)**

## Research to Build and Present Knowledge

- W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.

**Speaking and Listening (SL)**

## Comprehension and Collaboration

- SL.4.2 Paraphrase portions of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL.4.3 Identify the reasons and evidence a speaker provides to support particular points.

**Language (L)**

## Conventions of Standard English

- L.4.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

**Social Studies****Public Discourse, Decision Making and Citizens Involvement**

## P4.2 Citizen Involvement

- 4-P4.2.2 Participate in projects to help or inform others.

Providing energy education to students in the communities we serve.  
That's our Promise to Michigan.

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## 5<sup>th</sup> Grade

### SCIENCE

#### Inquiry Analysis and Communication

- S.IA.05.13 Communicate and defend findings of observations and investigations using evidence

#### Inquiry Process

- S.IP.05.11 Generate scientific questions based on observations, investigations and research.

### ENGLISH LANGUAGE ARTS

#### Reading Standards for Informational Text (RI)

##### Integration of Knowledge and Ideas

- RI.5.7 Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently.

#### Writing Standards (W)

##### Research to Build and Present Knowledge

- W.5.8 Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information in notes and finished work, and provide a list of sources.

#### Speaking and Listening (SL)

##### Comprehension and Collaboration

- SL.5.2 Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.
- SL.5.3 Summarize the points the speaker makes and explain how each claim is supported by reasons and evidence.

#### Language (L)

##### Conventions of Standard English

- L.5.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.

### Social Studies

#### Public Discourse, Decision Making and Citizens Involvement

##### P4.2 Citizen Involvement

- 5-P4.2.2 Participate in projects to help or inform others.

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### Lesson Outcome

Students will discuss and discover that energy comes from many different sources, including wind. They will make a model of a windmill that uses power from wind to do work. Students will also explore the impact of how technology can positively impact the world by learning about wind energy equipment used for the conversion of wind to energy.

### Rationale / Purpose for Lesson

For this activity, you will work as an engineer. An engineer is a person who uses Science and Technology to solve problems. Your challenge is to engineer a windmill that lifts a cup. You can experiment with different weights, increasing the amount of work your windmill can do. You can compare your model with the class and discuss different attributes of your windmill.

### Materials

- Paper milk or juice container (quart works best)
- Skewer
- Foam Ball
- Index Card
- Small paper/dixie cup
- Craft sticks
- Pencils/crayons
- Scissors
- Tape
- String



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For more great lesson plans and other resources visit:  
[www.ConsumersEnergy.com/kids](http://www.ConsumersEnergy.com/kids)

## Anticipatory Set

Depending on the student's prior knowledge, it may be necessary to review some information such as - definitions and ideas to engage them or start the thinking process.

- The more electricity a wind turbine can produce, the lower the unit cost of the electricity. The amount produced depends on the windiness of the site; the efficiency of the windmill, turbine, and generator; and the way the turbines are arranged.
- Wind turbines begin operating at wind speeds of around 10 mph and reach maximum output at 33 mph. At winds above 50 mph, wind turbines shut down. To be productive, therefore, wind turbines need to be located in areas that have a fairly constant wind speed between 10 and 33 mph.
- The length, shape and weight of the blades, the generator design, and the strength of the materials all affect the efficiency of a wind-power installation. To maintain an average of 15 to 50 revolutions per minute, friction must be minimized.
- Turbines in wind farms must be arranged so that they do not shadow (interfere with) each other.

## Procedures

(Students will complete the models in small groups.)

1. Poke a hole through the front and back of the milk carton about two-thirds of the way up.
2. Feed the dowel through the holes and fit the foam ball on the front of your windmill.
3. Use the string to tie the cup onto the dowel on the back of the windmill.
4. Design windmill blades on index cards. Color, cut out, and tape each blade to a craft stick.
5. Insert the craft sticks into the foam ball, separated out evenly.
6. Test out your windmill! Use a fan or a windy day to see how much weight your windmill can lift.

(Load various objects in the cup, which will be lifted when the dowel spins in the windmill.)

## Closure

### What's happening?

Wind can be used to do work. The kinetic energy from wind can be changed into other forms of energy, either mechanical energy or electrical energy.

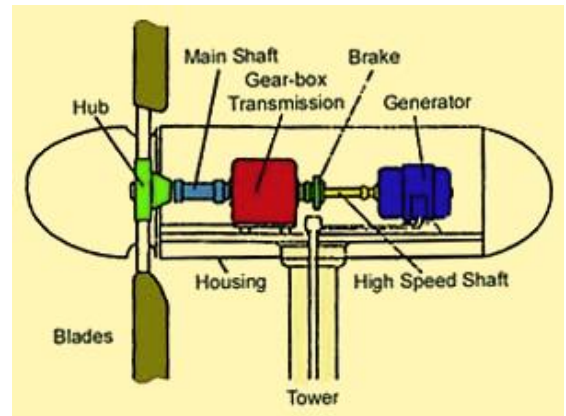
Farmers have been using wind energy for many years to pump water from wells using windmills. In Holland, windmills have been used for centuries to pump water from low-lying areas.

Today, the wind is also used to make electricity.

Blowing wind spins the blades on a wind turbine – just like a large toy pinwheel, or the windmill you built. This device is called a wind turbine. We see many wind turbines in areas of Michigan being built in the most recent years.

The blades of the turbine are attached to a hub that is mounted on a turning shaft. The shaft goes through a gear transmission box where the turning speed is increased. The transmission is attached to a high speed shaft which turns a generator that makes electricity.

If the wind gets too high, the turbine has a brake that will keep the blades from turning too fast and being damaged.



## Extensions

Scientists and Engineers redesign their process all of the time. What could you change on your windmill to improve your design?

The following websites may be useful for implementing this activity:

[Kidwind.org](http://Kidwind.org) - website that offers much information and advice on implementing the windmill activity for your class

[windpower.org](http://windpower.org) - get a crash course on wind power. Good website that keeps concepts simple for quick understanding.

[Otherpower.com](http://Otherpower.com) - Thorough website with lots of resources

[Energy Kids page](#) - Good website for students to read to get overall background on windmills and wind energy

[Renewable Energy Information](#) – Consumers Energy is a leader in renewable energy, especially wind energy. This website outlines the process to create a wind farm.

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