

Got Wind?

Exploring Wind Energy & Wind Farms

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Grade Level 5
Duration 3 class periods

National Standards

GEOGRAPHY

Element 5: Environment and Society

- 14. How human actions modify the physical environment
- 15. How physical systems affect human systems
- 16. The changes that occur in the meaning, use, distribution, and importance of resources

SCIENCE

3 -5.ETS1-1

- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Influence of Science, Engineering and Technology on the Natural World— People’s needs and wants change over time as do their demands for new improved technologies.

AZ Standards

ELA

Writing

Production and Distribution of Writing

5.W.4 Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.

Speaking and Listening Comprehension and Collaboration

5.SL.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others’ ideas and expressing their own clearly.
 d. Review the key ideas expressed and draw conclusions based on information and knowledge gained from the discussions.

SCIENCE

Earth and Space

5.P4U1.6 Analyze and interpret data to determine how and where energy is transferred when objects move.

Arizona Social Science Standards

GEOGRAPHY

Examining human population and movement helps individuals understand past, present, and future conditions on Earth’s surface.

5.G3.1 Use key historical events with geographic tools to analyze the causes and effects of environmental and technological events on human settlements and migration.
 Key concepts include but are not limited to consequences of territorial expansion on American Indians, the institution of slavery, the positive and negative impact of new technologies on the environment and the growth of cities, and the impact of transportation and infrastructure on settlement and migration

SLOP Elements

Preparation Adapting Content Linking to background Linking to past learning Strategies Used	Scaffolding Modeling Guided Practice Independent practice Comprehensible Input	Grouping Option Whole Class Small groups Partners Independent
Integrating Processes Reading Writing Speaking Listening	Application Hands on Meaningful Linked to objectives Promotes engagement	Assessment Individual Group Written Oral

Arizona English Language Proficiency Standards

Grade 5

Basic

Listening, Speaking, Reading, and Writing

Standard 6 By the end of each language proficiency level, an English learner can participate in grade-appropriate oral and written exchanges of information, ideas, and analyses, responding to peer, audience, or reader comments and questions.

B-1: participate in discussions about familiar topics and texts.

B-2: participate in written exchanges about familiar topics and texts.

B-4: ask questions to gain information or clarify understanding.

B-5: contribute information and evidence to collaborative oral and written discussions.

Overview

As the use of fossil fuels continues to be a debate on its sustainability and the protection of our environment, wind energy becomes a viable alternative.

Purpose

In this lesson students will learn how a wind turbine works by engineering one themselves. They will then research the benefits of wind energy. This lesson contains adaptations for English language learners.

Key Vocabulary

wind turbine: a large shape rotated by the wind to generate electricity

generator: a machine for converting energy into electricity

blade: the flat, wide section of a device (like an oar or propeller)

gears: a set of toothed wheels that work together

wind farm: an area of land with a group of energy-producing windmills or wind turbines

Materials

- Wind Energy PowerPoint
- Projection device
- Design, Construct, and Test Your Own Wind Turbine worksheets
- Materials for Building Wind Turbine
 - Wooden (popsicle) sticks
 - Bendable wire
 - String
 - Paperclips
 - Rubber bands
 - Toothpicks
 - Aluminum foil
 - Tape
- Wooden dowels
- Paper, cardboard
- Weight (5-8 pencils taped together)
- Hair dryer
- Glue gun
- Self-Assessment
- Claims, Explanations, and Evidence
- Vocabulary Card
- Vocabulary Test and Answer Key

Objectives

The student will be able to:

- Describe how energy is transferred.
- Construct a working wind turbine.
- Describe the benefits of wind energy.

Procedures

Prerequisite Knowledge: A background activity/lesson in wind mills used to pump water in U.S. settlements would be a good precursor to this lesson. Windmill Pumping Water (.41 min)
<https://www.youtube.com/watch?v=3AA8s3Jtetg>

SESSION ONE

Engage

1. Begin the lesson by showing the Title Page of the PowerPoint or another illustration of a wind farm or wind turbine. Ask who has seen these structures and where. Then explain that today they will be looking at wind energy and how it is produced. **(Preparation: Linking to Background)**
2. Project slide 2 and discuss the learning objectives.
3. Project slides 3-5 and discuss the vocabulary words and their meanings. Post the cards on the word wall. **(Scaffolding: Comprehensible input)**

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- Project slide 6 and slide 7 and discuss the images of how a turbine works and how the energy is transferred.
- Project slide 8 and show the video clips of wind turbines called Wind Power (2.33 min) and Wind Power (1.46)
- Involve the students in a discussion of what they already know or have just learned about wind turbines.
 - What are wind turbines used for?
 - How do they work?
 - Where can we place wind turbines?
 - What are the benefits of using wind power to generate electricity.
 - What are the downsides to using wind power? (**Preparation: Linking to Background; Integrating Process: Listening and Speaking**)
- Project slide 9 and explore the maps showing the best places to build a wind farm and discuss why these locations are good. (**Scaffolding: Comprehensible Input**)
- Project slide 10 showing the different wind turbines with different blade designs. Discuss why there are different designs and whether these differences might affect how well the wind turbine works.
- Exit Ticket: Project slide 11. Have students work with a partner and describe how energy is transferred in a wind turbine/wind farm and what are 3 ways that wind power benefits society.

SESSION TWO

Explore and Explain:

- Project slides 12-15 and explain the project of designing, constructing, and testing a wind turbine.
- Distribute the Design, Construct, and Test Your Own Wind Turbine worksheet and the Self-Assessment. Project slides 16-17 and explain the assignment sheet and how the students will assess themselves with the Self-Assessment rubric.
- Allow students time to design, construct and test.
- Collect the worksheets and self-assessment.
(**Application: Hands on & Promotes engagement, Grouping Option: Partners, Integrating Processes: Speaking and Writing, Assessment: Written and Group**)

SESSION THREE

Elaborate:

- Have small groups then share out with the whole class, discussing the design features they found most important in producing the most effective wind turbines.
- Encourage the class to compare the teams' ideas and discuss why these design features might be most important. Review the videos if needed. (**Integrated Processes: Speaking and Listening**)

Evaluate:

- Distribute the Claims Explanations and Evidence assessment. Project slide 18.
- Explain that they will use their hand held devices or computers to answer the two questions. Allow time for research. Can be homework if not completed in class. (**Assessment: Individual, Written**)

Assessment

ELA, Science, and Geography

The Design, Construct, and Test Your Own Wind Turbine worksheets can be graded for completeness. Mastery will be considered a score of 90% or higher. (**Assessment: Written and Group**)

The Claims, Explanation, and Evidence assessment can be graded for accuracy and completeness. Mastery will be considered a score of 80% or higher. (**Assessment: Written and Individual**)

The Vocabulary Test can be graded for correctness. Mastery will be considered a score of 80% or higher. (**Assessment: Written and Individual**)

Self Assessment is not a recorded grade.

Extensions

Students can conduct follow-up research to explore the impact of wind farms on the environment and wildlife of an area.

Students can research the difference between building a wind farm on land vs. in the ocean.

Explore book selections or video about *The Boy who Harnessed the Wind* by William Kamkwamba with Bryan Mealer. Trailer can be found at:
<https://www.youtube.com/watch?v=W0b6Q1pxG9g>

Sources

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Video:

https://www.youtube.com/watch?v=SQpbTTGe_gk

Interactive Maps:

<https://eerscmap.usgs.gov/uswtdb/viewer/#3.54/36.83/-97.07>

<https://www.energy.gov/articles/new-interactive-map-shows-big-potential-america-s-wind-energy-future>

<https://aws-dewi.ul.com/about-us/overview/wind-map-usa/>