

Program

Energy Transformations : Wind Farm

Three

Teacher's Guide



The "[wind farm](#)" in Bowling Green, Ohio, in some ways represents a beginning, a beginning of a change that addresses the [finite nature of the Earth's resources](#) and our need for sustainable energy. Our need for power continues to grow as do the costs and the risks associated with that need.

In this piece, Daryl Stockburger discusses how wind technology has evolved into a viable alternative energy solution — a viable alternative in terms of cost savings to the consumer and the ability to generate ample power from a completely sustainable, environmentally friendly source — the wind.

Another valuable component of this piece is Stockburger's discussion on the importance of scientific evidence being gathered and examined before the project began, to determine the potential risks and benefits to the community and the surrounding environment.

Program Objectives

Students will learn that:

- Science and scientists are at work in northwest Ohio solving the problems posed by declining resources and high energy costs.
- Businesses and governments routinely apply the process of scientific investigation to assess risk and cost to the community and environment.
- Alternative sustainable forms of energy are a reality.

Ohio Science Standards

Earth Science

Benchmark D

Describe the finite nature of Earth's resources and those human activities that can conserve or deplete Earth's resources.

Indicator 5, Grade 10

Explain how the acquisition and use of resources, urban growth and waste disposal can accelerate natural change and impact the quality of life.

Scientific Inquiry

Benchmark A

Participate in and apply the processes of scientific investigation to create models and to design, conduct, evaluate and communicate the results of

these investigations.

Indicator 1, Grade 9

Distinguish between observations and inferences given a scientific situation.

Materials

- Computer with access to the Internet
- Paper and pen
- Handouts

Pre-Viewing Activity – Prepare to Learn

The wind farm in Bowling Green, Ohio, is a classic example of a cutting edge technology becoming part of the mainstream. With the growth of our towns and cities, comes the need to minimize our impact on the environment; we are continually forced to investigate new technologies that help us meet that goal.

The wind turbines of Bowling Green, Ohio, are the result of one of these investigations. Because of the minimal amount of land needed for a wind turbine to operate, they are ideally suited to the farms and fields of Wood County, Ohio.

The wind turbines, while not as efficient as coal fired generators, do offer distinct advantages. Because the turbines emit no greenhouse gases they do not contribute to global warming, and because they draw from a free and renewable resource — the wind — they help the economy.

As with all electrical generating technologies, wind turbines rely upon a series of energy transformations. In this case, the heat from the sun convecting the atmosphere to produce the wind, which then passes over and turns the blades of the turbine, which then turns the generator to produce power.

The relationship between energy production and cost is an important one to establish; once understood it emphasizes the need for renewable energy and the positive impact it can have on society in terms of jobs and pollution.

Vocabulary

- Efficiency
- Meteorological
- Correlated
- Kilowatt
- Kilowatt hour
- Megawatt
- Hub height
- Impact on community
- Conventional technology
- Foot print

Related Discussion Items

- What are the environmental benefits of wind power?
- Will using more wind energy help to prevent global warming?
- Could using more wind energy reduce health care costs?
- What energy transformations are involved in the production of wind power?
- Are rising natural gas prices hurting our economy? Is this a problem that wind energy can help to solve?
- In what other ways does wind energy benefit the economy?
- How much electricity can one wind turbine generate?

Activity

Create a cognitive map as a follow-up to the guided discussion. Some possible discussion items might be the social and environmental benefits of sustainable versus non-renewable energy. Another might revolve around the possible benefits of wind power for the economy; for example, how does wind power effect either the loss or creation of jobs?

Quiz

1. Technology is continuously changing and evolving over time. As a result, it is important that we continuously update and reevaluate our information to determine if the technology we are using is best for a given situation.

True or False

2. Before beginning a large scale installation of a technology, such as wind turbines, it is really not necessary to measure their potential effects on the local community, since we already know from years of experience that they are safe and cost effective.

True or False

3. Wind turbines, while effective generators of electricity have, a considerable impact on community and land use.

True or False

4. The dollar cost of a sustainable energy resource, such as the wind, is always far less than that of coal or gas because it is endless in supply.

True or False

5. As the wind turbine project progressed, the technology behind it almost doubled in efficiency.

True or False

Related Lesson Plans

Renewable Energy Sources

(ORC# 467)

In this lesson, students use Internet resources to investigate renewable sources of energy. This lesson is designed to help students investigate and evaluate renewable energy sources. Most students can name several renewable resources, but have little understanding of them. It's important for students to examine controversial issues associated with renewable energy sources from multiple perspectives; by exploring benefits, drawbacks, and social ramifications, students will develop a deeper appreciation for these complex issues.

Converting Energy

(ORC# 3459)

The purpose of this promising practice lesson is to introduce students to energy through the idea of energy transformations and conversions, and to develop students' ideas of what energy is and how it can be measured. This investigation could be the beginning of a unit on energy. The lesson begins with students exploring several activities on the Atom's Family website. For best results students should carry out the investigations described in the website. Students then pick up some foundational information about energy as they read part of the *Energy Story*, an online book. Finally students design and conduct an experiment around a question they devise about heating water. Safety considerations should be reviewed with students before they begin their experiments.

Educational Resources

Additional Resources Using: D3A2

Search String = green energy
wind power
wind turbines
human impact on environment
environmental management



The D3A2 helps educators analyze data, and then points them to resources such as lesson plans, assessments and activities designed specifically to address the academic need identified by the data. In addition to linking content to data analysis, educators will have general search capabilities to locate education content resources aligned to the Ohio's Academic Content Standards. Examples of the state resources queried are:

INFOhio

<http://www.infohio.org/>

Ohio Resource Center

<http://ohiorc.org/>

Other Resources

Green Energy Ohio

<http://www.eere.energy.gov/>

U.S. Department of Energy

<http://www1.eere.energy.gov/windandhydro/>

Ohio Public Utilities Commission- The Science of Energy

<http://www.puco.ohio.gov/emplibrary/files/media/Publications/Brochures/The%20Science%20of%20Energy.pdf>

Dr. E's Energy Lab

<http://www.eere.energy.gov/kids/>

PicoTurbine Educational Kits

<http://www.picoturbine.com/>

Texas State Energy Conservation Office: Lesson Plans for Teachers

<http://www.infinitepower.org/lessonplans.htm>

Wind Learning Center at the Franklin Institute Science Museum

<http://sln.fi.edu/tfi/units/energy/wind.html>

American Wind Energy

<http://www.awea.org/default.htm>