SYNOPSIS:

Wind power is the fastest growing renewable energy source in the United States. With new advances in technology, wind turbines are becoming more efficient as a result of lightweight components that are durable and more reliable. Parts are becoming more affordable, operation costs are dwindling, and general maintenance requirements are minimal. Wind power is a very clean energy alternative, producing zero carbon dioxide emissions. But more importantly, wind power is a renewable energy as opposed to the finite amount of natural resources that we currently rely on. This program discusses the evolution of the wind turbine, focusing in on new technology and what we can expect in the future from wind energy production.

CURRICULUM UNITS:

Engineering
Meteorology
Physics

CAREER OPPORTUNITIES:

Engineer
Chemist
Computer Scientist
Electrical Engineer
Mechanical Engineer
Physicist

PROGRAM OVERVIEW:

Wind is created by the uneven heating and cooling of the atmosphere by the sun, the irregularities of the earth's surface, and rotation of the earth. As the sun warms the lands, air above the land is also warmed. The warm air rises and cooler air rushes in to replace it, creating wind. Wind flow patterns are modified by the earth's terrain, bodies of water, and vegetation. We use the wind for many things, such as sailing, flying a kite, and generating electricity. Wind is the fastest growing market for energy production. The Department of Energy is planning on making wind energy twenty percent of all power in the United States by 2030.

ISSUES & CRITICAL THINKING:

1) What unique adaptations for harnessing turbine energy are being explored for coastal cities in the United States? How are energy sources unique to different geographic locations?

2) Trace the original source of energy from wind, moving water, and fossil fuels. What similarities do they share? How is the sun related to each?

3) Create a timeline of the use of wind as an energy source. How have our needs changed, over time, in regard to the work we rely on wind energy to do?

4) Research the energy source used in your local community to power your home. Judge whether wind energy is a viable alternative in your environ ment, and what obstacles your local government may have to address to use a renewable energy source.

GLOSSARY:

Anemometer- An instrument for measuring wind speed.

Coriolis Force- A force that acts upon any moving body in an independently rotating system.

Dynamometer- A device that measures mechanical power, especially one that measures the output or driving torque of a rotating machine.

Electromagnetic Induction- Production of an electric current by changing the magnetic field enclosed in an electrical circuit.

Epoxy- Any of various usually thermosetting resins capable of forming tight cross-linked polymer structures characterized by toughness, strong adhesion, and low shrinkage, used especially in surface coatings and adhesives.

Furling- Turning or angling wind turbines with the purpose of catching or avoiding wind from a particular direction.

Generator- A machine that converts one form of energy into another, especially mechanical energy into electrical energy.

Geostrophic Winds- Wind whose velocity and direction are mathematically defined by the balanced relationship of the pressure gradient force and the Coriolis force; directed parallel to isobars.

Nacelle- Streamlined enclosure or casing that houses the rotor, gearbox, generator, and electrical components of a wind turbine.

Kinetic Energy- The energy possessed by a body because of its motion, equal to one half the mass of the body times the square of its speed.

Rare-earth permanent magnets- Strong, permanent magnets made of alloys of rare earth elements.

Tip speed ratio- Ratio between the rotational speed of the tip of a blade of a wind turbine and the actual velocity of the wind.

Torque- The measured ability of a rotating element of a gear or shaft to overcome turning resistance.

Wind shear- Changes in wind direction and speed between slightly different altitudes.

Yaw drive- A device used to keep the rotor of a wind turbine facing into the wind as it changes direction.

TMW MEDIA GROUP
2321 Abbot Kinney Blvd., Venice, CA 90291
(310) 577-8581 Fax (310) 574-0886
Email: sale@tmwmedia.com
Web: www.tmwmedia.com

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WIND POWER-A RENEWABLE ENERGY SOURCE

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