energy EXCHANGE

A publication of the National Energy Education Development Project NOV–DEC 2002

KEITH ETHERIDGE JOINS NEED TEAM

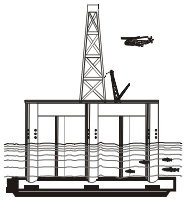
Keith Etheridge of East Lansing, Michigan, will formally join the NEED staff on a half–time basis in January 2003. Keith has been involved with NEED for ten years as a teacher and NEED Leader, conducting workshops and expanding the NEED program throughout Michigan.

Keith assumed a leadership role this summer at the Energy Conference for Educators in Charleston, South Carolina, and was instrumental in developing the new Energy Polls.

Upon his retirement this spring, Keith began working with NEED to develop new programs and partners in Michigan. He has also been involved with evaluating and revising the NEED curriculum as part of the Teacher Advisory Board.

In January, Keith will become the Michigan NEED Coordinator, as well as a national program associate, helping to implement and support programs across the country. Keith can be reached at ketheridge@need.org.

DISCOVERIES FOR EVERYONE



In a "colorful" partnership between the NEED Project, the National Ocean Industries Association, and the U.S. Department of Energy, giant coloring posters for young students are available free of charge to all NEED teachers.

The posters highlight many components of the offshore oil and gas industry. NEED has developed a companion teacher guide to use with the posters to teach the students about offshore resources. To order a class set of posters, email info@need.org or call NEED Headquarters at 1-800-875-5029. The teacher guide is at **www.need.org / energyawarenessmonth**.

NEED ENERGY POLLS

NEED's new Energy Polls are on-line and ready to go. The polls include multiple-choice questions and statements designed to determine what students think about energy and how they feel about assuming leadership roles in the classroom. The Energy Polls are available at four reading levels—Primary, Elementary, Intermediate, and Secondary—and focus on the information presented in NEED's basic energy units, which have been developed to meet the National Science Standards.

Teachers are encouraged to use the Energy Polls as pre- and post-program assessment tools. The on-line poll provides teachers with class-based results, so they can determine baseline knowledge and evaluate the effectiveness of their energy units. For teachers who do not have Internet access, the **Blueprint for Success** (included in NEED's Membership Packet) has the Energy Polls, which can be copied for classroom use.

Inside this issue....

The NEED Project

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The NEED Project is a 501(c)(3) nonprofit education association providing professional development, innovative materials correlated to the National Science Education Content Standards, ongoing support and recognition to educators nationwide.
A list of NEED sponsors is available on our website and in our Annual Report.

CALENDAR OF EVENTS

For more information, email info@need.org or call 1-800-875-5029

November 2002

5 Ohio Energy Project Workshop – Zanesville, OH
6 Ohio Energy Project Workshop – Dayton, OH
8 Ohio Energy Project Workshop – Lima, OH
12 KyNEED Workshop – Whitesburg, KY
13 KyNEED Workshop – Pippa Passes, KY
13 ILEED Workshop – Godfrey, IL
13 Ohio Energy Project Workshop – Akron, OH
14 Ohio Energy Project Workshop – Cleveland, OH
14 KyNEED Workshop – Hazard, KY
15 ILEED Workshop – Mt. Carroll, IL
14-15 NEED Workshop at the Energy in Schools Conference – Albany, NY
15 KyNEED Primary Workshop – Hazard, KY
18 KyNEED Workshop – Glasgow, KY
18 Rhode Island NEED Workshop – Cranston, RI
19 Barnstable County NEED Workshop – Hyannis, MA
19 KyNEED Workshop – Alexandria, KY
20 Ohio Energy Project Workshop – Springfield, OH
20 Illinois Schools Going Solar Workshop – Naperville, IL
21 Ohio Energy Project Workshop – Toledo, OH
21 KyNEED Workshop – Danville, KY
21-23 ILEED/NEED activities at the IL Association of School Boards Convention – Chicago, IL
22 KyNEED Workshop – Greenville, KY

December 2002

3 KyNEED Workshop – Prestonsburg, KY
3 North Carolina NEED Workshop – Harnett County, NC
3 Virginia NEED Workshop – Roanoke, VA
4 KyNEED Workshop – Pikeville, KY
5 KyNEED Workshop – Greenup, KY
4-6 ILEED Teacher Advisory Board Meeting – Chicago, IL
5-6 NEED Short Course at the National Science Teachers Association Regional Convention – Albuquerque, NM. If you are attending, contact Barbara or Robert Lazar at lazar@aps.edu.
5-6 Rhode Island NEED Workshops – Cranston, RI
6 KyNEED Primary Workshop – Erlanger, KY
10 Kentucky EnergySmart Schools Information-Gathering Trip to Raleigh, NC
10 Ohio Energy Project Workshop – Athens, OH
11 Ohio Energy Project Workshop – Ironton, OH
12 KyNEED Workshop – Cynthiana, KY

January 2003

7 New Mexico NEED Workshop – Roswell, NM
TBA Colorado NEED Workshop – Durango/Bayfield, CO
TBA RI EnergySmart Schools Elementary & Middle School Student Conference – Providence, RI

February 2003

25 California NEED Workshop – Carpinteria
27 California NEED Workshop – Carpinteria
TBA Rhode Island EnergySmart Schools/NEED Workshops – Providence, RI

March 2003

27-31 NEED workshops at the National Science Teachers Association National Convention – Philadelphia, PA. If you are attending, contact Mary Spruill at mspruill@need.org.

April 2003

11-13 NEED Teacher Advisory Board Annual Meeting – Middletown, VA
15 Youth Awards Projects due to State Offices or NEED Headquarters
15 Illinois Youth Leadership Award Applications due to NEED Headquarters
27 Youth Awards Projects due to NEED Headquarters from state offices

May 2003

6 ILEED Youth Awards Luncheon
7 KyNEED Youth Awards Luncheon

June 2003

9-14 (Tentative) Nebraska NEED Workshops – Columbus, NE
20-23 National Youth Awards for Energy Achievement – Hyatt Regency Crystal City, VA

July 2003

13-18 ILEED Camp KEEP (Kids for Energy and Environmental Protection) – Cantrall, IL
21-26 ILEED Camp KEEP (Kids for Energy and Environmental Protection) – Algonquin, IL
12-16 NEED National Energy Conference for Educators – Chicago, IL
19-23 NEED National Energy Conference for Educators – Galveston, TX
26-30 NEED National Energy Conference for Educators – Denver, CO

Massachusetts

A new program for Barnstable County, Massachusetts, kicked off with a workshop for over 40 elementary, middle, and high school teachers in Hyannis on November 19, 2002. The new program is a partnership between the Barnstable County Extension Service, the Cape Light Compact, and NEED. The training and materials provided will help teachers meet the goals of the Massachusetts education objectives, and will also tie the teachers to the Rebuild America/EnergySmart Schools program. Other Massachusetts programs are being implemented in partnership with Rebuild America/EnergySmart Schools.

Illinois

Thanks to the support of BP, several schools in the Chicago area are receiving photovoltaic systems for their schools. Marshall Elementary (Joliet), Washington Junior High (Naperville), Hadley Junior High (Glen Ellyn), and Waubonsie High School (Indian Prairie) will have 5-KW photovoltaic panels and monitoring equipment installed on their facilities. NEED's Schools Going Solar curriculum, written with funding from the Illinois Department of Commerce and Community Affairs, has been provided to each of the schools participating in the project, so that the students and teachers can integrate the solar panels on the roof into their activities in the classroom.

Solar Today

The November/December 2002 issue of the American Solar Energy Society's **Solar Today** magazine features a Solar Schools program as part of the Chicago Solar Partnership. The article highlights the involvement of Com Ed, Spire Solar Chicago, the Illinois Department of Commerce and Community Affairs, the U.S. Department of Energy's Chicago Regional Office, and NEED. To subscribe to the magazine, visit **www.ases.org**.

EnergySmart Schools Conferences

NEED recently conducted EnergySmart Schools Conferences in Illinois and North Carolina featuring speakers and sessions designed to help school decision-makers make smarter energy decisions. These conferences, attended by school business officials, school administrators, architects, energy managers, and facilities managers highlighted High Performance School construction, performance contracting, sustainable building designs, and the incorporation of renewables in school construction.

Featured speakers included Jeri Preddy – Wake County Public Schools (Raleigh, NC), David Ritchey – Association of School Business Officials (Reston, VA), Blanche Sheinkopf – EnergySmart Schools (Indian Harbor Beach, FL), Mary McCarron – Ohio Energy Project (Columbus, OH), Ken Redfoot – Corley Redfoot Zack Architects (Chapel Hill, NC), Mike Nicklas – Innovative Designs (Raleigh, NC), Bill Mullin – Carrboro Chapel Hill Schools (Chapel Hill, NC), and Judy Kincaid – Triangle J Council of Governments (Durham, NC). The conferences were sponsored by the Illinois Department of Commerce and Community Affairs, the North Carolina Department of Administration – State Energy Office, and the National Association of State Energy Officials.

Energy Ant and More!

In a continuing partnership with the U.S. Department of Energy, Energy Information Administration, the EIA Kid's Page is upgraded, enhanced, and expanded on a regular basis. Check out the new sections and information on the Kid's Page website at **www.eia.doe.gov/kids**.

Mississippi

The Mississippi Energy Division (Mississippi Development Authority) continues to sponsor NEED workshops throughout Mississippi, and has created a special focus on pre-service teachers. NEED and the MDA believe that reaching new teachers prior to their placement in classes will help them understand energy and prepare them to teach energy effectively in their classrooms.

Kentucky

Thanks to a grant from the Kentucky Division of Energy, KyNEED and American Electric Power are implementing the Kentucky Schools Going Solar program. Photovoltaic systems will be installed on participating schools and used as teaching opportunities in the science and math classes. The Kentucky Division of Energy also sponsors NEED workshops across the state and the Kentucky EnergySmart Schools program in Northern Kentucky. For more information, contact kreagor@need.org or pproctor@need.org.

2003 NEED Energy Conferences for Educators – Mark your Calendars!

The 2003 NEED Energy Conferences for Educators have been scheduled July 12-16 in Chicago, Illinois; July 19-23 in Galveston, Texas; and July 26-30 in Denver, Colorado. The summer conferences focus on providing classroom teachers and nonformal educators with the energy content and teaching methods needed to teach comprehensive energy units using a hands-on format designed to develop students' critical thinking skills. The conferences also prepare educators to deliver NEED workshops and programs in their local areas. The agendas for these conferences will be available soon on **www.need.org**.

Youth Awards 2003

Reminder! Youth Awards Projects Due April 15, 2003.

PRIMARY EXPLORATION: The Invisible Energy in Light

Background: Solar beads are white when there is no ultraviolet radiation.The beads contain special pigments that change color when they absorb ultraviolet (UV) radiation. They are not affected by visible light and do not react to indoor light or when shielded from UV radiation.

Concepts: Energy from the sun comes to the earth as radiant energy or radiation (in rays).

Some radiant energy we can see - it is visible light.

Some radiant energy we can't see - it is invisible light.

Ultraviolet light is invisible. It is the light that causes sunburns - it changes into heat when it touches someone.

We can't see ultraviolet light, but we can tell it's there with solar beads.

Ultraviolet light can be stopped by some materials.

Materials:
5 solar beads* for each student
2 clear ziplock bags with five beads in each
1 piece of string for each student
1 large bowl of water
Clear spray sunscreen, fabric, white and black paper, umbrella

Procedure:

1. Have the students string the beads into bracelets in a room with no sunlight.
2. Have the students hold the bracelets close to an indoor light source and observe the beads.
3. Take the students outside into the sun and have them observe the beads.
4. Move into a shaded area and observe the color and intensity of the beads.
5. Have the students hold the bracelets under an umbrella, the white and black paper, and a piece of fabric. Observe any changes in the beads.
6. Place the ziplock bags with the beads into the sun. Observe the beads. Spray one bag with sunscreen. Observe the bags. Note any difference.
7. Place the bowl of water in the sun. Place the beads from one of the bags in the water. Observe the beads.

Data: Have the students keep science journals of their explorations and observations.

Questions:

1. How can you tell there is energy in the light from the sun?
2. Is all light the same?
3. Where do you find ultraviolet light?
4. What materials can stop ultraviolet light?
5. What things can you do to keep from getting sunburned?
6. If you put on sunscreen and stayed in the water all day at the pool, do you think you could still get a sunburn?

** A package of 250 UV detecting beads from Educational Innovations is $6.95 (www.teachersource.com or 1-888-912-7474).*

ELEMENTARY ARTICLE: Will Your First Car Be An HEV?

Today, most people in the United States drive cars that run on gasoline. By the time you're ready to buy your first car, you will have lots of choices. You will be able to choose from cars that run on electricity, natural gas, ethanol, propane, or a mixture of fuels.

Gasoline-powered cars can produce harmful emissions. Many areas of the country must find ways to improve their air quality. One way is to put fewer or cleaner cars on the road. Car makers are working on several kinds of cars that run on clean-burning fuels or go farther on a gallon of gasoline.

The Honda Insight hybrid is a sporty two-seater that gets more than 60 miles per gallon.

The Hybrid Electric Vehicle (HEV)

One of the best kind of new cars is already being manufactured. It is the **hybrid electric vehicle**, or **HEV** *(hybrid means combination or mixture)*. HEVs have a gasoline engine and an electric motor with a battery. HEVs can run on the electric motor for short trips, using the gasoline engine for longer trips and higher speeds. Some HEVs can go twice as far as a regular car on the same amount of fuel. And they have the same power and performance.

When you drive an HEV, it seems the same as driving a regular car—except that there is no noise when the electric motor is running the car. When you stop at a red light, for example, the gasoline engine shuts off. The car is totally quiet. When the light turns green and you step on the accelerator, the electric motor starts the car moving. The gasoline engine kicks in as you need more power and speed.

The battery that powers the electric motor doesn't have to be recharged. The engine recharges the batteries whenever they are low. The braking system captures excess energy when the driver uses the brakes. This energy is also used to recharge the batteries.

Environmental Impact

HEVs may be the best kind of new car for the next 10 to 20 years, especially for individuals. They provide the same performance as regular cars, and they are better for the environment, reducing air pollutants by up to one-half.

The Honda Civic is available now at local car dealerships as a hybrid electric vehicle.

Hydrids Today and Tomorrow

There are several HEVs on the market today. The Honda Insight is a two-seater that gets 60 mpg and can go 700 miles on a tank of gasoline. Honda is also producing a Civic hybrid that gets more than 50 mpg. The Toyota Prius is a five-seat sedan that gets over 50 mpg and can go 500 miles before refilling.

By 2004, there will be at least seven hybrid models for sale. Ford will offer a hybrid SUV—the Escape HEV—and Chrysler, and Toyota also have hybrid SUVs in the works. There will also be Dodge Ram and GM hybrid trucks. In the long term, Toyota plans to offer hybrids in most of its models.

INTERMEDIATE ACTIVITY: Crunch the Numbers––Energy in the U.S.

UNITED STATES OVERVIEW

World Population: 6.1 billion people
U.S. Population: 281 million people
People per Vehicle (U.S.): 1.3

ENERGY OVERVIEW—COAL

World Coal Reserves: 1,083 billion short tons
U.S. Coal Reserves: 274 billion short tons
U.S. Coal Production: 1,121 million short tons (Mmst)
U.S. Coal Consumption: 1,060 Mmst
U.S. Coal Exports: 49 Mmst

ENERGY OVERVIEW—NATURAL GAS

World Natural Gas Reserves: 5,450 trillion cubic feet (Tcf)
U.S. Natural Gas Reserves: 177.4 Tcf
U.S. Natural Gas Production: 19.5 Tcf
U.S. Natural Gas Consumption: 22.4 Tcf
U.S. Natural Gas Imports (net): 3.65 Tcf

ENERGY OVERVIEW—PETROLEUM & CRUDE OIL

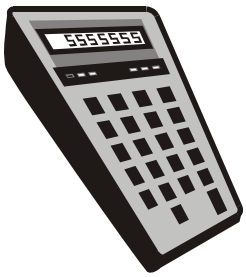
World Crude Oil Reserves: 1004.1 billion barrels
U.S. Crude Oil Reserves: 22.0 billion barrels
U.S. Crude Oil Production: 5.8 million barrels/day
U.S. Petroleum Consumption: 19.6 million bbl/day
U.S. Petroleum Imports (net): 10.9 million bbl/day
U.S. Petroleum Stocks: 1.57 billion bbl

ENERGY OVERVIEW—ELECTRICITY

U.S. Utility Generation: 2,630 billion kilowatt-hours (bkWh)
U.S. Non-utility Generation: 1,089 bkWh
U.S. Generation by Fuel: Coal 51%, Uranium 21%, Natural Gas 17%, Hydropower 6%, Petroleum 3%, Other 2%

ENERGY OVERVIEW—CONSUMPTION

World Energy Consumption: 397 quadrillion Btu (quad) *(1 Btu is about the amount of energy in one wooden match.)*
U.S. Energy Consumption: 97.3 quad
Consumption by Sector: Industrial (34%), Transportation (27%), Residential (21%), Commercial (18%)
Consumption by Fuel: Petroleum (39%), Natural Gas (24%), Coal (23%), Uranium (8), Renewables (6%)



CRUNCH THE NUMBERS—QUESTIONS TO ANSWER and GRAPHS TO MAKE

1. **What percentage of the world's population lives in the United States?**
2. **How many passenger vehicles are there in the U.S.?**
3. **What percentage of world oil reserves does the U.S. have?**
4. **If the U.S. continues to produce 5.8 million bbl/day of oil, how long will U.S. oil reserves last?**
5. **What percentage of U.S. petroleum consumption is supplied by imports?**
6. **If all production and imports stopped, how long would U.S. petroleum stocks last?**
7. **What percentage of world natural gas reserves does the U.S. have?**
8. **What percentage of U.S. natural gas consumption is supplied by imports?**
9. **If the U.S. continues to produce 19.5 Tcf of natural gas a year, how long will U.S. reserves last?**
10. **What percentage of world coal reserves does the U.S. have?**
11. **If the U.S. continues to produce 1,121 Mmst of coal a year, how long will U.S. reserves last?**
12. **What percentage of U.S. coal is exported to other countries?**
13. **What is the total electricity generation in the U.S.? What percentage is generated by utilities?**
14. **Make a bar graph of the fuels used to generate electricity.**
15. **What percentage of world energy does the U.S. consume each year?**
16. **How does U.S. energy consumption compare to U.S. population?**
17. **Make a pie chart of U.S. energy consumption by sector of the economy.**
18. **Make a pie chart of U.S. energy consumption by fuel.**

The U.S. Department of Energy—Energy Information Administration has profiles for most countries with the above energy information at ***www.eia.doe.gov/emeu/cabs***

SECONDARY ARTICLE: The Science Behind Glow-in-the-Dark Toys

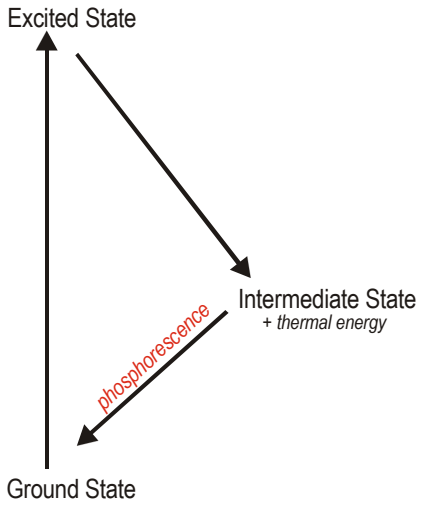
You see them everywhere—glow-in-the-dark toys, decorations, even clothes. You probably know that they work by absorbing light and emitting it later. But what makes them different from other things that absorb light?

All glow-in-the-dark materials contain phosphors. A **phosphor** is a substance that radiates visible light after being energized. The two places where we usually see phosphors are in a television screen or computer monitor and in fluorescent light bulbs. In a TV screen, an electron beam strikes the phosphor to energize it. A color television screen actually contains thousands of tiny elements with phosphors that emit three different colors—red, green, and blue. In a fluorescent light, ultraviolet light energizes a mixture of phosphors that together create light that appears white to us.

Phosphors have three separate characteristics: the type of energy required to energize them, the color of the visible light they produce, and their **persistence**—the length of time they glow after being energized. A glow-in-the-dark product must have a phosphor that is energized by normal light and has a long persistence. Two phosphors that have these characteristic are zinc sulfide and strontium aluminate, which is the newer phosphor with a very long persistence.

Glow-in-the-dark objects are **photoluminescent**—they are energized by light. Many materials are photoluminescent, but not all glow for a long period. Fluorescent materials glow as long as they are being energized, but stop glowing immediately when the energizing light is removed. **Phosphorescent** materials continue to glow after the energizing light is removed.

Substances that phosphoresce have electrons that are easily excited to higher energy levels when they absorb light energy. In phosphorescent materials—such as glow-in-the-dark objects—the excited electrons drop to a lower, but still excited intermediate level and stay there for a period of time before returning to their ground state *(original energy level)* and emitting the excess energy as visible light.



The return of the electrons to their ground state is temperature-dependent. A small amount of thermal energy *(heat)* is required to dislodge the electrons from the intermediate energy level and send them to their ground state. If the phosphorescent material is very cold—in liquid nitrogen, for example—the electrons cannot return to their ground state and the material will not glow.

Glow-in-the-dark objects are not excited only by visible light. Ultraviolet light, which is invisible to the human eye, is also within the range of wavelengths of light that is absorbed by the electrons of phosphors.

EXPLORE: Design and conduct experiments with a glow-in-the-dark object to answer the following questions:

1. Does the intensity of the light emitted by a glow-in-the-dark object depend on the intensity of the absorbed light?
2. Does the color of the light emitted by a glow-in-the-dark object depend on the color of the absorbed light?
3. Does the length of exposure to light have an effect on the length of time a glow-in-the-dark object emits light?
4. Which kind of light (incandescent, fluorescent, infrared, ultraviolet or black light) produces the highest intensity of emitted light from a glow-in-the-dark object?
5. Does the kind of light affect the persistence of the emitted light from a glow-in-the-dark object?
6. What effect does temperature have on the intensity and persistence of the emitted light (try using dry ice)?

*(For a more in-depth exploration of the wave-particle nature of light and phosphorescence, see NSTA's April 2002 issue of **The Science Teacher**.)*

Short Circuits

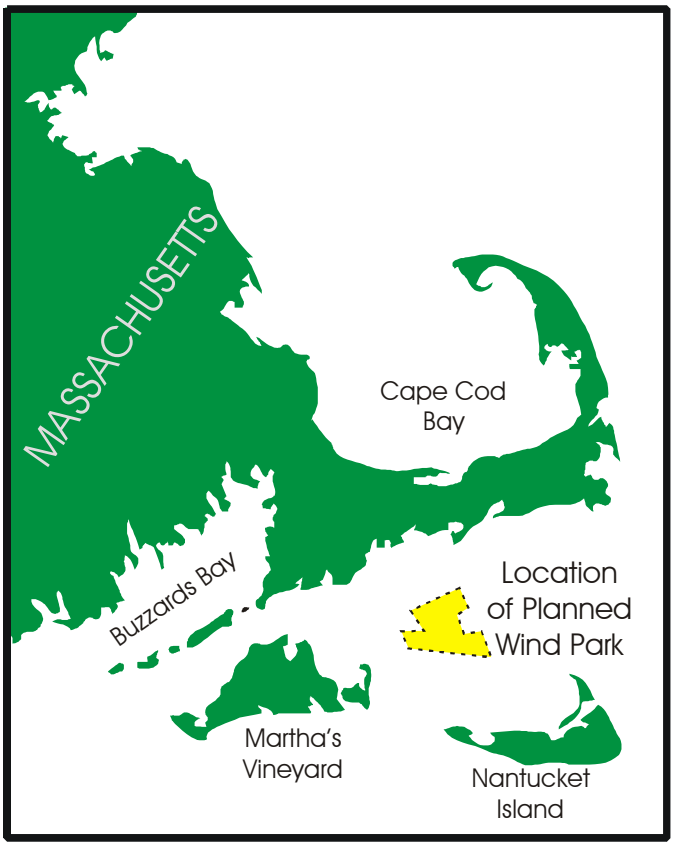
Cape Cod Wind Project

The first offshore wind park in the United States is planned for Nantucket Sound, five miles off the coast of Cape Cod, Massachusetts, in an area with optimal wind speed and direction. The wind park will consist of 170 wind turbines (each 260 feet tall with 164 foot blades) spread over a 25 square mile area of the sound (see the map at left). When the wind park is completed in 2005, the project will generate enough electricity to power more than a half million homes.

The wind park will be developed on Horseshoe Shoal, a shallow area in the sound that is almost above sea level at low tide, making construction a relatively simple process that will not interfere with boat traffic. The turbines will be spaced about one-third of a mile apart and connected by undersea cables.

Not everyone in the area is excited about the project, however. The area is a tourist destination and many people are upset about the impact of building large wind towers in pristine waters that are used by pleasure boaters and commercial fishermen. The developers insist the towers will be nearly invisible from shore, but others believe they will be visible and offensive, especially at night with hundreds of navigation lights.

What do you think about the Cape Cod Wind Project? To learn more about the pros and cons of this renewable energy project, you can go to **www.capewind.org** and **www.saveoursound.org**.



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