



Learning  
about  
Energy  
with  
Field Trips

[EnergyTeachers.org](http://EnergyTeachers.org)



Learning about Energy  
with  
Field Trips

by  
Shawn Reeves

Energy Teachers.org  
West Newton, MA

With funding from the  
Massachusetts Technology Collaborative,  
Renewable Energy Trust



# Learning about Energy with Field Trips

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West Newton, MA

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Bromfield High School students visiting PineTree Power

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# Introduction

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We publish this guide to encourage educators to expose their students to the science, technology, economics, and social studies of energy. Not only is it important for citizens and the future workforce to understand the concepts of clean energy, renewable resources, and resource economics, it is important to allow students to study what interests them. Our research has found that more and more students want to learn modern topics such as wind energy, where their waste goes, how their lights are powered, and greenhouse gas pollution.

Presented here are 27 sites and events in or near Massachusetts that provide students with meaningful experiences and expose them to innovative and/or historical examples of energy production and use. Our attention is mainly drawn to examples of renewable energy production, efficient or conservative use of energy, and other places where energy-science serves society's needs with environmental awareness and innovation.

## EnergyTeachers.org

In February 2004, high school physics teacher Shawn Reeves started EnergyTeachers.org as a personal project, publishing a web site and a newsletter, collecting and disseminating ideas for teaching about energy production and use. By November of that year, Stephen Cremer and Beth Bounds joined Shawn to form a not-for-profit corporation in Boston, MA.

Since those beginnings, we have visited numerous schools, conferences, educational fairs, field trips, and planning meetings, listening to educators express the joys and frustrations of teaching science, engineering, social studies, and other subjects. We've watched students' interest grow

in solar cookers, wind-turbine siting, residential energy efficiency, and related topics.

At the same time, more and more teachers have said that it is increasingly difficult to introduce such modern topics in the face of standardized curriculum and to take the time to plan and execute field trips. We hope this guide makes it easier.



National Park Service ranger Dawn Tesorero explaining Spectacle Island's history and its renewable energy demonstrator.

## How to use this guide

This guide lists several sites you can tour to learn more about energy and the ways people are making our energy production and use sustainable. There are power plants, efficient buildings, historical sites, parks, educational centers, museums, and more. We also note programs that can visit your classroom, and we list some that are annual

events.

Sites in this guide have several interesting features, as listed in the index on page three. Use the index to find sites with features that interest you.

For each site we list specific instructions, hours, contacts, photos, and/or other information. Some sites have separate contact information for the office ("Location") and for people who can help you arrange a tour ("Contact"). The address under "Location" may be an office that isn't necessarily also the address of the object of interest. Latitude and longitude of the place of interest are given so you can preview significant points using online photos or printed maps. The information herein is meant to save you time, but keep in mind that some contact information and even the names of companies are ephemeral. You may find more up-to-date information on our web page: <http://energyteachers.org/fieldtripguide.php>

The web page allows you to list sites by distance from any point, or to list sites with certain features. When an educator sends us a note or a photo for a specific site, we will add it to the record's online page. The web site also lists many more sites not in this guide.

You can discuss field trips and other ideas about curriculum on our online bulletin board. Comments on this book should be posted there:

<http://energyteachers.org/ETOForum/>

<http://energyteachers.org/ETOForum/viewforum.php?f=7>

Please also check our home page for more events, books, equipment, announcements, and ideas.

<http://energyteachers.org>

Educators are permitted to reprint or photocopy pages from this book for educational purposes only.

## Support & acknowledgements

This guide is funded by the Massachusetts Technology Trust (MTC), managers of the Renewable Energy Trust. We encourage you to explore MTC's guide to teaching about renewable energy and global warming. Teachers can find information topics and activities and how they relate to Massachusetts curriculum frameworks:

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

<http://www.masstech.org/cleanenergy/curriculum/about.htm>

EnergyTeachers.org is a nonprofit organization, IRS 501(c)(3), and we count on public grants and private donations. We gratefully acknowledge all our supporters, including the many educators who have shared their best ideas and information. Credit, for information about specific sites, is given to sources on the site's page.

Generally helpful comments have been submitted by Russ Anderson, Marybeth Campbell, Bob Cannon, Janna Cohen-Rosenthal, Matt Dawson, Jeff Dore, Al Errede, Mary Essary, John Francis, Gary Herl, Ben Hirsch, Larry Labelle, John LeClerc, Chris Mason, Don McCasland, Mary McLaughlin, Gary Menin, Arthur Mittler, Robert Phinney, Ray Rousseau, Niki Russell, Andrew Stern, and Jeff Williams.

Several organizations, companies, and government agencies deserve special recognition for creating an atmosphere in which such positive educational experiences thrive: American Associa-

tion of Physics Teachers, Cape & Islands Self Reliance, the Center for Ecological Technology, Fat Spaniel Technologies, Girl Scouts, Heliotronics, Massachusetts Association of Science Teachers, Massachusetts Audubon Society, Massachusetts Environmental Education Society, Massachusetts Technology Education/Engineering Collaborative, Museum Institute for Teaching Science, Museum of Science, National Park Service, National Renewable Energy Lab, Northeast Sustainable Energy Association, Solar Now, and Waquoit Bay National Estuarine Research Reserve.

This book was printed at Hatfield Printing and Publishing of Hatfield, Massachusetts. This worker-owned print-shop hosts a photovoltaic array with a capacity of 18 kW.



Display at Broadmoor Wildlife Sanctuary explaining layers of insulation

# Sites

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## Apeiron Institute

### Features

Efficiency Measures  
Solar Power  
Demonstration Home  
Solar Thermal  
Multipurpose Educational Site

### Location

451 Hammet Road  
Coventry, RI 02816  
41.717° North, 71.665° West  
401-397-3430

### Contact

401-228-7930  
info@apeiron.org

### Description

Half-day and full-day programs may tour this environmental housing model showcasing over fifty ecologically friendly systems, technologies and products:

- Energy-efficient design that uses 70 percent less energy than traditional homes
- Solar electricity and hot water
- Natural materials building methods
- Composting toilet and constructed wetlands waste treatment systems
- Recycled materials
- Solar greenhouse
- Organic gardens
- Two miles of nature trails
- Edible landscapes
- Nature hikes, picnics and other outdoor games and activities
- Campfires, complete with s'mores

Field trips to the Apeiron Institute can accommodate a typical class size of thirty students. Large groups can also be accommodated.

The Apeiron Institute also offers school-programs; either a field trip or an in-school presentation can include programs such as:

(Please ask about current offerings. They are growing and developing, just like kids do!)

Using It and Losing It Where Does Our Energy Come From?

Here Comes the Sun and How Do We Trap its Energy? This is not Barbie's Plastic Dream House Environmental Building Technologies and Choices.

Say Watt! Saving Energy and Money at Home and in School.

Tracking the Trail of Trash--Reduce, Re-use, and Recycle.

Clean Your Room! Another way of looking at it besides your parents' way.

What's for Dinner? Delicious & Healthful Food Choices.

You are What You Grow? Organic Gardening and Why it is Cruciferously Crucial.

### Costs

The cost is roughly \$150-400 depending on length of program and size of group.

### Web Sites

<http://www.apeiron.org/fieldtrips.htm>

<http://www.apeiron.org>

<http://www.apeiron.org/directions.htm>

# Audubon Society of Rhode Island Environmental Education Center

## Features

Educational Exhibit  
Solar Power

water; ecology; natural, local resources; marine science; and the seasons.

The site is powered by 8 kW of Kyocera modules.

## Location

1401 Hope Street  
Bristol, RI 02809  
41.710° North, 71.283° West  
401-245-7500  
401-245-9339 (fax)

## Costs

Group fees from \$94 up, depending on size.

## Appropriate ages

The center offers programs from pre-kindergarten to 12th grade.

## Contact

[eec@asri.org](mailto:eec@asri.org)

## Schedule

The center is open all year; booking for the first three seasons of the year begins in November, Fall visits are booked in the Spring/Summer.

## Description

The center offers a "Fun in the Sun" activity that complements and includes the interactive exhibit about solar energy. Students grades 4-6 get their hands on equipment that lets them explore energy sources, the difference between renewable and non-renewable energy, and photovoltaic cells. The center has many educational programs about wildlife;

## Web Sites

<http://www.asrieec.org/>  
<http://www.asrieec.org/school-scout.htm>

# Charlemont MA Waste Water Treatment Plant

## Feature

Solar Power

electricity from the system to help purify water without creating more pollution.

## Location

20 Factory Road  
Charlemont, MA 01339  
42.627° North, 72.872° West  
413-339-5767

## Schedule

Anytime, but call first

## Contact

**Dawn Peters**  
413-339-5767

## Web Sites

[http://www.pvsquared.coop/gallery\\_pages/PV\\_Systems/gallery\\_page\\_1.htm](http://www.pvsquared.coop/gallery_pages/PV_Systems/gallery_page_1.htm)  
<http://www.renewableenergyaccess.com/rea/news/story?id=37056>

## Description

This beautiful project consists of a 14.5 kW photovoltaic system on 8 poles, connected to the grid through three Fronius 4500 inverters. Each poles supports 12 Isofoton-165 modules.

The Charlemont Sewer District received a grant for approximately half the cost of installation from the Massachusetts Technology Collaborative. The District uses

# Blue Hill Observatory and Science Center

## Features

Educational Exhibit  
History  
Wind Measurement

## Location

P.O. Box 500  
East Milton, MA 02186  
42.212° North, 71.114° West  
617-696-0389

## Contact

**Don McCasland or Charles Orloff**  
617-696-0562  
dmccasland@bluehill.org

## Description

Group activities include Weather Watching at Great Blue Hill, Kite-Making Workshops, Windy Weather, Guided Hikes, Sky Art and Photography, Weather Forecasting, Balloon Launch, Observatory Exploration, The Math of Meteorology, and custom weather programs.

The Observatory also hosts a Women In Natural Sciences (WINS) program, wherein adolescent females gain confidence while studying meteorology, astronomy, geology and oceanography.

Visitors park at the bottom of Blue Hill, in the parking lot of the Trailside Museum (also worth a visit) at 1904 Canton Avenue, and hike up a scenic trail, about one mile. Groups can also arrange to drive to the observatory.



## Schedule

Observatory open all year.  
Nature Center: Wednesday through Sunday, and Monday holidays, 10 a.m. to 5 p.m.  
Trails: Open every day, dawn to dusk.

## Web Sites

<http://www.bluehill.org>  
<http://www.bluehill.org/programs.html>  
[http://www.massaudubon.org/Nature\\_Connection/Sanctuaries/Blue\\_Hills/index.php](http://www.massaudubon.org/Nature_Connection/Sanctuaries/Blue_Hills/index.php)



# Broadmoor Wildlife Sanctuary

## Features

Solar Power  
Efficiency Measures  
Educational Exhibit  
Multipurpose Educational Site  
Special Architecture  
Solar Thermal  
Daylighting

## Location

280 Eliot Street  
Natick, MA 01760  
42.256° North, 71.338° West  
508-655-2296

## Contact

**Education Coordinator**  
508-655-2296 x7304  
broadmoorschool@massaudubon.org



## Description

This Massachusetts Audubon sanctuary makes a great destination with several interesting opportunities. The visitors center is heated and powered by the sun, and everyone enjoys visiting the composting toilet, which can be seen from function room on the lower level.

Visitors can walk into the sun-space that heats large tubes of water. A fan directs heated air into a rock bed under the building, keeping the center warm.

You can view detailed data acquired from the photovoltaic panels on MTC's Soltrex web site.



School programs introduce students to the natural environment at the sanctuary, covering 624 acres.

## Costs

Two- hour field trip lessons \$67 (2007-08 rates) per group including one chaperone. Extra adults pay the \$4 fee (2006 rate).

## Appropriate ages

Junior Program (1.5 hrs) for pre-kindergarten through 1st grade. Standard (2 hrs) and Extended Programs for grades 2 and up. Groups of 10 students or less are best at any age.

Colleges or non-school groups (scouts, garden clubs, etc), please contact the Public Program Education Coordinator, 508-655-2296 x7303, broadmoorprograms@massaudubon.org.

## Schedule

Contact Broadmoor educators at least one month in advance. It is best to plan Fall and Winter trips in the summer, and Spring programs in the early winter. The solar building is best appreciated during the winter when outside temperatures are low.

## Web Sites

<http://soltrex.masstech.org/systems.cfm?systemid=S00000000229>

[http://www.massaudubon.org/Nature\\_Connection/Sanctuaries/Broadmoor/index.php](http://www.massaudubon.org/Nature_Connection/Sanctuaries/Broadmoor/index.php)

[http://www.massaudubon.org/Nature\\_Connection/Sanctuaries/Broadmoor/groups.php](http://www.massaudubon.org/Nature_Connection/Sanctuaries/Broadmoor/groups.php)

# Boston Harbor Islands National Park Area

## Features

Educational Exhibit  
History  
Solar Power  
Electric Vehicles

## Location

408 Atlantic Court, Suite 228  
Boston, MA 02110  
42.354° North, 71.048° West  
617-223-8666  
617-223-8671 (fax)

## Contact

**Ranger Dawn Tesorero**  
Dawn\_Tesorero@nps.gov

## Description

This multi-island getaway features composting toilets, electric vehicles that use power from photovoltaic panels, and great views of Deer Island, HullWind, Boston, and the airport.

Spectacle Island, formerly a landfill for Boston, 105 acres in all, features a marina, visitor center, cafe, two sandy beaches, and five miles of walking trails that lead to the crest of a 157 foot-high hill, offering panoramic views of the harbor and the city. Supervised swimming is offered daily. The photovoltaic panels on the visitor center charge batteries that run the fleet of electric vehicles on the island and provide electricity for operations across the island. The 8 kW array was installed on the roof by Lighthouse Electrical Contractors. The 32 modules,



manufactured by RWE Schott Solar, charge a bank of batteries. Power from the system charges two electric trucks and a passenger trolley.

When you crest the saddle at Spectacle Island, you see the impressive Deer Island waste water treatment plant, with its telltale anaerobic digestors.



Latitude and longitude are for the mainland office of the National Park Service, right next to the pier from which group tours often embark.

Your school may qualify for funds available to offset the cost of transportation and substitute teachers when you

visit the islands. Contact Kelly Fellner by e-mail, [kelly\\_fellner@nps.gov](mailto:kelly_fellner@nps.gov), or by fax.

## Schedule

Park ferries run from the mainland, May to October. Spectacle Island is open from dawn to dusk, June 24 to Labor Day.

## Web Sites

<http://www.nps.gov/boha/>  
<http://www.bostonislands.org/>  
[http://www.bostonislands.org/manage/manage\\_news\\_sresd2.html](http://www.bostonislands.org/manage/manage_news_sresd2.html)  
[http://www.bostonislands.com/learn/learn\\_teach\\_curriculum.html](http://www.bostonislands.com/learn/learn_teach_curriculum.html)

## Contributors

**Dawn Tesorero**



# Chewonki Foundation

## Feature

Multipurpose Educational Site

## Location

485 Chewonki Neck Road  
Wiscasset, ME 04578  
43.944° North, 69.716° West  
207-882-7323  
207-882-4074 (fax)

## Description

Chewonki offers a wide set of programs based on outdoor education, team-building, and principles of sustainability. Schools visit this beautiful setting in the center of Maine's coast for day, overnight, and longer trips. One program of special interest is a week-long course on sailing

and renewable energy, where students build devices using sunshine to make electricity and cook food, then learn about wind as they sail for three days on a 10 m sailboat. Another is "Renewable Energy for High School Students."

The center also often hosts meetings and workshops for teachers or consumers about energy and climate change.

## Web Sites

<http://www.chewonki.org/>  
[http://www.chewonki.org/pathways/pathways\\_renewableenrg\\_sail.asp](http://www.chewonki.org/pathways/pathways_renewableenrg_sail.asp)

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# Genzyme Center

## Features

Commercial Space  
Efficiency Measures  
Special Architecture  
Daylighting  
Water conservation  
Solar Power  
Transportation Alternatives

## Location

500 Kendall Street  
Cambridge, MA 02142  
42.364° North, 71.082° West  
617-768-9827 (fax)

## Contact

**Genzyme Center Tours**  
617-768-9303  
[genzymecentertours@genzyme.com](mailto:genzymecentertours@genzyme.com)

## Description

The center was built on a brownfield. Windows in the double-glass façade are operable for the comfort of the workers. The energy efficient glass allows them to use 41% less energy than a comparable building. Heliostatic panels on the roof, fixed mirrors, louvered sunshades and reflective blinds and ceiling panels and glass office walls provide natural, diffused light. All of the



power is green, which used to be a premium of 20% but has become a savings of 30% due to an increase in the price of natural gas.

Waterless urinals and dual flush toilets allow for a 30% reduction in water use as established in the building code. The vegetative roof prevents storm water runoff. It also prevents heat from building up on the roof.

Transportation alternatives include indoor bike spaces, showers and lockers, a guaranteed ride home program, employee shuttles between sites and ZipCar service.

## Web Sites

[http://www.genzyme.com/genzctr/genzctr\\_home.asp](http://www.genzyme.com/genzctr/genzctr_home.asp)  
<http://www.genzyme.com/genzctr/tour/genzyme.html>

# Deer Island Treatment Plant

## Features

Anaerobic Digester  
Combined Heat and Power  
Hydropower

## Location

190 Tafts Ave.  
Winthrop, MA 02152  
42.347° North, 70.956° West

## Contact

**Cindy Parks, DI Tour Coordinator**  
617-660-7607  
cindy.parks@mwra.state.ma.us



## Description

This plant uses anaerobic digestion to process waste from the Boston area. The large digester tanks are visible from the harbor and from ferries including the ferry to Hull. A hydro turbine, impelled by treated wastewater being discharged into the ocean through the "outfall tunnel," makes 10 percent of the electricity used by the plant. The plant also burns methane, produced by anaerobic bacteria feeding on waste, to power steam turbines that produce 50 percent of the electricity used by the plant; after pushing the turbines, the steam is used to heat the facility.

Individuals may participate in public tours, which are offered the first Tuesday of each month. Individuals must first call 617-660-7607 to reserve a space.

School groups from areas served by the Massachusetts Water Resources Authority may arrange a two hour tour. Tours begin with an interactive presentation, "Down the Drain," then groups tour the pump station, the digestors, and the disinfection and discharge area. Large groups may use their own bus to travel the site or, if they arrived by public transportation or boat, the tour can be a walking tour. Groups less than 14 people can use an MWRA shuttle.

Groups of educators may also arrange a tour, with Professional Development Points available. Educators should call Meg Tabacsko 617-788-1139, meg.tabacsko@mwra.state.ma.us with any questions or to inquire about classroom materials and presentations.

Towns served by MWRA as of 2007: Arlington, Ashland, Bedford, Belmont, Boston, Braintree, Brookline, Burlington, Cambridge, Canton, Chelsea, Chicopee, Clinton, Dedham, Everett, Framingham, Hingham, Holbrook, Lancaster, Leominster, Lexington, Lynn, Lynnfield, Medford, Malden, Marblehead, Marlborough, Melrose, Milton, Nahant, Natick, Needham, Netwon, Northborough, Norwood, Peabody, Quincy, Randolph, Reading, Revere, Saugus, Somerville, Southborough, Stoneham, Stoughton, Swampscott, Wakefield, Walpole, Waltham, Watertown, Wayland, Wellesley, Weston, Westwood, Weymouth, Wilbraham, Wilmington, Winchester, Winthrop, Woburn, Worcester.

## Costs

The tour is free.

## Appropriate ages

Strictly grades 7-12.

## Schedule

As of 2007, tours are conducted Tuesdays and Fridays, April through November.

## Web Sites

<http://www.mwra.state.ma.us/03sewer/html/sewditp.htm>  
<http://www.mwra.state.ma.us/02org/html/sti.htm>

## H.O.B.B.E.S.

### Feature

Multipurpose Educational Site

### Location (Office)

28 Mohawk Drive  
Acton, MA 01720  
978-635-1873

### Contact

**Lisa Wolf**  
978-635-1873  
lwolf@hobbessinc.org



5-8, students build wind turbines and anemometers, then use the boat to study benthic life in Salem Harbor, adjacent to a fossil-fuel power plant. Searching for creatures in fresh muck from the bottom of the harbor is especially exciting and memorable for students.

### Costs

Programs start around \$175 for classroom programs and go up to around \$375 for programs at sea.

### Description

Hands-On Boat-Based Education & Science is a program of science in which students use data from boating expeditions to learn about the environment. Classroom and boat-based programs introduce students to marine ecology and environmental issues specific to Massachusetts' North Shore. In the renewable energy program for grades

### Schedule

Boat-based programs are available from May through October.

### Web Site

<http://www.hobbessinc.org>

## Holyoke Dam and Robert E. Barrett Fishway

### Feature

Hydropower

### Location

North Bridge Street  
Holyoke, MA 01040  
42.211° North, 72.602° West  
413-548-9138

### Contact

**Kim Noyes**  
800-856-2960 x4462  
gnoyes@firstlightpower.com

### Description

This hydropower dam is open for fish viewing from Mother's Day to Father's Day. People walk right above the generators to access the fish viewing windows. The educational focus of the visits is on the anadromous fish. The curriculum guide which has pre and post visit materials is also about fish. Some schools choose to supplement their visit with more information about hydropower and may stop on the walkway as they are above the generators to take a more detailed look. The facility is owned by Holyoke Gas and Electric, and they contract with Northfield Mountain

Recreation & Environmental Center to provide educational services and staffing.

American shad, Atlantic salmon, sea lamprey, striped bass, blueback herring, American eel, and short-nosed sturgeon are hoisted up the face of the dam in water-filled elevators, which carry about 2000 fish per hour. These elevators were upgraded in 2005, operated automatically and manually. Students from Greenfield Community College count fish passing up the elevators.

### Schedule

Open for fish-viewing from Mother's Day to Father's Day, Wednesday through Sunday 9-5.

### Web Sites

<http://www.fws.gov/R5CRc/Fish/visit.html>  
<http://www.neenergyinc.com/stewardship/fish.asp>  
[http://www.hged.com/html/hadley\\_falls\\_fish\\_lift.html](http://www.hged.com/html/hadley_falls_fish_lift.html)

### Contributors

**Beth Bazler**

# George Robert White Environmental Conservation Center at Boston Nature Center

## Features

Educational Exhibit  
Efficiency Measures  
Multipurpose Educational Site  
Solar Power  
Special Architecture  
Geothermal Heat Exchange  
Daylighting

## Location

500 Walk Hill Street  
Mattapan, MA 02126  
42.288° North, 71.101° West  
617-983-8500  
617-983-8012 (fax)

## Description

In Mattapan, this office for the nature center monitors its roof's solar tiles using Heliotronics' software, which allows visitors to review recent and real-time data on the photovoltaic system. Solar Works, Inc. installed Atlantis Energy's SunSlate shingles producing 2.8 kW of AC power for the building.

The building's climate and plumbing is conditioned by a system using a ground-source heat pump and solar hot water; the "ground source" is a well 350 meters deep. Air going in and out of the building in winter goes through an energy recovery ventilator. Natural lighting helps light the offices via clerestory windows and reflectors; luminaires include a sensor to adjust to the level necessary to complement natural



light. Rain sensors can close some windows automatically. Argon-filled double-pane windows include a low-emissivity coating to help insulate.

Carefully cut fiberglass insulation gives the walls an insulation rating of R-21. The roof is made of SIPs, structurally insulated panels that fit tightly together. Local materials were used where possible to reduce energy waste in shipping; stone elements are "Roxbury puddingstone." The bathroom tiles include 55% recycled glass, some from used airplane windows!



Leafy vines shade the facade in the summer but allow sunlight in the winter. Each of the parking lot lights is powered by its own solar module.

The Boston Nature Center features a butterfly garden, a small amphitheater, and nature walks.

If you would like a tour, please call directly to schedule an appointment.

## Schedule

The building is open Monday through Friday 9 to 5; and Saturday, Sunday, and Monday holidays 10 to 4.

## Web Sites

<http://www.massaudubon.org>  
[http://www.massaudubon.org/Nature\\_Connection/Sanctuaries/Boston/green/index.php](http://www.massaudubon.org/Nature_Connection/Sanctuaries/Boston/green/index.php)  
<http://sunviewer.net/portals/BNC/>

## Contributors

**Andrew Birch**



# Gilman Ordway Campus, Woods Hole Research Center

## Features

Solar Power  
Geothermal Heat Exchange  
Efficiency Measures

## Location

149 Woods Hole Road  
Falmouth, MA 02540  
41.549° North, 70.644° West  
508-540-9900  
508-540-9700 (fax)

## Contact

**Allison White**  
508-540-9900

## Description

Special group tours may be arranged by prior arrangement.

The Research Center offers in-depth, explanatory tours, including an introduction to their 30 ton GeoExchange system and a 26.4 kW photovoltaic system. The 88 solar panels were manufactured by ASE Americas, now Schott Solar, a Massachusetts manufacturer.

88 2.3-square-meter panels, rated for 26.4 kW, are expected to produce 15 MWh annually, or 30% to 40% of the building's electricity use.

A 366-meter-deep well houses a heat exchanger, controlled by a heat extractor in the building. Ground water stays 12 degrees C all year. The heat exchanger uses the difference between the liquid pumped through the well and the temperature in the facility to pump hot or cold water through valence units, heating or cooling, individual offices.

The building is very well insulated and efficient, with offset-stud framing, double- or triple-glazed windows with low emissivity, natural daylighting, Icynene spray foam insulation, enthalpy wheels exchanging air without so much heat, fluorescent lights, laptop computers, ink jet printers, operable windows, minimized exterior lighting, and furniture with recycled content.

Woods Hole Research Center hopes to build a 100 kW wind turbine on campus, the summer of 2007.

The demonstrated energy efficiency amazes visitors.

## Web Sites

<http://www.whrc.org/building/design.htm>

<http://whrc.org/>

[http://whrc.org/resources/at\\_the\\_center/tours.htm](http://whrc.org/resources/at_the_center/tours.htm)

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# Monument Valley Regional Middle School

## Features

Solar Power  
Geothermal Heat Exchange  
Efficiency Measures  
Special Architecture

## Location

313 Monument Valley Road  
Great Barrington, MA 01230  
42.245° North, 73.330° West  
413-644-2300

## Contact

**Tom Renton**  
tom.renton@bhrsd.org

## Description

This building is part of an integrated campus for the school district, all built with several sustainable considerations.

352 BP Solar 160 W modules installed by Global Resource Options have a capacity of 56 kW.

Lights near windows are equipped with sensors that dim when adequate daylight comes in the windows.

A geothermal heat pump heats and cools the building.

The link from archive.org shows a video of the multi-school project.

## Web Sites

<http://www.archive.org/details/BHRSDNewBuildings>

[http://www.bhrsd.org/mvrms/mvm\\_index.htm](http://www.bhrsd.org/mvrms/mvm_index.htm)

[http://www.bhrsd.org/mvrms/MVM\\_webfiles/GreenSchoolarticle.htm](http://www.bhrsd.org/mvrms/MVM_webfiles/GreenSchoolarticle.htm)



## Hull Wind

### Feature

Wind Power

### Location

180 Main Street  
Hull, MA 02045  
42.304° North, 70.922° West

### Contact

**John MacLeod**  
781-925-0051  
jmacleod@town.hull.ma.us

### Description

One Vestas V47, "Hull Wind 1" or "HW1," rated to produce up to 660kW, is located at end of cape on which Hull sits, next to Hull High School; also right there is a public beach, a snack bar, and the ferry to Boston. HW1 began generating in December, 2001, producing about 1500MWh per year. The system cost almost \$800,000.

"Hull 2," a Vestas V8, rated to produce up to 1800kW, was built on a landfill in December, 2006. This \$3M turbine produces about 4500 MWh per year.

Both turbines are connected to the grid, supplying power to Hull Light, the municipal power company, which also owns the turbines.

Groups may charter a boat or ride a harbor ferry, run by Harbor Express, Water Transportation Alternatives. Call Harbor Express' main office for reservations: 617-222-6999

### Web Sites

<http://hullwind.org/education.php>

<http://hullwind.org>

<http://harborexpress.com>

### Contributors

**Andrew Stern**

# MassInnovation Center

## Features

Solar Power  
Geothermal Heat Exchange

## Location

1 Oak Hill Road  
Fitchburg, MA 01420  
42.580° North, 71.822° West  
978-683-2837

## Description

The center's web site has a page showing current solar (PV) production, building electricity use and pollution avoided.

The center is spread across two sites: Fitchburg and Lawrence.

North Central Charter Essential School is on the Fitchburg site.

From the web site:

"The Massachusetts Innovation Center in the Cleghorn neighborhood of Fitchburg is a testament to the

MassInnovation philosophy of community revitalization. The mixed-use development houses office space for community organizations and a charter school, and will soon incorporate Anwelt Heritage Apartments - mixed-income rental residences. The project incorporates many sustainable development practices, including a state-of-the-art geothermal heating and cooling system, reuse of original materials, and the largest [when it was built] solar photovoltaic panel system in New England. The buildings date from 1855, when they were constructed as part of the ParkHill Manufacturing complex."

There is a 147 kW photovoltaic system shading walkways and the roof of the 125 year old mill complex.

## Web Site

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

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# John H. Chafee Blackstone River Valley National Heritage Corridor

## Feature

Multipurpose Educational Site

## Appropriate ages

K-adult.

## Location

1 Depot Square  
Woonsocket, RI 02895  
42.003° North, 71.513° West  
401-762-0250

## Schedule

Programs all year, reservations required.

## Contact

**Kevin Klyberg**  
401-762-0440  
Kevin\_Klyberg@nps.gov

## Web Sites

<http://www.nps.gov/blac>  
<http://www.blackstoneeducators.net/destinations.php?id=6>  
<http://www.blackstonevalley.org>  
<http://www.tourblackstone.com>

## Description

This site features a free, one-hour program exploring the uses of water-power from the late 1700s to today in this industrial corridor. A tour along the river can be included.

Handicap accessible, bus parking is available.

Teacher training is available.

# Museum of Science

## Feature

Multipurpose Educational Site

## Location

1 Science Park  
Boston, MA 02114-1099  
42.368° North, 71.071° West  
617-723-2500

## Contact

fieldtrips@mos.org



## Description

Pre-visit planning sessions are available by appointment. Call Science Central at 617-723-2500 or e-mail [fieldtrips@mos.org](mailto:fieldtrips@mos.org) to set an appointment of approximately 2 hours to plan a field trip; parking for teachers in field trip workshops is free. You must call Science Central to reserve the trip itself.

MOS has online resources to help you plan learning experiences that support your curriculum goals and objectives. Use the "field trips" pages on line to plan or use a guide you can request from the museum after your reservation is taken.



You may be able to include a Design Challenge in your visit. Design Challenge programs focus on the engineering design process, where students create prototypes, or test their ideas, to solve a challenge. Two current challenges are energy-related: Building an energy-efficient birdhouse and making a wind-turbine. There

is one challenge offered each day; although teachers may request certain activities in advance, there is no guarantee that the challenge requested will be offered the day of the visit. Plan for 30 minutes for the activity. Reserve through the field trip program.

School groups from Maine and New Hampshire can travel on Amtrak's Discovery Student Group Travel Program. In the fall, group rates are as low as \$10 per student/chaperone.

Scholarships to reduce admission costs are available to qualifying schools; call 617-723-2500.

Two current exhibits on energy and power are "Catch the Wind" (grade 3 to adult) and "Sun Power" (grade 5 to adult), and they are recommended activities for groups on field trips.

The Museum has also developed a cell-phone guided tour of green buildings around Boston and Cambridge. Visitors call to listen to a tour of the green features and information about the designers, builders, and users. Plaques at the building include codes to listen to information about an area.

## Web Sites

<http://www.mos.org/challenges>

<http://mos.org/fieldtrips>

<http://www.amtrakdowneaster.com/discovery.html>

[http://mos.org/educators/field\\_trip\\_resources/plan\\_a\\_field\\_trip](http://mos.org/educators/field_trip_resources/plan_a_field_trip)

<http://mos.org/green>



# North Adams Public Library

## Features

Geothermal Heat Exchange  
Solar Power

## Location

North Adams, MA  
42.698° North, 73.109° West

## Description

The library is heated and cooled by a 60 ton GeoExchange system.

The public can view data from the solar power system online via Soltrex. Installed in December, 2004, 88 Evergreen EC-115 modules have a capacity of 9.7 kW, and they feed four grid tied inverters.

## Web Sites

<http://www.naplibrary.com/>  
<http://www.naplibrary.com/NAPLgreen.htm>  
<http://soltrex.masstech.org/systems.cfm?systemid=S00000000240>

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# Saugus Iron Works National Historical Site

## Features

Multipurpose Educational Site  
History  
Hydropower

## Location

244 Central Street  
Saugus, MA 01906-2107  
42.468° North, 71.009° West  
781-233-0050  
781-231-7345 (fax)

## Contact

**Amy Curry, Park Ranger, Education Specialist**  
781-231-7344  
[amy\\_curry@nps.gov](mailto:amy_curry@nps.gov)

## Description

This park will have been renovated by Fall of 2007. Please call the office phone to check on the status of the site.

National Park Service Rangers will be available to conduct special, curriculum-based programs in area classrooms.

From web site:

"This is the site of the first integrated ironworks in North America, 1646-1668. It includes the reconstructed blast furnace, forge, rolling mill, and a restored seventeenth century house.

"With the archeological site of the seventeenth-century iron-making plant, the museum collection, the seventeenth-century Iron Works House, and the reconstructed iron works complex, Saugus Iron Works National Historic Site illustrates the critical role of iron making to seventeenth-century settlement and its legacy in shaping the early

history of the nation. The site's enclave setting on the Saugus River, featuring an open-air museum with working waterwheels, evokes a unique experience for park visitors.

These resources demonstrate seveneenth-century engineering and design methods, iron-making technology and operations, local and overseas trade, and life and work in the Massachusetts Bay Colony.

"The original manufacturing site served as a training ground for skilled iron workers for what would become America's iron and steel industry. Iron making provided the infrastructure for

the rise of other colonial industries. Called, "the forerunner of America's industrial giants," the site served as a center for technology, innovation and invention. The site interprets early industrial manufacturing, with its enduring social, political and environmental ramifications."

All Malden 5th graders visit the Iron Works about three times per year.

The Park Service ensures that activities are accessible to people with disabilities, offering materials in braille or raised text, large print, and audio description for the visually impaired.

## Schedule

April 1 through October 31, daily, 9:00 a.m. to 5:00p.m.  
November 1- March 31, daily, 9:00 a.m. to 4:00 p.m.  
Closed Thanksgiving, Christmas, and New Year's Day.

## Web Site

<http://www.nps.gov/sair/>





'one' and 'two' are turned off for the day, and much of the presentation is given right under them. The beautiful mountain views and habitat make a good setting to discuss the mitigation of impacts of the power station.

To ensure that the wildlife, especially fauna, are not impacted by human activity, tours are limited to certain dates.

11 turbines, constructed in 1996, produce up to 6 MW. The turbines are interconnected at 69 kV. The turbines require at least 4 m/s wind to start, and produce the maximum power between 13 and 29 m/s winds. Above 29 meters per second, the turbines shut down to protect themselves. The blades are painted black, which keeps them from being colder or hotter than their environment, somewhat preventing icing.



## Searsburg Wind Farm

Feature  
Wind Power

Location  
Sleepy Hollow Road  
Searsburg, VT  
42.860° North, 72.973° West  
802-244-7522

Contact  
**Martha Staskus**  
802-244-7522  
marthas@northeastwind.com

### Description

Green Mountain Power retains Martha Staskus of Vermont Environmental Research Associates to give tours of the site from July 15 to October 15. There are about 10 tour dates during that time, two of which are targeted at schools; once each May there is also a special tour date just for schools. For safety, turbines

### Schedule

July 15 to October 15, prior arrangements required. A special day for school tours occurs near the end of each May.

### Web Sites

<http://www.cetonline.org>  
<http://www.northeastwind.com>  
<http://www.gmpvt.com/>  
<http://www.gmpvt.com/whoware/searsburg.shtml>



## Solar Now

### Features

Solar Power  
Wind Power  
Educational Exhibit

### Location

100 Sohier Road  
Beverly, MA 01915  
42.568° North,  
70.880° West  
978-927-9786  
978-927-9191 (fax)

### Contact

**Nancy Bain**  
978-927-9786  
solarnow@comcast.net



Solar Now also maintains curriculum resources in their office.

Solar Now has also been hosting an annual Renewable Energy Fair each June for three years, with food, exhibits, and live entertainment.

### Costs

Tour: adults \$10, young students \$5

### Appropriate ages

All ages

### Description

For years, students, teachers, scouts, and other groups, as well as the general public have toured GREENERGY PARK, site of a 100 kW PV and a 10 kW wind turbine.

Solar Now, with an office in the adjacent Beverly High School, conducts the hour-long Site Tours on weekdays during the Spring, Summer, and Fall for a nominal fee.

### Schedule

Weekdays during the spring, summer, and fall.

### Web Site

<http://www.solarnow.org>

### Contributors

**Nancy Bain, Fred Hopps**

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## Wheelabrator Millbury Trash to Energy

### Feature

Waste-to-Energy

### Location

331 Southwest Cutoff Road  
Millbury, MA 01527  
42.221° North, 71.767° West

### Description

Two units can incinerate, at 1600 Kelvins, up to 1,500 tons (750 tons per unit average) of waste a day, producing up to 40 MW using steam. The plant can also burn natural gas. The waste that comes out is 5% of the volume of the waste that goes into the plant.

Pollution Controls include a dry scrubber, fabric filters, selective non-catalytic reduction, and carbon injection. Leftover ash is buried at the Shrewsbury Ash Landfill.

There are 36 communities with a contract to deliver waste to the plant: Auburn, Dover, East Brookfield,



Franklin, Grafton, Holden, Holliston, Hopedale, Hopkinton, Maynard, Medfield, Medway, Mendon, Milford, Millbury, Millis, Millville, Natick, Needham, Newton, Northborough, Northbridge, Oxford, Paxton, Princeton, Rutland, Sherborn, Shrewsbury, Southborough, Spencer, Upton, Walpole, Westborough, Weston, Westwood, and Worcester.

### Web Sites

<http://mass.gov/dep/recycle/solid/wheelm.htm>

[http://www.eia.doe.gov/kids/energy\\_fungames/energyant\\_trips/trip\\_resco.html](http://www.eia.doe.gov/kids/energy_fungames/energyant_trips/trip_resco.html)

[http://www.wheelabratortechnologies.com/WTI/env/wheelabrator\\_animation/wheelabrator\\_animation.html](http://www.wheelabratortechnologies.com/WTI/env/wheelabrator_animation/wheelabrator_animation.html)

# Tsongas Industrial History Center

## Features

History  
Multipurpose Educational Site  
Industrial Space  
Hydropower

## Location

115 John Street  
Lowell, MA  
42.648° North, 71.307° West  
978-970-5080  
978-970-5085 (fax)

## Contact

**Sheila Kirschbaum, School Liaison**  
978-970-5000 (reservations)  
Sheila\_Kirschbaum@uml.edu

## Description

The center, operated by a partnership between Lowell National Historical Park and the University of Massachusetts Lowell Graduate School of Education, sits on the site of a complex of mills built the 19th century.

Suffolk Mill, aka Wannalancit Mill, is a working hydro-powered turbine. It features a giant flywheel gathering water power from the Merrimack River. This powerful river powered textile machinery, one of the most technologically advanced industries, in Massachusetts and New Hampshire during the 19th century.

There are several activities for school groups: Historical child labor; mills; immigration; invention; looms; assembly lines; water power; water quality and pollution; and Lowell's canals. All the school programs have been reviewed to ensure relevance to the Commonwealth's Curriculum Frameworks.

Reservations for school programs begin each May for the following school-year. Pre- and post-visit activities are provided. Programs are interdisciplinary, covering issues in social studies, life sciences, engineering and technology, and physical sciences.

The center also offers professional development for educators.

*[The editor of this guide enjoyed the activity, shown at right, where participants build raceways for waterpower and compare work done by different configurations.]*

## Costs

The four-hour Power to Production program, appropriate for groups 20-30, costs \$175.

## Appropriate ages

Grades 3-12, depending on activity. "Power to production" is appropriate for grades 4-12.

## Schedule

Programs offered all school-year.

## Web Sites

<http://www.uml.edu/tsongas/index2.htm>  
<http://www.nps.gov/lowe/forteachers/index.htm>  
[http://www.uml.edu/tsongas/programs/school\\_programs.htm](http://www.uml.edu/tsongas/programs/school_programs.htm)  
<http://www.nps.gov/ert>

## Contributors

**Beverly Perna, Timothy Lavallee**



# Events

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## AltWheels Festival

### Features

Educational Exhibit  
History  
Transportation Alternatives

### Location

City Hall Plaza  
Boston, MA  
42.360° North, 71.059° West

### Contact

**Alison Sander**

### Description

Early each fall, enthusiasts for alternative transportation converge on Boston to celebrate, educate, and demonstrate all types of choices for more sustainable living. For years, visitors to this weekend event have ridden, seen, and



studied alternative fuels, hybrid vehicles, human-powered vehicles, smart urban planning, renewable energy, student-projects, hands-on displays, clean machinery, solar toys, and more. Activities for all ages are planned, as well as sessions for managers of fleets.

AltWheels is usually held on Boston City Hall Plaza.

### Schedule

Occurs for two or three days late each September.

### Web Site

<http://altwheels.org>

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## Junior Solar Sprint

### Features

Educational Competition  
Educational Exhibit  
Transportation Alternatives  
Solar Power

### Location

Springfield, MA

### Contact

**Susan Reyes**  
413-774-6051  
[sreyes@nesea.org](mailto:sreyes@nesea.org)



and organizations related to renewable energy and more sustainable living.

The championship is organized by the Northeast Sustainable Energy Association (NESEA). You can learn about local competitions both from NESEA and from the National Renewable Energy Lab (NREL).

### Description

Every spring, students grades 5-8 race shoebox-size cars powered by a three-watt photovoltaic panel. Teams from Washington DC to Maine compete in local races, then come together for a championship in Springfield, MA. Not only do teams compete for speed, they receive awards for innovation, craftsmanship, and technical merit.

Many races, including the championship, are accompanied by an exhibition of vendors, educators,

### Appropriate ages

Races open to students grades 5-8.

### Web Sites

<http://nesea.org/education/jss/>

[http://www.nrel.gov/education/jss\\_hfc.html](http://www.nrel.gov/education/jss_hfc.html)

# Virtual tours

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## Maine Solar House

### Features

Efficiency Measures  
Demonstration Home  
Solar Power  
Special Architecture  
Solar Thermal

### Location

Kennebunkport, ME  
43.396° North, 70.443° West

### Contact

**Bill Lord**

### Description

Take a virtual tour using several web-based tools generated by Bill Lord, owner. Listen to a podcast, review photovoltaic production and electricity use month by month, learn about the design of this 2900 square foot home.

### Schedule

The house is usually open during the annual National Solar Tour

### Web Sites

<http://www.solarhouse.com>

<http://www.ases.org/tour/>

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## Renewable Energy Field Trips

### Features

Geothermal Heat Exchange  
Hydropower  
Solar Power  
Solar Thermal  
Wind Power

diagrams, videos, and photos to explain how the resource is used. Each page includes references and learning objectives.

### Web Sites

<http://pennstatebehrend.psu.edu/academic/science/degrees/biology/energyfieldtrips/index.htm>

### Description

This is a web-based curriculum created at Pennsylvania State University, Erie, The Behrend College.

Visitors review reasons for renewable energy, then learn about specific sites in Pennsylvania, Ohio, and California. Each page, about a specific resource and a specific site, uses

# References

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## Books and Periodicals

*Look for updates and new books online at EnergyTeachers.org. Recommendations welcome.*

Augustyn, Jim. *The Return of the Solar Cat Book*. Berkeley, CA: Patty Paw Press, 2003.  
Notes: As you might guess, cute, tongue in cheek, but plenty of real talk about applications of solar.  
ISBN: 0-9729949-0-4

Butti, Ken; Perlin, John. *A golden thread : 2500 years of solar architecture and technology*. Palo Alto, CA: Cheshire Books; Van Nostrand Reinhold, 1980.  
Keywords: Solar energy History.; Architecture and solar radiation History.  
Call Number: TJ810 .B88 621.47/09  
ISBN: 04422400580917352076 (Cheshire Books)

Chiras, Daniel D.. *The Solar House*. White River Junction, VT: Chelsea Green Publishing Company, 2002.  
Call Number: 697.78 C44S TH7414.C475 2002  
ISBN: 1931498121

Cole, Joanna; Degen, Bruce. *The magic school bus and the electric field trip*. New York: Scholastic Press, 1997.  
Abstract: Ms. Frizzle takes her class on a field trip through the town's electrical wires so they can learn how electricity is generated and how it is used. Trip through a coal plant, but a page highlights cleaner alternatives.  
Call Number: TK148 .C57 1997 621.3  
ISBN: 05904468270590446835 (pb)

Cole, Joanna; Degen, Bruce. *The magic school bus at the waterworks*. New York: Scholastic Inc., 1986.  
Abstract: When Ms. Frizzle, the strangest teacher in school, takes her class on a field trip to the waterworks, everyone ends up experiencing the water purification system from the inside. Does not explore using energy from falling water, but get students thinking about whence the water comes.  
Call Number: TD487 .C64 1986  
ISBN: 0590403613

Cothran, Helen. *Energy alternatives : opposing viewpoints*. San Diego, CA: Greenhaven Press, 2002. Opposing viewpoints series.  
Call Number: TJ163.2 .E4555 2002 333.79  
ISBN: 0737709049 (pbk. alk. paper) 0737709057 (lib. bdg. alk. paper)

*Energy Education Resources: Kindergarten through 12th Grade*. Washington, DC: Energy Information Administration, National Energy Information Center, US Department of Energy, 2003.  
Abstract: An annotated list of key organizations and resellers in energy education.  
Notes: request one from the EIA ( <http://www.eia.doe.gov> ).

Ewing, Rex A.. *Hydrogen--hot stuff, cool science : journey to a world of hydrogen energy and fuel cells at the Wasserstoff Farm*. Masonville, CO: PixyJack Press, 2004.  
Call Number: TP359.H8 E95 2004  
ISBN: 0965809862

Friedman, Lauri S. ed. *Energy Alternatives*. Farmington Hills, MI: Greenhaven Press, 2006. Series: Writing the Critical Essay, an Opposing Viewpoints Guide.  
Call Number: TJ163.24.E527 2006 333.79

Hagopian, Emily. *Green Dollhouse: Creating a Doll's Eye View of a Healthier World*. Kansas City, MO: Ecotone, LLC, 2005.  
Notes: Ideas produced by entrants to the Green Dollhouse competition, sponsored by Sustainable San Mateo County in 2005.  
Call Number: TT175.3 .G72 2005 745.592/3  
ISBN: 0-9749033-3-7

Huler, Scott. *Defining the wind : the Beaufort scale, and how a nineteenth-century admiral turned science into poetry*. New York: Crown Publishers, 2004.  
Call Number: QC933 .H85 2004 551.51/8  
ISBN: 1400048842 (hardcover)

Levy, Matthys; Panchyk, Richard. *Engineering the city : how infrastructure works : projects and principles for beginners*. Chicago, IL: Chicago Review Press, 2000.

Available at Boston Museum of Science: [http://www.mos.org/learn\\_more/lyman.html](http://www.mos.org/learn_more/lyman.html)

Call Number: TA149 .L49 2000  
624

ISBN: 1556524196 (alk. paper)

Page, Deborah S., Nemzer, Marilyn L. ed. *Energy for keeps : electricity from renewable energy : an illustrated guide for everyone who uses electricity*.

Tiburon, CA: Energy Education Group, 2005.

Call Number: TJ808 .P326 2005  
333.793/2 22

ISBN: 0974476528

Parker, Steve. *Water power*. Milwaukee, WI : Gareth Stevens Pub., 2004.

Call Number: TC147 .P37 2004  
621.2/0422 22

ISBN: 083684033X

Petersen, Christine. *Alternative energy : a true book*. New York, N.Y.: Childrens Press, 2004.

Abstract: Discusses various forms of energy derived from renewable resources, such as wind power, solar power, water power, geothermal energy, and biofuels.

Call Number: TJ808 .P47 2003  
ISBN: 0516228048

*Solar power : a true book*. New York: Children's Press, 2004.

Abstract: Describes how the sun's energy supports all living things on Earth and how it is used as a power resource to create electricity.

Middle school level, large type. Includes references and glossary.

Call Number: TJ810 .P425 2003  
ISBN: 0516228072

*Wind Power: A True Book*. New York: Children's Press, 2004.

Abstract: Describes how wind occurs in nature and how it can be used to produce electricity, both now and in the future.

Large type, glossary, references. For middle school readers, or could be read to elementary schoolers with visual aids.

Call Number: TK1541 .P48 2004  
ISBN: 0516228099

*Solar Today*. Boulder, CO: American Solar Energy Society.  
Bimonthly

Strong, Steven J.. *The solar electric house : a design manual for home-scale photovoltaic power systems*.

Emmaus, PA: Rodale Pres, 1987.

Notes: With William G. Scheller

Call Number: TH7414 .S77 1987  
697.78 19

Williams, Wendy and Robert Whitcomb. *Cape wind : money, celebrity, class, politics, and the battle for our energy future on Nantucket Sound*. New York:

PublicAffairs, 2007.

Call Number: HD9502.5.W554 C37 2007

333.9/20916346 22

ISBN: 9781586483975

Woelfle, Gretchen. *The wind at work : an activity guide to windmills*. Chicago: Chicago Review Press, 1997.

Abstract: An introduction to windmills and their advantages as renewable energy providers, with activities for understanding some of the principles of wind.

\$14.95 at American Wind Power Center, a windmill museum in Lubbock, TX.

Lists windmills you can visit all over US, overseas; careers; glossary.

Call Number: TJ823 .W64 1997  
ISBN: 1556523084



The ubiquitous waterless urinal, staple of green buildings, icon of fascination.

## Useful web links

*Research more links online at [EnergyTeachers.org](http://EnergyTeachers.org).*

### **Massachusetts Technology Collaborative, Renewable Energy Trust**

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

The Massachusetts Technology Collaborative maintains the Renewable Energy Trust, a fund generated by the ratepayers of MA for supporting economic revitalization through the industry of renewable energy.

### **Massachusetts Technology Collaborative, Renewable Energy Trust, K-12 Initiative**

<http://masstech.org/renewableenergy/k-12/k12.htm>

To ensure that renewable energy gets incorporated into the curriculums of Massachusetts schools, the Trust has initiated programs to encourage and make it easy for teachers to teach their students about renewable energy.

### **Northeast Sustainable Energy Association**

<http://nesea.org/>

The Northeast Sustainable Energy Association, NESEA, organizes Building Energy, an annual conference for sustainable-building professionals and consumers; Junior Solar Sprint, a model solar car race for middle-school-age children, Sustainable Green (Yellow) Pages, and more educational and supportive programs promoting sustainable energy and building.

### **Clean Green Power Project**

<http://nesea.org/education/ycleanenergy/>

This NESEA program encourages youth to study renewable energy and visit exemplary sites. A patch for Girl Scouts is available to students who follow a program of research and presentation.

### **Energy Citations Index**

<http://www.osti.gov/energycitations/>

The US Department of Energy, Office of Scientific and Technical Information, hosts a database of tens of thousands of articles about science and technology, many with PDF documents available freely.

### **US EPA's EnviroMapper**

<http://www.epa.gov/enviro/html/em/>

Use this site from the US Environmental Protection Agency, to make maps of any area in the US, showing EPA-related features like toxic releases and air-monitoring sites along with important features like rivers and schools.

### **Green Schools Project--Alliance to Save Energy**

<http://www.ase.org/section/program/greenschl>

The Green Schools Program of the Alliance to Save Energy engages students in creating energy-saving activities in their schools, using hands-on, real-world projects.

### **National Energy Education Project**

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

The NEED program includes innovative curriculum materials, professional development, evaluation tools, and recognition. NEED teaches the scientific concepts of energy and provides objective information about conventional and emerging energy sources— their use and impact on the environment, economy, and society. The program also educates students about energy efficiency and conservation while providing tools to help educators, energy managers, and consumers use energy wisely.

### **Why Field Trips?**

<http://www.mits.org>

Museum Institute for Teaching Science published a guide about the movement in MA to defend the use of field trips as valuable instruction.

### **NREL Photo Database**

<http://www.nrel.gov/data/pix/searchpix.html>

This database lists photos available for non-commercial use from the US DOE National Renewable Energy Laboratory. You and your students may use photos for educational purposes in the classroom. Low-res photos are free, high res photos for posters etc. are \$42.

## Photo Credits

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Broadmoor Wildlife Sanctuary  
page 9

National Park Service  
page 19

Shawn Reeves  
pages 2, 4, 5, 8, 9, 10, 11, 12, 13, 14, 16, 18, 20, 21, 23, 26, 28;  
cover; illustration page 1

Tsongas Industrial History Center  
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# Hints for field trips

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1. Make name-tags for students.
2. If using private vehicles, such as parents' cars, practice due diligence in checking the car itself for safety features, like number of working seat belts.
3. Print maps and other basic information more than a week in advance for parents, administrators, and drivers.
4. Have students take journals with them, and ask them to write something simple on the bus before and after the visit. Let students decide some of the things they'd like to include in the journal. Encourage them to include drawings or to make a scrapbook of brochures and papers from the site.
5. Take photos. Delegate this task.
6. Ask a representative of the site what other schools have done there.
7. Take someone with CPR training.
8. The calmer you want the students to be, the calmer you should be.
9. Be sure to let your administration know exactly who is actually in vehicles just before leaving your school.
10. Find out where students have toured in the past.
11. Give different groups of students different creative responsibilities, such as sending a thank-you letter to the site after the visit, reporting to the school newspaper, reporting to EnergyTeachers.org, printing photos, making a poster for the hallway, making an entry for the yearbook, etc.
12. Make sure the school administration has a mobile phone they can call in case they need to contact a student or a teacher.
13. Encourage everyone to carry a little drinking water, or bring along some small bottles of water.
14. Use EnergyTeachers.org and other networks to find knowledgeable people who can help chaperone.
15. Think carefully about what you expect students to gain from the trip, before deciding to set it in stone.
16. Collect your own hints and notes; share them with other teachers.



A little rain didn't hurt this tour.



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