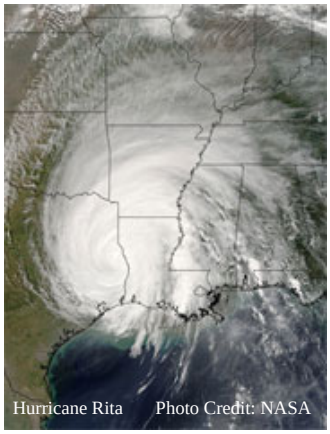
energy EXCHANGE

A publication of the National Energy Education Development Project November 2005

Saving Energy This Winter

Hurricanes Katrina, Rita, and Wilma affected not only the Gulf Coast, but also every home, school and business in America. The impact on energy prices will likely be felt for months to come.



Hurricane Rita Photo Credit: NASA

Thousands of refineries and offshore oil and natural gas platforms were in the paths of the hurricanes. These production facilities are so important to our energy supply that the availability and price of products made from petroleum and natural gas were immediately influenced.

Shortly after the hurricanes passed, President Bush made oil available from the Strategic Petroleum Reserve to refineries that were structurally unaffected by the storms. This action kept the national supply of gasoline, diesel fuel, and other petroleum products stable.

How will the destruction on the Gulf Coast affect the rest of the nation in the long-term? We will all share the impacts of increased insurance premiums, higher gasoline prices, and more expensive goods and services. With the harsher elements of winter starting to sweep across our nation, many people are wondering what impact they will see on their home heating bills.

To alleviate some of the energy stress the hurricanes have put on our nation, President Bush has asked all federal agencies to conserve natural gas, electricity, gasoline, and diesel fuel. By reducing consumption, more energy can be diverted to hurricane relief efforts.

Recommended ways to conserve energy include carpooling, telecommuting, using ENERGY STAR appliances, using public transportation, and auditing operations to discover abuse and implement ways to reduce overall fuel use.

Now is an ideal time to start saving energy at school and home, too. The Department of Energy has launched their "Easy Ways to Save Energy" campaign. Directed at citizens, businesses, and government agencies, this campaign promotes energy conservation and efficiency. An Energy $avers Guide, available at www.energysavers.gov in both Spanish and English, offers many ways for home owners to save energy and money.

One of the major points of the DOE campaign is "Getting Kids Involved." With our motto of "Kids Teaching Kids," NEED's energy management curriculum supports not only the DOE's new campaign, but also the President's directive for all Americans to reduce energy consumption. Do your part to help and join NEED in saving energy this winter!

Inside This Issue

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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.

Energy Exchange is published five times a year by NEED for educators and students, and is available at www.need.org.

NEED welcomes questions, comments, and suggestions. Please contact info@need.org.

Calendar of Events

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

November 2005

1	New York Energy Smart Students Workshop - Niagara-Orleans, NY
1	Biofuels Workshop - Rochester, MI
2	Connecticut Energy Workshop - Niantic, CT
2	Hydrogen Public Forum - Rochester, NY
2-4	NEED Sessions at New Mexico Science Teachers Association – Roswell, NM
3	Biofuels Workshop - Allendale, MI
3-5	Kentucky Science Teachers Association Conference – Lexington, KY
4-5	NEED Project Kick-Off – San Juan, PR
5	BP A+ for Energy/NEED Session at Gold Coast Science Network Conference – Oxnard, CA
5	New York Energy Bike Workshop - Bronx, NY
6-8	NY ESS Sessions at Science Teachers Association of New York State Conference - Ellenville, NY
7	Virginia Association of Independent Schools Conference - Richmond, VA
8	New York Energy Smart Students Workshop - Manhattan, NY
8	Rhode Island NEED Workshop – Cranston, RI
9	Kentucky NEED Workshop - Hazard, KY
9	Hydrogen Public Forum - Manhattan, NY
9	Rhode Island NEED Workshop – Cranston, RI
10	Kentucky NEED Workshop - Knott County, KY
10	Deadline - PG&E Solar Schools Bright Ideas Grants Program
10-12	NEED Sessions at NSTA Regional Conference - Chicago, IL
11	NEED H_2 Educate Hydrogen Workshop at NSTA Regional Conference - Chicago, IL
11	Kentucky NEED Workshop - Whitesburg, KY
15	Kentucky NEED Workshop - Campbell County, KY
15	America Recycles Day (www.americarecyclesday.org)
16	School Energy Efficiency Workshop – Bakersfield, CA
17	Kentucky NEED Workshop - Frankfort, KY
17	Michigan NEED Workshop - Lawrence, MI
22	Kentucky NEED Workshop - Paducah, KY
28	Kentucky NEED Workshop - Murray, KY
29	Kentucky NEED Workshop - Hopkinsville, KY
TBA	Launch of Indiana NEED Programs and Workshops - Statewide
TBA	North Carolina NEED Workshops - Statewide

December 2005

1	New York Energy Smart Students Workshop - Hauppauge, NY
1-3	NEED Sessions at NSTA Regional Conference - Nashville, TN
3	New York Energy Smart Students Workshop - Bronx, NY
6	Kentucky NEED Workshop - Bowling Green, KY
7-9	NEED/NASULGC 4-H Energy Training - Golden, CO
13	Kentucky NEED Workshop - Kenton County, KY
14	Kentucky NEED Workshop - Lexington, KY
20	Rhode Island NEED Workshop – Cranston, RI
21	Rhode Island NEED Workshop – Cranston, RI

January 2006

12	Kentucky NEED Workshop - Union, KY
12	Rhode Island ESL Workshop – Cranston, RI
	Launch of BP's 2006 A+ for Energy Program - CA

February 2006

2-5	NEED sessions at the National Biodiesel Conference – San Diego, CA
18	BP A+ for Energy/NEED Sessions at Greater Los Angeles Science Teachers Association Meeting – Los Angeles, CA
TBA	NEED Biodiesel for Educators Workshop – San Diego, CA

NEED News

Alaska

Thanks to the support of BP and the U.S. Department of the Interior – Minerals Management Service, NEED conducted an Alaska Energy Conference for 40 educators from across the state. Participants received NEED curriculum materials, Science of Energy Kits, and great kits from the Alaska Mineral and Energy Resource Education Fund (AMEREF) in addition to the new Get Energized CD from the U.S. Department of the Interior – Bureau of Land Management. Additional workshops and activities are planned for late winter and spring.

California

As part of Pacific Gas and Electric's Solar Schools program, two one-day PG&E Solar Schools workshops were held in partnership with the Santa Clara County Office of Education. Over 90 educators participated and received NEED Science of Energy Kits, Schools Going Solar Kits, and many other great resources. Additional workshops will be held in Santa Maria, West Sacramento, and other locations to be determined. To be placed on the announcement list, please send your name and school contact information to info@need.org.

Indiana

Starting this month, new resources and training will be available to Indiana teachers and students, thanks to the support of Cinergy/PSI, Indianapolis Power and Light, Vectren, Citizens Gas, and the Indiana Department of Commerce. The program, sponsored as part of a Demand Side Management program in Indiana, will provide NEED classroom and Energy Management for Schools curriculum and kits to participating schools, two Energy Management for Schools Conferences for school district energy and facilities personnel, and several NEED workshops for teachers. In addition, 1,500 students will be selected to participate in a home energy conservation program to help reduce energy use and costs at home. To be notified of upcoming programs please send your name and school contact information to info@need.org.

Massachusetts

Great things are happening on Cape Cod with the support of the Cape Light Compact and Barnstable County. Education Coordinator Debbie Fitton works with schools to provide NEED curriculum kits and materials, workshops on a variety of subjects, and support for the NEED Youth Awards Program. Coming soon are efforts to implement solar programs for local schools.

Mississippi, Louisiana, Alabama, Texas, and Florida

Over the last two months, NEED schools around the country have been asking what they can do to help their NEED colleagues and partners in communities impacted by Hurricanes Katrina, Rita, and Wilma. NEED has reached out to our schools in the regions and continues to receive feedback on what resources may be needed. Many NEED schools have been destroyed and the teachers and students are without classrooms and homes. We have asked that NEED teachers contact us to let us know what materials and resources are needed so that we can alert others in our national network. Our corporate and agency sponsors have indicated an interest in working with us to put NEED programs back into those classrooms – replacing kits, curriculum materials, and providing additional workshops to help train teachers new to the areas and improve morale. If you know of NEED schools that need resources or are interested in "adopt-a-school" programs, please email info@need.org.

Biodiesel

The National Biodiesel Board and U.S. Department of Agriculture Biodiesel Education Program have renewed their support of NEED's biodiesel education activities. Teacher workshops and school district decision maker conferences are available for interested school districts and regions. To discuss co-hosting a workshop or conference in your region, please call Mary Spruill at 800-875-5029.

BP's A+ for Energy Program

BP's 2006 A+ for Energy Program to support energy education in California classrooms will launch in January. New for 2006 is BP's A+ for Energy Program in Texas for teachers in Harris, Fort Bend, Galveston, Chambers and Brazoria Counties. The website (www.aplusforenergy.com) is under construction and more information will soon be available. To request an application, email info@need.org.

NEED News

Dominion Sponsored NEED Workshops

Once again, Dominion has made resources available for NEED workshops in Oklahoma City, OK; Calvert County, MD; McAllen, TX; Houston, TX, and Northeastern North Carolina. To learn more about these workshops, contact NEED at info@need.org.

EIA Kid's Page

As the school year continues, don't forget the great resources available on the Energy Information Administration's Kid's Page. Visit www.eia.doe.gov/kids for resources, fun games and riddles, and more.

H_2 Educate!

Thanks to the support of the U.S. Department of Energy, NEED has funding to conduct several H_2 Educate workshops for teachers around the country. If your company, organization, or district is interested in co-hosting one of the workshops, call Mary Spruill at 800-875-5029.

IREC Announces 2005 Winners

Each year the Interstate Renewable Energy Council recognizes state and local governments, schools and nonprofit or community groups that promote renewable energy technologies. This year, one of the recipients was Mary Spruill of NEED! Congratulations, Mary!

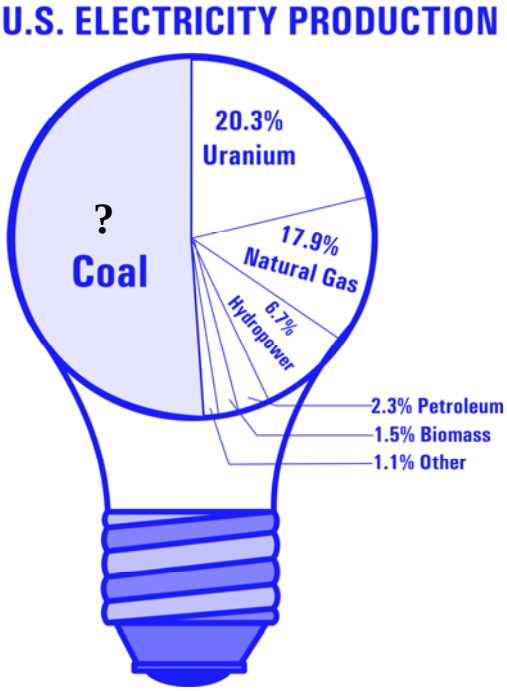
PG&E Solar Schools Bright Ideas Grants – California

November 10, 2005 is the deadline for the current round of PG&E Solar Schools Bright Ideas Grants. To apply, visit www.need.org/pgesolarschools. Schools may apply online or print an application to submit. Grants for $2,500 and $5,000 are available.

energy connections

Math Connections

How much electricity is produced by coal in the United Sates?



Language Arts Connections

Fossil Fuel Power
by Josepha Sherman
Capstone Press, 2004
- Table of Contents
- Short Chapters
- True-to-life Graphics
- Activity
- Glossary
- Additional Resources

Coal
by Steve Parker
Gareth Stevens Publishing, 2004
- Table of Contents
- Short Chapters
- True-to-life Graphics
- Glossary
- Additional Resources

energy connections

Coal Flowers

Social Studies Connections

Goal: To learn about crystal formation and traditions surrounding coal mining families.

Time: 30 minutes, plus additional time for observation of crystal formation

Materials Needed Per Student

- Shallow glass or plastic bowl
- Pieces of coal* or charcoal briquettes
- Cup or small bowl
- Spoons or stirring stick
- 6 tablespoons salt
- 6 tablespoons laundry bluing**
- 6 tablespoons water
- 1 tablespoon ammonia
- Optional items
  - Glue
  - Twigs or toothpicks
  - Paper or pieces of cloth
  - Food coloring

** Contact the American Coal Foundation for free coal samples at www.teachcoal.org*
*** Found at grocery or hardware stores, or www.mrsstewart.com*

Procedure

1. Explain to the class that making coal flowers is a historic craft from the late 1800s. Mining families with little money to decorate or purchase toys for holidays used common household items and coal to make crystal flowers. Since they resemble snowflakes, coal flowers made without food coloring are great winter decorations, and were often used by mining families throughout their homes.
2. Explain to the students that the coal plays no chemical role in the formation of the crystals. The coal provides a location for the crystals to grow and it was readily available to mining families.
3. Provide the students with the following instructions for growing coal flowers:
   a. Place several small lumps of coal in the shallow bowl.
   b. If desired, glue twigs, toothpicks, paper or pieces of cloth onto the coal.
   c. In a separate cup, mix together the salt, laundry bluing, water, and ammonia.
   d. Pour the mixture over the coal.
   e. Drop dots of food coloring over the coal for a colored effect, if desired.
   f. Place mixture in a safe location. Crystals should begin to form quickly but could take several hours (depending on room temperature and mixture concentration).

Science Extensions

- Repeat the crystallization process with one mixture at room temperature, one under heat lamps (or outside on a warm, sunny day) and one in a refrigerator. Determine what affect temperature has on crystal formation.
- Repeat the crystallization process with different concentrations of the mixture. Determine what affect solution concentration has on crystal formation.

Activity from American Coal Foundation, www.teachcoal.org, used with permission.

PRIMARY/ELEMENTARY Activity: Chocolate Chip Cookie Mining

Concepts

- Coal is an energy resource that is mined from the earth.
- Coal is a nonrenewable resource.
- Some places have more coal than others.
- Some places have coal that is easier to mine than others.
- Coal on the surface is easier to mine than coal that is underground.

Time

One 45-minute class period

Materials Needed Per Student

2 different kinds of chocolate chip cookies
2 toothpicks
2 napkins
1 piece of paper

Procedure

1. Explain that coal was formed from plants that lived millions of years ago. When the plants died, they were buried under sand and silt. Over time, the sand and silt built up, putting heat and pressure on the thick layer of dead plants, and changing it into coal.
2. Ask the students how we use coal. Discuss the ways in which we use coal every day. Remind the students that coal is a nonrenewable energy source. Once we use it, we cannot make more of it in a short period of time.
3. Explain that coal is buried underground and it is harvested through the process of mining. When coal is mined, the land that the coal came from must be reclaimed so that people can use the land again.
4. Explain to the students that they will be comparing two different land sites containing coal. They will mine the coal from each piece of land.
5. Show the students their "land" (cookies) and "mining equipment" (toothpicks). Emphasize that the cookies are not to be eaten during the mining, but may be at the end. Make sure all students know which cookie is A and which is B.
6. Explain the mining process to the students, using the directions on the worksheet.
7. Make a chart on the board with class totals from cookies A and B. Compare the results.
8. Eat the cookies!
9. Ask the students which type of cookie was easier to mine and which type of cookie contained the most coal (chips). Discuss with the students how this compares with coal resources. Do some areas have coal that is easier to mine than others? Do some areas have more coal than others?
10. Ask if it was easier to mine chips on the surface of the cookie or chips inside the cookie. Discuss with the students the differences between surface and underground mining.
11. Ask the students if their reclaimed cookies looked like the original cookies. Discuss land reclamation and why it is important.

Additional information on coal formation, uses and mining can be found in the Primary Energy Flipbook and Elementary Energy Infobook, available at www.need.org.

Student Worksheet

Chocolate Chip Cookie Mining

Name: _____

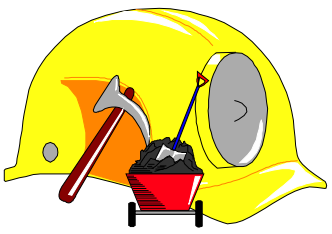
1. Trace the outline of cookie A on a piece of paper. Map the location of the chocolate chips you can see on the top.
2. Count the number of chips you can see on the top and sides of the cookie. Record this number on the chart.
3. Using the toothpick, carefully mine as many chocolate chips as you can from the cookie. Set the chips aside in a pile.
4. Count the number of chips mined from the cookie. Record the number on the chart.
5. Put the cookie back together without the chocolate chips. Compare to your map of the cookie.
6. Repeat the procedure for the other cookie.

My Totals			Class Totals		
Cookie	# of surface chips	# of chips mined	Cookie	# of surface chips	# of chips mined
A			A		
B			B		

Which cookie was easier to mine and why?

What is reclamation and why is it important?

List two ways we use coal today.



INTERMEDIATE/SECONDARY Article: Carbon Sequestration

Carbon dioxide (CO_2) is a colorless, odorless gas that is produced naturally when humans and animals breathe. The primary source of man-made CO_2 emissions, however, is the burning of fossil fuels (oil, natural gas and coal) for energy production. Carbon dioxide is essential to the photosynthesis process that sustains plant and animal life, but it can accumulate in the air and trap heat near the earth's surface, a phenomenon known as the greenhouse effect.

Fossil fuels will be a major source of energy production for generations to come. The availability of these fuels to provide clean, affordable energy is essential for global prosperity and security. Nevertheless, atmospheric concentrations of CO_2 due to carbon emissions will continue to rise unless major changes are made in the way we produce and use energy and, especially, how we manage carbon.

Three approaches to managing carbon are being supported by the U.S. Department of Energy:

1. Use energy more efficiently to reduce our need for fossil fuel combustion;
2. Increase our use of low-carbon and carbon-free fuels and technologies, such as nuclear power and renewable sources of energy; and
3. Carbon sequestration.

Carbon sequestration is the capture and long-term storage of carbon dioxide and other greenhouse gases that would otherwise be emitted into the atmosphere. The greenhouse gases can be captured at the point of emission (direct sequestration), or removed from the air (indirect sequestration). The captured gases can be stored in underground reservoirs (geological sequestration), injected deep into oceans (ocean sequestration), stored in vegetation and soils (terrestrial sequestration), or converted to rock-like solid materials (advanced concepts).

Geological Sequestration involves storing carbon dioxide in depleted oil and gas reservoirs, unmineable coal seams and underground saline formations.

- *Depleted Oil and Gas Reservoirs* - Injecting compressed carbon dioxide into a depleted oilfield creates a CO_2 "flood" that forces the remaining oil into a well where it can be captured; the CO_2 remains behind, safely and permanently stored beneath the earth's surface.
- *Unmineable Coal Seams* - Coal beds typically contain large amounts of methane-rich gas. The current way to recover coal bed methane is to depressurize the bed, usually by pumping water out of the reservoir. An alternative approach is to inject pressurized carbon dioxide into the bed. The porous coal surfaces absorb CO_2 more easily than methane, so the CO_2 displaces the methane and remains sequestered in the bed.
- *Underground Saline Formations* - Carbon dioxide can be pumped into underground saline, or brine, formations. Underground brine formations are so common that geologists believe they could provide enough space to store all the CO_2 captured from fossil fuels burned in the 21st century.

Ocean Sequestration involves enhancing the natural process of carbon sequestration in the ocean and directly injecting CO_2 deep into the ocean. Carbon dioxide is soluble in sea water and oceans absorb and emit huge amounts of CO_2 into the atmosphere naturally. Ocean sequestration, however, is considered controversial.

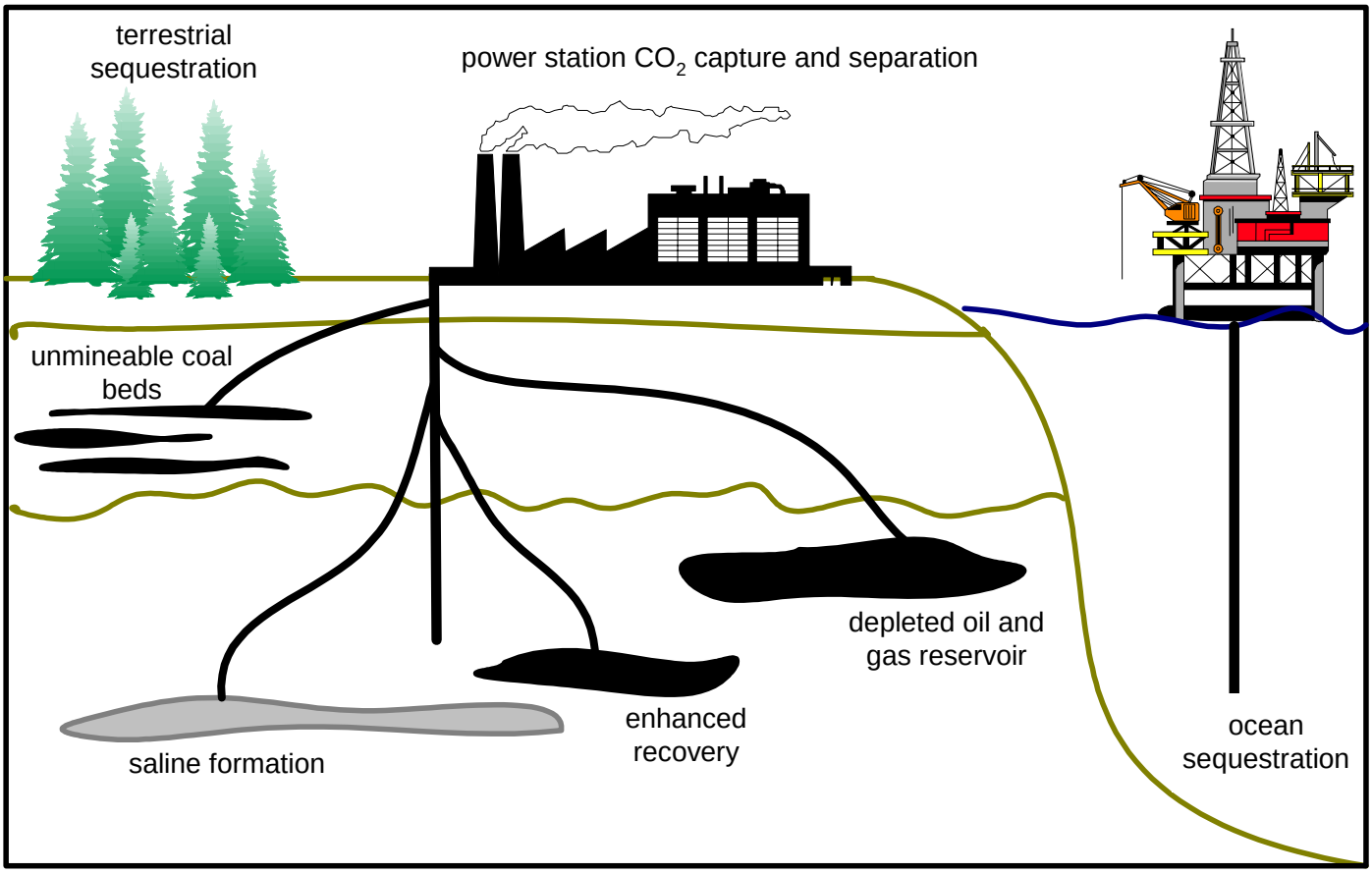
- *Enhancement of Natural Carbon Sequestration* - To stimulate the growth of phytoplankton, which consume great amounts of CO_2, scientists add nutrients to ocean surface waters. When the phytoplankton use up the carbon in ocean surface waters, it is replaced naturally by CO_2 drawn from the atmosphere.
- *Direct Injection of CO_2* - Technology exists for the direct injection of CO_2 into deep areas of the ocean, but scientists do not yet have enough knowledge to determine the effectiveness of the sequestration or understand potential changes it may cause to the ocean, such as the effect of CO_2 on the acidity of the water.

Terrestrial Sequestration involves the removal of CO_2 from the atmosphere by terrestrial ecosystems. Vegetation and soils are widely recognized as carbon storage sinks. The global biosphere absorbs about two billion tons of carbon annually, an amount equal to one third of all global carbon emissions from human activity. Significant amounts of this carbon remain stored in the roots of certain plants and in the soil. Ecosystems with significant opportunities for carbon sequestration include forests, agricultural lands such as crop land, grassland and range land, biomass crop lands, deserts and degraded lands, boreal wetlands and peat lands.

Advanced Sequestration Concepts seek to reduce the cost and energy required to chemically and/or biologically convert CO_2 into commercial products and stable solid compounds.

- Scientists are working with minerals that could change huge amounts of carbon dioxide gas into a compact, solid state. Two promising chemical pathways are magnesium carbonate and CO_2 clathrate, an ice-like material. Scientists believe the global carbon emissions from an entire year could be contained as magnesium carbonate in a space 10 kilometers by 10 kilometers by 150 meters.
- Biological systems research is under development to enhance the carbon uptake of photosynthetic systems. Also, harnessing naturally occurring, non-photosynthetic microbiological processes capable of converting CO_2 into useful forms, such as methane and acetate, could represent a technology breakthrough.

Scientists continue to research and develop carbon sequestration technologies. It is important to make sure these new processes are environmentally acceptable and safe. For example, scientists must determine that CO_2 will not escape from underground formations and migrate up to the earth's surface or contaminate drinking water supplies. Carbon capture and storage is an expanding area of research and development for today's scientists.



Information from the U.S. Department of Energy - Office of Fossil Energy, www.fossil.energy.gov.

Short Circuits

Change a Light, Change the World

On October 5, the U.S. Environmental Protection Agency and U.S. Department of Energy launched their "Change a Light, Change the World" campaign, which runs through November. The campaign emphasizes that small changes can make a big difference. According to the EPA, "if every U.S. home changed just one light to an ENERGY STAR qualified one, we would save enough energy to light **7 million homes** and prevent greenhouse gas emissions equivalent to those from **one million cars**."

Photo Credit: Kentucky Office of Energy Policy.

KY First Lady Fletcher changes a light at the Governor's Mansion to an ENERGY STAR qualified CFL.

Participating in kick-off events in Kentucky were NEED students from Glenn O. Swing Elementary, Meece Middle School, and Harrison County High School. The elementary students gave First Lady of Kentucky, Glenna Fletcher, the "Change a Light, Change the World" pledge to sign as well as an ENERGY STAR bulb for the Governor's Mansion. Students from the middle and high schools spoke about the advantages of using compact fluorescent light bulbs and ENERGY STAR bulbs as well as the ENERGY STAR campaign and pledge.

For more information about ENERGY STAR products, saving energy, or signing the "Change a Light, Change the World" pledge, visit www.energystar.gov.

NEED
Putting Energy into Education