

Day 1: Introduction

Goal: To introduce students to the concept of global warming and energy conservation
To begin to discover how temperature rises might affect their area/state

Standards:

- Geography: Understands global development and environmental issues
- Language arts: Uses reading skills and strategies to understand and interpret a variety of informational texts

Process:

1. **Heat it up:** Begin a discussion with your student about global warming by asking students to describe general trends in the weather over their lifetime. Do they notice changes in temperature since they were small children? Do their parents comment on how the weather has changed? What weather extremes can they remember in their lifetime?

2. Have students fill out a K-W-L chart about global warming/energy conservation.

3. **Set the stage:** Introduce students to the unit on global warming.

Although there is great debate about what causes global warming, climate experts agree that the global air temperature has risen 0.3 to 0.6 Celsius over the last 100 years. Factors such as rising sea levels and coral bleaching are indicative of increases in air temperatures. Most specialists predict that if we do not take drastic steps to curb greenhouse gas emissions, global temperature will increase 1 to 3.5 Celsius in the next century. Although the number may sound small, even a 1 Celsius increase can cause significant worldwide change. For example, during a period called the Little Ice Age (1500-1800) where the temperature was only about .5 Celsius cooler than it was in 1900, there were extensive glacial advances in almost all alpine regions. Most scientists argue that global warming in the next century will cause more frequent and intense heat waves, significant ecological disruptions, difficulties with agricultural production in the tropics and subtropics, and rising sea level. All of these will impact life on earth. You can illustrate the changes in glaciers by showing students the following photos of the warming trend over time (<http://www.koshlandscience.org/exhibitgcc/intro01.jsp>)

4. Have students go the climate choice website (http://www.climatechoices.org/ne/impacts_ne/temperatures.html) and look at the projections of temperature for this century of their region. Students can also read about the potential impact in their state at

<http://yosemite.epa.gov/OAR/globalwarming.nsf/content/ImpactsStateImpacts.html> Discuss the following questions:

- a. What area would your state be most like in both the higher and lower emissions scenario?
 - b. What industries in your area would be affected by this change?
 - c. How might day to day life be different for you?
1. **Take Action:** Tell students that for the next ten lessons that class will be studying about energy conservation and the impact of global warming on the world. Throughout this unit, they will be developing ways in which individuals and organizations can help conserve energy and protect the environment. During the unit, they will create a project that addresses how to decrease energy use and

- educate people about the importance of energy conservation. Each lesson will provide students with information and/or techniques to help educate the public about the importance of energy conservation. Have students choose a topic to focus their efforts on for these next ten lessons. Some ideas might include:
- a. Carpooling group
 - b. Recycling efforts
 - c. Campaigning for the use of renewable energy sources
 - d. Creating a documentary/website about energy conservation
5. Note: In some instances, it may be more appropriate to let the students decide what their project should be after the unit has begun and students have become acquainted with the basic concepts of global warming.

Lesson 2: The Science of Global Warming—It's getting hot in here!

Goal: To learn about greenhouse gases and how they keep the earth warm
To discuss the power of language to make difficult concepts more understandable

Standards:

- Geography: Understands global development and environmental issues
- Language Arts: Gathers and uses information for research purposes
- Language Arts: Uses the stylistic and rhetorical aspects of writing
- Science: Understands atmospheric processes and the water cycle

Process

1. **Heat it up:** Take two cups and fill them with water that is the same temperature. Wrap one of the cups with plastic wrap. Leave both cups in a sunny place for a few hours. Take the temperature of the water in both cups. Have students predict which one will be warmer? Why?
2. **Provide Background:** Introduce students to the science behind global warming. Sunlight sends energy into the climate, most of which is absorbed by oceans and land. Heat is then radiated outward as infrared energy. Some of this heat is absorbed by what are called greenhouse gases, which exist naturally in the atmosphere. Greenhouse gases include carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O). Water vapor is also an important greenhouse gas, but human activity does not change it directly. When energy is absorbed, greenhouse gases transmit energy in all directions. Some of the infrared energy is emitted towards space while some is reabsorbed, further warming the earth. The greenhouse gases are often compared to a blanket around the earth which keeps the earth warm. Increased concentrations of CO₂ and other greenhouse gases cause more infrared energy, in essence thickening the earth's blanket. This, in turn, causes increases in the temperature of the atmosphere and Earth's surface.

Normally, the Earth maintains a balance in the amount of carbon dioxide in the atmosphere. Ocean uptake (dissolving of CO₂ gas into the oceans) and sedimentation

(burial of plant and animal matter, which overtime becomes limestone, coal, gas, and oil) are two processes whereby CO₂ is absorbed from the atmosphere. This naturally occurring system readjusts to return the balance to normal states. However, the system is slow-moving and cannot keep up with the pace at which humans are burning fossil fuel, and thereby releasing carbon dioxide into the atmosphere. Furthermore, the clearing and burning forests transforms organic carbon into gas, which contributes to an increase in carbon dioxide in the atmosphere. The constant need for energy causes a reliance on fossil fuels, which, in turn, means more and more CO₂ being released into the atmosphere.

3. **Synthesize:** In partner pairs, have students develop a chart that explains their understanding of the science of global warming. Rather than just having students create a two dimensional drawing, encourage students to go their daily non-food trash and use the items they find to make the poster three-dimensional. This will also help students realize what items get thrown out everyday. Discuss what items are wasted most often in a school environment. What might be reused?
4. **Take Action:** One way to raise awareness about the importance of energy conservation is to educate others about global warming. Discuss how using the metaphor of a blanket is helpful to have people understand in a basic way what is occurring with global warming. If they choose to educate others, what powerful ways can students use language to help others understand the urgency? What metaphors or symbols will make people take notice?

Lesson 3: What are the Consequences of Global Warming?

Goal: To learn about the potential consequences of global warming

Standards:

- Geography: Understands global development and environmental issues
- Language Arts: Uses the stylistic and rhetorical aspects of writing
- Arts and Communication: Understands ways in which the human experience is transmitted and reflected in the arts and communication
- Science: Understands atmospheric processes and the water cycle

Materials:

Strategy Worksheet
Video of an Inconvenient Truth

Vocabulary:

Ethos
Logos
Pathos

Process:

1. **Heat up:** Start by showing students a clip of Al Gore’s “an inconvenient truth” and discuss the consequences of global warming. Begin a discussion around techniques that you can use to persuade others. For example, how might a child get his parents to let him/her stay out late? Ask for a few examples.
2. **Provide Background:** Have students investigate the effects and consequences of global warming:
<http://www.pbs.org/wgbh/nova/warnings/waterworld/>
<http://www.time.com/time/2001/globalwarming/a.html>
<http://www.cnn.com/SPECIALS/1997/global.warming/>
3. **Synthesize:** As a class, discuss how to speak and write persuasively. How does Gore try and convince the viewer about the dangers of global warming? Cite examples of how he engages the emotions of the viewer? What images make the most impact? Why?
4. Discuss persuasive techniques and have students look again at a clip and discuss what techniques are being used. How does the combination of all three of these strategies support Gore’s point of view? *For MS students, you may want to give them the worksheet to help organize the notes they take while viewing.*
 - a. **Logos:** use of evidence to support your points (facts, statistics, accounts)
 - b. **Pathos:** use of emotions to engage the support of the audience
 - c. **Ethos:** credibility or reliability of your argument (expert opinions, celebrity endorsement).
5. **Take Action:** As part of their project, encourage students to create something that they can share with others that build awareness about the importance of energy conservation and the consequences of global warming. Some ideas might include a collage, poem, song, or poster that students can share with others. How can they use logos, pathos, and ethos to get their point across? Have students discuss their ideas in groups.

Lesson 4—If the shoe fits. . . Learning about Ecological Footprints

Goal: Students will examine their own energy consumption and think about ways they can conserve energy.

Standards:

- Geography: Understands global development and environmental issues

Vocabulary:

Ecological Footprint

Process:

1. **Heat it up:** Begin a discussion by asking students to contemplate their own energy use? Have them think of their morning and list all the energy they used. For example, do they have an alarm clock? Which lights did they turn on? How long was their shower? Did they take food from the refrigerator? Did they drive to school?

2. **Provide Background:** Begin by describing the concept of an ecological footprint. Explain to students that ecological footprints have been done on a global, national and individual level. A nation's footprint is calculated using its population, the amount consumed by the average resident, and the amount of resources used in providing goods and service required to meet people's consumption. Also included is the area required to absorb the CO₂ that is released due to fossil fuel burning.
3. Have students go to <http://www.earthday.net/Footprint/index.asp#> to find out their ecological footprint. Discuss with class:
 - a. How did they compare to their national average?
 - b. How many earths would we need if everyone lived the same way they did?
 - c. What are some things they do that increased their score? What are some things they do that decreased it?
4. Calculate the overall score of the class. Tell them that through the course of the year, they will work to decrease this score, so as to have less of a detrimental effect on the environment.
5. **Synthesize:** After students have determined their footprint, discuss what contributes to a "deeper" ecological footprint. Using the categories from the website (Food, Mobility, Transportation, Shelter, and Goods and Resources) have students think of ways that they could conserve energy. Look at a list of recommended actions that individuals can take. For example, eat less meat, donate magazines to hospitals, avoid purchasing disposable items with lots of packaging, drive fuel efficient vehicles, plant vegetables or visit local green markets, use less trees by getting off of junk mail lists, write a letter about your concerns to a congressman
 (http://www.earthday.net/Footprint/english/individuals.asp?country=United+States&langauge=English-US&total=27&food=3.2&shelter=4.4&mobility=9.9&gAnd=9.6&planets=6.1&pid=2217828644141741&hect_total=11&sess_natavg=24)
6. After students have listed options for each category, have each student personally arrange what they would be most willing to do/change in their life to what they would be least willing to do.
7. Have students choose one action to try for the week and then report back on their outcome. Inform other students by creating "footprint" signs that show how other students can help conserve energy through simple actions.
8. **Take Action:** How can the class get other to be more aware of their energy use? Is their a way/venue to provide an ecological footprint reading for students?

Lesson 5: How Green is your School?

Goal: To learn about how schools can participate in energy conservation

Standards:

- Geography: Understands global development and environmental issues

- Language Arts: Uses the stylistic and rhetorical aspects of writing
- Arts and Communication: Understands ways in which the human experience is transmitted and reflected in the arts and communication

Process:

1. **Heat-it up:** Have students look around the classroom and list everything they see in the classroom that uses energy. How energy efficient do they think their school is? How much energy/resources are wasted daily? Discuss with students how higher heating costs have made some school districts think twice about school trips and the number of days class is in session. See http://www.pbs.org/newshour/extra/features/july-dec05/gascosts_11-21.html for further information.
2. **Provide Background:** Read and discuss what the article about green schools: <http://www.bizjournals.com/boston/stories/2003/09/22/editorial4.html>
3. Introduce students to the LEED rating system. “The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is the nationally accepted benchmark for the design, construction, and operation of high performance green buildings.” (US Green Building Council). LEED has developed a rating system for schools. This rating system looks at elements such as air quality, cleaning and chemical use, water efficiency, recycling, exterior maintenance and system maintenance to meet high energy performance standards (from US Green Building Council).
4. Introduce students to one energy-saving concept called green roofs. “A **green roof** is a roof or building that is partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane. This does not refer to roofs which are merely colored green, as with green shingles. It may also include additional layers such as a root barrier and drainage and irrigation systems.” (Wikipedia.com)
5. **Synthesize:** Have students develop their own plan for a “Green School”. They can draw out the plans and write a brief explanation of their ideas for their green school. Students should focus on the following questions:
 - a. What innovations could they design in the architecture?
 - b. How could the curriculum/student activities support an ecological design?
 - c. Why should the city give public money to building a new school? How efficient are “Green Schools”? Students can read about other Green schools:
 - i. <http://www.usgbc.org/News/USGBCInTheNewsDetails.aspx?ID=3043>: Minnesota Green School
 - ii. http://www.pbs.org/newshour/extra/features/july-dec06/green_12-26.html: Schools across the nation that are taking steps to being more green
6. **Take Action:** Have students continue working in their action groups.

Other Activities

1. Have students develop a survey to measure how green their school is? Share the results with the student body.

Lesson 6: Energy Hog- Who's using up all the energy?

Goals: To learn about energy use across American compared to other countries

Standards:

- Geography: Understands how human actions modify the physical environment
- Geography: Understands global development and environmental issues

Process:

2. **Heat up:** Ask students the night before to count the number of SUV's or large vehicles that they see on their way to school. How many people were in those vehicles? What do they notice?
3. **Provide Background:** Explain to students that although Americans make up only about 5 percent of the world's population, they consume 26% of the world's energy. Each day the average American uses approximate seven gallons of gasoline. Over a course of year this is about 2,500 gallons (The Need Project). Most energy savings in the last few years have come from improved efficiency for various technologies (US Department of Energy).
4. Have students look at the predicted energy use for each country
<http://timeforchange.org/prediction-of-energy-consumption>
<http://www.worldwatch.org/node/808> --read about global energy trends
 - Which countries show the greatest increase in energy use?
 - How can students account for this increase
 - Why is energy a global issue?
 - What should developing nations do to ensure that they maximize their energy use? How can we encourage this help?
5. Use the following website to have students look at energy use in their state:
<http://tonto.eia.doe.gov/state/>
6. **Synthesize:** Have students create an energy brochure/or website for their state that details the state's main energy use. The brochure should discuss the following:
 - a. How does their state's energy use compare to the national average? Why do they think this is?
 - b. What types of alternative fuels are used in their state?
 - c. What types of emissions are listed?
 - d. What percentage of the total national emissions does this make up? How does this compare with the population that lives in their state?
7. **Take Action:** Have students meet in their action groups and continue to develop their project.

Other Lessons

1. Have students create a map that illustrates both actual and predicted energy use over time for various areas.

Lesson 7 Renewable Energy Sources

Goal: To learn the difference between renewable and nonrenewable energy

To explore various types of renewable energy sources

Standards:

- Geography: Understands how human actions modify the physical environment
- Geography: Understands global development and environmental issues
- Science: Understands atmospheric processes and the water cycle

Vocabulary:

- Geothermal Energy
- Hydropower
- Landfill gas
- Photovoltaic solar power
- Renewable Energy
- Wind power

Materials:

Attached Worksheet

Process:

1. **Heat-it up:** Hide a bunch of m & m's around the classroom. Ask for a few volunteers. Give the volunteers ten seconds to find them. Count the number of candies retrieved. Ask the volunteers to continue searching in ten second intervals, recording the number of candies that are found each time. As the supply of m&m's drops, the number of candies found should get less and less. Connect this to your discussion about renewable energy.
2. Begin a discussion on renewable and non-renewable energy. Discuss America's reliance on fossil fuel. Fossil fuels – coal, oil and natural gas -- provide more than 85% of all the energy consumed in the United States. According to the U.S. Department of energy, nearly two thirds of our electricity and almost all of US transportation fuels comes from fossil fuel. It is likely that the need for fossil fuel will increase over the next decade.
3. Ask students to think of some other sources of energy. Once you have exhausted their list, review alternate sources of energy that they might not know about it.
 - Geothermal energy:** electricity generated by naturally occurring geological heat sources
 - Hydropower:** energy obtained from flowing water
 - Wind power:** using the kinetic energy of the wind or wind turbines to extract the wind's energy
 - Landfill gas:** utilizing emitted gases from landfills to produce electricity
 - Photovoltaic solar power:** gaining energy from sunlight using solar panels
4. **Synthesize:** Put students into pairs and give them a type of energy source to research. They should describe each source and list the pros and cons of using this type of energy and provide examples of where this energy source is currently used. Have students create large charts that demonstrate the pros and cons of each of these sources to the class. *For students in MS, you may want to have them used the attached worksheet to take notes as other students present.* How expensive is each type of energy source? Is it difficult to create? Discuss and

provide examples of these alternative forms of energy for preparation for the next day.

5. **Take Action:** Have students continue working on their action projects.

Day 8: How do you see it?

Goal: To engage students in a discussion about the pros and cons of renewable energy

Standards:

- Geography: Understands how human actions modify the physical environment
- Geography: Understands global development and environmental issues
- Language Arts: Uses listening and speaking strategies for different purpose
- Language Arts: Applies basic trouble-shooting and problem-solving techniques
- Language Arts: Understands and applies the basic principles of presenting an argument

Process:

1. **Heat it up:** Describe the following scenario to students:
Imagine this scenario. The year is 2080 and the world's fossil fuel supply has been nearly exhausted. Most people don't have cars anymore because of high gas prices. Since the cost of heating and cooling homes is so expensive, most people live for long periods of times in extreme temperatures. Many businesses have shut down because of the high cost of transporting goods and electricity. What needs to be done now to prevent this from happening?
2. **Provide Background:** Have each student review their notes on alternative energy. Discuss questions before beginning the activity.
3. **Synthesize:** Create groups of 3-4 students. Students should work together to decide how much to rely on the various type of energies. They should think about the pros and cons of each that were discussed the day before and then assign a percentage to a certain type of energy source. At the end, they will be asked to explain their choices.

Give each student a role in their group:

- a. Environmentalist (Mr. Brad Conserve) This person wants to go use a 100% renewable energy. They believe in conservation and reducing fossil fuels. They do not worry about the cost of creating plants to harness alternative energies.
- b. Oil company (Ms. Olive Oil) Wants to satisfy stock holders and continue to provide revenue for her company. Cares about her company now then in the future. Will never agree to abandoning use of oil.
- c. Family guy/gal (Joe Regular/ Ms. Jane Plain) Working person who cares about what this whole endeavor will cost him/her. This person's main concern is providing for his/her family now, not what will happen some years in the future.
- d. Moderator: This person will help moderate and lead the discussion. They can decide how the final distribution will be made.

4. Have students do a quick write from the perspective of their character about what to do about this problem. Then have the groups discuss the various alternative energies.
5. **Take Action:** Have students continue working on their take action projects.

Lesson 9—The Politics of Energy Conservation

Goals: To debate the pros/cons of governmental involvement in energy conservation

Standards:

- Geography: Understands how human actions modify the physical environment
- Geography: Understands global development and environmental issues
- Language Arts: Uses listening and speaking strategies for different purpose
- Language Arts: Applies basic trouble-shooting and problem-solving techniques
- Language Arts: Understands and applies the basic principles of presenting an argument
- Civics: Understand the essential characteristics of limited and unlimited governments
- Civics: Understands the impact of significant political and nonpolitical developments on the US and other nations

Process:

1. **Heat-up:** Begin your class by asking students if they believe that energy conservation is a problem and if the government should play a role in preventing it? Should the government limit people's energy consumption? Or should this be up to individuals?
2. Ask students what techniques can governments use to influence global warming? (Policies, taxes, treaties, laws, trade, research) Discuss how these techniques can influence global policy and individual people's actions?
3. Tell students that global warming has become a very political issue that is often decided through party lines. Explain to students that today students will be exploring both sides of global warming and then having a debate.
4. **Provide Background:** Split students into two groups: those that want the government to take an active role in preventing global warming and those that do not believe global warming to be a serious enough of a problem that merits government involvement. Have students read the following articles to determine arguments that are pro and con and make notes for their side. PBS provides a number of interviews of climatologists, politicians, and those in the business world presenting different perspectives.

<http://www.pbs.org/wgbh/warming/debate/>

You may want to have your HS student a look at the following websites to find further information:

<http://epw.senate.gov/speechitem.cfm?party=rep&id=264027>

<http://epw.senate.gov/speechitem.cfm?party=rep&id=263759>

Senate speeches on media global warming alarmism

<http://www.pbs.org/wgbh/warming/debate/palmer.html>:

<http://www.us-cap.org/>: Business organizations that call on strong government action to prevent global warming

5. **Synthesize:** Set up a debate in your classroom.
 - a. Line debate: Create groups of four students—two that are anti government involvement and two that are pro-government involvement. The groups of four students should face each other. Have one of the sides begin the debate. Only one person may talk at a time. Then have the other side present their ideas. Finally each group can present a rebuttal. During the debate, call a spotlight on certain groups of four by having the rest of the class sit down and listen to the arguments being presented. They can then use those arguments in their own debates. At the very end, ask them quickly to switch positions and argue for the other point of view.
6. **Take Action:** Continue working on your take action projects and develop a presentation of your work for lesson 10.

Other Ideas

1. Research the Kyoto Protocol and discuss the issues around the US signing the treaty.
2. Choose your favorite politician and research their stance on energy conservation.

Lesson 10: Presentation

Goal: To have students present their energy conservation projects

To discuss students' impressions of energy conservation efforts

Standards:

- Geography: Understands how human actions modify the physical environment
- Geography: Understands global development and environmental issues
- Language Arts: Uses listening and speaking strategies for different purpose
- Language Arts: Applies basic trouble-shooting and problem-solving techniques

Process:

1. **Heat up:** Have students go back to their K-W-L chart from day one and add to the list of what they have learned. What questions have been answered? What still need to be addressed? Was there anything they learned in this unit that was surprising? What do they feel is important to share with others?
2. Have students present their take action projects.
3. During the projects students should talk about the challenges they faced accomplishing this task and how they can continue the work beyond these ten days to address issues of energy conservation.
4. **Reflection:** Have students discuss the following topics:
 - a. Do they feel that energy conservation is a topic worth teaching as part of a curriculum? What grade should you start teaching conservation?

- b. How responsive are young people of their generation to environmental issues?
- c. How willing are people to make changes to their lifestyle to save energy?
- d. How has this unit impacted their view of energy consumption?