Viewpoints

Students use research skills to investigate various viewpoints surrounding the issue of global climate change.

Grade Level: (5–8) 9–12

Subject Areas: English Language Arts, Mathematics, Science, Social Studies

Setting: Classroom

Time:
Preparation Time: One half hour
Class Time: Up to one week

Vocabulary: Global climate change, Global warming, Greenhouse effect

Getting Ready: It may be helpful to involve the school librarian with this activity.

Objectives

Students will be able to

- provide an overview of the theories behind global climate change;
- identify at least two different viewpoints about global climate change; and
- write an objective paper about the opinions of different people involved in the global climate change debate.

Rationale

Differing opinions about an environmental problem make the problem an issue. The issues concerning global climate change are frequently in the news. Encouraging students to investigate all sides of this issue (or any other that results from our energy use) helps them to make objective and thoughtful decisions.

Materials

- Copies of the following pages:
  - ***Some Basics about Global Warming and Climate Change*** (optional)
  - ***Global Climate Change Viewpoint Form***
  - ***Action Ideas: Energy Efficiency Measures*** (optional)
- Find additional resources related to this activity on keepprogram.org > Curriculum & Resources

Background

"It now seems probable that human beings have succeeded in achieving a momentous and unwanted accomplishment—inadvertent alteration of the planet's climate."

T. R. Karl — Senior Scientist, NOAA's National Climactic Data Center

"Given the history of such environmental scares—over all of human history—my guess is that global warming is likely to be another transient concern."

Julian L. Simon — Economist, University of Maryland

"The risks of climate change pose the most critical and pervasive environmental threats ever to the security of human community and to life as we know it."

Kofi Annan — UN Secretary General

"A crucial point gets lost in the debate: Global warming, if it were to occur, would probably benefit most Americans. Even if the pessimists are right and it would, on net, harm Americans, the curse of capping the greenhouse gas emissions would be much worse...Global change is inevitable; warmer is better; richer is healthier."

Thomas Gale Moore — Senior Fellow, Hoover Institute

These are just some of the viewpoints surrounding the issue of global warming. One can find varying viewpoints around just about any issue, including those that result from energy use. People have varying viewpoints because they or the organizations they represent have different values and perspectives regarding resource management.

To better understand environmental issues such as global warming, it is helpful to analyze the viewpoints surrounding the issue. Investigating the viewpoints involves research, observation, and critical thinking skills.

The global warming debate has been in the news for several years and has been the focus of international conferences. Initially, the debate focused on projected outcomes of an enhanced "greenhouse effect" (accelerated increases of carbon dioxide and other gases to the atmosphere). Some scientists projected marked increases in global temperatures, while others thought there would be little effect. Today, there is general acceptance that greenhouse gases will affect global climates, but disagreements continue about how imminent and extreme the changes will be. This disagreement leads to debates on how societies should alter their energy use practices to reduce greenhouse gases or if more research is needed before actions are taken (see "Going on a Carbon Diet" in the **Extensions** for an overview of actions individuals can take to reduce their atmospheric contributions).

Some Basics about Global Warming and Climate Change is a fact sheet developed by the Wisconsin Office of Energy Innovation. This background information serves as a foundation for further investigations regarding different viewpoints that surround global climate change.

Procedure

NOTE: This activity focuses on the issues surrounding global warming or climate change. The activity can be adapted to investigate any environmental issue.

Orientation

Write the words climate change on the board and ask students what they have heard or know about this topic. Note their responses. Underline any comments that relate to energy use.

Survey students to ascertain their opinions about the subject. Ask students if they think there is agreement about the existence, cause, and effects of global warming. Help students to understand that there are disagreements about this problem and they are going to learn about the varying viewpoints.

Provide students with a basic understanding of global warming and climate change. (See ***Some Basics about Global Warming and Climate Change***; lecture on basic points or have students read on their own. See "Read and Explain Pairs" for a cooperative reading strategy.) Make sure students understand that the "greenhouse effect" itself is necessary to maintain temperatures that sustain life (see ***Greenhouse Misconceptions***). The concern focuses on an enhanced greenhouse effect caused by increased levels of atmospheric carbon. Have students list activities that they do that add greenhouse gases to the atmosphere (see **Background** and "Going on a Carbon Diet" in the **Extensions**).

Tell students that there is scientific consensus that the amount of carbon dioxide and other greenhouse gases in the atmosphere is increasing. There is increased acceptance that this increase will affect our climate. However, there is not agreement on what this change will be. Many scientists prefer the term global climate change because this expression encompasses many of the effects, including warming, that could result from increased greenhouse gases in our atmosphere. Even when there is agreement about what kind of climate change may occur, there is disagreement about the gravity of the change and whether the benefits of slowing the change will outweigh the associated costs.

Greenhouse Misconceptions

There's a hole in the ozone and the sun shines through the hole and heats the air. This is one of several misconceptions associated with the greenhouse affect and global warming. Many students think that our planet is heating up because too many of the sun's rays were reaching Earth. One of the biggest obstacles to understanding the greenhouse effect is its name; the image of greenhouse glass probably attributes to students envisioning a layer of gas that traps solar heat. However, given that is unlikely for the name to change, science and environmental educators need to take the extra steps to ensure students are able to differentiate between the greenhouse effect as it relates to the atmosphere versus the building structure designed to facilitate plant growth. Prior to studying the greenhouse effect, global warming, or the ozone layer it is important to elicit student ideas. After assessing students' current conceptions, teachers can help students to understand that greenhouse gases are part of the atmosphere that blankets the planet, rather than a layer of gases way up in the sky. Understanding that we are surrounded by greenhouse gases and that these gases absorb the sun's heat can also help students appreciate how the atmospheric effect (more popularly known as the greenhouse effect) keeps our planet warm and sustains life.

Steps

1. Tell students that they are going to investigate different people's opinions about how we should respond to the possible results of an enhanced greenhouse effect. The responses may vary from "nothing; there isn't a problem" to "implement federal regulations that limit the use of automobiles in urban areas."

2. Discuss sources where students can find more information about global climate change. Students should mention the Internet, journal articles, news reports, and books. Invite the school librarian to speak to the class about researching information. See the KEEP Website for links to global climate change pages.

3. Have students work in pairs or groups of three to investigate the various viewpoints involved in this issue. The groups can designate responsibilities for each member. For example, one student can be responsible for looking at Web sites and newspapers. Another student can research journal articles and books. Students can use various strategies to research viewpoints. Following is one approach:
   - Each group should find at least six sources of information on global climate change (or global warming). Allot about a week for students to research the information. Out of class assignments may be necessary.
   - Ask the group to select two sources to investigate further. At this time, they can share their choices with you to make sure a diversity of resources is being investigated.
   - Have students use the ***Global Climate Change Viewpoint Form*** to summarize their findings. Review the different parts of the form. The "Viewpoint" is a one-sentence summary that succinctly states the author's opinion. Students should use "Additional or supplementary information" to explain the reasoning or background behind the viewpoint. Ideally, students should cite scientific facts that were referenced within the source. The "Source" includes reference information to help the reader find the information, but it also identifies who authored the resource. (Knowing if the author is a member of a certain organization or receives funding from a particular agency can provide insight into motivations or influences behind the viewpoint presented).
   - Everyone in the group should read all the sources, but each group member can be responsible for drafting the ***Global Climate Change Viewpoint Form*** for one of the sources. They should then meet as a group and share their work and edit and revise the form together.

4. After the groups have investigated at least two different sources of viewpoints about global climate change, have each group present their findings to the class.

5. When students finish their presentations, have them post the ***Global Climate Change Viewpoint Form*** on the wall. Challenge the class to group similar or related viewpoints together. They can create a chart

similar to the one above, where "Global Climate Change" is in the center and the viewpoints are grouped around the center.

Closure

Have students summarize the various opinions presented in the ***Viewpoints*** diagram. Were they aware of these different viewpoints before they conducted this research? Why do students think there are varying opinions?

Ask students to present their own viewpoints (compare to the survey conducted in the **Orientation**). Do they find themselves agreeing with one or more of these viewpoints? Generate a list of questions about what else they would like to know about the greenhouse effect before they form an opinion. See **Extensions** for suggested approaches to further investigate the viewpoints.

Have students examine their energy use in relation to carbon dioxide production (their "carbon diet"). See **Extensions** for suggested approaches to further explore this issue.

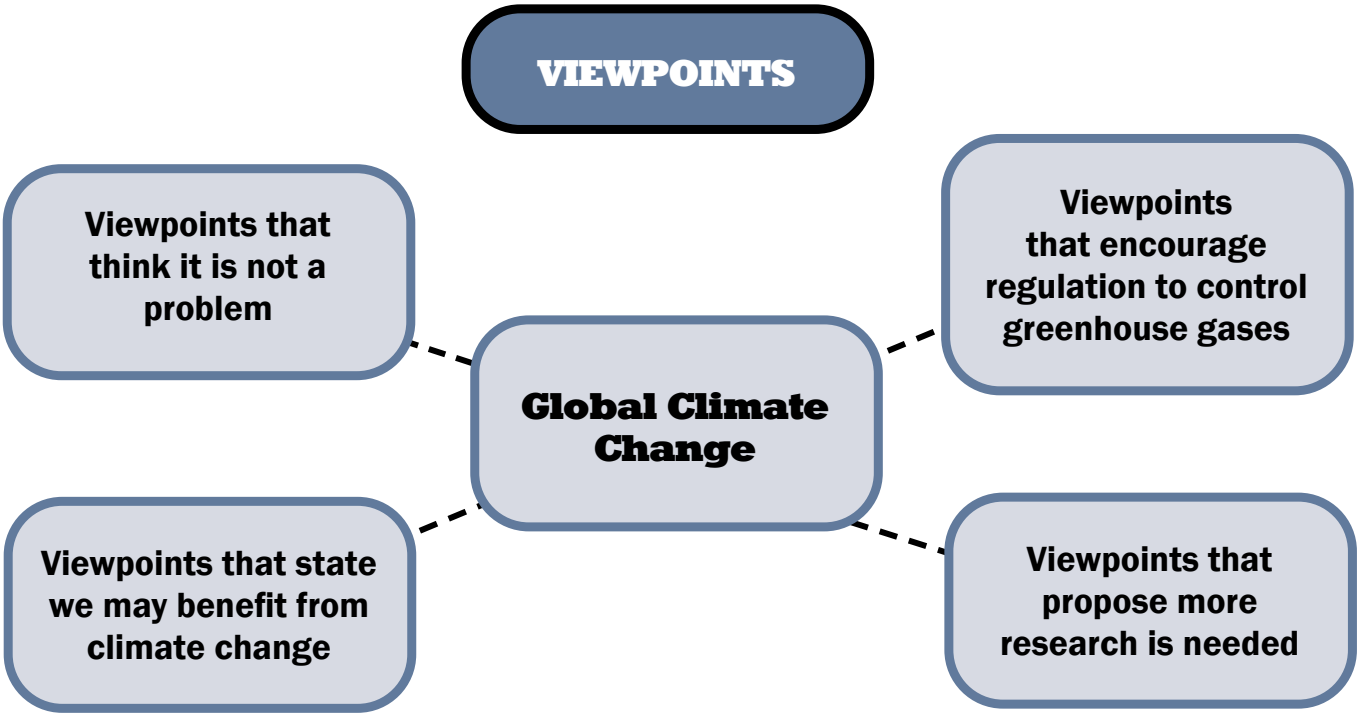
Assessment

Formative

- Did students use effective research strategies to identify a variety of different viewpoints about global climate change?
- By reading students' ***Global Climate Change Viewpoint Forms***, can the reader quickly understand the viewpoint of the source?
- Were students able to group similar viewpoints together?

Summative

Have students write an informative article about global climate change and the various viewpoints involved. Encourage students to be objective and not to favor any viewpoint. Discuss the challenges with developing a paper of this format and the strategies they use to remain impartial. They can submit the article to the school newspaper or their local paper.



Extensions

The ***Viewpoints*** diagram can be used by the class for a variety of future investigations. Following are a few ideas:

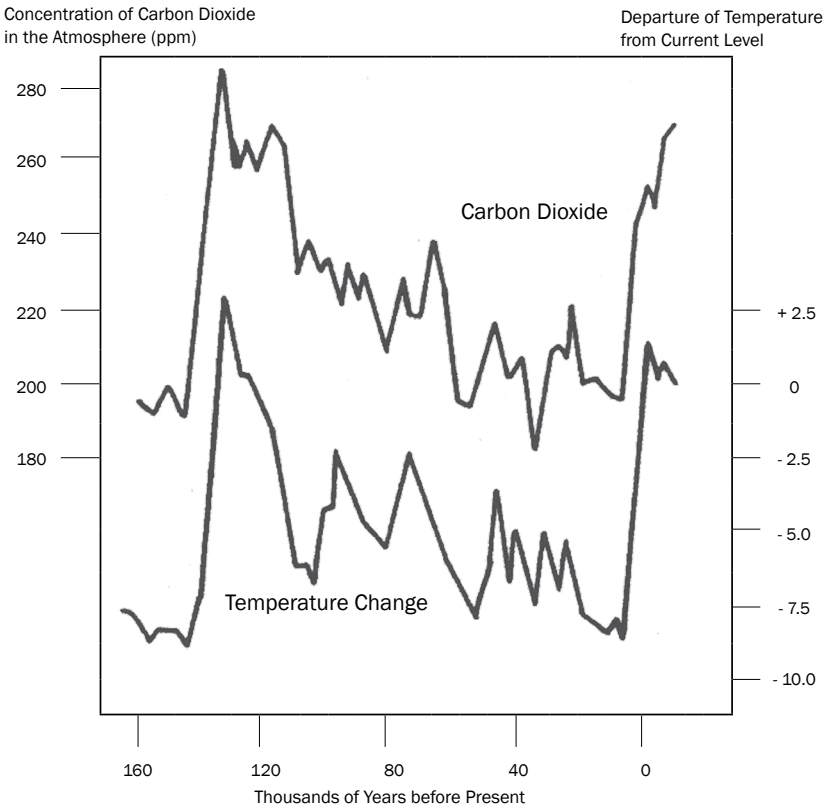
- Assign values to the varying viewpoints. See ***Value Descriptors***.
- Research the organizations or writers who authored the sources. Contact the organizations and ask for copies of the mission statement, board of directors, and other projects. How might the philosophy or values of the organization influence its viewpoint?
- Analyze the various viewpoints for bias and fairness. Do the authors represent certain organizations? What are their backgrounds? Do the authors' viewpoints favor a certain political or economic philosophy? What data do the authors reference to support their views? Did they collect the data themselves or reference other sources? What are these sources (government organizations, private groups, research agencies)? Does the data support the authors' viewpoints? Could there be more than one interpretation?
- Create a "handout" on how to evaluate websites/sources for credibility and reliability. Include the following: Does the website identify the author and his/her qualifications/expertise? What is the source? Is it a .com, .edu, .gov, .mil, .net, .org, etc. What is the purpose of the website? Personal, company, organization, scholarly/ research? Who is the intended audience? Is the information intended to inform/teach, explain/ enlighten, persuade, or sell a product? Is the language free of emotion-rousing words? Is the information biased, objective, factual; are the arguments well supported, is it propaganda? How do you know? Is it current? When was the site last updated? Is the information reviewed/ refereed? Is the information free of grammatical, spelling, and typographical errors?

Climate Change in the Past

The ***Long-Term Variations of Global Temperature and Atmospheric Carbon Dioxide*** graph was created from readings from a 10-centimeter-wide, 2,083-meter-long ice core from Vostock, Antarctica.

What relationship do students see between CO_2 concentrations and temperature change? The current atmospheric CO_2 level is 360 ppm, (compared to the 275 ppm recorded by the ice core for the year 200 AD). What do students think about this current increase compared to 1700 years ago? What other questions can students generate about this graph?

Long-Term Variations of Global Temperature and Atmospheric Carbon Dioxide



Source: J.M. Barnola et al., "Vostock Ice Core Provides 160,000-year Record of Atmospheric CO2" *Nature Vol. 329, No 6138 (1987),* p 410, as cited in World Resources Institute in collaboration with the United Nations Environment Programme and the United Nations Development programme, *World Resources 1990–1991,* (New York, Oxford University Press: 1990).

Temperature and Carbon Dioxide

Find out if there is a connection between global temperature changes and carbon dioxide concentrations in the atmosphere. Plot the actual average global temperature data from the ***History of Global Surface Temperature Since 1880*** table onto a graph. Draw a line connecting the data points graphed. Ask students to examine the data carefully. Does the data support the conclusion that increasing CO_2 emissions are responsible for the temperature increase during the past 110 years? What are some other phenomena (natural and human-made) that might explain the increases in temperature? What other information do they think they need to answer these questions?

Going on a Carbon Diet

The increase in greenhouse gases is related directly or indirectly to energy use. We often talk about climate change, however, without acknowledging that any strategy to slow climate change might require us to change our energy use behaviors. If their electricity comes from a power plant that burns coal, they need to consider use of many appliances as adding greenhouse gases to the atmosphere (an approximate value is that every kilowatt-hour of electricity produces 1.6 pounds of CO_2). Help students adapt the calculations from the activity "At Watt Rate?" (available at keepprogram.org > Curriculum & Resources > Curriculum - by activity guide > KEEP Energy Education Activity Guide) to interpret results in terms of carbon rather than dollars. If they ride in or drive a car they are directly involved in adding carbon gases to the air. What activities would they be or not be willing to cut back on to help reduce their carbon diet? (See ***Action Ideas: Energy Efficiency Measures*** for a list of ideas.)

History of Global Surface Temperature Since 1880	
Year	**Change in Average Surface Temperature (degrees Celsius)**
1880	- 0.1
1890	- 0.3
1900	- 0.1
1910	- 0.4
1920	- 0.2
1930	- 0.1
1940	0.1
1950	- 0.2
1960	0.0
1970	0.0
1980	0.3
1990	0.4
2000	0.4
2010	0.7
2011	0.6
2012	0.6
2013	0.7
2014	0.7
2015	0.9
2016	0.9
2017	0.9
2018	0.8

Source: NOAA: climate.gov/news-features/understanding-climate/climate-change-global-temperature

Related KEEP Activities

Prior to this activity, you may want to have students explore sources of greenhouse gases. Some of these emissions are described in "Dirty Half Dozen." "Energy Efficiency Measures." provides ways to save energy (and produce less carbon). Students can use strategies in the activity "Energy Futures" to investigate various scenarios of climate change.

Credits

Some Basics about Global Warming and Climate Change adapted from Wisconsin Office of Energy Innovation, North Tower, 6th Floor, Hill Farms State Office Building 4822 Madison Yards Way, Madison, WI 53705.

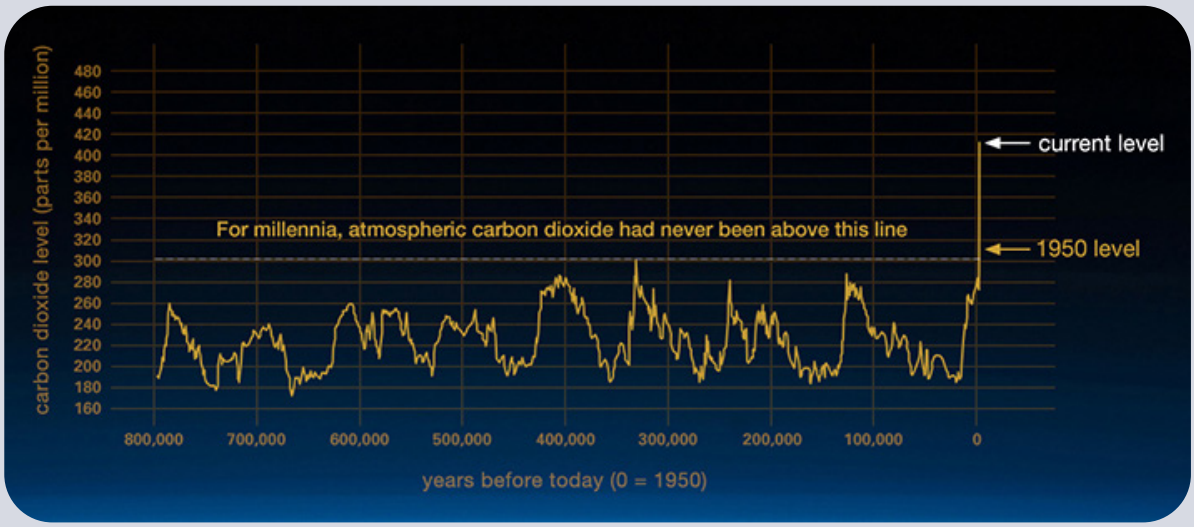
The procedure for "Viewpoints" is adapted from "Perspectives" pages 397-399 in the *Project WET Curriculum and Activity Guide*. Bozeman, Mont: The Watercourse and the Western Regional Environmental Education Council, 1995.

Climate Change in the Past in the Extensions Adapted from "*Greenhouse Gases: Yesterday-Today-Tomorrow*" by Al Stenstrup in EE News, vol. 14, no. 3 (Spring 1998): 4–6.

"Temperature and Carbon Dioxide" in the **Extensions** adapted from Day, Harlan, Robert Harris, and Joe Wright. "Analyzing Greenhouse Data." pp. 142–144 in *Energy Economics and the Environment: Case Studies and Teaching Activities for High School*. Indianapolis, Indiana: Indiana Department of Education, 1994. Used with permission. All rights reserved.

Graph of Atmospheric CO_2 Concentrations

This graph, based on the comparison of atmospheric samples contained in ice cores and more recent direct measurements, provides evidence that atmospheric CO_2 has increased since the Industrial Revolution. (Credit: Luthi, D., et al.. 2008; Etheridge, D.M., et al. 2010; Vostok ice core data/J.R. Petit et al.; NOAA Mauna Loa CO_2 record.)



Source: NASA: climate.nasa.gov/climate_resources/24/graphic-the-relentless-rise-of-carbon-dioxide/

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Read and Explain in Pairs

It's often more effective to ask students to read assigned material in cooperative pairs than individually. The expected criterion for success is that both members be able to explain the meaning of the assigned material correctly. The task is for the pairs to ascertain the meaning of each section and the assigned material as a whole (a "section" is text covering a specific topic and introduced by a section heading shown in bold type). The cooperative goal is for both members to agree on the meaning of each section, formulate a joint summary, and be able to explain their answer.

Here's how it works:

1. Assign a high reader and a low reader to be a reading pair, telling them what specific pages (passages) that you want them to read.
2. Students read all section headings for an overview.
3. Students silently read the first section and then take turns acting as summarizer and accuracy coach. They rotate roles after each section.
4. The summarizer outlines in his/her own words the content of the section to his/her partner.
5. The accuracy coach listens carefully, corrects any misstatements, adds anything that was left out, and explains how the material relates to something they already know.
6. The students then move on to the next section and repeat the procedure. They continue until they have read all assigned material. At that point, they come to an agreement on the overall meaning of the assigned material.

During the lesson, systematically monitor each reading pair and assist students in following the procedure. To ensure individual accountability, randomly ask students to summarize what they have read so far. Remind students that there is intergroup cooperation—whenever it is helpful, they should check procedures, answers, and strategies with another group, or if they finish early, they should compare and discuss answers with another group.

Value Descriptors

The purpose of an issue analysis is to identify values and analyze how they contribute to the issue. There are many reasons people think and feel the way they do. One factor is their personal values. Values are the worth or importance someone attributes to something or someone else.

The descriptors listed below may be helpful as you analyze issues. These statements attempt to name and define values that might be held by individuals. The definitions, as well as the list itself, should not be considered complete. They are simply tools to help you in the complex task of identifying values.

Value	Description: The appreciation of, or focus upon...
Aesthetic	form, composition, and color through human senses.
Economic	the use and exchange of money, materials, and/or services.
Ecological	natural biological systems and principles.
Educational	the accumulation, use, and communication of knowledge.
Egocentric	self-centered needs and fulfillment.
Ethical/Moral	present and future human responsibilities, rights and wrongs, and ethical standards.
Ethnocentric	the fulfillment of ethic/cultural goals.
Health & Safety	the maintenance of positive human physical conditions.
Legal	national, state, or local laws; law enforcement; law suits.
Political	the activities, functions, and policies of governments and their agents.
Recreational	human leisure activities.
Religious	the use of belief systems based on faith or dogma.
Scientific	the process of empirical research; knowledge gained by systematic study.
Social	shared human empathy, feelings, and status.
Technological	the use of technology for human/societal goals.

Some Basics about Global Warming and Climate Change

Greenhouse Effect, Global Warming, Climate Change: What do these terms mean?

For most of human history, changes in the earth's climate resulted from natural causes that usually took place over hundreds or thousands of years. But today, human activities are beginning to affect our climate in serious and immediate ways, intensifying the "greenhouse effect."

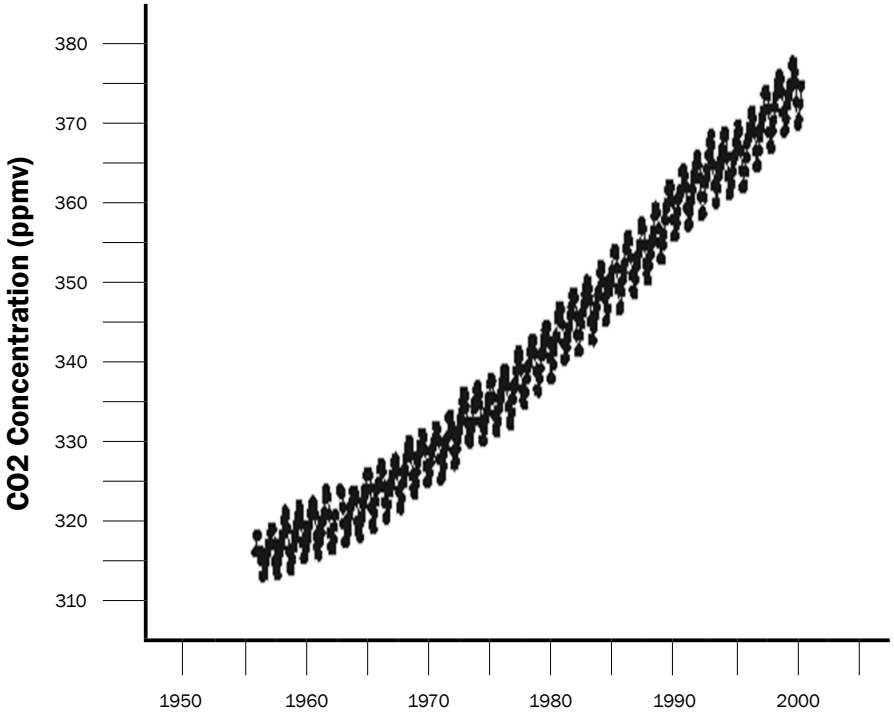
The greenhouse effect is the natural phenomenon that keeps the earth at the right temperature for life to flourish. The sun's enormous energy warms the earth's surface and its atmosphere. As this energy radiates back toward space as heat, a portion is absorbed by a delicate balance of heat-trapping gases in the atmosphere, among them carbon dioxide, which creates an insulating layer. This insulating layer functions much like the glass windows of a greenhouse and elevates temperatures here on earth. Without it, the earth could not sustain life.

Human contributions to greenhouse gases have led to an "enhanced greenhouse effect" often referred to as global warming. As the concentration of greenhouse gases grows, more heat is trapped by the atmosphere and less escapes back into space. This increase in trapped heat alters atmospheric processes and their interaction with the oceans and the land. The climate, the product of that interaction, changes as well, causing altered weather patterns that bring unexpected rain or dry spells; sudden, severe storms; and temperature changes. The term climate change is used to describe this interconnected chain of events.

What causes climate change?

Scientists have concluded that human activities are contributing to climate change by adding large amounts of heat-trapping gases to the atmosphere. Our fossil fuel use is the main source of these gases. Every time we drive a car, use electricity from coal-fired power plants, or heat our home with oil, we release carbon dioxide. Since preindustrial times, the atmospheric concentration of carbon dioxide has increased 32 percent from about 275 ppm to 364 ppm (in 1997).

Over that same period, the amount of atmospheric methane, a potent greenhouse gas, has risen 145 percent. Sources of methane include agricultural activities and decaying garbage in our landfills. If emissions of greenhouse gases



Source: Dave Keeling and Tim Whorf (Scripps Institution of Oceanography)

Some Basics about Global Warming and Climate Change

continue to grow, carbon dioxide concentrations will approach twice their preindustrial level by the end of the twenty-first century.

How do we know it's happening?

Temperature is one sign of global climate change. The ten warmest years this century have occurred since 1980. However, temperature is only one indicator. Studies show that during the last century an increase in precipitation worldwide has also occurred. These two phenomena—along with a decrease in the amount of snow that covers the northern hemisphere, a simultaneous decrease in Arctic sea ice, continued melting of alpine glaciers, and a rise in sea level—are all consistent with global warming.

How much warmer is our Earth likely to become?

The 1995 report from the Intergovernmental Panel on Climate Change projects that Earth's average temperature will increase 1.8 degrees to 6.3 degrees Fahrenheit in the next 100 years. This increase is in addition to the increase of 0.5 degrees to 1.1 degrees Fahrenheit that has already occurred since 1860. Scientists predict that even if we stop emitting heat-trapping gases now, the climate won't stabilize for many decades because of the gases we've already sent into the atmosphere.

Would a temperature increase of one or two degrees really change the global climate?

Even a modest rise of temperature could have dramatic effects. In the last 10,000 years, Earth's average temperature hasn't varied by more than 1.8 degrees Fahrenheit. Temperatures only 5 degrees to 9 degrees Fahrenheit cooler than those today resulted in the last Ice Age, in which the Northeast was covered by one kilometer of ice.

Even though a 2 degree to 3 degree Fahrenheit increase may not seem like a lot, this temperature rise is happening at the most rapid rate of change in recorded history. It is this rapid rate of change that people, plants, and animals may not be able to adjust to.

An increase of a few degrees won't generally make for pleasantly warmer temperatures around the globe, either. Some regions may be affected more than others. Some may receive less rainfall, with severe impacts on agriculture and forests. Others may lose coastal wetlands through rises in sea level. Agriculture in low-lying areas, such as along the Mississippi River, could be severely affected by floods. Scientists predict that continued global warming is likely to result in

- a rise in sea level between 6 and 37 inches and consequent coastal flooding;
- severe stress on forests, wetlands, and other ecosystems;
- damage to human health as mosquitoes and other insects spread diseases over larger geographical areas; and
- disruption of agriculture through changes in temperature and water resources.

What is the best source of scientific information on climate change?

In 1988, the United Nations Environment Programme and the World Meteorological Organization set up the Intergovernmental Panel on Climate Change (IPCC) to examine the most current scientific information on global warming and climate change. More than 2,500 of the world's leading climate scientists, economists, and risk-analysis experts from 80 countries contributed to the panel's most recent report, Climate Change 1995: The IPCC Second Assessment Report. These scientists worked together to determine what this information indicates about the global climate and about the impact of human actions on it. In this report the panel concluded that "the balance of evidence suggests that there is a discernible human influence on global climate."

Global Climate Change Viewpoint Form

Viewpoint

Write a one or two sentence summary of the information in this source.

Additional or Supplementary Information

Source

Author or organization:

Title (of article or web page):

Title of book or journal:

Date:

Other reference information (Website address or volume number):

Action Ideas: Energy Efficiency Measures

Below is a list of action ideas that can improve energy efficiency at home, at school, and in the community. Students can perform many of these measures themselves, or they can work with their peers, family, school personnel, and community members to improve energy efficiency.

Energy efficiency measures that correspond to the ***Appliance Survey*** from "At Watt Rate?" (available at keepprogram.org) are listed under each end use category. Teachers may want to have students do these surveys first. If students discover other energy efficiency measures not listed here, they should be encouraged to undertake them if possible.

The cost of implementing energy efficiency measures varies widely. Measures listed under Basic Action Ideas for each end use are free. Many other measures only cost a few dollars. A few require a major investment, such as purchasing a large appliance, buying a new vehicle, or adding insulation as part of a home improvement project. Each energy efficiency measure is ranked from the least costly to the most costly within a specific energy end use category. The rankings are symbolized as follows:

No cost: Ø
Low cost: ¢ - $ (less than $1 to $25)
Medium cost: $ - $$ ($25 to $200)
High cost: $$$ (Greater than $200)

Broader cost ranges are shown using two cost symbols separated by a dash. For example, a cost range shown as "Ø - $" means that the cost to implement this measure ranges from no cost to a low cost. All costs are initial investment costs that save energy (and money) over time. Even those that cost little or no money may yield noticeable energy savings. The energy efficiency measures listed here represent only some of the many possible measures that can be taken.

Lighting

Implement Basic Action Ideas Ø

- Remember to turn off lights that are not in use.
- Do not turn on more lights than you need for specific tasks such as reading or writing.
- Clean light bulbs and fixtures by removing dust and dirt that have accumulated on them. **Caution: Never use water to clean light bulbs while they are turned on. The water's cooling effect could shatter hot bulbs.**

Delamp and Relamp Fixtures

- Reduce light levels that are too bright by removing unnecessary bulbs from fixtures (delamping). Ø
- Replace high wattage bulbs with lower wattage bulbs of the same type (relamping). ¢ - $
- Combine delamping and relamping to get the desired amount of light from a fixture. For example, replacing two 60-watt incandescent bulbs (120 watts and 1,730 lumens total) with one 100-watt, 1,710 lumen incandescent bulb will save 20 watts and provide the same amount of light. NOTE: Be sure to delamp and relamp first those fixtures that are used most often (4 hours or more per day).

Action Ideas: Energy Efficiency Measures

Replace Incandescent Light Bulbs with More Efficient Bulbs

- Replace incandescent bulbs with light emitting diodes (LEDs) or compact fluorescent lamps (CFLs). Be sure to install LEDs/CFLs first in fixtures that are used most often (4 hours or more per day). $ - $$ (depending on the number of bulbs being replaced)

Use Daylight

- Rearrange living and work spaces to take advantage of daylight. Ø
- Open curtains and blinds during the day to reduce the use of indoor lighting. Ø
- Consider repainting walls and ceilings with light colors to reflect more light. $ - $$
- Consider investing in skylights or extra windows to allow more daylight to enter the room. $$$

Use Other Lighting Energy Efficiency Measures

- Connect a timer or a light sensor to outdoor lights so that they automatically turn off during the daytime and turn on at night. $ - $$

Insulation and Air Infiltration

Implement Basic Action Ideas—Air Infiltration Ø

- Close drapes and window shades during the winter and the summer.
- Close doors when going in and out.
- Make sure that all interior windows and storm windows are closed during the heating season.
- If your home has a fireplace, make sure that the damper is tightly closed when you don't have a fire burning.

Add Insulation

- Add insulation to the attic, walls, and basement as needed. Contact a building supply dealer, a home builder, an energy professional, the Wisconsin Energy Bureau, or the Wisconsin Department of Industry, Labor, and Human Relations (the state agency that oversees building codes) to find out recommended R-values for the areas where insulation is to be added. $$ - $$$

Reduce Air Infiltration in Windows

- Place clear plastic barriers over windows during the heating season to prevent drafts. Many department and hardware stores sell window plastic kits for this purpose. ¢ - $
- Replace cracked and broken windowpanes. ¢ - $
- Caulk and weatherstrip air leaks around the exterior and interior of window frames. ¢ - $
- Install new storm windows or repair old ones. $ - $$

Action Ideas: Energy Efficiency Measures

Add Window Coverings

- Install drapes, shades, or insulating coverings that can be rolled down and closed into place. $ - $$$ (depending on the type of window coverings installed and the number of windows covered)

Reduce Air Infiltration in Doors

- Install door sweeps or make fabric "snakes" and place them at the bottom of doors to prevent drafts. ¢ - $
- Caulk and weatherstrip air leaks around doors. ¢ - $
- Repair door closing mechanisms so that doors close automatically. ¢ - $
- Install storm doors on exterior doors if none are present. $ - $$

Reduce Air Infiltration in Walls, Foundations, and Other Openings

- Install foam rubber gaskets behind electrical outlet cover plates. ¢ - $
  Caution: Make sure that the electricity to the outlet is turned off before removing a cover plate.
- Caulk or seal cracks in the foundation and gaps or openings where wires and vents enter exterior walls of homes and buildings. ¢ - $$
- If your fireplace damper doesn't work, either have it repaired, install a chimney-top damper, or install a door on the fireplace. $ - $$

Space Heating, Water Heating, and Air Conditioning

Implement Basic Action Ideas—Space Heating Ø

- During the heating season, set your thermostat to 68 degrees F (20°C) during the day (or when you are home) and to 58-60 degrees F (13 °C) when you go to bed (or when you are away).
- Close heating vents, radiators, etc. in rooms and other interior spaces that do not need to be heated. Also, clean the dust and cobwebs from heating vents (registers).
- Bleed the air out of hot water radiators.
- Close off rooms that do not need to be heated.

Implement Basic Action Ideas—Water Heating Ø

- Turn down the water heater thermostat to 120 degrees F (49 °C). Turn it down even further when your family goes on vacation. Some water heaters have a vacation setting specifically for this purpose.
- Do not let the water run while washing your hands, brushing your teeth, shaving, or washing dishes.
- Do not let the shower run for more than a few seconds before stepping into it.

Action Ideas: Energy Efficiency Measures

Implement Basic Action Ideas—Air Conditioning Ø

- During the cooling season, set the air conditioner at 78 degrees F (26 °C). Set it higher if your home has ceiling fans.
- Turn off the air conditioner if you leave your home for more than an hour.
- Close off rooms that do not need to be cooled.

Implement Space Heating Energy Efficiency Measures

- Clean or change the air filter of your furnace monthly. ¢ - $
- Build reflectors out of aluminum foil and place them between the radiator and the wall. This will help reflect heat from the radiators into a room. ¢ - $
- Install a programmable thermostat. $ - $$
- Have your boiler or furnace serviced every one or two years. $ - $$
- Seal and insulate warm-air heating ducts that come out of your furnace. $ - $$
- Consider installing a high-efficiency furnace or boiler if replacing an old furnace or boiler. $$$

Implement Water Heating Energy Efficiency Measures

- Install a low-flow shower head in your shower. ¢ - $
- Install water-efficient faucet aerators (faucet heads) in your kitchen and bathroom sinks. ¢ - $
- Fix leaky faucets. ¢ - $
- Install an insulating blanket around your water heater. ¢ - $
  Caution: Do not cover thermostats, burners, water heater controls, or air inlets of water heaters with insulating blankets. Do not cover the tops of natural gas water heaters. Make sure that blankets are taped securely to water heaters to prevent them from slipping down. Ask an adult for help when adding blankets to water heaters. Note that installing insulating blankets on certain high-efficiency water heaters may reduce efficiency. Follow directions and manufacturer's recommendations.
- Insulate the first three feet (90 cm) of the hot water pipe coming out of the water heater. ¢ - $
- Insulate all hot water pipes in unheated basements and crawlspaces. $ - $$
  Caution: Do not replace or cover older pipe insulation on your own. It may contain asbestos and should not be touched or disturbed except by a professional.
- Consider installing a high-efficiency water heater, if replacing an old water heater. $$$

Implement Air Conditioning Energy Efficiency Measures

- Place window air conditioners on the shaded sides of the house. Ø - $, depending on whether you have to buy mounting brackets
- Clean or change your air conditioner is air filter every one or two months. ¢ - $
- Build an awning over the air conditioner so that it is not exposed to the sun. $$ - $$$
- Consider installing a high-efficiency air conditioner, if replacing an old air conditioner. $$$.

Action Ideas: Energy Efficiency Measures

Major Home Appliances

Implement Basic Action Ideas—Refrigerators and Freezers Ø

- Set your refrigerator's temperature between 38 and 42 degrees F (3 and 6°C), and your freezer between 10 and 15 degrees F (-12 and -9 °C). Use a thermometer to check these temperatures, since refrigerator or freezer dials usually do not show temperatures.
- Do not open the refrigerator or freezer door longer than necessary.
- Decide what you want to get from the refrigerator or freezer before you open the door.
- Stock your refrigerator with food and fill any remaining large spaces with jugs of water. However, do not overfill your refrigerator to the point where you reduce air circulation and cooling effectiveness.
- Clean the coils behind your refrigerator and freezer at least once a year.
- Make sure the refrigerator door seal is tight when closed.
- Move refrigerators and freezers away from direct sunlight, stoves, dishwashers, and other heat sources.
- Make sure that the refrigerator is not pushed tightly against the wall; air must circulate through the coils.
- Use energy-saving settings on your refrigerator and freezer if they have them.

Implement Basic Action Ideas—Clothes Washers, Clothes Dryers, and Dishwashers Ø

- Use energy-saving settings on your clothes washer, clothes dryer, and dishwasher if they have them.
- Run clothes washers, clothes dryers, and dishwashers with full loads when possible.
- Wash clothes in cold or warm water when possible.
- Hang washed clothes on a clothesline to dry.
- Wash dishes by hand, especially if there aren't enough to fill a dishwasher. Use water-conserving habits (for example, don't let the water run unnecessarily) when washing.
- If your dishwasher doesn't have a no-heat air dry feature, turn off the dishwasher after the final rinse cycle and open its door to let dishes air dry.

Implement Basic Action Ideas—Stoves (Ranges) Ø

- Use microwave ovens and toaster ovens in place of electric ranges and ovens when possible.
- Cover pots when cooking food or boiling water, except when cooking food that may boil over (like pasta).
- Place small pots or pans on small burners when cooking.
- Make sure that the metal reflectors under burners are kept clean so they can reflect heat to pots and pans during cooking.
- Avoid opening the oven to look at food while it is cooking. Turn on the oven light and look through the window instead.
- Reduce cooking time by defrosting foods in the refrigerator before cooking.

Action Ideas: Energy Efficiency Measures

Implement Refrigerator and Freezer Energy Efficiency Measures

- Consider purchasing a high-efficiency refrigerator if replacing an old refrigerator. $$$

Small- and Medium-Sized Electrical Appliances & Equipment

Implement Basic Action Ideas Ø

- Turn off appliances and equipment if they are not being used.
- Substitute manual effort (labor) for using an appliance when possible. Think of it as a way of getting exercise.

Implement Electrical Appliance and Equipment Energy Efficiency Measures

- Buy energy-efficient appliances and equipment whenever possible. ¢ - $$$

Transportation

Use Transportation Alternatives

- Walk or bike to destinations whenever possible. Ø
- Start or join a carpool to commute to school or work. Ø - $ (depending on how the cost of carpooling compares to the cost of using your own vehicle)
- Use mass transit (buses, trains) for commuting purposes, when possible. Ø - $$ (depending on how the cost of using mass transit compares to the cost of using your own vehicle)

Maintain Vehicles for Greater Fuel Efficiency

- Keep the tires of your vehicle inflated to the manufacturer's recommended maximum pressure. Ø
- Change engine oil and the oil filter according to the manufacturer's recommended schedule. ¢ - $
- Have your vehicle's engine tuned up regularly. $ - $$
- Have the wheels of your vehicle aligned regularly. $ - $$

Practice Driving Habits That Increase Fuel Efficiency Ø

- Combine several errands into one trip.
- Reduce any unnecessary weight carried by the vehicle. Extra weight reduces fuel efficiency.
- If you stop for more than one minute, it is more efficient to turn off the engine than to let it idle.
- Avoid revving up the engine.

Action Ideas: Energy Efficiency Measures

- Avoid rapid acceleration and braking. Drive smoothly and anticipate traffic stops.
- Obey speed limits. Most vehicles reach their optimum fuel efficiency at speeds between 40 and 55 miles per hour (mph) (64.4 and 88.5 km/hr). As speed increases over 55 mph (88.5 km/hr), fuel efficiency drops quickly. Speeds of 65 mph (104.6 km/hr) use from 10 to 15 percent more fuel than 55 mph (88.5 km/hr). Losses at 75 mph (120.7 km/hr) compared to 65 mph (104.6 km/hr) are even greater.
- Use cruise control when driving on level highway roads.

Consider Buying a More Fuel Efficient Vehicle $$$

- If you or a member of your family plans to buy a new or used vehicle, consider choosing one with the highest possible fuel efficiency (miles per gallon, or mpg) rating. Small vehicles with four-cylinder engines and manual transmissions generally have the highest fuel efficiency ratings. However, fuel efficiency ratings also vary for different classes of vehicles (cars, minivans, station wagons, light trucks, etc.), so make sure to consider the most efficient vehicle within a certain class.

Trip Planning

- Design a travel brochure of Wisconsin that identifies energy-efficient ways of getting to various destinations and points of interest within the state.

Energy Efficient Landscaping

Plant Trees

- It's much cooler to sit under a densely leafed, spreading tree that blocks the sun's rays than under one that only filters rays. The Arbor Day Foundation suggests planting trees with round or horizontal-oval crowns. Trees rated highest for shade are maple, horse chestnut, beech, green ash, walnut, poplar, and sycamore.
- Consider the plant's adaptability and hardiness. For the north side of a building, choose a shade-tolerant plant that's extremely winter hardy. For the south and west sides, use plants that are adaptable to drought, excessive sun, and hot winds.
- To prevent foundation damage, a tree planted within 10 feet (300 cm) of a building should be selected from those species that have a taproot instead of a lateral root system.
- Plant trees with strong wood. However, for quick shade, interplant fast-growing weaker trees such as willows. When the slower, stronger trees reach a desirable height, remove the weaker ones.
- When deciding where to plant your trees, observe summer shadows on your property and plant trees where they will shade hot spots during the hottest days of summer. Locate large deciduous shade trees on the south, southwest, and west sides of the building about 15 to 25 feet (45-75 m) apart and 10 to 15 feet (30-45 m) from the building. Deciduous trees block the summer sun but let winter's warming rays filter through after the leaves fall. Plant trees with strong wood, such as oaks, lindens, or ashes. (Weaker trees can cause damage if branches break off during high winds.)

Action Ideas: Energy Efficiency Measures

Plant Dwarf Shrubs near Building Foundations

- Dwarf shrubs are suitable for energy-efficient landscaping because they remain small at maturity (2 to 3 feet high [60-90 cm]) and can be planted near buildings. Also, since they stay small, they require little maintenance. Small plantings near your building can save energy year-round. In the winter, dwarf shrubs, especially evergreens, can block the force of cold winter winds against the foundation. This reduces both heat loss through the walls and cold air leaks. In the summer, dwarf shrubs can cool the air near your building by a process called transpiration. As plants give off moisture to the air, the air cools, similar to the way perspiring cools humans. The air temperature can be as much as 10 degrees cooler by shrubs. Evergreen dwarf shrubs are especially effective for cutting heat loss in the winter. Many of the conifers (needle types) are very hardy and form an effective foundation wind barrier year-round. Locate these shrubs on the north and northwest sides of your building.